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Blood pressure control practice and determinants among ambulatory hypertensive patients attending primary health care facilities in Addis Ababa

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Abstract

Background: Hypertension is the major risk factor for cardiovascular diseases related morbidity and mortality. Blood pressure is often not adequately controlled in clinical practice. Information regarding blood pressure control in primary care settings is limited in Ethiopia.

Objectives: This study aimed to assess blood pressure control practice and determinates among hypertensive patients attending primary health care facilities in Addis Ababa.

Methods: A cross-sectional study was conducted on 616 hypertension patients in 12 health centers in Addis Ababa city. Data were collected by interviewing patients and reviewing their medical records. Data were collected from 3 August to 30 October 2015.

Results: A complete information was obtained from 616 patients' medical records, and patients were then interviewed. The mean age was 58.90 (SD ± 13.04) years, and most of them (n = 321, 52.1%) were 60 years old or above, and more than three-fourth (n = 485) were on monotherapy. Methyldopa was the most monotherapy medication prescribed, 128 (20.8%). Only 31% (n = 191) of the patients had controlled blood pressure. Determinants for poor blood pressure control were age less than 60 years (adjusted odds ratio (AOR) = 3.06, 95% confidence interval (CI): 1.96, 4.78); work status: government employee (AOR = 2.41, 95% CI: 1.18, 4.90), retired (AOR = 1.79, 95% CI: 1.01, 3.18), and private business (AOR = 2.09, 95% CI: 1.17, 3.74); and being hypertensive for 10 or more years (AOR = 1.96, 95% CI: 1.11, 3.43). Significant predictors of achieving controlled blood pressure were weekly blood pressure measurement practice (AOR = 0.57, 95% CI: 0.36, 0.90) and tertiary-level education (AOR = 0.26, 95% CI: 0.13, 0.54).

Conclusions: Only one-third of the patients had controlled blood pressure. Efforts should be made to address identified determinants including age, regular blood pressure monitoring practice, and level of education.

Keywords

Blood pressure control, hypertension, primary health care

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Introduction

Hypertension is a significant contributor to the global burden of disease and mortality.[1] An estimated 1.13 billion (14.7%) people worldwide have hypertension[2] and the proportion is estimated to rise to over 29% by 2025.[3] Hypertension prevalence was reported highest in Africa (30%) in 2014 and ranged from 25% to 41% in sub-Saharan Africa.[4] The consequences of poor blood pressure (BP) control are known to cause human suffering and impose severe financial and service burdens on health systems.[1,5,6] In Ethiopia, non-communicable diseases are estimated to account 30% of total annual deaths, of which

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9% is attributed to cardiovascular diseases (CVD).[4] A 24% death rate from CVD was also reported in Addis Ababa.[7] The reported prevalence of hypertension in different regions of Ethiopia varied widely[8–12] and the prevalence in the country is estimated to be between 20% and 30%.[13,14]

Hypertension management involves pharmacological and non-pharmacological interventions.[6,15] Despite hypertension being the major risk factor for CVD, it remains inadequately managed, and BP is often not adequately controlled in clinical practice.[16,17] This is pronounced in developing countries including Ethiopia. Most Ethiopian populations receive medical care in primary health care facilities. Health centers (HCs) are the main primary health care providing facilities in Addis Ababa, the capital of Ethiopia. HCs are staffed mainly with health officers and nurses for the provision of medical care, unlike hospitals where physicians take the primary role.[18] HCs provide outpatient services for patients with hypertension in Addis Ababa. Hypertension-related studies in Ethiopia are mainly focused on the prevalence and conducted in hospital setups. There is limited data on hypertension management at primary health care facilities. Therefore, this study had two objectives: (1) determine the level of BP control among hypertensive patients on medication(s); and (2) to identify potential determinants of uncontrolled BP at primary health care facilities in Addis Ababa, Ethiopia. Addis Ababa had an estimated population of four million in the year 2019, with an annual growth rate of 3.8%.[19] The city has 10 sub-cities. According to the Ethiopian health care tier, one HC serves 15,000–25,000 population.[20]

Methods

Study design

An institution-based cross-sectional study was conducted in 12 HCs of Addis Ababa located in four sub-cities, namely, Gulelle, Lideta, Nifasilk-Lafto, and Akaki-Kaliti from 3 August to 30 October 2015.

