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Prevalence of uncontrolled hypertension and associated factors among adult hypertensive patients on follow-up at selected public hospitals, Addis Ababa, Ethiopia

Muhaba Reshid[1], Wudma Alemu[1], Teshome Habte[1*], Zeleke Argaw[1]
1. Department of Nursing, School of Nursing and Midwifery, College of Health Sciences, Addis Ababa University, Ethiopia.

ABSTRACT

The study aimed to assess the prevalence of uncontrolled hypertension and associated factors among hypertensive patients on follow up in selected public hospitals. This cross-sectional study was conducted from February to March 15, 2022. The study participants were selected by systematic random sampling technique, and data were collected using a structured and pretested questionnaire and a patient chart review. The collected data were analyzed using SPSS version 25. Binary and multivariate logistic regression was used. A total of 336 adult hypertensive patients were selected from this 94.6% of them were participated in the study, and the mean age of participants was 59.71 ±7.552 years. The prevalence of uncontrolled hypertension was 48.1%. Advanced age, comorbidity, non-adherence to low-salt diets, Alcohol abuse, weight management activities and comorbidities such as diabetes and cardiovascular diseases were significantly associated with uncontrolled hypertension in the multiple logistic regression analysis. Hypertensive patients who were obese or high body mass index was 4.7 times more likely to have uncontrolled hypertension, and patients who were not adherent to Alcohol abstinence 2.5 times more likely to have uncontrolled hypertension. The prevalence of uncontrolled hypertension in this study was very high, and non-adherence to a low-salt diet, physical exercise, and weight management were significantly associated with uncontrolled hypertension. Therefore, The Federal Ministry of Health should develop national strategic guidelines and public health initiatives focusing on education, lifestyle modification.

Keywords: Uncontrolled hypertension, prevalence, associated factors, Adult patients

*Corresponding Author Email: teshome.habte@aau.edu.et
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INTRODUCTION

Uncontrolled hypertension is an important risk factor for cardiovascular, renal, and cerebrovascular morbidities and mortality [1]. Approximately one billion people worldwide live with uncontrolled hypertension. A research study reveals that, at least 45% of deaths from heart disease and at least 51% of deaths from stroke [2-4]. 1.4 billion People worldwide suffer from high blood pressure. This number is expected to increase to 1.6 billion by the year 2025 [5].

Hypertension is a major cause of the increased burden of sub-Saharan African cardiovascular disease and is expected to nearly double by 2030. The prevalence of hypertension in sub-Saharan Africa is 30%, of which only 7% have controlled blood pressure [6]. A study conducted in some parts of Ethiopia revealed that a high risk of uncontrolled hypertension was associated with socio-demographic and economic factors, clinical and anthropometric factors, lifestyle modification factors, healthcare service-related factors, and knowledge-related factors [7]. A systematic review of 38 studies from 23 African countries, including Ethiopia, reported poor hypertension control [8]. Research conducted in Ethiopia revealed that the prevalence of uncontrolled hypertension among hypertensive patients was 52.7%, 57.1%,11.4% and 69.9% [9,10,11,12] respectively. This finding revealed that the level of blood pressure control among patients with hypertension was low. Therefore, this study was conducted to assess the prevalence of uncontrolled hypertension and its associated factors among hypertensive patients on follow-up in Addis Ababa public hospitals, and possible solutions to improve the quality of healthcare service provision to reduce morbidity and mortality resulting from Uncontrolled Hypertension (UHPN) complications.

Statement of the problem

Nearly one billion people worldwide live with uncontrolled hypertension, the majority of which are in developing countries [1]. Hypertension (HTN) is the leading cause of cardiovascular disease (CVD) and death worldwide, with approximately 7.5 million deaths annually, accounting for 12.8% of all deaths. Of the 17.5 million cardiovascular deaths in 2012 and hypertension accounted for 9.4 million. Most hypertension-related deaths occur due to their complications [2, 3]. It is becoming the major cause of sub-Saharan African cardiovascular disease and is expected to nearly double by 2030. The prevalence of hypertension in sub-Saharan Africa is 30%, of which only 7% have controlled blood pressure [6].The WHO 2018 report show that the annual mortality rate of the Ethiopian population due to uncontrolled hypertension and other non-communicable diseases remains high (39%and 15%, respectively). These deaths have been attributed to CVD [1, 13]. According to reports in Ethiopia, the prevalence of uncontrolled hypertension is 37-63% [1]. Uncontrolled

hypertension is a serious health problem in low-income countries, including Ethiopia, and affects individuals' quality of life [7, 8]. However, data on the prevalence and factors associated with uncontrolled hypertension in Addis Ababa are limited. Therefore, this study aimed to determine the prevalence of uncontrolled hypertension with the various contributing factors in patients with hypertension.

