Research Article

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Uncontrolled Hypertension and Associated Factors among Adult Hypertensive Patients in Public Hospitals of Central Zone, Tigray, Ethiopia, 2018: A Cross-Sectional Study

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Abstract

Background

Hypertension is a silent killer disease and it is an important worldwide public health challenge because of its high frequency and a risk factor for cerebrovascular, cardiovascular, and kidney disease. This study aimed to assess the magnitude of uncontrolled hypertension and associated factors among adult hypertensive patients in public hospitals of central zone, Tigray, Ethiopia, 2018.

Methods

A hospital-based cross-sectional study design was used. The study population was all sampled adult hypertensive patients who had to follow-up in public hospitals of central zone, Tigray, Ethiopia and the data collection period were from March 01 to April 30, 2018. About 421 study participants were selected using systematic random sampling. Interviewer administered structured questionnaire, chart review checklist, and measurements were used. The collected data was checked for its completeness manually and then entered and cleaned into epi-data version 3.1 and exported to statistical packages for social science version 22 for analysis. Bivariate and multivariable analyses were done to identify factors of uncontrolled hypertension. Then those variables significant at p<0.25 with the outcome variable in bivariate analysis were selected for multivariable analysis and odds ratio with 95% confidence level was computed and p-value < 0.05 was described as a significant association in multivariable analysis.

Results

Among 421 respondents about 177(42%) had uncontrolled hypertension. Co-morbidity [AOR=0.36, (0.205, 0.631)], five to ten years' duration of medication taken [AOR=0.398, (0.218, 0.725)], side effect of medication [AOR=0.542, (0.339, 0.866)] and medication adherence [AOR=4.092, (2.419, 6.924)] were significantly associated with uncontrolled hypertension.

Conclusions

Magnitude of uncontrolled hypertension was high. Co-morbidity, antihypertensive medication taken for long duration, side effect of antihypertensive medication, and non-adherence to antihypertensive medication are associated factors.

Keywords: Hypertension, Uncontrolled, Lifestyle, Medication Adherence.

Introduction

Hypertension is defined as a persistent systolic blood pressure reading (SBP) of 140 mm Hg or greater and/or a diastolic blood pressure reading (DBP) of 90 mmHg or greater(1). Uncontrolled hypertension is also defined as if SBP is ≥140 mm Hg and/or DBP ≥90 mm Hg for the general hypertensive population or if SBP ≥130 mm Hg and/or DBP ≥80 mm Hg in patients with established diabetes mellitus (DM) or chronic kidney disease (CKD) based on the average of two or more properly measured, seated, BP readings on each of two or more office visits(1). Uncontrolled hypertension signifies blood pressure that is inadequately treated rather than blood pressure that is resistant to treatment(2).

The overall prevalence of hypertension among U.S. adults aged ≥18 years in 2003-2010 was 30.4% or an estimated 66.9 million. Among those with hypertension, an estimated 35.8 million (53.5%) were uncontrolled hypertension(3).

Hypertension is a silent killer disease in both developed and developing nations of the world(4). It is an important worldwide public health challenge because of its high frequency and a risk factor for cerebrovascular, cardiovascular, and kidney disease(5).

Uncontrolled hypertension is a major cardiovascular a risk factor, if not early controlled, it causes stroke, myocardial infarction, cardiac failure, dementia, renal failure, and blindness, causing human suffering and imposing severe financial and service burdens on health systems (6, 7).

Once hypertension develops, it may require lifelong treatment with medicines. Because of the high magnitude, drug treatment can be costly and is a challenge for resource-constrained settings. However, neglecting treatment needs interventions that are even more costly, such as cardiac bypass surgery, carotid artery surgery, renal dialysis and thus draining both individual and government budgets(8). The added burden of diseases as a result of complications from uncontrolled hypertension places additional pressure on the limited health care budget in developing countries and thus adequate control of hypertension among hypertensive patients is vast public health importance (9).

