Integrated Blood Pressure Control

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ORIGINAL RESEARCH

Knowledge and Attitude of Self-Monitoring of Blood Pressure Among Adult Hypertensive Patients on Follow-Up at Selected Public Hospitals in Arsi Zone, Oromia Regional State, Ethiopia: A Cross-Sectional Study

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Integrated Blood Pressure Control

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Background: Self-monitoring of blood pressure (BP) among hypertensive patients is an important aspect of the management and prevention of complication related to hypertension. However, self-monitoring of BP among hypertensive patients on scheduled follow-up in hospitals in Ethiopia is unknown. The aim of the study was to assess knowledge and attitude of self-monitoring of BP among adult hypertensive patients.

Methods: A cross-sectional survey was conducted on 400 adult hypertensive patients attending follow-up clinics at four public hospitals of Arsi Zone, Oromia Regional State, Ethiopia. The data were collected from patients from March 10, 2019 to April 8, 2019 by face-to-face interview using a pretested questionnaire and augmented by a retrospective patients' medical records review. The data were analyzed using the SPSS version 21.0 software.

Results: A total of 400 patients were enrolled into the study with the response rate of 97.6%. The median age of the participants was 49 years (range 23–90 years). More than half (225 [56.3%]) were male. The majority (160 [40%]) were married and more than two-thirds (282 [70.5%]) were Oromo by ethnic background. About 206 (51.5%) had attended primary education. The proportion of patient's knowledge toward self-monitoring of BP and the practice of self-monitoring of BP among hypertensive patients was 31.5% (n=126 [95% CI; 26.5, 36.5]) and 7.75% (n=31 [95% CI; 5.3, 10.5]) respectively. The multivariable logistic regression analysis revealed; higher education (AOR=2.73, 95% CI [1.33, 13.88]), governmental employed (AOR=1.52, 95% CI [1.06, 6.48]), having an income of >3500 Ethiopian Birr (AOR=2.16, 95% CI [1.56, 7.39]), duration of hypertension >6 years (AOR=1.87, 95% CI [1.21, 6.37]), having health insurance (AOR=3.56, 95% CI [1.39, 10.53]), having co-morbidities (AOR=3.93, 95% CI [1.35, 10.32]), receiving a health professional recommendation toward self-monitoring of BP (AOR=6.08, 95% CI [2.45, 15.06]), and having an awareness of hypertension-related complication (AOR=3.94, 95% CI [1.34, 11.44]) were factors significantly associated with self-monitoring of BP.

Conclusion: In this study, the proportion of knowledge of self-monitoring of BP and the practice of self-monitoring of BP among hypertensive patients on follow-up were low. Educational programs on self-monitoring of BP including teaching through demonstration may be needed to be in place.

Keywords: blood pressure, self-monitoring of blood pressure, hypertension, knowledge, attitude

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Background

Hypertension is a systolic blood pressure (SBP) ≥140 mm Hg and a diastolic pressure (DBP) ≥90 mm Hg based on the average of two or more accurate BP measurements taken during two or more contacts with a health care provider.[1] It is one of the major, but preventable risk factors of coronary artery disease, hemorrhagic and ischemic stroke, heart failure and chronic kidney disease.[2] Hypertension is also expressed as a "silent killer" because usually hyperpressure does not show any symptoms for years or even decades.[3] Most hypertensive patients do not show any symptoms entirely.[4,5] Therefore, it can only be detected by having one's BP measured regularly.[5] It is important that we take advantage of the early warning signal by taking our BP regularly.[3]

Hypertension has identified risk factors like age, body mass index (BMI), low physical fitness and waist–hip ratio (WHR). Whereas; age, BMI, low physical fitness, and WHR and ethnicity were factors significantly associated with isolated systolic hypertension (ISH).[6] Another evidence also showed that age, BMI and WHR were risk factors for hypertension and obesity was a risk factor of ISH. Whereas, ethnicity was significantly associated with ISH.[7] Obesity can cause fatal health complications and it can wield a huge burden on the economy with its connected disorders. Evidence shows that this burden is predicted to rise.[8] A positive relationship was found between waist circumference and SBP or DBP in both males and females and between BMI and SBP or DBP in women.[9]

Self-monitoring of BP is the consistent measurement of BP by a patient at home or somewhere outside the clinic setting using an own-home measurement device.[10,11] The evolution in the usage and accessibility of self-monitoring BP devices has been realized because of the rising problem of hypertension.[12] In integration with clinical support it is one alternative to traditional office care that could improve access to care and quality of care for individuals with hypertension, while making BP control more convenient and accessible across the population.[10] It could support identification of white-coat hypertension and masked hypertension.[13–15] Further to this, it is highly reproducible, has greater prognostic value, is extremely effective for the evaluation of drug effects and their duration, can be used for telemedicine, facilitates long-term BP control, improves the adherence to medications, can detect seasonal variations and long-term changes in BP, can detect morning and night-time hypertension, and can have a great effect on the medical economy.[14] It is a fundamental part of hypertension control and patients who practiced with self-initiation reported being more self-efficacious, but the absence of involvement and direction from their doctors created misunderstandings and prevented the real advantages of self-monitoring of BP.[16]