Significance of the study

Uncontrolled hypertension (HTN) is associated with cardiovascular morbidity and mortality. It is responsible for the occurrence of stroke, ischemic heart disease, peripheral arterial disease, aortic aneurysm, and congestive heart failure. Evidence is currently showing that the prevalence of uncontrolled hypertension is alarmingly increased in Ethiopia owing to related risk factors. Identifying these determinants and related factors is important to reduce uncontrolled hypertension in patients with hypertension. The findings of this study can be used as baseline information by other researchers. Furthermore, the findings of this study will provide input for healthcare providers, educators, and policymakers in the Ministry of Health and help both individuals and the community for early detection and follow-up of the disease. Therefore, this study aimed to assess the prevalence of uncontrolled hypertension and its associated factors among adult patients with hypertension at selected public hospitals in Addis Ababa, Ethiopia.

Conceptual framework

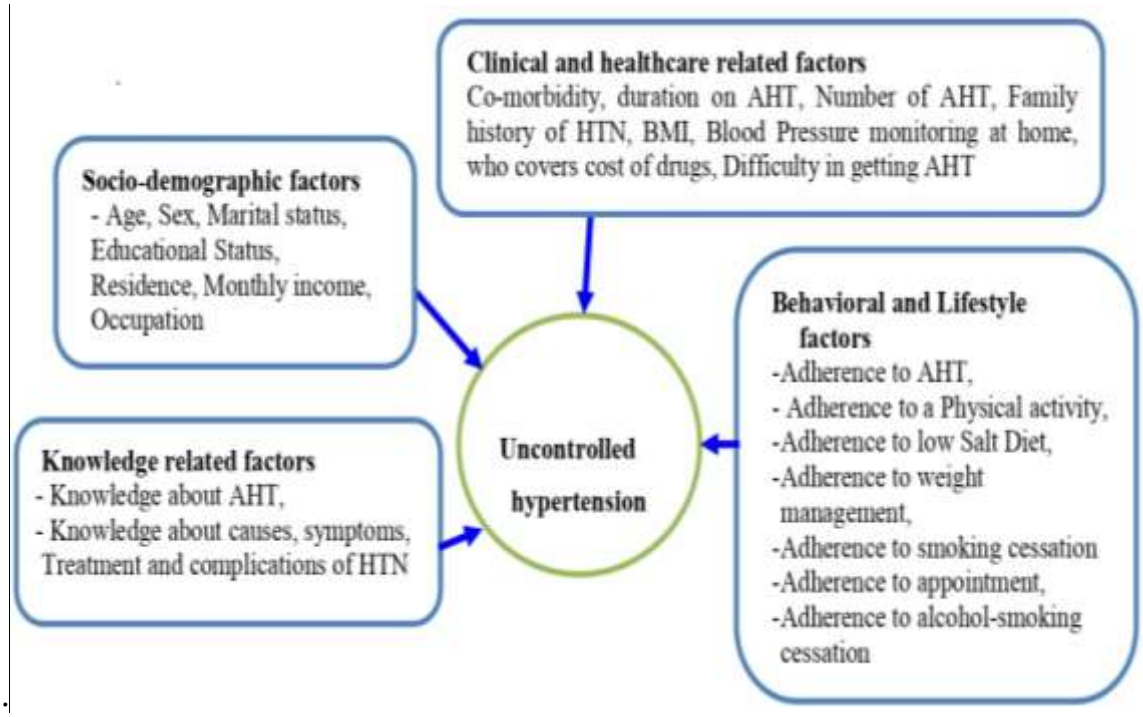

Figure 1: Conceptual framework for the prevalence of uncontrolled hypertension among hypertensive patients in Addis Ababa Ethiopia.

Key: AHT: Anti-Hypertension/medication/therapy.