In Ethiopia, a few previous studies are done to determine the magnitude of hypertension but there is limited data on the uncontrolled rates of it among patients on treatment, particularly in Tigray region little is known and there is no published research article. In addition to this, most of the previous studies were done in developed countries and cannot represent developing countries like Ethiopia. Therefore, the purpose of this study is to determine the magnitude of uncontrolled hypertension and to identify the underlying factors associated with uncontrolled hypertension among hypertensive patients in hospitals of central zone, Tigray.

Findings of this study would had such importance for policy makers (MOH, TRHB) while designing strategies to develop effective intervention and for the community including the patients and families to raise awareness towards the importance of blood pressure control and factors that affect the control of blood pressure.

In addition, it would help for health care professionals to give attention on the severity of the disease and to focus on the prevention and control. It will also use for NGOs as a base line data for helping to solve the problem. It can also be used as a base line data for further research who want to undertake similar study in the country.

Materials and Methods

Study Design and Setting

A hospital-based cross-sectional study design was used. The study was carried out in public hospitals of central zone, which is one of the seven zones of Tigray. Aksum town is the capital city of central zone which is 1015 kms far from north of Addis Ababa. The Northern Ethiopia or Tigray Region is the homeland of the Tigrayan, Irob and Kunama peoples. Tigray is also known as Region one according to the federal constitution. Its capital and largest city is Mekelle. Tigray is the 5th largest by area, the 5th most populous, and the 5th most densely populated of the 10 Regional States. The region has public hospitals such as Aksum Saint Marry hospital, Adwa hospital, Abyi-Adi hospital, and Aksum referral hospital. The study was conducted from November, 2017 to June, 2018.

Source Patients

All hypertensive patients attending chronic illness outpatient department in public hospitals of central zone of Tigray, Ethiopia.

Study Patients

All volunteer hypertensive patients attending chronic illness outpatient department and available at public hospitals of central zone of Tigray, Ethiopia during the data collection period.

Study Subjects

All sampled subjects (421) participated in this study.

Inclusion Criteria

All adult hypertensive patients whose age greater than 18 years, who were on antihypertensive medication for at least 6 months and who had regular follow up at least two consequent previous visits would be included in the study.

Exclusion Criteria

All adult hypertensive patients who were Pregnant and critically ill or had cognitive impairment were excluded from the study.

Sample Size Determination

The actual sample size for the study was determined using the formula for single population proportion formula by assuming 5% marginal error, 95% confidence interval (α (alpha)=0.05) and the magnitude (p-proportion = 52.7%) would taken from a research conducted on Jimma University Teaching and Specialized Hospital, Ethiopia(10). The required final sample size with 10% of non-response rate was 421 study subjects.

Data Collection Procedure

After getting ethical clearance from the institutional review board of Mekelle University, data collection was carried out from March, 01to April 30, 2018 and take a maximum of 30 minutes. The questionnaire was prepared in English and then translated to local language (Tigrigna) and back translated to English to check for consistency. Four degree nurses were recruited as data collectors (one for each hospital) and two master's nurse as supervisor were selected who had an experience of supervision.

Data Collection Tools

Structured Questionnaire

Interviewer administered structured questionnaire was used to interview the patients. This questionnaire contains four parts. Part-one was collect data about socio demographic characteristic of the respondents. Part two was collect data on disease related factors. Part three and four were also collect data about Life style modifications related to hypertension and medication related factor respectively.

Chart Review Checklist

It was used to record the necessary information from the patient's medical chart.

Measurements

Anthropometric Measurements

Anthropometric measurements of weight and height were measured to calculate BMI using the Seca weighing scale and stadiometer respectively and participants were wearing light clothing (single and thin) and without shoes to the nearest kilogram and centimetre respectively.

Blood Pressure

Two blood pressure measurements taken after five minutes apart were determined for each participant using standard adult digital blood pressure apparatus with the correct size arm cuff. Participants were measured after 5 minutes of rest in the sitting position, the arm should be rest on the table at the heart level and the average readings of the two measurements were recorded (1).

Data Quality Assurance

Prior to data collection pre-test was conducted on 10 % of the study subjects and training for data collectors and supervisors was given for two days. The collected data was checked by the supervisor and principal investigator daily. Data was checked again for its completeness before data entry.