Self-monitoring of BP is principally valuable in the management of hypertension if out-of-office BP is consistently < 130/80 mm Hg, despite elevated in office readings and for those without target organ damage in order to avoid drug therapy and smokers.[17] It is an actual scheme to progress hypertension control and it could be combined into the common care of hypertensive patients.[18] Patients who have practiced self-monitoring of BP showed high adherence rates to antihypertensive medications and approval of enhanced lifestyle.[19] Moreover, it offers wide BP information gained under fixed timeframes and circumstances over a long period, has a stronger predictive value in terms of cardiovascular risk when compared with clinic BP measurements and it is easy to integrate into regular day-to-day habits.[12]

Hypertension remains a massive public health and economic burden globally, regardless of recent improvements in the trend of BP control. It is an independent prognosticator of cardiovascular disease and cause of mortality.[20] The burden of hypertension is substantial. The prevalence and the health significances of uncontrolled hypertension make it one of the world's most lethal diseases.[21] The prevalence of hypertension was 40% and 46% globally and in African region respectively[22] and 19.6% in Ethiopia of which 23.7% was in rural and 14.7% was urban collective population while 20.6% was in males and 19.2% was in females as indicated by a meta-analysis study.[23]

Globally, over the past 25 years, the estimated associated deaths of individuals with SBP levels of ≥140 mm Hg has increased substantially worldwide.[24] About 17 million deaths occur because of cardiovascular disease. Out of these, 9.4 million deaths occur due to hypertension-related complications worldwide every year. Hypertension is responsible for at least 45% and 51% of deaths due to heart disease and stroke respectively.[4] Hypertension is a principal cause of cardiovascular diseases (CVDs) such as myocardial infarction and stroke and it is the key cause of morbidity and mortality globally.[5] Hypertension was also observed as a risk factor for intrauterine growth restriction among pregnant women.[25]

The report of meta-analysis showed the projected rate of SBP of ≥140 mm Hg and related annual deaths increased from 17,307 to 20,526 per 100 000 persons and 97.9 to 106.3 per 100 000 persons between 1990 and 2015 years globally respectively.[26] The report of systematic analysis showed about 130.2 million cases of hypertension were estimated in 2010 and a projected increase to 216.8 million cases of hypertension by 2030 in Africa.[27] The Status reports on hypertension showed the proportion of hypertension has increased over the past two or three decades in Africa. In 2000, there were about 80 million adults with hypertension in sub-Saharan Africa and this number is expected to increase to 150 million by 2025. Evidence has shown that hypertension-related complications, principally stroke and heart failure, are increasingly common in this region.[28]

The American Heart Association (AHA), American Society of Hypertension (ASH), and Preventive Cardiovascular Nurses Association (PCNA) encourages increased regular use of self-monitoring of BP by clinicians for most patients with known or suspected hypertension to increase patients' engagement and ability to self-manage their condition, enabling the care team to assist in timely achievement and maintenance of control and preventing heart attacks and strokes.[10] There is increasing evidence that the office BP measurement procedure may yield misleading estimates of a patient's true BP status.[29] Whereas, self-monitoring of BP has better predictive precision than office BP measurement.[30]

The studies have confirmed that the self-monitoring of BP can yield a small but clinically substantial decrease in BP.[31] It also assists as motivation and drive to maintain or modify a patient's activities.[32] It is a complementary system because patients are involved with their self-care practice when they are self-monitoring their BP. These consequences show an improved faithfulness to treatment, a decrease in BP and they encourage patients to expect it as a routine part of their management.[13] This is supported by Dorothea Orem's Self-Care Theory: "the performance or practice of activities that individuals initiate and perform on their own behalf to maintain life, health and well-being".[33] However, there is a lack of studies that have addressed knowledge and attitude to the self-monitoring of BP among adult hypertensive patients on follow-up in the study area and even in our country, Ethiopia. Therefore, this study was intended to determine knowledge and attitude to self-monitoring of BP among adult hypertensive patients on follow-up at the study area.

Objectives

General Objective

The objective of this study was to assess the knowledge and attitude to self-monitoring of BP among adult hypertensive patients on follow-up at selected public hospitals in the Arsi zone, Oromia Region, Ethiopia.

Specific objectives

1. To determine the level of knowledge of self-monitoring of BP among adult hypertensive patients on follow-up at selected public hospitals in the Arsi zone, Oromia Region, Ethiopia.
2. To assess the attitude of self-monitoring of BP among adult hypertensive patients on follow-up at selected public hospitals in the Arsi zone, Oromia Region, Ethiopia.
3. To determine the prevalence of self-monitoring of BP among adult hypertensive patients on follow-up at selected public hospitals in the Arsi zone, Oromia Region, Ethiopia.
4. To identify factors associated with self-monitoring of BP among adult hypertensive patients on follow-up at selected public hospitals in the Arsi zone, Oromia Region, Ethiopia.
5. To identify factors which are barriers to self-monitoring of BP among adult hypertensive patients on follow-up at selected public hospitals in the Arsi zone, Oromia Region, Ethiopia.

Methods

Study Design and Setting

A cross-sectional survey was conducted on 400 adult hypertensive patients attending follow-up clinics at four public hospitals of Arsi Zone, Oromia Regional State, Ethiopia, from March 10/2019 - April 08/2019. Arsi zone is one of the zones which is found in Oromia regional states and is located in southeast of Ethiopia. The zone contains about 3.5 million of total populations with 24 Woredas (the lowest administrative unit), which is classified into 499 rural villages and 58 towns with 1 administrative town. The zone contains 7 public hospitals but only four public hospitals were included into the study with a probability lottery method: Asella, Gobesa, Bele and Bekoji Hospital.