BMI: Body mass Index

HTN, Hypertension

This conceptual framework was developed after reviewing the literature (figure 1). It shows the cause-and-effect relationship or the interaction between independent variables, such as socio-demographic and economic factors, clinical and healthcare-related factors, Behavioral and Lifestyle factors, and knowledge-related factors with the dependent variable uncontrolled hypertension [9,14--17].

MATERIALS AND METHOD

Study area and setting

This study was conducted in Addis Ababa, Ethiopia's capital. Twelve public hospitals were located in the city, three of which were randomly selected for this study. These hospitals were the Tikur Anbesa Specialized Hospital (TASH), Yekatit 12 Medical College Hospital (Y12MCH) and Zewditu Memorial Hospital (ZMH).

Tikur Anbesa Specialized Hospital serves as a tertiary referral hospital across all regions of Ethiopia and is the largest teaching and specialized hospital, providing services for more than 700,000 patients per annum. It offers specialized, semi-specialized, and super-specialized medical services. It has approximately 625 beds in inpatient wards [18, 19]. Evidence from the hospital patient registry in 2022 indicates that the hospital provided follow-up care for approximately 1,200 hypertensive patients before the data collection period.

Yekatit 12 Hospital Medical College was established in 1922. According to the annual hospital report, the hospital has provided a public service in Addis Ababa City administration. The catchment population is over 20 million, with over 800 outpatient visits daily and 750 inpatient beds.

Zewditu Memorial hospital is a teaching and general referral hospital that works in collaboration with a Tikur-Anbesa-specialized hospital. Approximately 272 patients with hypertension receive treatment services per month in cardiac clinics. Approximately 112,172 patients receive services annually in hospitals. The hospital has different units such as hospital pharmacies, cardiac clinics, diabetic clinics, internal medicine, surgery, neurology, and dialysis centers are the major ones [12].

Study design and period

A hospital-based cross-sectional study design was conducted among adult hypertensive patients attending in the selected public hospitals of Addis Ababa, Ethiopia and this study was conducted from February 15, 2022 to March 15, 2022.

Study Population

Source population

All adult hypertensive patients were admitted to the cardiac centers of selected public hospitals in Addis Ababa.

Study population

A total of 5,500 adult hypertensive patients were followed up in the outpatient department of the cardiac center for at least six months at three selected public hospitals in Addis Ababa.

Sample population

Adult hypertensive patients who were on follow-up in the outpatient department for at least six months at the cardiac center at three selected public hospitals and who fulfilled the inclusion criteria were 336 patients.

Inclusion and Exclusion Criteria

Inclusion criteria

All adult hypertensive patients who were on follow-up unit /clinic attended in the three selected public hospitals for at least six months and were aged 18 years or older.

Exclusion criteria

Patients who were seriously ill or hypertensive were excluded from the study because of physiological changes during pregnancy.

Sampling size determination

The sample size was calculated using a single-population proportion formula applied.

$N0= (Z\propto/2)2*P\ (1-p)\ /d2$

$= \frac{(1.96)^2\ (0.699*0.301)}{(0.05)^2} =323$

Where;

N0= number of the study subjects

Z= is standardized normal distribution curve/value for the 95% confidence level (1.96)

α = Level of significance (set at 0.05)

p=69.9% the prevalence of uncontrolled hypertension in Zewditu Memorial Hospital, Addis Ababa [12].

d= the margin of error 5% considered as (0.05)

The total number of patients with hypertension (N) who were followed up for three

There were less than 10, 000, so the finite correction formula was used, and the final sample size were 305. By assuming non-response rate 10% and thus, the final sample size was calculated to be 336.

Sampling procedure

The sample size was proportionally allocated to each hospital based on the number of patients with hypertension, as shown in *figure 2 below*. A systematic random sampling procedure was used to recruit participants from selected hospitals.