Data Processing and Analysis

After the data collection, the data was entered in to Epidata 3.1 and exported to SPSS version 22 statistical package for analysis. The results of the descriptive statistics were expressed as percent¬ages and frequencies. Associations between independent and dependent variables were analyzed first using bivariate analy¬sis to identify factors associated with the outcome variable. Those variables which were found to have an association with the outcome variable at P<0.25 was used in multivariable logistic regression to test for statistical association of independent variable with dependent variable. Odds ratio with 95% confidence level was computed and p-value < 0.05 was described as a significant association in the final multivariable logistic regression analysis. Model fitness was checked by using Hosmer and Lemeshow goodness fit model which was o.519.

Operational Definition

Controlled Hypertension

if BP <140/90 mmHg in hypertensive patients and/or <130/80 mm Hg with diabetes or chronic kidney disease(1).

Uncontrolled Hypertension

if SBP is ≥140 mm Hg and/or DBP ≥90 mm Hg for general hypertensive population or if SBP ≥130 mm Hg and/or DBP ≥80 mm Hg in patients with established diabetes mellitus (DM) or chronic kidney disease (CKD) based on the average of two or more properly measured, seated, BP readings on each of two or more office visits(1).

Medication Adherent

a patient with Modified Morisky Medication Adherence Scale (MMMAS) scores of ≥ 6 (using MMMAS scale).

Medication Non-Adherent

A patient with MMMAS scores of < 6 (using MMMAS scale).

Body Mass Index

calculated as weight in kilograms divided by height in square meters and interpreted as underweight (BMI<18.5), normal weight (18.5 - 24.9), overweight (25.0 - 29.9), and obese (≥30.0) (11).

Physically Active

an individual who perform physical exercise for at least 30 minutes per day for at least 3 day per week (12).

Physically Inactive

an individual who performs a physical exercise for less than 30 minutes per day for less than 3 days per week (12).

Non-Smoker

Respondents who reported having never smoked or stopped smoking.

Moderation of Alcohol Consumption

Limit consumption no more than 2 drinks per day in most men, and to no more than 1 drink per day in women and lighter weight persons. (A drink is 12 oz of beer, 5 oz of wine, 1.5 oz of 80-proof Whiskey and 01 oz is 30 ml of ethanol)(1).

Low Salt Consumption

to less than 5 g (about 1 teaspoon) per day or less than 2 gram sodium per day in adults, to help prevent hypertension, heart disease, and stroke (8).

Result

Socio-Demographic Characteristics

A total of 421 adult hypertensive patients were enrolled in this study. Of these respondents 201 (48%) were males. The mean age of the respondents was (59.2±(12.6) SD years) (Table1).

Table 1: Socio-demographic characteristics of adult hypertensive patients who were attending in public hospitals of central zone of Tigray, Ethiopia, 2018, n=421

Variable	Category	Medication adherence N (%)	Medication non-adherence N (%)	Total N (%)
***Age**	18-34 years	23(31.9)	49(68.1)	72(17.1)
	35-49 years	36(22)	128(78)	164(39)
	50-92 years	61(33)	124(67)	185(43.9)
Sex	Male	50(24.9)	151(75.1)	201(47.7)
	Female	70(31.8)	150(68.2)	220(52.3)
Residence	Urban	102(30.8)	229(69.2)	331(78.6)
	Rural	18(20)	72(80)	90(21.4)
Marital status	Single	8(40)	12(60)	20(4.8)
	Married	76(28.4)	192(71.6)	268(63.7)
	Divorced	9(20.5)	35(79.5)	44(10.5)
	Widowed	27(30.3)	62(69.7)	89(21.1)
Ethnicity	Amhara	0(0)	6(100)	6(1.4)
	Tigray	120(28.9)	295(71.1)	415(98.6)
Educational status	No formal education	57(31.3)	125(68.7)	182(43.2)
	Primary school	39(29.3)	94(70.7)	133(31.6)
	Secondary school	11(23.9)	35(76.1)	46(10.9)
	College/university	13(21.7)	47(78.3)	60(14.3)
Occupation	Housewife	37(47.4)	41(52.6)	78(18.5)
	Private business	28(31.1)	62(68.9)	90(21.4)
	Government employee	12(22.6)	41(77.4)	53(12.6)
	Farmer	17(17.9)	78(82.1)	95(22.6)
	Unemployed	16(25.8)	46(74.2)	62(14.7)
	Daily laborer	3(30)	7(70)	10(2.4)
	Retired	7(21.2)	26(78.8)	33(7.8)
*age category (10)				