Sample Size and Sampling Procedure

All hypertensive patients aged 18 years and above who had been on follow-up at least for six months were included in the study. Whereas, hypertensive patients who were severely ill and who were not mentally and physically capable of being interviewed at the time of data collection were excluded. A simple random sampling technique was employed to select four public hospitals from a total of seven public hospitals in the Arsi zone. The survey was conducted among four public hospitals. Since the survey was undertaken, all hypertensive patients attending follow-up clinics at selected public hospitals of the Arsi zone were included in the study and the final sample size was 400.

Study Variables

Independent Variables of the Study Were

- Age
- Gender
- Educational level
- Occupation
- Monthly income
- Family history of hypertension
- Health insurance
- Co-morbidities
- Recommendations toward using self-monitoring of BP
- Regular professional health carevisits.

Dependent Variables

- Knowledge of self-monitoring of BP
- Attitude to self-monitoring of BP
- Self-monitoring of BP.

Operational Definitions

Self-monitoring of BP: was defined as self-measurement of BP by patients at home or outside the clinic setting using a personal self-monitoring device.[10,11]

Self-monitoring of BP was assessed by patient's self-reported dichotomized questions with a yes or no response to "do you currently self-monitor your blood pressure using a self-monitoring blood pressure device at home?"[34–36]

Awareness of hypertension-related complications: In this study it means the patient's awareness of the complication of hypertension on target organs (brain, heart, kidney and eyes).

Awareness of hypertension-related complication was assessed by patient's self-reported dichotomized questions with a yes or no response to the question "Can uncontrolled hypertension lead to organ damage?" where yes meant aware, and no meant not aware.[37,38]

Knowledge of self-monitoring of BP was assessed by patient's self-reported dichotomized questions with a yes or no response to the question "do you know about self-monitoring blood pressure?" where yes meant they knew, and no meant they did not know.[39]

Attitude to self-monitoring of BP was assessed by patient's self-reported dichotomized questions with a yes or no response to each question raised on attitude to self-monitoring BP.[39]

Barrier: In this study it means any situation or factor that inhibits a hypertensive patient from self-monitoring his/her BP.

Data Collection Tool and Procedure

A semi-structured interviewer-administered questionnaire and a retrospective patients' medical records review was used to collect data. The questionnaire was prepared after reviewing relevant literature,[34–36,40–44] with modification fit to the local context. The questionnaire was prepared in English and translated to Afan Oromo and finally translated back to English to maintain consistency. The questionnaire was pretested on 5% of the calculated sample size. Data collectors and supervisors were trained for two days on the data collection instrument and data collection procedure. A total of four Bachelors of Science degree (BSc) nurses' data collectors and two Master of Science degree (MSc) nurses' supervisors were recruited for the study. The reliability of the questionnaire was checked by the reliability analysis and a Cronbach's alpha value was 0.85 which suggests a reliable tool. During the data collection period, close supervision was carried out by the principal investigator and the supervisors, by supervising how data collectors interview the respondents and checking the collected data for completeness.

Data Processing and Analysis

Data was checked, coded and entered into Epi-Data version 4.2.0.0 and then it was exported to Statistical Package for the Social Sciences (SPSS) version 21.0 (IBM Corporation, North Castle Drive, Armonk, NY, USA) for statistical analysis. The presence of multicollinearity was examined using the Variance Inflation Factor (VIF) and there was no multicollinearity. The outcome variable was dichotomized and coded as 0 and 1 representing self-monitoring of BP nonuser and self-monitoring of BP user, respectively. Descriptive statistics were summarized by using tables, figures and texts. Primarily, bi-variable logistic regression analysis was applied to identify variables associated with self-monitoring of BP and fit for multivariable logistic regression analyses with p-value of <0.25. All independent variables with p-value of <0.25 in bi-variable logistic regression analysis were included in the multivariable logistic regression model to identify variables associated with self-monitoring of BP. Both crude odds ratio (COR) and adjusted odds ratio (AOR) with the corresponding 95% (CI) were calculated to display the strength of the association. Model fitness was checked by Hosmer-Lemeshow's goodness-of-fit test for self-monitoring of BP while the result was found to be (p-value = 0.63) where (p-value >0.05). Lastly, variables in the multivariable logistic regression with p-values <0.05 were considered as statistically significant.

Results

Socio-Demographic Characteristics of Study Participants

A total of 400 patients were enrolled into the study resulting in the response rate of 97.6%. The median age of the participants was 49 years (range from 23 to 90 years) and 150 (37.5%) of them were middle aged. More than half (225 [56.3%]) were males. The majority (160 [40%]) were married and more than two-thirds (282 [70.5%]) were Oromo by ethnic background. The majority (187 [46.7%]) were orthodox followers. About half (206 [51.5%]) of the respondents had a primary education. Regarding monthly income, nearly half (195 [48.8%]) of the respondents had <2500 Ethiopian birr. Whereas, the majority (242 [60.5%]) of the respondents were urban dwellers (Table 1).

