

Determinants of adherence to anti-hypertensive medications among adult hypertensive patients on follow-up in Hawassa Referral Hospital: A case–control study

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Abstract

Introduction: Hypertension is a global challenge which accounts for high morbidity and mortality rates in the world. The availability of effective anti-hypertensive medications does not result in a good outcome in controlling blood pressure which points towards poor adherence. Thus, this study was conducted to assess the determinants of adherence to anti-hypertensive medication among hypertensive patients on follow-up in Hawassa Referral Hospital.

Methods: Institution-based case–control study was conducted on a sample of 289 clients from February to May 2018. Census was conducted on 1600 clients to select cases and controls. Then, systematic random sampling was used to select study subjects, and adherence was measured by Morisky medication adherence scale. The associations of variables were analyzed using bivariable followed by multivariable logistic regression analyses.

Results: The respondent's adherence to medication was found to be 67% as measured by Morisky medication adherence scale. The multivariate logistic regression analysis showed that medication adherence was found to be better in younger age (<45) (AOR = 3.8), clients living in urban areas (AOR = 6.84), those clients who had good knowledge (AOR = 3.13), those with no co-morbidities (AOR = 3.14) and patients who controlled their blood pressure (<140/90) (AOR = 2.35).

Conclusions: The rate of medication adherence was found to be low, and hence educational interventions focusing on factors promoting adherence and patients' health support should be implemented.

Keywords

Adherence, hypertension, Morisky Medication Adherence scale, Hawassa Referral Hospital

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Introduction

According to the World Health Organization (WHO), hypertension (HTN) is defined as “a persistent raised systolic or diastolic blood pressure (BP) \geq 140/90 mmHg in adults aged \geq 18 years above”.¹ HTN is often called the “silent killer” because it often has no warning signs or symptoms, and many people do not realize they have it.² HTN is a modifiable cardiovascular risk factor, in which early detection, proper management and control of BP can avoid long-term complications by using appropriate treatment plan.^{3,4}

Strong evidence from randomized controlled trials has revealed that the treatment of high BP significantly

decreases cardiovascular disease (CVD)-associated morbidity and mortality.⁵

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However, poor adherence is one of the biggest obstacles in therapeutic control of high BP.⁶ Failure to adhere to treatment causes medical and psychological complications of the disease, reduces patients' quality of life and wastes healthcare resources.⁷

In developing countries like Ethiopia, the burden of HTN is becoming critical and increased from time to time due to the expansion of urbanization, sedentary lifestyles, and low level of literacy rate.⁸ Untreated or sub-optimally treated HTN could lead to increased risk of morbidity and mortality due to cardiovascular, cerebrovascular or renal diseases. The common reason for poor BP control among hypertensive patients is poor medication adherence.⁹

Good adherence to anti-hypertensive medications is necessary in order to achieve BP control and improve outcome.^{10,11} As there are different factors affecting the adherence of patients to their medication, identifying and understanding the barriers affecting a patient's ability to adhere to anti-hypertensive therapy will allow to design effective interventions against different barriers of medication use, adherence rates and patient outcomes. Thus, the purpose of this study was to assess the determinants of adherence to anti-hypertensive medication among hypertensive patients on follow-up in Hawassa Referral Hospital (HRH), Ethiopia, 2018.

Methods

Study setting, period and design

The study was conducted at HRH, in Hawassa town, located 219 km away from Addis Ababa, Ethiopia. The study was conducted from February to May 2018 by applying the institution-based un-matched case-control study design.

Eligibility criteria

All hypertensive patients with age 18 and above who have been on follow-up and receiving anti-hypertensive treatment at HRH chronic illness follow-up clinic for at least one month were included in the study.

Operational definition

- **Adherent:** respondents who score ≥ 6 in Morisky Medication Adherence Scale-8 (MMAS-8)
- **Non-adherent:** respondents who score < 6 in MMAS-8.
- **Cases:** Non-adherent respondents.
- **Control:** Adherent respondents.
- **Good knowledge:** those respondents who scored points at the mean and above from the eight-item knowledge questions prepared on HTN.