Disease Related Factors

One hundred sixteen (27.6%) were overweight and 24 (5.7%) were obese. Among the study participants 98 (23.3%) patients were with co-morbid conditions and from these 57 (58.2%) were diabetic (Table 2).

Table 2: Description of participant's disease related factors among adult hypertensive patients who were attending in public hospitals of central zone of Tigray, Ethiopia, 2018, n=421.

Serial number	BMI	Under weight	4(28.6)	10(71.4)	14(3.3)
1		Normal weight	104(39)	163(61)	267(63.4)
		Over weight	53(45.7)	63(54.3)	116(27.6)
2		Obese	16(66.7)	8(33.3)	24(5.7)
		Every-2 weeks	10(41.7)	14(58.3)	24(5.7)
		Monthly	155(41.7)	217(58.3)	372(88.4)
		Every-2 months	10(47.6)	11(52.4)	21(5)
3	Co-morbidity conditions	Yes	61(62.2)	37(37.8)	98(23.3)
		No	116(35.9)	207(64.1)	323(76.7)
4	Type of co-morbidity	Diabetic	37(64.9)	20(35.1)	57(58.2)
		Stroke	21(58.3)	15(41.7)	36(36.7)
		Heart failure	2(50)	2(50)	4(4.1)
		Hyperlipidemia	1(100)	0(0)	1(1)

5	BMI	Under weight	4(28.6)	10(71.4)	14(3.3)
		Normal weight	104(39)	163(61)	267(63.4)
		Over weight	53(45.7)	63(54.3)	116(27.6)
		Obese	16(66.7)	8(33.3)	24(5.7)

Life-Style Modification Factors

Among the study participants 266 (63.2 %) had low consumption of salt in diet (Table 3).

Table 3: Participants adherence status on life style modifications among adult hypertensive patients who were attending in public hospitals of central zone of Tigray, Ethiopia, 2018, n=421.

Serial number	Variable	Category	Medication adherence N (%)	Medication non-adherence N (%)	Total N (%)
1	Cigarette smoking	Yes	1(25)	3(75)	4(1)
		No	119(28.5)	298(71.5)	417(99)
2	Alcohol drinking status	Yes	27(28.7)	67(71.3)	94(22.3)
		No	93(28.4)	234(71.6)	327(77.7)
3	Physical activity	Active	44(31.2)	97(68.8)	141(33.5)
		Inactive	76(27.1)	204(72.9)	280(66.5)
4	Salt used in diet	Low consumption	79(29.7)	187(70.3)	266(63.2)
		High consumption	41(26.5)	114(73.5)	155(36.8)

Medication Related Factors

Among the study participants, about 272 (64.6%) were taken medication for less than five years of duration and 87 (20.7%) were used more than three antihypertensive drugs (Table 4).

Table 4: Medication related factors among adult hypertensive patients who were attending in public hospitals of central zone of Tigray, Ethiopia, 2018, n=421.