Health Care Professional Related Factors

Of the total respondents', more than half (221 [55.3%]) of the respondents had no regular health care professional visit, around eight in every ten (332 [83%]) of them were not recommended to self-monitorBP while, a little more than half (212 [53%]) of them were told about hypertension-related organ complications by a health care professional during follow-up, the smallest proportion (15 [3.8%]) of the respondents were advised on the procedure of self-monitoring BP and nine (2.2%) were advised about a self-monitoring BP device by a health care professional (Table 2).

Prevalence of Self-Monitoring of Blood Pressure

The prevalence of self-monitoring of BPamong hypertensive patients was 7.75% (95% CI; 5.3, 10.5).

Table 1 Sociodemographic Characteristics of Hypertensive Patients Attending Public Hospitals in the Arsi Zone, Oromia Regional State, Ethiopia, 2019 [n=400]

Variable	Category	Frequency	Percent (%)
Age	20–39	142	35.5
	40–59	150	37.5
	≥60	108	27.0
Gender	Male	225	56.2
	Female	175	43.8
Ethnicity	Oromo	282	70.5
	Amhara	87	21.8
	Gurage	27	6.7
	Other	4	1.0
Religion	Orthodox	187	46.7
	Muslim	159	39.8
	Protestant	51	12.7
	Other	3	0.8
Educational level	Primary education	206	51.5
	Secondary education	100	25.0
	Higher education	94	23.5
Marital status	Single	95	23.8
	Married	160	40.0
	Divorced	72	18.0
	Widowed	73	18.2
Occupation	Government employed	96	24.0
	Unemployed	304	76.0
Residency	Urban	242	60.5
	Rural	158	39.5
Average monthly income	<2500 ETB	195	48.8
	2500–3500 ETB	99	24.7
	>3500 ETB	106	26.5
Family history of hypertension	Present	154	38.5
	Not sure	104	26.0
	Absent	142	35.5
Duration of hypertension	≤ 6 years	230	57.5
	> 6 years	170	42.5
Health insurance	Yes	72	18.0
	No	328	82.0
Presence of co-morbidities	Yes	88	22.0
	No	312	78.0

(Continued)

Table 1 (Continued).

Variable	Category	Frequency	Percent (%)
Diagnosed co-morbidities (n=88) (multiple response)	Stroke Heart disease Kidney disease Eye disease Diabetes mellitus	17 25 37 20 33	19.3 28.4 42.0 22.7 37.5
Current smoking status	Yes No	65 335	16.2 83.8

Table 2 Health Care Professional-Related Factors Among Hypertensive Patients Attending Public Hospitals in the Arsi Zone, Oromia Regional State, Ethiopia, 2019 [n=400]

Variable	Response	Frequency	Percent (%)
Regular health care professional visit	Yes No	179 221	44.8 55.2
Recommendation toward using self-monitoring BP	Yes No	68 332	17.0 83.0
Advised on the procedure of self-monitoring BP	Yes No	15 385	3.8 96.2
Advised on type of self-monitoring BP device	Yes No	9 391	2.2 97.8
Told about hypertension-related organ complication	Yes No	212 188	53.0 47.0

Knowledge and Attitude to Self-Monitoring of Blood Pressure

Less than one third (126 [31.5%]) of respondents know about self-monitoring BP. Seventy-five (18.75%) agreed that self-monitoring BP is important, 68 (17%) of respondents agreed that self-monitoring BP could benefit them, 42 (10.5%) of the respondents agreed that self-monitoring BP is not accurate and 90 (22.5%) of the respondents agreed to recommend self-monitoring BP to other hypertensive patients.

Out of the respondents who know about self-monitoring BP 59.52% of them think self-monitoring BP is important; 51.59% of them agreed that self-monitoring BP could benefit them; 13.49% of them agreed that self-monitoring BP is not accurate and 69.05% of the respondents agreed to recommend self-monitoring BP to other hypertensive patients (Table 3).

Table 3 Patients' Knowledge and Attitude to Self-Monitoring of Blood Pressure Among Hypertensive Patients Attending Public Hospitals in the Arsi Zone, Oromia Regional State, Ethiopia, 2019 [n=400]

Questions	Yes, n (%)	No, n (%)
Knowledge questions		
Know about self-monitoring of blood pressure	126(31.5)	274(68.5)
Attitude questions		
Think that self-monitoring of blood pressure is important	75(18.75)	325(81.25)
Think that self-monitoring of blood pressure is beneficial	68(17.0)	332(83.0)
Think that self-monitoring of blood pressure is not accurate	42(10.5)	358(89.5)
Recommend others to use self-monitoring of blood pressure	90(22.5)	310(77.5)

Characteristic of Self-Monitoring of Blood Pressure

The result of this study showed that about two-third s (21 [67.7%]) of the respondents remembered their last BP reading. The respondents were asked their last BP reading to check whether they remembered or not, because if it was not remembered they could not compare it to the office BP reading. Regarding frequency, one-fourth (8 [25.8%]) of the participants were irregular when monitoring their BP. In addition to this, around one-sixth (5 [16.1%]) of them do not know how frequently they were self-monitoring their BP which shows that they were not fully conscious about self-monitoring BP.

Nearly half (16 [51.6%]) of the respondents had no specific time to measure their BP. In spite of self-monitoring their BP, about two-thirds (21 [67.7%]) of the respondents did not keep a chart of their measurements. Of all the precautions listed, the majority (14 [45.2%]) of respondents did not measure their BP within 30 mins of caffeine intake. While 13 (41.9%) of them had no precautions when measuring their BP, even though they were self-monitoring their BP. Less than two-thirds (19 [61.3%]) of the respondents did not compare their home BP reading to their office BP reading. Comparing those two readings was used to rule out the likelihood of a white coat hypertension and to confirm that their device is operating correctly.