- **Poor knowledge:** those respondents who scored points less than the mean from the eight-item knowledge questions prepared on HTN.
- **Good patient-provider relationship:** those respondents who scored points at mean and above from the eight-item patient-provider relationship questions prepared on HTN.
- **Poor patient-provider relationship:** those respondents who scored points less than the mean among the eight-item patient-provider relationship questions prepared on HTN.
- **Respondents' reason/s to their non-adherence behavior:** open-ended question "what is the reason/s that makes you non-adherent to your anti-hypertensive medication?" was forwarded to the cases, and their response was collected using the prepared questionnaire.

Sample size determination and procedure

The sample size was computed by Epi-info version 7 by considering a ratio of non-adherent cases to adherent controls of 1:2, power 80, 95% confidence interval and adjusted odds ratio 2.18 with a proportion among cases 0.4 and among controls 0.35.¹²

Accordingly, the maximum sample size was 289, among which 96 cases and 193 controls were used. The sample size formula for the method described in Kelsey was used.¹³

Institution-based census was conducted on 1600 hypertensive patients on follow-up in HRH using MMAS-8 to select cases and controls (1072 controls and 528 cases). Out of these, the controls and cases were selected by systematic random sampling method with interval of $K=5$.

Data collection procedure

Two trained Bachelor degree nurse professionals and one pharmacist collected data using structured questionnaire in two isolated chronic care units.

BP measurement

Three sitting BP measurements were taken in 2 min apart,¹⁴ and the average of the three readings was used to determine the BP level.

Data quality assurance

The interviewer-administered structured questionnaire was translated into local language (Amharic) from its English version and then back to English. Data collection instrument and research procedures were pretested with 30 participants in Bombe Primary Hospital, and some modifications were made on the questionnaire

based on the pretest. Training was given for data collectors. Data collectors were supervised while collecting the data by the principal investigator. Data were checked daily for completeness and consistency throughout the data collection period.

Data analysis

Data were checked for completeness, coded and entered into Epi Data Version 4.2, and then exported into SPSS version 25 for data analysis. The MMAS was used to assess the adherence status using ≥ 6 as adherent or < 6 as non-adherent score. Variables with a P-value of less than 0.25 in the bivariable logistic regression analysis were entered into the multivariable logistic regression model for final analysis. A P-value less than 0.05 was considered to determine the statistical significance of the association and odds ratio with a 95% confidence interval was used to determine the presence, strength and direction of association between covariates and the outcome variable.

Results

Socio-demographic characteristics

Participants enrolled in the study were 289 (96 cases and 193 controls) with a 100% response rate. Seventy percent of the respondents were males in both controls and cases. Among the controls, 75% of the respondents were urban residents. Majority of the cases (42.7%) do not read and write. In addition, two-thirds of the respondents were belonging to the age of ≥ 55 years (Table 1).

Respondents' level of adherence to their anti-hypertensive therapy

Institution-based census conducted using MMAS-8 showed that about more than two-thirds (67%) of respondents were found to be adherent, whereas 528 (33%) were non-adherent to their medication treatment.

Table 1. Socio-demographic characteristic of the respondents at HRH, 2018.

Variables	Category	Controls (%)	Cases (%)	Total (%)
Sex	Male	135 (69.95)	68 (70.83)	203 (70.24)
	Female	58 (30.05)	28 (29.17)	86 (29.76)
Age	18–44	45 (23.31)	9 (9.38)	54 (18.69)
	45–54	48 (24.87)	13 (13.54)	61 (21.12)
	55–64	65 (33.68)	33 (34.38)	98 (33.91)
	≥ 65	35 (18.13)	41 (39.58)	76 (26.3)
Ethnicity	Amhara	39 (20.21)	29 (30.21)	68 (23.52)
	Oromia	49 (25.39)	35 (42.71)	84 (29.06)
	Tigray	9 (4.66)	3 (3.13)	12 (4.14)
	SNNs	96 (49.74)	29 (30.21)	125 (43.24)
Residence	Rural	37 (19.17)	62 (64.58)	99 (34.25)
	Urban	156 (80.83)	34 (35.42)	190 (65.74)
Marital status	Single	21 (10.88)	4 (4.17)	25 (8.65)
	Married	139 (72.02)	71 (73.96)	210 (72.66)
	Divorced	3 (1.55)	2 (2.08)	5 (1.71)
	Windowed	30 (15.54)	19 (6.57)	49 (16.95)
Religion	Orthodox	60 (31.09)	34 (11.76)	94 (32.52)
	Muslim	38 (19.69)	30 (10.38)	68 (23.52)
	Catholic	9 (4.66)	3 (3.12)	11 (3.80)
	Protestants	86 (44.56)	29 (30.21)	115 (39.79)
Education	Could not read and write	53 (28.)	53 (42.7)	96 (33.21)
	Read only – High school	95 (49.22)	33 (33.33)	127 (43.94)
	\geq College	45 (22.28)	10 (23.96)	66 (22.84)
Employment	Governmental	31 (16.06)	26 (27.08)	74 (25.59)
	Private	55 (28.5)	7 (15.62)	48 (16.60)
	Farmers	40 (20.73)	28 (29.17)	68 (20.48)
	Not employed	67 (33.16)	35 (36.46)	99 (34.25)