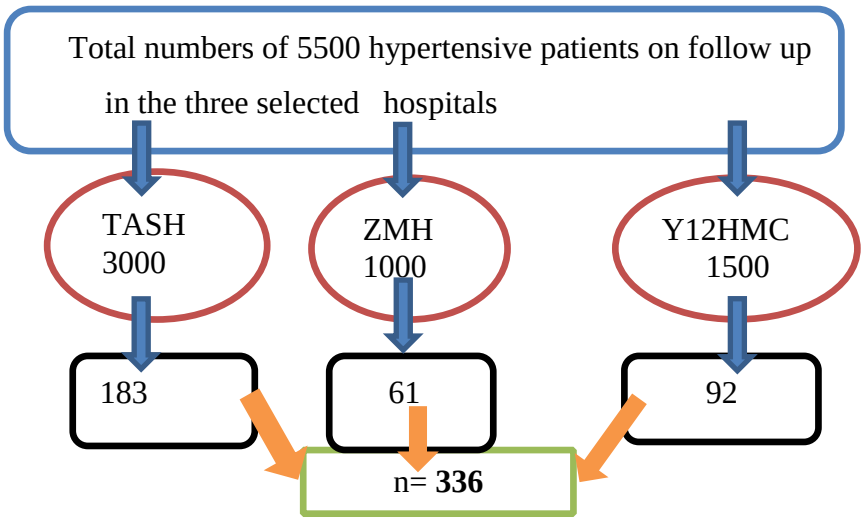

Figure 2: Proportional allocation of study participants among hypertensive patients on follow up in the three selected public hospitals in Addis Ababa, Ethiopia.

Study variables

Dependent variable: Uncontrolled hypertension

Independent variable

Socio-demographic factors (Age, Sex, Marital status, occupation, educational status, residence, and economic status).

Clinical and anthropometric factors (body mass index (BMI), comorbidity (diabetes mellitus (DM), chronic kidney disease (CKD), congestive heart failure (CHF)], family history of hypertension, duration (FHT), and number of anti-hypertension/medication/therapy (AHT).

Behavioral and life style modification factors (adherence to AHT, weight management, physical activity plan, low-salt diet consumption, excess alcohol consumption, smoking cessation, and scheduled appointments).

Healthcare related factors (difficulty in availability of AHT drugs, difficulty in paying for AHT drugs, and waiting time in the hospital).

Knowledge related factors (Knowledge about complications of HTN, Knowledge about symptoms of HTN and Knowledge about treatment of HTN).

Operational definitions

Uncontrolled hypertension:

The three consecutive follows average SBP is ≥140 mm Hg and/or DBP ≥90 mmHg for hypertensive patients aged < 60 years and Average SBP ≥150 mmHg and/or DBP ≥90 mmHg

for hypertensive patients greater than 60 years old, taken from three consecutive office visits, two measurements were taken from the patient's card, and one measurement was taken from the current visit [10].

Adherence to medication:

was assessed using the four-item Morisky Green Levine Scale (MGLS4), which assesses self-reported measures of medication-taking behavior of the patient using four questions, each with yes (0) or no (1) responses and total sum scores of (0-4). Patients with a score of ≥3 (range,0–4) had good adherence. Otherwise, non are adherent [14].

Adherence to low-salt diet:

Nine items assessed practices related to eating a healthy, low-fat, and low-salt diet, similar to the Dietary Approaches to Stop Hypertension (DASH) diet. The response options ranged from 0 to 7 days. Patients were considered adherent if they practiced the low-salt technique in at least 6 out of 7days (scores≥54 points out of 63). Otherwise, they are non-adherent [13].

Adherence to physical activity: Physical activity was assessed using two items. "How many of the past 7 days did you do at least 30 minutes total of physical activity?" and "How many of the past 7 days did you do a specific exercise activity (such as swimming, walking, or biking) other than what you do around the house or as part of your work?" The response options for both items ranged from 0 to 7 days. The responses were summed (range: 0–14). Adherent if a patient performs three or more days of vigorous intensity activity of at least 20 min per day, five or more days of moderate-intensity activity, or walking for at least 30 min per day otherwise not adherent [13].

Smoking status:

Smoking exposure was assessed using two items, "How many of the past 7 days did you smoke a cigarette or cigar, even just one puff?" and to assess passive smoking exposure "How many of the past 7 days did you stay in a room or ride in an enclosed vehicle while someone was smoking?" The response options for both items ranged from 0 to 7 days. Responses were summed (range, 0–14), with higher scores indicating greater tobacco exposure [13].

Alcohol abstinence:

Alcohol consumption was measured using three questions: 'In any one year, have you had at least 12 drinks of any type of alcoholic beverage?' "In your entire life, have you had at least 12 drinks of any type of alcoholic beverage?" "In the past year, how many days per week, per month or per year did you drink any type of alcoholic beverage?" Respondents who reported ≥ 12 drinks in their lifetime and at least one drink in the past year were defined as drinkers [14].