Of those respondents who compared office BP reading with home BP reading, about one-third (4 [33.3%]) of them responded that their readings matched, whereas the majority

(5 [41.7%]) of them answered that it was sometimes a match. Office BP was higher among three-quarters (6 [75%]) of the respondents whose home BP reading was not always a match with their office readings (Table 4).

Reason for Using Self-Monitoring of Blood Pressure

This section was required to identify possible reasons for respondents to self-monitor their BP. Among the patients who reported using self-monitoring BP, the majority (58.10%) mentioned a health care professional recommendation for self-monitoring BP as their primary reason; 12.90% stated they self-monitored BP because of personal motivation; 19.40% cited that they self-monitored BP on the advice of family members, and 9.70% mentioned that they were self-monitoring BP because they had BP monitors in their homes (Figure 1).

Barriers for Non-Use of Self-Monitoring of Blood Pressure

This section was required to identify potential barriers for respondents' inability to self-monitor their BP. Respondents were requested to agree or disagree to proposed reasons for not self-monitoring their BP. The majority (91.9%) of the respondents did not understand how to operate the device; 41.2% could not afford to purchase the device; 15.4% did not think carrying out self-monitoring of their BP was important; 14.1% think self-monitoring BP is not beneficial; 85.6% were unaware of self-monitoring BP; 88.6% had never heard of self-monitoring BP devices; 28.7% perceived

Table 4 Characteristic of Self-Monitoring of Blood Pressure Users Among Hypertensive Patients Attending Public Hospitals in the Arsi Zone, Oromia Regional State, Ethiopia, 2019 [n=31]

Variable	Response	Frequency	Percent	95% CI
Did you remember your last blood pressure reading?	Yes	21	67.7	[48.4, 83.9]
	No	10	32.3	[16.1, 51.6]
How frequently do you assess your blood pressure?	Once a day	4	12.9	[3.2, 25.8]
	More than once a day	4	12.9	[3.2, 25.8]
	Once a week	3	9.7	[0.0, 22.6]
	Twice a week	4	12.9	[3.2, 25.8]
	Once a month	3	9.7	[0.0, 22.6]
	Irregularly	8	25.8	[12.9, 41.9]
	Do not know	5	16.1	[6.5, 32.2]
What time of the day do you measure your blood pressure?	In the morning	6	19.4	[6.5, 35.5]
	In the evening	3	9.7	[0, 19.4]
	In the morning & evening	6	19.4	[6.5, 32.3]
	No specific time	16	51.6	[35.5, 71.0]
Do you maintain a record of your measurement?	Yes	10	32.3	[13.0, 48.4]
	No	21	67.7	[51.6, 87.0]
Which of the following precautions do you take when measuring your blood pressure?	Within 30 mins of caffeine intake	14	45.2	[25.8, 64.4]
	Within 30 mins of exercise	9	29.0	[13.0, 45.2]
	In a noisy environment	10	32.3	[16.1, 48.4]
	During having stress	4	12.9	[3.2, 25.8]
	No precautions	13	41.9	[25.8, 58.1]
Do you compare your home blood pressure reading with office blood pressure reading?	Yes	12	38.7	[22.6, 54.8]
	No	19	61.3	[45.2, 77.4]
If yes, does your blood pressure reading at home match with your blood pressure taken at a clinic? (n=12)	Always	4	33.3	[8.3, 58.3]
	Sometimes	5	41.7	[16.7,66.7]
	Rarely	3	25.0	[0.0, 50.0]
If not always matching, is your bood pressure higher when measured by a doctor as compared to when measured at home? (n=8)	Yes	6	75.0	[37.5, 100.0]
	No	2	25.0	[0.0, 62.5]

to be inaccurate; 20.1% cannot read and write; 86.4% were never asked to use a BP self-monitoring device; 2.2% were discouraged by health care professionals, and 3.3% of the participants mentioned that their result was not used by health care professionals as reasons or barriers for not using self-monitoring BP (Figure 2).

Factors Associated with Use of Self-Monitoring of Blood Pressure

Factors associated with self-monitoring of BP were classified as sociodemographic factors and health professional related factors. In bi-variable analysis, age, gender, educational level, monthly income, occupation,

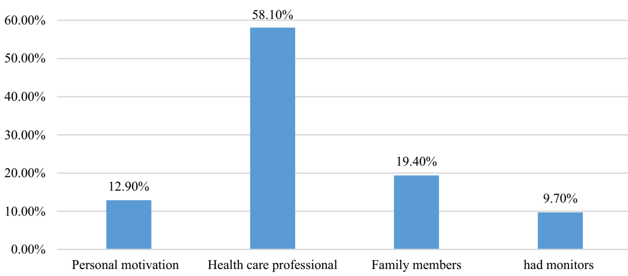

Figure 1 Reason for self-monitoring blood pressure among hypertensive patients attending public hospitals in the Arsi Zone, Oromia Regional State, Ethiopia, 2019 [n=31].

duration of hypertension, health insurance, comorbidity, regular health care professional visit, recommendation toward using self-monitoring of BP and an awareness of hypertension related target organ complication were factors that had *p*-value < 0.25. However, family history of hypertension, residency, marital status and current smoking status were factors that had *p*-value > 0.25 and they were not entered into multivariable analysis. In the multivariable analysis, educational level, occupation, monthly income, duration of hypertension, presence of comorbidities, health insurance, recommendation toward using self-monitoring of BP, and an awareness of hypertension related target organ complications were factors that have shown an association with self-monitoring of BP.