Sample size and sampling technique

The HCs were selected by multistage sampling technique considering the 10 sub-cities of Addis Ababa as geographical clusters and hence as a primary sampling unit. The HCs in the selected four sub-cities were considered as a secondary sampling unit. Simple random sampling was used to select the sub-cities and HCs.

The sample size was calculated using the formula of a single population proportion with a finite population correction as follows

$$n = \frac{Nz^2 pq}{d^2\left(N-1\right)+\mathrm{z}^2\ pq}$$

To calculate the sample size, (n):1.96 was substituted for Z which is the standard normal value at 95% confidence level, p which is the proportion of controlled BP was taken as 50%, the value of q was taken as $1-p$, d which is the margin of error was taken as 0.05, and 1155 was substituted for N which was the number of hypertensive patients at the HCs. Finally, 2 for the design effect multiplied the sample size calculated according to the above formula, and an addition of 10% non-response brought the final sample size to 634. The sample size at each HC was allocated using probability proportional to the total number of hypertensive patients on medication at specific HC. Study participants from each HC were selected by systematic random sampling.

Ethics approval

Ethical clearance was obtained from the Ethics Review Committee of the School of Pharmacy, Addis Ababa University (ERB/SOP/53/04/2015), and Health Bureau Institutional Review Board of Addis Ababa City Administration (AAHB/7023/227). A support letter was obtained from the Health Bureau to the included sub-cities health offices. A support letter was written from the four sub-cities health offices to HCs residing in each sub-city. Permission was obtained from each HC medical director to conduct the study. The benefits and risks of the study were explained to each participant included in the study, and oral informed consent was obtained from each patient involved in the study. To ensure confidentiality, name and other identifiers of patients and health care professionals were not recorded on the data collection tools.

Data collection procedure

Participants were asked for their consent and verified for inclusion. The inclusion criteria for the study were hypertensive patients attending the outpatient departments of selected HCs with age of 18 years or above, on medication for hypertension at least for 6 months at the selected HC. Data were collected by patient interview and medical record review. A record review was done to obtain three BP readings from three consecutive visits. A data abstraction format was used to record data regarding comorbid condition/s, BP measurements, and type(s) of antihypertensive medication(s) from the patient's medical record. Patients were interviewed after the review of their medical record to obtain socio-demographic, disease, lifestyle, and drug-related information. Height, weight, and waist circumference were measured on the day of the interview (Supplemental material). The data were collected by a nurse. To ensure the quality of data, a pre-test was done on 5% of the total sample at one HC.

Data analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics were used to summarize study variables and evaluate the distribution of responses. The level of BP control was assessed

by using the average of three BP records obtained from three different visits. Logistic regression was used to identify potential determinant variables for the outcome measure (uncontrolled BP). A variable with $p < 0.25$ in the bivariable analysis (presented as crude odds ratio (COR) at 95% CI) was included in multivariable logistic regression analysis (presented as adjusted odds ratio (AOR) at 95% confidence interval (CI)). A variable was considered to be significant for a p-value of less than 0.05 at 95% CI. Controlled BP was defined based on the joint national committee (JNC) 8 guideline[21] as BP < 150/90 mmHg in hypertensive patients aged 60 or older, or BP < 140/90 mmHg in hypertensive patients aged less than 60 years and all ages of hypertensive patients with diabetes or chronic kidney disease (CKD). Sensitivity analysis was done by using a cutoff point of BP < 130/80 mmHg for those with diabetes and CKD and BP < 140/90 mmHg for others. Body mass index was calculated as weight over height per meter square and classified as underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), and obese (⩾30 kg/m^2). Central obesity was defined as waist circumference >102cm for men and >88 cm for women. A patient was described as physically active if he or she performs physical activity at least 30 min per day for at least 5 days per week. Persons who smoke at the time of data collection and who stopped smoking in less than a year were considered a current smoker.