SNNs: South Nations Nationalities.

Clinical and medication characteristics of the respondents

Thirty-five and 86 respondents among cases and controls, respectively, had co-morbidities. Among the controls, 24% of the respondents had been taking one drug per day. Based on the BP measurement, 61% of the control clients presented with controlled BP, whereas two-thirds of respondents in the cases presented with uncontrolled BP. Among the controls, 15% of respondents have got free health service coverage given by the government (Table 2).

Knowledge about HTN

Among controls, 186 (64%) of the respondents have good knowledge about HTN disease and its treatment. Majority of respondents (71.5%) in the control group have good knowledge about HTN (Table 3).

Patient-provider relationship

Among controls, 133 (46.02%) of the respondents have good relationship with health workers. Twenty-nine (10.03%) of respondents had poor relation with their healthcare providers (Figure 1).

Respondents' reason to their non-adherence behavior

The most common reason was forgetfulness (29.16%) followed by being busy (20.83%) and false perception that they are cured (16.6%) (Figure 2).

Respondents' response regarding life style modification

One hundred and eight (55%) study participants in the controls perform physical exercise. Sixteen percent of the respondents in the case group were

smokers. Seventeen percent and 15 percent of the cases and controls were always using salt in their food (Table 4).

Results of the bivariable and multivariable analyses

This study revealed that respondents of young age group (18–44) were three times more adherent as compared to elderly people (>65) (AOR = 3.80 (1.08, 13.31)). Respondents living in urban area were six times more likely adherent than those living in rural area (AOR = 6.84 (3.05, 15.36)). Those who have good knowledge were three times more likely adherent than whose knowledge was poor (AOR = 3.13 (11.43–6.82)) and those with no co-morbidity were three times more likely adherent than clients with co-morbidity. Those clients who controlled their BP were two times more likely adherent

Table 3. Knowledge regarding hypertension at HRH, 2018.

Variables	Category	Controls (%)	Cases (%)	Total (%)
Knowledge	Good	138 (71.5)	48 (50)	186 (64.35)
	Poor	55 (28.5)	48 (50)	103 (35.64)

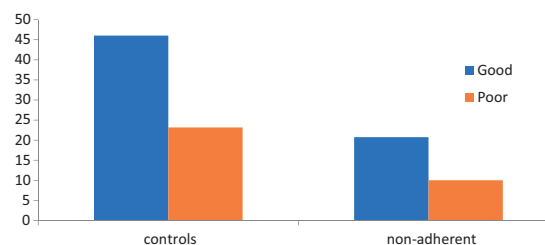


Figure 1. Patient-provider relationship status at HRH, 2018.

Table 2. Response regarding medication and clinical characteristics at HRH, 2018.