The odds of self-monitoring of BP among participants who have attended higher education was almost three times higher (AOR=2.73, 95% CI [1.33, 13.88]) than those who have attended primary education. On the other hand, the likelihood of self-monitoring of BP among participants who were governmental employees were nearly twice more likely (AOR=1.52, 95% CI [1.06, 6.48]) to self-monitor BP when compared to those who were unemployed.

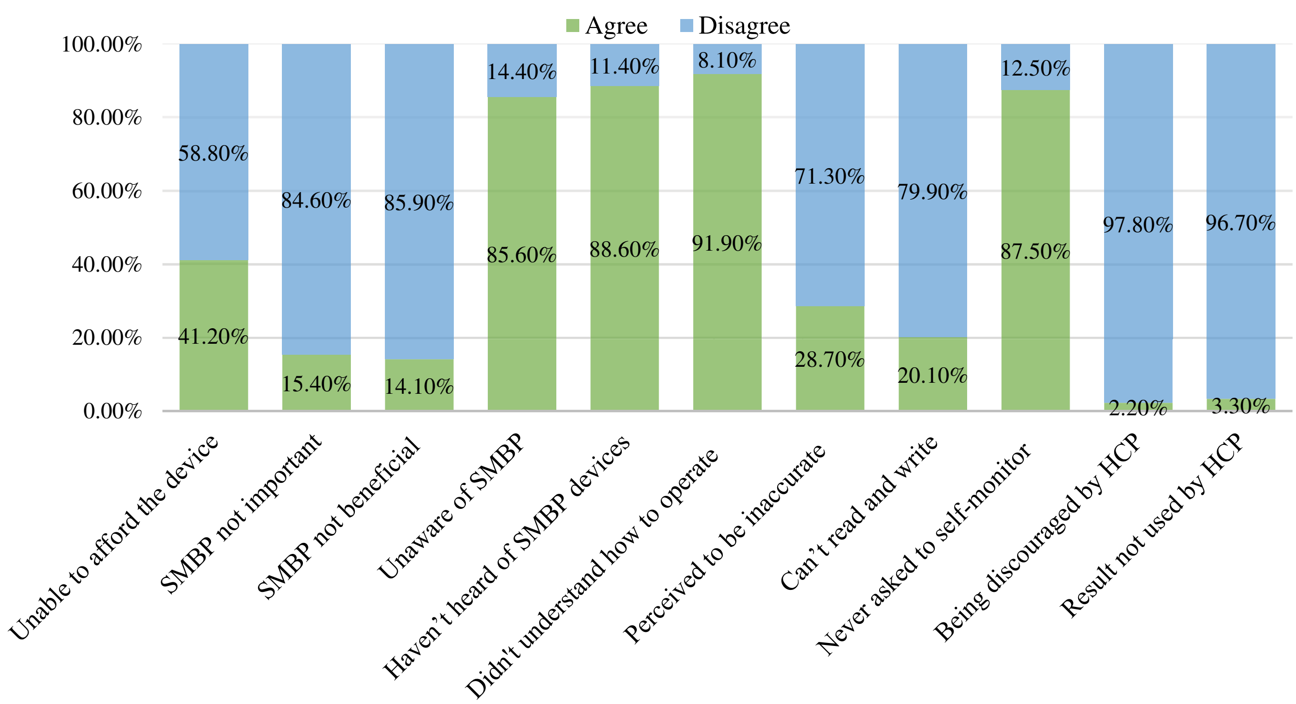

Figure 2 Reason for not using self-monitoring of blood pressure among hypertensive patients attending public hospitals in the Arsi zone, Oromia Regional State, Ethiopia, 2019 [n=369].

Likewise, participants who had monthly income of >3500 Ethiopian birr were almost twice (AOR=2.16, 95% CI [1.56, 7.39]) more likely to self-monitor BP when compared to those who have monthly income of <2500 Ethiopian birr. The odds of self-monitoring BP among participants who have a duration of hypertension >6 years were approximately twice as likely (AOR=1.87, 95% CI [1.21, 6.37]) than participants who have duration of hypertension diagnosis ≤6 years.

Moreover, the likelihood of self-monitoring BP among participants who had health insurance were nearly four times more (AOR=3.56, 95% CI [1.39, 10.53]) when compared to their contraries. Participants who had comorbidities were nearly four times (AOR=3.93, 95% CI [1.35, 10.32]) more likely self-monitor BP when compared to their contraries. The odds of self-monitoring BP among participants who were recommended to use self-monitoring of BP were almost six times higher (AOR=6.08, 95% CI [2.45, 15.06]) than participants who did not receive a recommendation.

Finally, participants who were awareof hypertension-related complications were almost four times more likely (AOR=3.94, 95% CI [1.34, 11.44]) to self-monitor BP when compared to their opposites (Table 5).