Results

Overall, 634 participants were included in this study with a response rate of 616 (97%). The number of participants per HC was as follows: Selam HC (149), Shegole HC (35), Shiro meda HC (34), Guto Meda HC (33), Lideta HC (109), Teklehaymanot HC (20), Wereda 03 HC (80), Wereda 09 HC (39), Wereda 06 HC (33), Wereda 12 HC (30), Kaliti HC (26), and Gelan HC (28). Most study participants were females 346 (56.2%). The mean age of the respondents was 58.9 (SD = 13.0) years and the majority 321 (52.1%) were with the age of 60 or above. Majority 419 (68.0%) were married, 213 (34.6%) had no formal education, and 200 (32.5%) were housewives. Of all the study participants, 368 (59.7%) had normal body weight and 196 (31.8%) were overweight. The measurement of waist circumference showed that 202 (58.4 %) of females and 53 (19.6 %) of male participants had abdominal obesity. Nearly one-third (n = 198) of patients had a family history of hypertension and 559 (90.7%) had a monthly follow-up at the HC. Only four (0.6%) measured their BP every day. Only one-fifth (n = 122) had comorbid illnesses, among which 98 (15.9%) were diabetic. There were no pregnant patients and patients with CKD. The mean duration of time (year) since the diagnosis of hypertension was 5.59 ± 5.77. The mean duration of drug therapy for hypertension was 4.6 (SD = 4.9) years with a range of 0.5–40. Two-third of the patients (n = 417) have been taking antihypertensive therapy for less than 5 years, and nearly half of them obtain their medications for free 294 (47.7%). Among the study participants, 209 (33.9%) reported the experience of at least one side effect from the medication/s (Table 1).

Among the participants, very few (six) reported being a current smoker, and 75 participants reported the use of alcohol. Concerning physical exercise, 185 (30.0%) participants reported to perform a physical exercise among whom 88 (14.3%) were physically active. Above three-fourth of the participants reported reducing salt in their diet.

The overall utilization of antihypertensive drugs by pharmacologic category showed thiazide diuretics to be the most commonly prescribed 225 (36.5%) followed by angiotensin-converting enzyme inhibitors (ACEIs) 180 (29.2%) and calcium channel blockers (CCBs) 159 (25.8%). Nearly 80% of patients were on monotherapy (n = 486) and alpha two agonist (methyldopa) was the most common monotherapy medication used 128 (20.8 %). For multiple drug therapy, thiazide and ACEI were the most common combination drugs used 46 (7.5%). The treatment regimen of 523 (84.9%) patients was not modified at their latest visit. More than one-third of the study participants had a controlled systolic blood pressure (SBP), while half had controlled diastolic blood pressure (DBP). Based on JNC 8, the overall control of BP was achieved in one-third (n = 191) of the study participants (Table 2). In our sensitivity analysis, the level of BP control was only 19% (n = 117) when target BP for diabetic and/or patients with CKD s was BP < 130/80 mmHg and <140/90 for the remaining patients. On the other hand, when a cutoff point of <140/90 mmHg was used for all the study participants, only 24% (n = 148) of patients had controlled BP.

In multivariable logistic regression analysis, significant determinants for having uncontrolled BP were age < 60 years (AOR = 3.06, 95% CI: 1.96, 4.78, $p < 0.001$) compared with those with age ⩾ 60 years and duration of hypertension diagnosis of 10 years or longer (AOR = 1.96, 95% CI: 1.11, 3.43, P = 0.02) compared with those with a diagnosis of less than 5 years. On the other hand, tertiary-level education (AOR = 0.26, 95% CI: 0.13, 0.54, $p < 0.001$) compared with those with no formal education and weekly BP measurement (AOR = 0.57, 95% CI: 0.36, 0.90, p = 0.02) compared with monthly measurement were found to be predictors to achieve controlled BP (Table 3).

Discussions

The result of the study showed that only one-third of hypertensive patients on pharmacologic treatment had a controlled BP (31%). Inadequate control of BP appears to be a prevalent problem challenging the primary care in Addis Ababa. The level of BP control found in this study (31%) is lower than obtained from HC-based studies from Chile (59.7%),[22] Oman (39%),[23] Greece (55.6%),[24] the United States (49.8 %),[25] and South Africa (57%).[26] This difference in the level of BP control might be due to a more goal-oriented strategy in the treatment of hypertension, as the use of combination

Table 1. Socio-demographic, anthropometric, and clinical characteristics of hypertensive patients attending health centers of Addis Ababa, 2015.