Serial number	Variable	Category	Medication adherence N (%)	Medication non-adherence N (%)	Total N (%)
1	Duration of medication taken	< 5 years	67(24.6)	205(75.4)	272(64.6)
		5-10 years	32(34.8)	60(65.2)	92(21.9)
2		>10 years	21(36.8)	36(63.2)	57(13.5)
	Number of antihypertensive drugs used	Only 1 drug	58(34.7)	109(65.3)	167(39.7)
3		2 drugs	53(31.7)	114(68.3)	167(39.7)
		≥ 3 drugs	9(10.3)	78(89.7)	87(20.7)
4	Side effect of medications	Yes	70(35)	130(65)	200(47.5)
		No	50(22.6)	171(77.4)	221(52.5)
5	Each type of side effect	Erectile dysfunction	4(57.1)	3(42.9)	7(3.5)
		Head ache	41(54.7)	34(45.3)	75(37.5)
		Weakness	44(47.8)	48(52.2)	92(46)
		Dry mouth	9(52.9)	8(47.1)	17(8.5)
		Others*	3(33.3)	6(66.7)	9(4.5)
6	Way of getting medication	Free of charge	25(32.9)	51(67.1)	76(18.1)
		Sponsorship	4(44.4)	5(55.6%)	9(2.1)
		Self-sponsorship	91(27.1)	245(72.9)	336(79.8)
7	Co-morbid	Yes	31(31.6)	67(68.4)	98(23.3)
		No	89(27.6)	234(72.4)	323(76.7)
8	Type of co-morbid disease	Diabetic	17(29.8)	40(70.2)	57(58.2)
		Stroke	13(36.1)	23(63.9)	36(36.7)
		Heart failure	1(75)	3(75)	4(4.1)
		Hyperlipidaemia	0 (0)	1(100)	1(1)
*loss of appetite, epigastric pain, abdominal bloating					

Magnitude of Uncontrolled Hypertension

Among the study participants 177(42%) with 95% CI (37.3, 47) had uncontrolled their blood pressure and about 244(58%) had controlled their blood pressure.

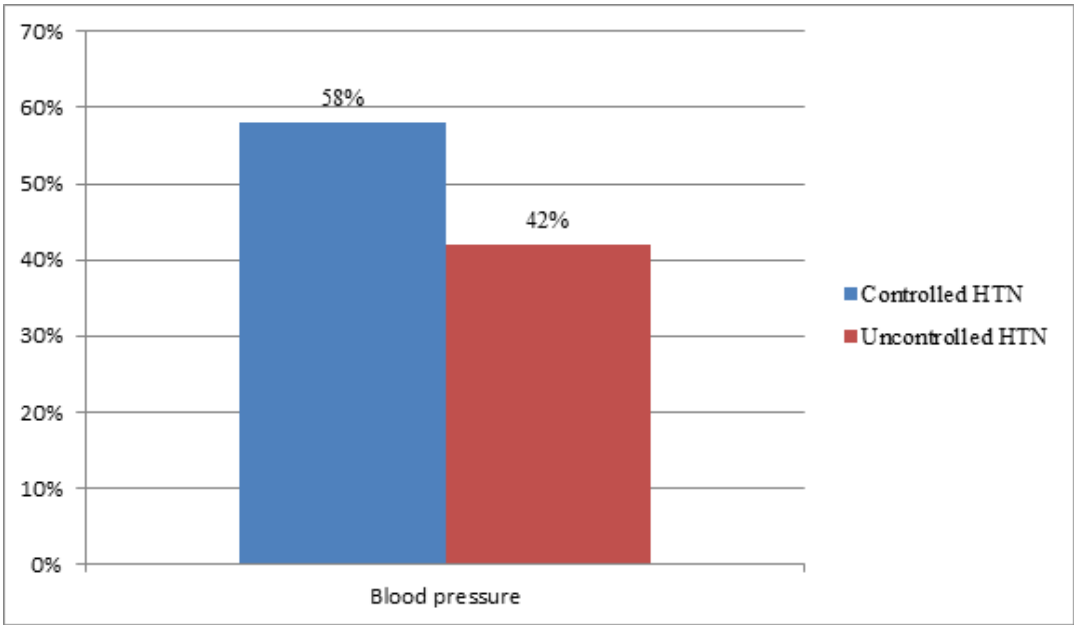

Figure 1: Uncontrolled hypertension among adult hypertensive patients who were attending in public hospitals of central zone of Tigray, Ethiopia, 2018, n=421, (10).

Factors Associated with Uncontrolled Hypertension

The association of independent variables with the dependent variable was investigated using both bivariate and multivariable logistic regression technique. The enter method regression was used. In the multivariable binary logistic regression analysis, only four variables had shown overall significant effect on uncontrolled hypertension at 5% level of significance.