Discussion

This study revealed that the practice of self-monitoring BP among hypertensive patients was 7.75% (95% CI; 5.3,

Table 5 Bivariate and Multivariate Analysis of Factors Associated with Self-Monitoring of Blood Pressure Among Adult Hypertensive Patients in Public Hospitals in the Arsi Zone, Oromia Regional State, Ethiopia, 2019 [n=400]

Variables	Category	Self-Monitoring of BP		COR (95% CI)	AOR (95% CI)	p-value
		User	Nonuser			
Age	20–39 40–59 ≥60	8(5.6%) 9(6.0%) 14(13.0%)	134(94.4%) 141(94.0%) 94(87.0%)	1 1.07(0.40, 2.85) 2.50(1.01, 6.18)	1 1.01(0.37, 4.90) 1.48(0.42, 4.92)	 0.409 0.547
Gender	Male Female	21(9.3%) 10(5.7%)	204(90.7%) 165(94.3%)	1.70(0.78, 3.71) 1	0.64(0.23, 1.80) 1	0.369
Educational level	Primary education Secondary education Higher education	11(5.3%) 6(6.0%) 14(14.9%)	195(94.7%) 94(94.0%) 80(85.1%)	1 1.13(0.41, 3.15) 3.10(1.35, 7.13)	1 0.69(0.19, 2.57) **2.73(1.33, 13.88)**	 0.585 **0.015**
Occupation	Government Employed Unemployed	9(9.4%) 22(7.2%)	87(90.6%) 282(92.8%)	1.33(0.59, 2.99) 1	**1.52(1.06, 6.48)** 1	**0.043**
Monthly income	<2500 ETB 2500–3500 ETB >3500 ETB	11(5.6%) 6(6.1%) 14(13.2%)	184(94.4%) 93(93.9%) 92(86.8%)	1 1.08(0.39, 3.01) 2.55(1.11, 5.83)	1 0.79(0.20, 3.20) **2.16(1.56, 7.39)**	 0.738 **0.022**
Duration of hypertension	≤6 years >6 years	12(5.2%) 19(11.2%)	218(94.8%) 151(88.8%)	1 2.29(1.08, 4.85)	1 **1.87(1.21, 6.37)**	 **0.035**
Health insurance	Yes No	13(18.1%) 18(5.5%)	59(81.9%) 310(94.5%)	3.80(1.76, 8.16) 1	**3.56(1.39, 10.53)** 1	**0.012**
Presence of co-morbidities	Yes No	18(20.5%) 13(4.2%)	70(79.5%) 299(95.8%)	5.91(2.77, 12.64) 1	**3.93(1.35, 10.32)** 1	**0.010**
Regular HCP visit	Yes No	24(13.4%) 7(3.2%)	155(86.6%) 214(96.8%)	4.73(1.99, 11.26) 1	2.26(0.69, 7.32) 1	0.176
Recommendation for SMBP	Yes No	18(26.5%) 13(3.9%)	50(73.5%) 319(96.1%)	8.83(4.08, 19.14) 1	**6.08(2.45, 15.06)** 1	**0.000**
Awareness of HTNC	Aware Not aware	22(16.9%) 9(3.3%)	108(83.1%) 261(96.7%)	5.91(2.64, 13.24) 1	**3.94(1.34, 11.44)** 1	**0.009**

Notes: Figure in bold shows statistically significant ($p < 0.05$), number[1] represents the reference category, and the currency for the monthly income is Ethiopian birr.
Abbreviations: COR = Crude Odds Ratio; AOR = Adjusted Odds Ratio; CI = Confidence Interval; HTNC = Hypertension Complication; BP = Blood Pressure; SMBP = Self-Monitoring of Blood Pressure; HCP = Health Care Professional; ETB = Ethiopian Birr.

10.5). This finding is lower when compared to a study conducted in America, the Czech Republic, the United States, Canada, and Italy which were 53.8%, 40%, 41.6%, 50% and 74.7%, respectively.[42,45–48] This variation might be due to differences in sample sizes (559) and sampling procedures, where a study was undertaken with an online survey and patients with low-income category might not be involved due to service inaccessibility which could overestimate the proportion of self-monitoring of BP for a study carried out in America. Population segment and sample size differences for the Czech Republic study was conducted among 552 hypertensive patients aged between 25 and 75 years. The study design and study setting differences for the United states study was a cross-sectional, correlational design used with the urban community population. The study setting differences for Canada was that the study was conducted among community pharmacies and hypertensive patients, and in Italy the sample size was 855 hypertensive patients.

This result was also lower than findings reported from the studies carried out in the West Midlands (UK), Muscat (governorate of Sultanate of Oman) and Amman (Jordan), they showed that the proportion of self-monitoring BP was 30.7%, 40%, and 82% respectively.[34,36,49] The difference might be due to differences in sample size (1815) for a study carried out in the West Midlands (UK), while the highest proportion in Amman (Jordan) might be due to differences in a study setting, where it was conducted among institutions in Amman,and the pharmacist participation for counseling patients on the proper use of BP monitors and delivering required relevant education in addition to other health care professional as a study report.

This finding was lower than results reported from a study carried out in Karachi (southern Asia), northeastern Singapore (Asia), northern Carolina, and China where the prevalence of self-Monitoring of BP among hypertensive patients was 25%, 24%, 43.1%, and 24.5% respectively.[35,40,41,44] This variation might be due to the differences in a study setting where a study was conducted at a tertiary hospital for the study in Karachi, and differences in the sample size (700) for the study carried out in northern Carolina.