Adherence to Weight Management:

Practice of weight management activities was assessed with 10 items related to dietary practices, and activities were assessed based on recall during the past 30 days. Responses were using a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5), with scores ranging from 10 to 50. Adherent if the patient agreed with all 10 statements (responses $\geq$ 40 out of 50) [13].

Adherence to scheduled appointments:

Non-adherent when there is a tendency to miss greater than 3 out of 10 appointments for the question "out of every 10 appointments, on average, how many do you miss?" [15].

Knowledge about hypertension:

Knowledge was measured by calculating the mean score and categorized as "knowledgeable" if individuals scored the mean and above or "not knowledgeable" if they scored less than the mean [16].

Data collection instrument and method

Data were collected using a structured interviewer-administered questionnaire and document review adopted from peer-reviewed published literature on uncontrolled hypertension and associated factors [13-15, 17].

The questionnaire contained five parts:1) socio-demographic and economic factors (seven questions), 2) clinical and anthropometric factors' that contains 8 questions, 3) lifestyle and behavioral factors (32 questions), 4) healthcare service-related factors (five questions), and 5) knowledge-related factors' that contains 9 questions.

The questionnaire contained both closed and open-ended questions. The patients' current blood pressure was measured using standardized mercury sphygmomanometers, their weight was measured using a pre-calibrated scale, and their height was measured in the standing position to a precise 1 cm using a portable height board. For some necessary medical information data, such as drugs the patient took, two consecutive recent blood pressure measurements, and Co-morbidity, the patients' cards were reviewed.

Data were collected by six Bachelor of Science in Nursing (BSc nurses) using structured face-to-face interviews, and two BSc nurses were assigned as supervisors, who were selected from a hypertension follow-up Out Patient Department (OPD) and had experience in data collection. Two data collectors and two supervisors were assigned to each hospital. One day training was offered for data collectors and supervisors on data collection methods and materials and pilot survey was conducted at Alert referral hospital from 10% of the actual sample size and took for about two consecutive days two weeks before the actual field activities. During the pilot survey, the data collection tools (questionnaires) were checked for

clarity and comprehensiveness. After the data collection, the principal investigators rechecked the correct fulfillment of the questionnaires.

Data processing and analysis

All questionnaires were checked for completeness and consistency, coded, entered into Epi-data (Version 4.6), and then exported to SPSS version 25 for statistical analysis. Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated. To analyze the association between dependent and independent variables, all predictor variables with a significant association in the bivariate analysis with a p-value< 0.25 at a 95 percent confidence interval were incorporated into the multivariate logistic regression model. The association between independent factors associated with uncontrolled hypertension was measured using odds ratios and crude ratios at 95 percent confidence intervals, and p-values were computed to verify the association between and among variables. Statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

Socio-demographic and Clinical characteristics of the study participant

From a total of 336 study participants, about 318 participated in the study with a response rate of 94.6%. The mean age of the study participants was 59.71 ±7.552 years, and as depicted in Table 1 below the majority of the participants 127 (39.9%) were between the ages of 52 and 61. Females involved More than half of the respondents 201(63.3%). The majority of the respondents 297(93.4%) were married. Approximately 117 (36.6%) of the study subjects had a family history of hypertension. Approximately 203 (63.2%) of the study participants had been on antihypertensive medication for less than five years, and 97 (30.5%) had been on it for five to 10 years. Co-morbidity was found in 61 (19.2%) of cases with diabetes mellitus, 37 (11.6%) cases were chronic kidney disease, and 28 (8.8%) cases were chronic heart disease.

Table 1: Socio-demographic characteristics variable of the study participants at public hospitals in Addis Ababa, Ethiopia: (n=318).