Variables	Category	Controls (%)	Cases (%)	Total (%)
Co-morbidities	Yes	86 (44.56)	35 (36.46)	121 (41.86)
	No	107 (55.44)	61 (63.54)	168 (58.13)
BP control	Controlled	119 (61.66)	37 (38.54)	156 (53.97)
	Uncontrolled	74 (38.34)	59 (61.46)	133 (46.02)
Anti-hypertensive	Two drugs	131 (67.88)	65 (67.71)	196 (67.82)
	One drug	47 (24.35)	22 (22.92)	69 (23.87)
	Three and above	15 (7.77)	9 (9.38)	24 (8.30)
Frequency	Once	116 (60.1)	45 (46.88)	161 (55.70)
	Twice	62 (32.12)	37 (38.54)	99 (34.25)
	Three and above	15 (7.77)	14 (14.58)	29 (10.03)
Who pays	Self	128 (66.32)	55 (57.29)	163 (56.4)
	Family	35 (18.13)	27 (28.13)	62 (21.45)
	Free	30 (15.54)	14 (14.58)	44 (15.22)

BP: blood pressure.

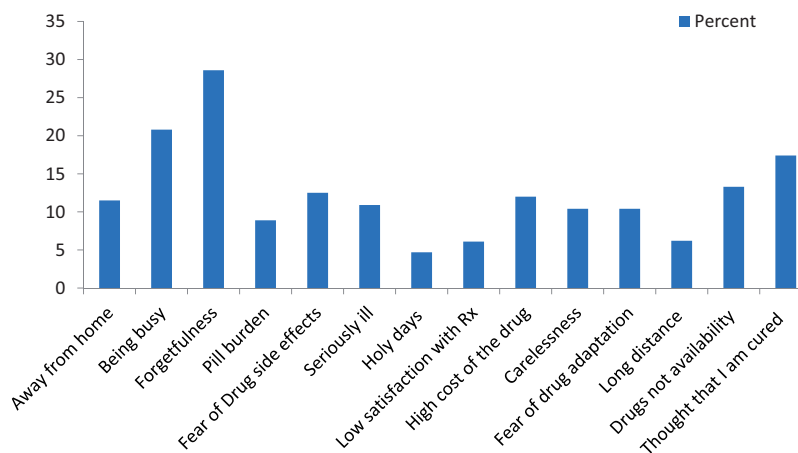


Figure 2. Percentage distribution of reasons for being non-adherent to their medication treatment at HRH, 2018.

Table 4. Response regarding life style modification at HRH, 2018.

Variable	Category	Category	Cases (%)	Controls (%)	Total (%)
Exercise	Yes		58 (60.42)	108 (55.96)	166 (57.44)
	No		38 (39.58)	85 (44.04)	123 (42.56)
exercise (yes)	Per week	<3	27 (46.55)	52 (48.15)	75 (45.18)
		≥3	31 (53.45)	56 (61.85)	91 (54.82)
	Per session	<30 min	28 (48.28)	39 (36.11)	63 (37.95)
		≥30 min	30 (51.72)	69 (63.89)	103 (62.05)
Ever smoked	Yes		16 (16.67)	40 (20.73)	56 (19.38)
	No		80 (83.83)	153 (79.27)	233 (80.62)
Fruits eaten		Still smoke	13 (81.25)	9 (22.5)	21 (7.26)
		Try to quit	3 (18.75)	31 (77.5)	34 (11.76)
		Never	25 (26.04)	10 (5.18)	35 (12.11)
		Usually	52 (15.63)	109 (56.48)	161 (55.70)
		Rarely	16 (16.67)	68 (35.23)	114 (39.44)
Salt in diet		Always	3 (3.12)	6 (3.1)	9 (3.11)
		Never	31 (32.29)	81 (41.97)	112 (38.75)
		Rarely	35 (36.46)	58 (30.05)	93 (32.17)
		Usually	13 (13.54)	25 (12.95)	38 (13.14)
	Always	17 (17.7)	29 (15.02)	46 (15.91)	

than those not controlling their BP (AOR = 2.35 (1.15, 4.81) (Table 5).

Discussion

Ensuring patients' adherence to anti-HTN medications to prevent complications of HTN remains a major challenge to public health in many developing countries. Poor adherence to treatment is a reason for uncontrolled HTN, serious complications and wastage of healthcare resource.^{6,15} This study tried to identify factors associated with adherence to anti-hypertensive treatment.