Variable	Frequency (%)
Sex	
Female	346 (56.2)
Male	270 (43.8)
Age	
<60 years	295 (47.9)
⩾60 years	321 (52.1)
Marital status	
Married	419 (68.0)
Widowed	120 (19.5)
Divorced	46 (7.5)
Single	31 (5.0)
Educational status	
No formal education	213 (34.6)
Primary education	209 (33.9)
Secondary education	110 (17.9)
College/university	84 (13.6)
Work status	
House wife	200 (32.5)
Private business	144 (23.4)
Retired	123 (19.9)
Government employee	95 (15.4)
Unemployed	33 (5.4)
Others[a]	21 (3.4)
Body mass index	
Under weight	14 (2.3)
Normal weight	368 (59.7)
Over weight	196 (31.8)
Obese	38 (6.2)
Waist circumference	
Female	
<88 cm	144 (41.6)
⩾88 cm	202 (58.4)
Male	
<102 cm	217 (80.4)
⩾102 cm	53 (19.6)
Family history of hypertension	
Yes	198 (32.1)
No	418 (67.9)
Duration of hypertension diagnosis	
<5 years	368 (59.7)
5–10 years	141 (22.9)
⩾10 years	107 (17.4)
Frequency of follow-up	
Weekly	4 (0.6)
Every 2 weeks	33 (5.4)
Monthly	559 (90.8)
Every 2 months	16 (2.6)
Others[b]	4 (0.6)
Frequency of BP measurement	
Monthly	304 (49.4)
Weekly	150 (24.4)
Every 2 weeks	135 (21.9)
When feeling ill	16 (2.6)
Every day	4 (0.6)
Others[c]	7 (1.1)
Comorbid conditions	
Diabetes mellitus	98 (15.9)
Asthma	6 (1.0)
CVD	5 (0.8)
HIV/AIDS	3 (0.5)
Others[d]	10 (1.6)
Duration of therapy	
<5 years	417 (67.7)
5–10 years	125 (20.3)
⩾10 years	74 (12)
Source of medication/s	
Free of charge	294 (47.7)
By sponsorship	44 (7.2)
Self-sponsored	278 (45.1)
Side effect	
Yes	209 (33.9)
No	407 (66.1)
Side effects	
Headache	103 (16.7)
Weakness	92 (14.9)
Dry mouth	38 (6.2)
Postural hypotension	37 (6.0)
Gastrointestinal complaint	7 (1.1)
Erectile dysfunction	5 (0.8)
Others[a]	21 (3.4)

BP: blood pressure; CVD: cardiovascular diseases; HIV: human immune virus; AIDS: acquired immune deficiency syndrome.
[a]Daily laborer, farmer, construction, guard.
[b]Every 3 months.
[c]Twice weekly, every 2 months.
[d]Musculoskeletal disease, gout, migraine.

antihypertensive agents was common in most of the studies. In addition, the difference in the expertise of health professionals involved in the management of hypertension might have contributed to the discrepancy. Moreover, in three of the studies, hypertensive patients on lifestyle modifications who were not on antihypertensive drugs were included[22,25,27] which could have contributed to better control of BP than our study.

The level of BP control in this study was similar to the result obtained from hospital-based studies conducted in Zimbabwe (32.8 %),[28] Kenya (33.4%),[29] and Nigeria (35.0%).[30] This similarity in the level of BP control might be a result of the similarity in the inclusion criteria of the studies as only hypertensive patients on pharmacologic therapy were included in the studies similar to the present study. On the contrary, a study conducted in the United States at a different level of the health system showed 60% of treated hypertensive people to have a controlled BP[31] and

Table 2. Drug therapy, treatment modification, and blood pressure control among hypertensive patients attending health centers of Addis Ababa, 2015.