This study also revealed that the patient's knowledge of self-monitoring BP was 31.5% (95% CI; 26.5, 36.5). This finding is lower when compared to a study conducted in Nigeria which was 54.7%.[39] This difference might be due to differences in the study setting, where the study of Nigeria was conducted in a cardiology clinic.

The odds of self-monitoring BP among participants who have attended higher education were almost three times higher (AOR=2.73, 95% CI [1.33, 13.88]) than who have attended primary education. This finding is supported by the study conducted in Karachi and Italy.[44,48] This could be due to the fact that higher education provides better information about self-monitoring of BP and hypertension-related complications. The education helps to make the patient conscious of their health status and also creates the opportunity of being aware of the disease condition and its weightiness.

This study also showed that the likelihood of self-monitoring BP among participants who were government employees were almost twice as likely (AOR=1.52, 95% CI [1.06, 6.48]) to self-monitor BP when compared to those who were unemployed. This finding is consistent with a study carried out in the West Midlands (UK).[36] This is probably because of the potential to cover their device expenses and they could have access to the media and gain information regarding their health conditions.

This study also showed that participants who had a monthly income of >3500 Ethiopian birr were nearly twice as likely (AOR=2.16, 95% CI [1.56, 7.39]) to self-monitor BP when compared to those who have a monthly income of <2500 Ethiopian birr. This result is similar with a study conducted in northeastern Singapore.[40] This might be due to the fact that the patient may be able to afford the device and could also be familiar with the media, another source of information concerning disease and self-monitoring of BP.

This study also showed that the odds of self-monitoring of BP among participants who had a duration of hypertension of >6 years were nearly twice as likely (AOR=1.87, 95% CI [1.21, 6.37]) than participants who have a duration of hypertension ≤6 years. The possible justification is that the patient could be mindful about the hypertension-related complications during the course of the disease and the patient might use self-monitoring of BP to control those complications.

This study also revealed that the likelihood of self-monitoring of BP among participants who had health insurance were almost four times as likely (AOR=3.56, 95% CI [1.39, 10.53]) when compared to their contraries. This finding is supported by a study conducted in the United States.[43] This is probably because of the coverage of the medical expenses, the device could be accessible for the patient through a health insurance system and the patient might self-monitor their BP.

This study also demonstrated that the likelihood of self-monitoring of BP among participants who had comorbidities were four times as likely (AOR=3.93, 95% CI [1.35, 10.32]) when compared to their contraries. This finding is supported by a study carried out in northern Carolina and the United States.[35,43] This could be due to the fact that the patient's health seeking behavior would be improved because of the burden of the disease and the patient would use strategies to control hypertension and the diagnosed co-morbidities.

This study also revealed that the odds of self-monitoring of BP among participants who were recommended to self-monitor their BP were nearly six times higher (AOR=6.08, 95% CI [2.45, 15.06]) than participants who did not receive a recommendation. This finding is supported with a study carried out in northern Carolina and the United States.[35,43] This could be due to the fact that awareness was created by a health care professional regarding the importance of self-monitoring BP during recommending its utilization.

This study also showed that the likelihood of self-monitoring BP among participants who had an awareness of hypertension-related complication was almost four times more likely (AOR=3.94, 95% CI [1.34, 11.44]) whencompared to their counterparts. A possible justification is that having an awareness of hypertension-related complications could make the patient more conscious about the seriousness of the disease and the patient might focus on hypertension control through the personal device at home.

Conclusion

This study revealed that the proportion of knowledge of self-monitoring BP and the practice of self-monitoring BP among hypertensive patients on follow-up were low. The multivariable logistic regression analysis showed educational level, occupation, monthly income, duration of hypertension, health insurance, co-morbidities, a health professional recommendation toward self-monitoring BP, and an awareness of hypertension-related complications were factors significantly associated with self-monitoring of BP.

This study had also identified the potential barriers for respondents' inability to use self-monitoring of BP. These include: did not understand how to operate the device, was unable to afford to purchase the device, did not think carrying out self-monitoring of BP was important, thought self-monitoring of BP was not beneficial, unaware of self-monitoring of BP, never heard of self-monitoring BP devices, perceived readings to be inaccurate, patient cannot read or write, never asked to self-monitor BP, being discouraged by health care professionals, and their result not being used by health care professionals were cited as barriers for not self-monitoring BP.

Furthermore, this study delivers important evidence for encouragement of the communities' health and preventive interventions program to the communities living in the study area in Ethiopia. It also provides a cornerstone to encourage health care providers to consider hypertension management and support them to focus on and plan the strategies to address this problem. Finally, we recommend educational programs on self-monitoring of BP, including teaching through demonstration, which may be needed to abate the problem.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from institutional review board of Addis Ababa University, college of health sciences, school of Nursing and Midwifery research committee. Then, the letter was submitted to Asella, Bekoji, Bele and Gobesa hospital. Permission was attained from those concerned bodies. Prior to data collection, all participants recruited to the study was received written information sheet about the study. Respondents was insured about the confidentiality of information acquired. Then consents were gained from each study subjects after explaining the objectives of the study and procedures. Lastly, they were confirmed it with their signature.

Data Sharing Statement

The data used to support the findings of this study are included within the article.

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Author Contributions

Addisu Dabi Wake and Daniel Mengistu Bekele designed the study and supervised the data collection. Then all authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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