The current study found that the majority of hypertensive patients had low levels of medication adherence

in line with the local study conducted in referral hospitals of North West Ethiopia,¹⁵ Adama¹⁶ among patients with HTN. Various international studies in Malaysia (53.4%),¹⁷ Egypt (74.1%)¹⁸ and Uganda¹⁹ have also documented similar poor adherence. The finding of the present study showed a lower percentage of adherence level than studies in Egypt (74.1%),¹⁸ Pakistan (77%),²⁰ Sunderland (79%)²¹ and the Western population (Scotland) reports (91%).²² This might be due to better access and care to patients in these countries.

Patients' age was positively associated with the adherence score in other international studies.^{23–26} In this study, patients with age <44 years old were three times more likely adherent than elderly patients.

Table 5. Bivariable and multivariable analysis results at HRH, 2018.

Variables	Category	Cases	Controls	Crude Odds Ratio (COR)	Adjusted Odds Ratio (AOR)
Age	18–44	9 (9.38)	45 (23.31)	5.58 (2.51, 13.64)	3.80 (1.08, 13.31)
	45–54	13 (13.54)	48 (24.87)	4.32 (2.02, 9.25)	2.79 (1.01, 7.78)
	55–64	33 (34.38)	65 (33.68)	2.30 (1.24, 4.27)	0.76 (0.32, 1.80)
	≥65	41 (42.71)	35 (18.13)	1	1
Residence	Rural	62 (48.96)	37 (26.94)	1	1
	Urban	34 (51.04)	156 (73.06)	7.68 (4.43, 13.33)	6.84 (3.05, 15.36)
Education	Could not read and write	53 (55.2)	53 (27.46)	1	1
	Read only – High school	33 (34.38)	95 (49.22)	2.87 (1.66, 4.99)	
	≥College	10 (10.42)	45 (23.32)	4.50 (2.05, 9.85)	
Work	Governmental	26 (27.08)	31 (16.06)	1	1
	Private	7 (7.29)	55 (28.5)	6.59 (2.56, 16.93)	
	Farmers	28 (29.17)	40 (20.73)	1.19 (0.58, 2.43)	
	Not employed	35 (36.46)	67 (34.72)	1.60 (0.82, 3.11)	
Co-morbidities	Yes	65 (67.71)	85 (44.04)	1	1
	No	31 (32.29)	108 (55.96)	2.66 (1.59, 4.45)	3.14 (1.48, 6.67)
Frequency	1	45 (46.88)	116 (60.1)	2.40 (1.07, 5.38)	
	2	37 (38.54)	62 (32.12)	1.56 (0.67, 3.60)	
	≥3	14 (14.58)	15 (7.77)	1	
Knowledge	Good	48 (50)	138 (71.5)	2.50 (1.51, 4.16)	3.13 (1.43, 6.82)
	Poor	48 (50)	55 (28.5)	1	
BP	Controlled	59 (61.46)	74 (38.34)	2.56 (1.55, 4.24)	2.35 (1.15, 4.81)
	Uncontrolled	37 (38.54)	119 (61.66)	1	1
Who paid	Self	55 (57.29)	128 (66.32)	1	1
	Family	27 (28.13)	35 (18.13)	0.55 (0.30, 1.08)	0.37 (0.15, 0.90)
	Free	14 (14.58)	30 (15.54)	0.92 (0.45, 1.82)	1.43 (0.49, 4.12)

BP: blood pressure.

According to some reports in line with this study, younger patients showed better adherence to pharmacological treatment,²⁷ while others stated that young age is a determinant of poorer adherence to hypertensive medication.^{12,25,26} Non-adherence in younger patients might be due to the lack of symptoms at early stages of the illness or more concerns about medication side effects.

In contrast, some researchers have also found better adherence among older patients,²³ in which patients in the age group of >40 but not >60 and >65 were more adherent than younger age patients.^{23,24} The better adherence to treatment found in elderly patients has been explained by the presence of co-morbidities, which make the patients perceive themselves as very ill and take the prescribed treatment seriously, and elderly patients in the study area might have received better care by their caregivers.

In this study, a significant association was observed between patient residence and medication adherence. Hypertensive patients who lived in urban areas were six times more likely to adhere to their medications as compared to those who lived in rural areas. This is in line with a study conducted in Debre Tabor.²⁷ This might be due to the fact that rural residents lived too far away from the health facility and took more time

reach the health facility for their medications. They might even forget to take their medication on time.