Drugs	Frequency (%)
Monotherapy	485 (78.7)
Methyldopa	128 (20.8)
Enalapril	123 (20.0)
Hydrochlorthiazide	108 (17.5)
Nifedepine	108 (17.5)
Amlodipine	1 (0.2)
Atenolol	13 (2.1)
Propranolol	4 (0.6)
Two drugs combinations	125 (20.3)
Hydrochlorthiazide + Enalapril	45 (7.3)
Hydrochlorthiazide + Nifedepine	42 (6.8)
Hydrochlorthiazide + Atenolol	13 (2.1)
Hydrochlorthiazide + Propranolol	3 (0.5)
Hydrochlorthiazide + Methyldopa	9 (1.5)
Enalapril + Nifedepine	1 (0.2)
Enalapril + Atenolol	1 (0.2)
Enalapril + Propranolol	2 (0.3)
Enalapril + Methyldopa	2 (0.3)
Nifedepine + Methyldopa	3 (0.5)
Atenolol + Methyldopa	1 (0.2)
Atenolol + Amlodipine	3 (0.5)
Three drugs combinations	6 (1.0)
Hydrochlorthiazide + Enalapril + Atenolol	4 (0.6)
Enalapril + Nifedepine + Atenolol	1 (0.2)
Hydrochlorthiazide + Enalapril + Methyldopa	1 (0.2)
Treatment modification	
No modification	523 (84.9)
Switch to another drug	62 (10.1)
Addition of drug	19 (3.1)
Increase in dose	3 (0.5)
Decrease in dose	1 (0.2)
Deletion of drug	2 (0.3)
Increase in frequency	1 (0.2)
Decrease in frequency	5 (0.8)
Control of BP	
Uncontrolled SBP	359 (58.3)
Uncontrolled DBP	297 (48.2)
Uncontrolled BP	425 (69)

BP: blood pressure; SBP: systolic blood pressure; DBP: diastolic blood pressure.

hospital-based studies from Adama, Ethiopia, and Nigeria showed a BP control level of 43.6%[32] and 42%,[33] respectively. This difference in level of BP control might have resulted from the frequent use of combination antihypertensive therapy in hospitals as patients attending hospitals have associated comorbidities.

The proportion of patients with controlled SBP and DBP was almost similar from a study in Saudi Arabia (40.4% and 51.6%)[34] but lower than a study in the United States (55.7% and 77.1%).[27] This difference in the level of control of SBP and DBP might be due to age-related increase in SBP as a large proportion of study participants (52.1%) were older than 60 years of age.[35,36] More importantly, the level of health care in the United States is expected to be better than in Ethiopia in terms of resources and human skill.

In the study, age younger than 60 years was a contributing factor for poor BP control. A similar result was obtained from a study in Brazil.[37] On the other hand, the result of other studies showed that patients aged younger than 60 years were more likely to have controlled BP than older patients.[27,29] Better BP control among the elderly in this study may be because of an increased prevalence of comorbidities hence a high probability of intensive treatment and/or a better rate of adherence. In addition, health professionals could have shown more concern in counseling and ordering appropriate management for elders.

Consistent with our findings, a study in Chile at HC set up showed a low education level to have a negative association with BP control.[22] This is most likely associated with the level of awareness of hypertension and adherence to lifestyle modifications to decrease BP. In addition, government employees, retirees, and patients on private businesses were more likely to have uncontrolled BP than housewives. This might have resulted because of forgetfulness and hence non-adherence to antihypertensive medications.

In our study, being hypertensive for a longer period ($\geqslant$10 years) was found to be a significant predictor for not achieving target BP. This could be due to asymptomatic nature of the disease, a decrease in health-seeking behavior from patients and clinical inertia.[38]

More frequent BP monitoring is one of the essential factors to achieve target BP.[6,16] We found weekly BP measurement to be a significant predictor to have controlled BP. Encouraging home-based BP measurement is one of the ideal interventions that may increase patients' health-seeking behavior, adjustment of lifestyle, and adherence to their medication.

The antihypertensive medication utilization pattern in this study was more similar to a study conducted in South Africa.[26] However, a study conducted in Chile[20] and the United States[25] used ACEI more often than diuretics. This frequent use of ACEI over diuretic might be a result of a large proportion of diabetic and CKD patients included in Chile and US studies. An additional factor that might have contributed to this discrepancy is race.[6,21] The frequent use of methyldopa in this study might have resulted from gaps in knowledge among health professionals involved in the management of hypertension in the HCs, lack of other optional drugs or lack of standard treatment guideline to control prescribing practice at the HCs.

Most (80%) of our study participants were prescribed a single antihypertensive agent. This was similar to a study conducted in Zimbabwe (70%).[28] However, different results were reported on studies from Chile (34%)[22] and the United States (29%).[27] The high prevalence of antihypertensive

Table 3. Determinants of uncontrolled BP among hypertensive patients attending health centers of Addis Ababa, 2015.