Table 5: Bivariate and multivariable analysis of factors among adult hypertensive patients who were attending in public hospitals of central zone of Tigray, Ethiopia, 2018, n=421.

Variable	Category	Uncontrolled HTN N(%)	Controlled HTN N(%)	COR(95%CI)	AOR(95%CI)
*Age	18-34 years	26(36.1)	46(63.9)	1	1
	35-49 years	81(49.4)	83(50.6)	0.58(0.3281,1.024)	0.621(0.306,1.261)
	50-92 years	70(37.8)	115(62.2)	0.93(0.528,1.634)	1.554(0.704,3.431)
Residence	Urban	144(43.5)	187(56.5)	1	1
	Rural	33(36.7)	57(63.3)	1.33(0.823,2.151)	1.138(0.512,2.528)
Educational level	No formal education	73(40.1)	109(59.9)	1	1
	Primary school	62(46.6)	71(53.4)	0.77(0.488,1.205)	1.168(0.659,2.072)
	Secondary school	16(34.8)	30(65.2)	1.26(0.639,2.467)	1.799(0.757,4.277)
	College/university	26(43.3)	34(56.7)	0.876(0.485,1.581)	1.987(0.656,6.019)
Occupational status	House wife	39(50)	39(50)	1	1
	Private business	49(54.4)	41(45.6)	0.837(0.456,1.536)	0.471(0.216,1.026)
	Government employee	26(49.1)	27(50.9)	1.038(0.517,2.087)	0.434(0.141,1.337)
	Farmer	31(32.6)	64(57.4)	2.065(1.114,3.827)	0.668(0.267,1.669)
	Unemployed	15(24.2)	47(75.8)	3.133(1.508,6.511)	1.743(0.734,4.142)
	Daily laborer	3(30)	7(70)	2.33(0.562,9.687)	1.215(0.262,5.63)
	Retired	14(42.4)	19(57.6)	1.357(0.597,3.084)	0.382(0.122,1.191)

Frequency of follow up	Monthly	163(41.2)	233(58.5)	1	1
	Every-2 month	14(56)	11(44)	0.55(0.243,1.241)	0.581(0.230,1.47)
Co-morbidity conditions	Yes	61(62.2)	37(37.8)	0.34(0.213,0.542)	0.36(0.205,0.631)*
	No	116(35.9)	207(64.1)	1	1
BMI	Under weight	4(28.6)	10(71.4)	1	1
	Normal weight	104(39)	163(61)	0.627(0.192,2.051)	0.809(0.209,3.135)
	Over weight	53(45.7)	63(54.3)	0.475(0.141,1.604)	0.825(0.2,3.393)
	Obese	16(66.7)	8(33.3)	0.2(0.048,0.842)	0.248(0.045,1.348)
Physical activity	Active	73(51.8)	68(48.2)	1	1
	Inactive	104(37.1	176(62.9)	1.817(1.206,2.737)	0.93(0.515,1.678)
Salt used in diet	Low consumption	122(45.9)	144(54.1)	1	1
	High consumption	55(35.5)	100(64.5)	1.54(1.024,2.316)	1.638(0.98,2.737)
Duration of medication taken	< 5 years	101(37.1)	171(62.9)	1	1
	5-10 years	55(59.8)	37(40.2)	0.397(0.245,0.645)	0.398(0.218,0.725)*
	>10 years	21(36.8)	36(63.2)	1.013(0.56,1.83)	0.889(0.43,1.837)
Side effect of medication	Yes	101(50.5)	99(49.5)	0.514(0.347,0.761)	0.542(0.339,0.866)*
	No	76(34.4)	145(65.6)	1	1
Medication adherence	Adherent	77(64.2%)	43(35.8%)	1	1
	Non-adherent	100(33.2%)	201(66.8%)	3.599(2.31,5.609)	4.092(2.419,6.924)*
*p-value<0.05-statistically significant, HTN- hypertension, BMI- body mass index. *Age category (10)					

Discussion

This study was aimed to assess the magnitude of uncontrolled hypertension and associated factors among adult hypertensive patients in public hospitals of Northern Ethiopia. The magnitude of overall uncontrolled hypertension was 177(42%) which is consistent with the study conducted in Chilean (40%)(13), and Spain (40%) (14).