Variable	Categories	Frequency	Percent (%)
Age	Mean ±SD	59.71 ± (7.552 SD)	
	52-61	127	39.9
	62-71	120	37.7
	72-80	10	3.1
Sex	Male	117	36.8
	Female	201	63.2
Marital status	Single	12	3.8
	Married	297	93.4
	Separated	3	0.9
	Divorced	6	1.9
Educational	Can’t read and write	36	11.3

Level	Primary education	111	34.9
	Secondary (9-12)	96	30.2
	College and above	75	23.6
Residency	Urban	313	98.4
	Rural	5	1.6
Monthly income	<2000	66	20.9%
	2000	3	0.9%
	>2000	249	78.3%

Life style and behavioral characteristic of study participants

Three hundred (94.1%) of the study participants followed their treatment centers on a routine basis. As shown in Table 2 below, approximately 285(89.6%) of the study participants were taking two or fewer antihypertensive therapy/medication/AHT/ (AHT) drugs in combination. Among hundred thirteen (67%) of the study participants took their AHT drugs regularly. The majority of the study participants170 (53.5%) followed a low-salt diet for hypertension treatment. Of hundred twelve (66.7%) of the study participants adhered to physical exercise to manage hypertension, while 106 (33.3%) did not. Approximately 300 (94.1%) of those who took part in the study were non-smokers and 268 (84.3%) of the total study participants were abstinent from alcohol drinking.

Table 2: Life style and behavioral characteristic of the study participants at public hospitals in Addis Ababa, Ethiopia: (n=318).

Variable	Characteristics	Controlled BP	Uncontrolled BP	Percent (%)
Adherence to follow up	Adherent	162(50.97%)	153(48.13%)	315(99.1%)
	Non-Adherent	3(0.9%)	0	3(0.9%)
Number of AHT medication	≤2	159(49.98%)	126(39.59%)	285(89.6%)
	≥ 3	6(1.89%)	27(8.50%)	33(10.4%)
Medication Adherence	Adherent	130(40.89%)	83(26.11%)	213(67.0%)
	Non-Adherent	35(10.04%)	70(22.01%)	105(33%)
Adherence to low salt diet	Adherent	123(38.70%)	47(14.79%)	170(53.5%)
	Non-Adherent	42(13.2%)	106(33.3%)	148(46.5%)
Adherence to Physical activities	Adherent	69(21.7%)	37(11.6%)	106(33.3%)
	Non-Adherent	96(30.2%)	116(36.49%)	212(66.7%)
Adherence to Non smoking	Adherent	162(50.97%)	153(48.13%)	315(99.1%)
	Non-Adherent	3(0.8%)	1(0.1%)	3(0.9%)
Adherence to Alcohol abstinence	Adherent	156(49.07%)	112(35.23%)	268(84.3%)
	Non-Adherent	9(2.83%)	41(12.9%)	50(15.7%)
Adherence to weight management	Adherent	91(28.6%	28(8.8%)	119(37.4%)
	Non-Adherent	74(23.3%)	125(39.32%)	199(62.6%)

Characteristics of knowledge distribution of the study participants

Two hundred ninety-three (92.1%) of the study participants were knowledgeable about hypertension and 25(7.9%) were not knowledgeable about hypertension.

Factors associated with uncontrolled hypertension

Uncontrolled hypertension was observed in 48.1 percent of the study population. In a bivariate logistic regression analysis, nine variables were found to be significantly associated with Uncontrolled hypertension with 95% CI, p values of <0.25). In the multivariate logistic regression analysis, only six variables (advanced age, increased BMI, co-morbidity, non-adherence to alcohol abstinence, and non-adherence to weight management activities) were significantly associated with Uncontrolled hypertension at 95 percent CI (p <0.05). Ages above 62 years old were found to be 1.7 times more likely to have UHTN (Uncontrolled hypertension) as compared to those aged 50 and below (AOR 1.654, 95%CI: 1.137-2.406). As depicted in table 3 below, hypertensive patients who were obese were 4.7 times more likely to have UHTN as compared to those who were in normal body weight (AOR 4.656, 95% CI: 2.783-7.790). Hypertensive patients with a familial history of hypertension were 4.728 times more likely to have Uncontrolled hypertension as compared to those who had no familial history of hypertension (AOR, 4.728; 95% CI: 2.165-10.321). Hypertensive Patients with Comorbidity like DM are 1.8 times more likely to develop Uncontrolled hypertension as compared to those who had no co-morbidity (AOR 1.78 95% CI:1.412-2.414).). Hypertensive patients who were not non-adherent to alcohol abstinence were 2.5 times more likely to have UHTN as compared to those who were adherent to alcohol abstinence (AOR 2.482, 95% CI 1.329-4.637).

Table 3: Factors associated with Uncontrolled hypertension at public hospitals in Addis Ababa, Ethiopia: (n=318).