Variable	Blood pressure control		COR (95% CI)	AOR (95% CI)
	Uncontrolled (%)	Controlled (%)		
Age category				
⩾60 years	191 (31.0)	130 (21.1)	1.00	1.00
<60 years	234 (38.0)	61 (9.9)	2.61 (1.82, 3.74)	3.06 (1.96, 4.78)[a]
Marital status				
Married	297 (48.2)	122 (19.8)	1.00	1.00
Single	24 (3.9)	7 (1.1)	1.41 (0.59, 3.36)	1.56 (0.59, 4.12)
Divorced	31 (5.0)	15 (2.4)	0.85 (0.44, 1.63)	0.93 (0.45, 1.93)
Widowed	73 (11.9)	47 (7.6)	0.64 (0.42, 0.98)	0.75 (0.45, 1.24)
Education level				
No formal education	143 (23.2)	70 (11.4)	1.00	1.00
Primary education	149 (24.2)	60 (9.7)	1.22 (0.80,1.84)	0.82 (0.51, 1.32)
Secondary education	83 (13.5)	27 (4.4)	1.51 (0.89,2.53)	0.70 (0.36, 1.35)
College/university	50 (8.1)	34 (5.5)	0.72 (0.43, 1.21)	0.26 (0.13, 0.54)[a]
Frequency of BP measurement				
Monthly	220 (35.7)	84 (13.6)	1.00	1.00
Every day	2 (0.3)	2 (0.3)	0.38 (0.05, 2.75)	0.56 (0.06, 5.01)
Weekly	87 (14.1)	63 (10.2)	0.53 (0.35, 0.79)	0.57 (0.36, 0.90)[a]
Every 2 weeks	99 (16.1)	36 (5.8)	1.05 (0.67, 1.66)	1.13 (0.69, 1.86)
When feeling ill	13 (2.1)	3 (0.5)	1.66 (0.46, 5.95)	1.34 (0.35, 5.14)
Others	4 (0.6)	3 (0.5)	0.51 (0.11, 2.32)	0.41 (0.08, 2.06)
Work status				
House wife	124 (20.1)	76 (12.3)	1.00	1.00
Private business	110 (17.9)	34 (5.5)	1.98 (1.23, 3.20)	2.09 (1.17, 3.74)[a]
Retired	83 (13.5)	40 (6.5)	1.27 (0.79, 2.04)	1.79 (1.01, 3.18)[a]
Government employee	73 (11.9)	22 (3.6)	2.03 (1.17, 3.55)	2.41 (1.18, 4.90)[a]
Unemployed	24 (3.9)	9 (1.5)	1.63 (0.72, 3.70)	1.81 (0.75, 4.41)
Others	11 (1.8)	10 (1.6)	0.67 (0.27, 1.66)	0.70 (0.26, 1.90)
Duration of diagnosis				
<5 years	249 (40.4)	119 (19.3)	1.00	1.00
5–10 years	94 (15.3)	47 (7.6)	0.96 (0.63, 1.44)	1.06 (0.65, 1.71)
⩾10 years	82 (13.3)	25 (4.1)	1.57 (0.95, 2.58)	1.96 (1.11, 3.43)[a]
Source of medication/s				
Free of charge	194 (31.5)	100 (16.2)	1.00	1.00
By sponsorship	27 (4.4)	17 (2.8)	0.82 (0.43, 1.57)	0.96 (0.45, 2.05)
Self-sponsored	204 (33.1)	74 (12.0)	1.42 (0.99, 2.04)	1.35 (0.88, 2.06)
Drug group				
Thiazides	70 (11.4)	38 (6.2)	1.00	1.00
ACEI	87 (14.1)	36 (5.8)	1.31 (0.75, 2.28)	1.20 (0.66, 2.20)
CCB	72 (11.7)	37 (6.0)	1.06 (0.60, 1.85)	1.07 (0.58, 1.96)
β-blockers	7 (1.1)	10 (1.6)	0.38 (0.13, 1.08)	0.35 (0.11, 1.13)
Alpha 2 agonist	100 (16.2)	28 (4.5)	1.94 (1.09, 3.45)[a]	1.78 (0.94, 3.39)
Thiazide + ACEI	35 (5.7)	11 (1.8)	1.73 (0.79, 3.78)	1.52 (0.65, 3.56)
Thiazide + CCB	24 (3.9)	18 (2.9)	0.72 (0.35, 1.49)	0.85 (0.38, 1.91)
Thiazide + β-blockers	10 (1.6)	6 (1.0)	0.91 (0.31, 2.68)	0.81 (0.25, 2.57)
Other combination	20 (3.2)	7 (1.1)	1.55 (0.60, 3.99)	0.52, 4.10)