This study revealed that the presence of co-morbidities had significant impact on adherent behavior. Patients with no co-morbidities were more likely to adhere to their treatment than those with co-morbidities in line with a study done in North West Ethiopia.²⁸ However, a study done in Scotland showed no significant association between the number of co-morbidities and adherence.²⁹ The reason for this difference might be that co-morbidities in Scotland and Iran might be diagnosed early and treated well, but this might not be the practice in this study area.

Knowledge towards HTN and its treatment was found to be positively associated to the adherence behavior of patients. A similar study done in Gondar and Debre Tabor, Malaysia and China demonstrated that patients who had good knowledge of their diseases and treatment had a better adherence compared to those who do not.^{27,30} The possible justification might be that knowledge about HTN and its treatment creates a clear understanding and avoids confusion about the treatment and the disease.

Those with controlled BP were likely to be adherent and those adherents were also observed to have controlled HTN. This finding is in line with the study done

in Gondar.³⁰ The reason might be the increase of patient satisfaction and creation of strong motivation towards the treatment secondary to the reported controlled BP.

Limitation of the study

As the study is institution based, participants might not be representative of the general population, and hence it might be difficult to generalize the findings to the population. Self-reporting was used as the only method of measuring adherence which could result in overestimation of adherence.

Conclusions

The rate of medication adherence was found to be low. Factors like age, residence, presence of co-morbidities, knowledge towards HTN and its treatment were seen to have an influence on the adherence behavior of patients. Therefore, patient support and management of comorbidities should be strengthened and provided to the hypertensive patients. In addition, health educational strategies that specially focus on medication adherence should be designed and provided to hypertensive patients and to the community in general.

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Availability of data and materials

The data are available in the public library of Debre Markos University in a form of graduate student thesis.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

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Guarantor

YM.

Contributorship

AG designed and conducted all data collection procedures, analyzed and interpreted results. MT, AF and YM participated in proposal development and final paper write up. YM prepared the article. All authors read and approved the final version of the article.

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References

1. Alwan A. *Global status report on noncommunicable diseases 2010*. Geneva: World Health Organization, 2011.
2. Control CfD, Prevention. Vital signs: prevalence, treatment, and control of hypertension – United States, 1999–2002 and 2005–2008. *MMWR Morb Mortality Wkly Rep* 2011; 60: 103.
3. Tomaszewski M, White C, Patel P, et al. High rates of non-adherence to antihypertensive treatment revealed by high-performance liquid chromatography-tandem mass spectrometry (HP LC-MS/MS) urine analysis. *Heart* 2014; 100: 855–861.
4. Staessen JA, Fagard R, Thijs L, et al. Randomised double-blind comparison of placebo and active treatment for older patients with isolated systolic hypertension. *Lancet* 1997; 350: 757–764.
5. Group SCR. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. Final results of the Systolic Hypertension in the Elderly Program (SHEP). *JAMA* 1991; 265: 3255–3264.
6. Balkrishnan R. The importance of medication adherence in improving chronic-disease related outcomes: what we know and what we need to further know. *Med Care* 2005; 43: 517–520.
7. Bonsa F, Gudina EK and Hajito KW. Prevalence of hypertension and associated factors in Bedele Town, Southwest Ethiopia. *Ethiop J Health Sci* 2014; 24: 21–26.
8. Tesfaye F. Epidemiology of cardiovascular disease risk factors in Ethiopia: the rural-urban gradient: *Epidemiologi och folkhälsovetenskap* 2008.
9. Hameed MA and Dasgupta I. Medication adherence and treatment resistant hypertension: a review. *Drugs Context* 2019; 8: 212560.
10. Verdecchia P, Staessen JA, Angeli F, et al. Usual versus tight control of systolic blood pressure in non-diabetic patients with hypertension (Cardio-Sis): an open-label randomised trial. *Lancet* 2009; 374: 525–533.
11. Czernichow S, Zanchetti A, Turnbull F, et al. The effects of blood pressure reduction and of different blood pressure-lowering regimens on major cardiovascular events according to baseline blood pressure: meta-analysis of randomized trials. *J Hypertens* 2011; 29: 4–16.
12. Tibebu A, Mengistu D and Bulto LN. Adherence to prescribed antihypertensive medications and associated factors for hypertensive patients attending chronic follow-up units of selected public hospitals in Addis Ababa, Ethiopia. *Int J Health Sci* 2017; 11: 47.