But this study is lower than with a study conducted in Zimbabwe (67.2%), Jimma specialized hospital (52.7%), Oman (61%), and Gonder hospital (53.4%) [9, 1015, 16].

This variation might be due to discrepancies in life-style behaviours such as feeding habits.
this study reveals that, those who had co-morbid conditions were 64% times less likely associated with uncontrolled hypertension than those who didn't have and this is supported by a study conducted in Kenya Nyeri provincial hospital (17).

This might be due to the patient's vigilant monitoring of their co-morbid conditions by having regular follow up in the health institutions and appropriately applied their health care provider's advice.

This study showed that those who were taken five to ten years were 60% times less likely associated with uncontrolled hypertension than those who were taken less than five years and this is supported by a study done in a tertiary hospital of Abia State in Eastern Nigeria (19).

This might be due to providing continuous health education about the effect of hypertension if not properly taken the antihypertensive medication for a long time and this might increase the awareness related to their case.this study showed that those who had a side effect of antihypertensive medications were 46% times less likely associated with uncontrolled hypertension than those who didn't have and this study was contradicted with the study conducted in the USA(18).

This might be due to when the side effect happened, they gone to the health institution instead of stopped to take antihypertensive medications by themselves.This study reveals that adherence to antihypertensive medications was significantly associated with uncontrolled hypertension, and this is in line with a study conducted in Gonder University hospital(16).

Jimma University teaching and specialized hospital (10). and Nigeria (19).
This might be due to the patient's ignorance that is when the patients feel a good, they might think that they are completely relieved from their problem and poor counselling related to medication adherence by health care providers and the cost of the medications.

Conclusions

The magnitude of uncontrolled hypertension was high among adult hypertensive patients. Co-morbidity, antihypertensive medication taken for long duration, side effect of antihypertensive medication, and non-adherence to antihypertensive medication were associated factors.

Limitation of the Study

There might be social desirability bias, especially on self-reported sensitive issues like cigarette smoking status and alcohol intake status, which might result in an overestimate of the number of participants who were abstainers.

Adherence to antihypertensive medications was measured through self-reported interview and this may cause recall bias and hence, may underestimate medication adherence.

List of Abbreviations

BMI: Body Mass Index, BP: Blood Pressure, CI: Confidence Interval, CKD: Chronic Kidney Disease, CSA: Central Statistical Agency, DBP:Diastolic Blood Pressure, DM: Diabetic Mellitus, ETB: Ethiopian Birr, HC: Health Centre, HLT: Hosmer-Lemeshow Test, HTN: Hypertension, JNC:Joint National Committee, MMMAS: Modified Morisky Medication Adherence Scale, MOH: Ministry Of Health, NGO: Non-Governmental Organization, NHANESIII: National Health And Nutrition Examination Survey,OPD:Outpatient Department, SPSS: Statistical Package for the Social Science, SBP: Systolic Blood Pressure, TRHB: Tigray Regional Health Bureau, UK: United Kingdom, WHO: World Health Organization.

Ethics Approval and Consent to Participate

Ethical approval for the study was obtained from the institutional review board of Mekelle University College of health science on 14 February 2018 with ethical number ERC 1310/2018. The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from each participant before their participation and confidentiality were kept.

Consent for Publication

Not applicable

Availability of Data and Materials

The datasets used and/or analysed during the current study are presented with in the manuscript and available from the corresponding author on reasonable request.

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Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

All authors listed in this research article have been involved and contribute for this thesis. 'AIN' contributes in conception, design, analysis, data interpretation, data acquisition, drafting and writing the final manuscript, 'DS', 'TH', 'BHK', and 'GGG' contributes in conception, design, analysis, data acquisition, drafting and revising the manuscript, 'GTW', 'TMZ', 'KTG', and, 'HH' contributes in design, analysis, data interpretation, drafting and revising it critically for important intellectual content. All authors read and approved the final manuscript to be published.

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