BP: blood pressure; COR: crude odds ratio; CI: confidence interval; AOR: adjusted odds ratio; ACEI: angiotensin-converting enzyme inhibitor; CCB: calcium channel blocker.
[a]Statistically significant.

monotherapy in the presence of uncontrolled BP should be a concern. To achieve optimal BP level, the use of multiple antihypertensive agents is recommended.[6,15–17,21,39] A study also showed the benefit of using multiple antihypertensive agents to achieve optimal BP control.[22] The prevalent use of monotherapy might have resulted from a lack of drug

availability at the health facilities and unaffordability of drugs by patients.[28]

Switching to another drug and the addition of a drug were the leading type of treatment modifications. This might be because most of the present study participants had uncontrolled BP.[40] The treatment modification was low when compared with a study by Banegas et al.,[41] which reported treatment modification in 49% of hypertensive patients from which the addition of a drug and increasing dose were observed more frequently. This discrepancy might be a result of the frequent use of combination antihypertensive therapy for hypertension in the later study and clinical inertia in the present study.

Almost all patients did not smoke, which might be a result of the Ethiopian socio-cultural influence. More than one-third of the study participants were overweight or obese and one-fifth of the female, as well as two-third of the male participants had abdominal obesity. This result is different from the result of the study by Tesfaye and Wall[8] conducted in Addis Ababa which showed 20% of males and 38% of females to have a BMI of $\geqslant$25 kg/m^2 and 12.9% of males and 64.6% of females to have abdominal obesity. This difference might be a result of the difference in the age of the participants; predominance of elderly patients in the present study; the difference in the characteristics of the study population; inclusion of patients without a diagnosis of hypertension in the latter study; or a change in the lifestyle of the population of Addis Ababa. Since high BMI and increased abdominal circumference are risk factors for hypertension and uncontrolled BP among hypertensives, emphasis should be given to counsel patients on the importance of implementing lifestyle modifications.

Limitation of the study

The study has extensively addressed all relevant data regarding BP control and the determinants among treated hypertensive patients in HCs of Addis Ababa. However, there are certain limitations to mention. BP readings were taken from patients' medical records; hence, no information was available on how BP was measured. A cross-sectional study design was used, which does not allow a temporal relationship to be established. Since only public HCs of Addis Ababa were included, caution should be exercised in extrapolating the results to all HCs of Addis Ababa.

Conclusion

BP control to target goal was suboptimal and achieved only in one-third of pharmacologically treated patients attending HCs of Addis Ababa. The frequently used antihypertensive drug classes were found to be thiazide diuretics, ACEIs, CCBs, alpha 2 agonist and β-blockers. The majority of the patients were on monotherapy. Alpha 2 agonist was the frequently used monotherapy while the combination of thiazide and ACEIs was the commonest combination therapy. Switching to another drug was the most common type of treatment modification. Age younger than 60 years, work status (being a government employee, a retired and in private business), and hypertension diagnosis of $\geqslant$10 years were identified factors for poor BP control. While weekly BP measurement and tertiary level of education were important contributing factors that facilitate achieving target BP. This implies the need for closer monitoring of hypertensive patients attending the primary health care center. More emphasis should be given on identified determinants including age-based care, consider the patient level of awareness, and encourage patients to have more often BP monitoring practice, especially older patients with a prolonged history of hypertension. In addition, in light of new evidence showing the benefit of tighter BP control to reduce CVD morbidity and mortality associated with hypertension, the BP control practice in HCs of Addis Ababa should be frequently evaluated.

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Author contributions

FA, TN, and DFB conceived the study and drafted the proposal. All authors had a substantial contribution to the study design and development of data collection checklist. All authors were also involved in data acquisition, analysis, interpretation, and write up. FA drafted the manuscript; TN and DFB revised the manuscript and prepared the final version for publication. All authors read and approved the final version of the manuscript.

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Availability of data and materials

All the data used for the study are contained within the manuscript.

Supplemental material

Supplemental material for this article is available online.

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