13. Kelsey JL, Whittemore AS, Evans AS, et al. *Methods in observational epidemiology*. 2nd ed., Oxford University press, New York 1996.
14. Muntner P, Shimbo D, Carey RM, et al. Measurement of blood pressure in humans: a scientific statement from the American Heart Association. *Hypertension* 2019; 73: e35–e66.
15. Hareri HA and Abebe M. Assessments of adherence to hypertension medications and associated factors among patients attending Tikur Anbessa Specialized Hospital Renal Unit, Addis Ababa, Ethiopia 2012. *Int J Nurs Sci* 2013; 3: 1–6.
16. Hareri HA, Gedefaw M and Simeng B. Assessment of prevalence and associated factors of adherence to anti-hypertensive agents among adults on follow up in Adama Referral hospital, East Shoa, Ethiopia cross sectional study. *Int J Curr Microbiol App Sci* 2014; 3: 760–770.
17. Morisky DE, Ang A, Krousel-Wood M, et al. Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens* 2008; 10: 348–354.
18. Youssef R and Moubarak I. Patterns and determinants of treatment compliance among hypertensive patients. *Eastern Mediterranean Health Journal* 2002; 8 : 579–592.
19. Mugwano I, Kaddumukasa M, Mugenyi L, et al. Poor drug adherence and lack of awareness of hypertension among hypertensive stroke patients in Kampala, Uganda: a cross sectional study. *BMC Res Notes* 2016; 9: 3.
20. Hashmi SK, Afridi MB, Abbas K, et al. Factors associated with adherence to anti-hypertensive treatment in Pakistan. *PloS One* 2007; 2: e280.
21. Khan MU, Shah S and Hameed T. Barriers to and determinants of medication adherence among hypertensive patients attended National Health Service Hospital, Sunderland. *J Pharm Bioall Sci* 2014; 6: 104.
22. Inkster ME, Donnan P, MacDonald T, et al. Adherence to antihypertensive medication and association with patient and practice factors. *J Hum Hypertens* 2006; 20: 295.
23. Khayyat SM, Khayyat SMS, Alhazmi RSH, et al. Predictors of medication adherence and blood pressure control among Saudi hypertensive patients attending primary care clinics: a cross-sectional study. *PloS One* 2017; 12: e0171255.
24. Jankowska-Polańska B, Chudiak A, Uchmanowicz I, et al. Selected factors affecting adherence in the pharmacological treatment of arterial hypertension. *Patient Prefer Adherence* 2017; 11: 363.
25. Lee GK, Wang HH, Liu KQ, et al. Determinants of medication adherence to antihypertensive medications among a Chinese population using Morisky Medication Adherence Scale. *PloS One* 2013; 8: e62775.
26. Al-Ramahi R. Adherence to medications and associated factors: a cross-sectional study among Palestinian hypertensive patients. *J Epidemiol Glob Health* 2015; 5: 125–132.
27. Teshome DF, Bekele KB, Habitu YA, et al. Medication adherence and its associated factors among hypertensive patients attending the Debre Tabor General Hospital, northwest Ethiopia. *Integr Blood Pressure Control* 2017; 10: 1.
28. Mekonnen HS, Gebrie MH, Eyasu KH, et al. Drug adherence for antihypertensive medications and its determinants among adult hypertensive patients attending in chronic clinics of referral hospitals in Northwest Ethiopia. *BMC Pharmacol Toxicol* 2017; 18: 27.
29. Smith W, Lee A, Crombie I, et al. Control of blood pressure in Scotland: the rule of halves. *BMJ* 1990; 300: 981–983.
30. Ambaw AD, Alemie GA and Mengesha ZB. Adherence to antihypertensive treatment and associated factors among patients on follow up at University of Gondar Hospital, Northwest Ethiopia. *BMC Public Health* 2012; 12: 282.