Variables		Characteristics		COR (95%CI)	P-Values	AOR (95%CI)	P-Values
		CHTN	UHTN				
Age	42-51	43	16	1			
	52-61	51	68	3.583(1.817-7.067)	0.001*		
	62-71	60	65	2.481(1.266-4.861)	0.008*	1.654(1.137-2.406)	0.009**
	72-80	8	12	4.031(1.005-10.173)	0.049*		
BMI	Normal	141	65	1			
	Overweight	34	54	7.5(6.032-10.797)	<0.001*		
	Obese	10	14	3.037(1.281-7.199)	0.012*	4.656(2.783-7.790)	<0.001**
Familial History of hypertension	No	72	45	1			
	Yes	93	108	1.858(1.168-2.956)	0.009*	4.728 (2.165-10.321)	0.000
Co-morbidity	No	124	68	1			
	DM	15	46	5.592(2.909-10.750)	<0.001*	1.763(1.412-2.414)	0.009**
	CKD	16	21	2.393(1.171-4.890)	0.017*		
	CHD	10	18	3.282(1.435-7.510)	0.005*		
Adherence to Low salt diet	Adherent	123	47	1			
	Non adherent	42	106	1.512(1.193-4.1247)	<0.001*	1.112(1.045-2.273)	<0.001**
Adherence Exercise	Adherent	69	37	1			
	Non adherent	90	122	3.297(2.741-7.192)	<0.001*		
Adherence to Alcohol Abstinence	Adherent	156	112	1			
	Non adherent	9	41	6.345(2.964-13.568)	<0.001*	2.482(1.329-4.637)	0.004**
Adherence to weight management activities	Adherent	91	28	1			
	Non adherent	74	125	1.823(1.091-3.045)	<0.001*	1.246(1.112-2.462)	<0.001**
AHT Medication un availability	Yes	37	59	1			
	No	128	94	1.161(1.1282-752)	0.002*		

Note: "*" Variables with P-value<0.25, "**" variables with p value <0.05, P- value =0.000 considered as P<0.001, "**AOR**" adjusted odds ratio, "**BMI**" body mass index, "**CI**" confidence interval, "CHTN" controlled hypertension "**COR**" crude odds ratio, "**1**" reference category, "**UHTN**" uncontrolled hypertension.

DISCUSSION

Exploring the risk factors of uncontrolled hypertension is fundamental for the prevention of morbidity and mortality in patients with hypertension. In contrast, uncontrolled hypertension is a major cause of stroke, ischemic heart disease, peripheral arterial disease, congestive heart failure, and death. In Ethiopia, there are few studies on factors associated with uncontrolled hypertension. Therefore, this study aimed to determine the prevalence of uncontrolled hypertension about various contributing factors among patients with hypertension during follow-up in selected public Hospitals in Addis Ababa City.

A recent study result discovered that the prevalence of uncontrolled hypertension is among a major public health problem, and nearly half (48.1%) of hypertensive patients who participated in the study had uncontrolled hypertension. This finding is lower than the studies carried out in China (55.4%), Thailand (54.4%), Florida (66.7%), and Addis Ababa Zewditu Memorial Hospital (66.9%) [12, 20-22]. This discrepancy might be due to higher rates of medication adherence, good knowledge of hypertension control practices, and a lower magnitude of co-morbidity. Conversely, the findings are higher than those studies conducted in Sudan (34%), Debra Tabor Referral Hospital (11.4%), and northwestern Ethiopia [11, 23]. This discrepancy might be due to the lower rates of medication adherence, higher rates of co-morbidity, and differences in the healthcare delivery system.

The current study revealed that patient age was significantly associated with uncontrolled hypertension, and patients aged > 50 years were 1.7 times more likely to have uncontrolled hypertension than those aged 50 years and below.

In this study, patients with hypertension and DM were 1.8 times more associated to have uncontrolled hypertension than patients without DM. This is in line with a study by Florida and Tigray [18,8]. This might be because different types of diseases can be risk factors for hypertension, which might be difficult to control.

Furthermore, this study reported that hypertensive patients who were non-adherent to dietary salt restriction and alcohol abstinence (2.5 times) were less likely to have controlled hypertension than those who were adherent to them. This result is comparable to those reported by Jimma and Gonder [10, 11]. This might be because known dietary factors like salt restriction and alcohol abstinence are recommended as a treatment for hypertension that was grouped under lifestyle modification treatment modalities [24, 26]. Non-adherence to these recommendations can be a risk factor for uncontrolled hypertension.

Strength and Limitation of the study

Strength of the study

- Data collection from multiple Hospitals: Involving selected public hospitals enhances the generalizability of the findings within the healthcare system of the region.
- Ethical Rigor: The study likely emphasizes informed consent and ethical considerations, ensuring the rights and well-being of participants are prioritized.
- It contribution to Public Health Knowledge as the results can help raise awareness of the burden of uncontrolled hypertension and inform future research and health initiatives and the study aims to uncover various factors contributing to uncontrolled hypertension, which can inform targeted interventions and public health strategies.

Limitation of the study

The study was conducted in only three public hospitals in Addis Ababa City, and the small sample size may affect the generalizability of the study. In addition, the cross-sectional study design did not illustrate the cause and outcome (effect) between the dependent and predictor variables. Therefore, large-scale studies are required in the future.

CONCLUSION

The current study revealed that the prevalence of uncontrolled hypertension among adult hypertensive patients was high (48.1%), and advanced age, Comorbidity, increased BMI, non-adherent to salt restriction, non-adherent to alcohol abstinence, and non-adherent to weight management activities were significantly associated with uncontrolled hypertension. Therefore, the Ethiopian Ministry of Health, health professionals, and managers of health care institutions should emphasize educating hypertensive clients about lifestyle modifications to control hypertension, such as exercise, alcohol abstinence, dietary salt restriction, weight management abstaining from smoking, and maintaining normal body weight, consequently preventing the occurrence of end-organ damage and loss of life as a result of uncontrolled hypertension. In addition, promoting the use of standard guidelines for the early identification and monitoring of patients with hypertension and management of comorbidities among hypertensive patients are important aspects of controlling hypertension.

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ABBREVIATIONS

AHT: anti-hypertension/medication/therapy; AOR, adjusted odds ratio; CHF, congestive heart failure; CHTN, controlled hypertension. CKD: chronic kidney disease; COR: crude

odds ratio; CVD: cardiovascular disease; DASH: Dietary Approaches to Stop Hypertension; DBP: diastolic blood pressure; DM, diabetes mellitus; ETB, Ethiopian birr; HTN, hypertension; MGLS4: four items Morisky Green Levine Scale, SBP: Systolic Blood pressure; UHTN, uncontrolled Hypertension, RX: treatment

DECLARATIONS

Ethics approval and consent to participate

Written ethical clearance was obtained using the protocol number (ref. Number):46/SNM/14 from the Institutional Review Board (IRB) of Addis Ababa University (AAU), College of Health Sciences, School of Nursing and Midwifery. Written permission was obtained from TASH, Yekatit-12 Hospital Medical College, and Zewditu Memorial Hospital. After providing a detailed explanation of the aim, procedure, potential risks, benefits, and participants' rights. Informed consent was obtained from all the study participants including illiterate and/ or their legal guardian (s). To respect the participants' dignity and maintain appropriate precautions against covid 19 the interview was conducted in a ventilated, lighted, clean, and quiet room attached to the unit. Confidentiality of information was maintained; no unauthorized person had access to the information and names or other identifiers were not recorded. The study was performed in accordance with the Declaration of Helsinki guidelines and regulations.

Consent for publication: applicable.

Availability of data and materials

All the important data have been incorporated into the manuscript. If necessary, the corresponding author was contacted to obtain additional documents.

Competing interests

This thesis is submitted as a partial achievement of the requirement for an MSc degree from the School of Postgraduate Studies at Addis Ababa University. This thesis has been deposited in the Library of Addis Ababa University and is made available to the user under the rules of the library. The authors declare that they have no conflicts of interest.

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Authors' Contributions

This study is the result of joint research, and the contribution of each author is comparable to the others. The roles of each author are as follows:

Muhaba Reshid: Conception, Design, Materials, Data Collection, data analysis, Literature **Review and Writing.**

Wudma Alemu: Design, Supervision, Data Processing, Interpretation and Critical Review.

Teshome Habte: Supervision, Data Analysis and Interpretation, Writing and Critical Review.

Zeleke Argaw: Conception, Design, Supervision, Writing and Critical Review

Finally, all authors read/reviewed and approved the final manuscript.

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