

## Research Article

# Antihypertensive medication non-adherence and its determinants among patients on follow up in public hospitals in Northern Ethiopia

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## ABSTRACT

**Background:** Adherence to pharmacological treatment for hypertension is considered a key factor in guaranteeing successful therapy outcomes. Non-adherence to antihypertensive therapy can be determined by demographic, drug related, disease related and setting related factors. The primary aim of this study was to investigate antihypertensive medication non-adherence and its determinants among patients on follow up in Ayder referral hospital and Mekelle general hospital.

**Methods:** A prospective cross-sectional study was conducted in Ayder Referral Hospital (ARH) and Mekelle General Hospital (MGH) from May to June, 2013. A total of 121 patients were interviewed with a structured standard questionnaire and patient medication charts were reviewed. The questionnaire contained of demographic questions, the 8-item Morisky medication adherence scale (MMAS) and questions about characteristics of hypertension and its therapy. The data collected were cleaned, entered and analyzed using Statistical Package for Social Science (SPSS) version 16 for windows with 95% confidence interval and P value <0.05.

**Results:** Around one fourth (26.4%) of the study participants were found to be non-adherent to their treatment. Family support on adherence (AOR = 0.170, 95%CI = 0.030-0.905), spot blood pressure (AOR = 0.052, 95%CI = 0.003-0.242), place of patient residence (AOR = 0.184, 95%CI = 0.024-0.597) and hypertension related complications (AOR = 21.737, 95%CI = 1.568-418.428) were found significantly and strongly associated with treatment non-adherence.

**Conclusions:** A quarter of the participants of this study were completely non-adherent and only around half of them were adherent to their medications. The absence of family support, being at the prehypertension class of blood pressure, living in Mekelle city and presence of hypertensive heart disease were shown to decrease adherence to antihypertensive medications. Therefore, health care professionals should be adequately trained and resourced to offer proper counseling to hypertensive patients on their medication and disease conditions.

**Keywords:** Antihypertensive, Non-adherence, Determinants, ARH, MGH

## INTRODUCTION

Untreated or suboptimally treated hypertension could lead to increased risk of morbidity and mortality due to cardiovascular, cerebrovascular, or renal diseases. Hypertension is an overwhelming global challenge which ranks third as a cause of disability-adjusted life-years. It

affects close to one billion individuals worldwide. The number is continuously growing due to the progressive aging of the population.<sup>1</sup> The WHO reported that suboptimal blood pressure (>115 mmHg systolic blood pressure) was the cause of 62% of cerebrovascular diseases and 49% of ischemic heart diseases.<sup>2</sup> It is well known that high blood pressure increases the risk of ischemic heart disease 3- to 4-fold and of overall

cardiovascular risk by 2- to 3-fold. The incidence of stroke increases approximately 3-fold in patients with borderline hypertension and approximately 8-fold in those with definite hypertension. It has been estimated that 40% of cases of acute myocardial infarction or stroke were attributable to hypertension.<sup>3</sup>

Adherence is a term that is often inappropriately used interchangeably with compliance. However, the term adherence is preferred over compliance because it implies an interactive, collaborative relationship between the patient and the care-giver.<sup>4</sup> Compliance is defined as the extent to which a person's medication-taking behaviour coincides with the healthcare providers' medical advice.<sup>5</sup> The word compliance originated from a practitioner - centered paradigm and implies an authoritarian model that places the patient in a passive role.<sup>6</sup> Adherence includes both dosing regularity and timing of intake, and for some specific patient populations (e.g., for HIV/AIDS patients), selected drug-food interactions.<sup>7</sup> Non-adherence can take many different forms. Patients can fail to fill or refill a prescription, take an incorrect dose, take a medication at the wrong time, forget to take doses, or stop therapy too soon. Non-adherence can also involve taking foods or other medications that alter bioavailability or alter metabolism rates.<sup>8</sup> From the available research in the field of hypertension treatment, factors influencing hypertensive patients' adherence behavior to antihypertensive medication include patient-related factors (e.g., socio-demographic factors and the individual's knowledge and skills), health system-related factors (such as treatment cost and patients' resources), and provider-related factors (such as patient-provider relationships and communication).<sup>3,9</sup> Medication non-adherence is an enormous burden to the world's health care system. For example, half of the 3.2 billion annual prescriptions dispensed in the United States were not taken as prescribed and numerous studies have shown that patients with chronic conditions adhere only to 50-60 percent of medications as prescribed, despite evidence that medication therapy improves life expectancy and quality of life. On its top, approximately 125,000 deaths per year in the United States were linked to medication non-adherence and between 33 and 69 percent of medication-related hospital admissions in the United States were due to poor adherence, with total cost estimates for non-adherence ranging from \$100-300 billion each year including costs for additional doctor visits, emergency room visits, hospital admissions, and additional medicines.<sup>10,11</sup>

Unfortunately, poor adherence to medications is widespread especially in the treatment of chronic conditions such as hypertension leading to poor health outcomes and huge medical spending on drug-related morbidity. Only 20 to 80% of patients receiving treatment for hypertension in real life situations are considered to be "good compliers". The situation is reported to be worse in developing countries due to poor accessibility to medications and health care services. The

asymptomatic nature of the condition intensifies the problem of non-adherence in hypertension. Studies also have shown that patients' attitude about hypertension, their reliance on their medications and whether or not their lifestyle has been modified greatly affect their adherence to antihypertensive therapy. In addition, people with hypertension tend to see hypertension not as a disease but as a risk factor for myocardial infarction or stroke.<sup>12-15</sup> Hence, in view of the consequences of non-adherence to anti-hypertensive medicines and high cost of standard hypertension medication, the aim of this research was to assess antihypertensive medication non-adherence and its determinants among patients on follow up in Ayder Referral Hospital (ARH) and Mekelle General Hospital (MGH).

## **METHODS**

### ***Study area and period***

This study was conducted from May to June, 2013 in ARH and MGH, Mekelle. Mekelle, the capital city of the Tigray regional state in Ethiopia, lies 783 km north of Addis Ababa. It covers 28 km square and has an estimated population of 175000.<sup>16,17</sup>

### ***Study design and study population***

A prospective cross sectional study was conducted in ARH and MGH among hypertensive patients, who had follow up visits from May to June, 2013. All people who were diagnosed with hypertension and were on follow up as outpatients in MGH and ARH were considered as source population and all adult hypertensive patients attending the facility on out-patient basis and on medication for not less than six months were used for the study as a study population.

### ***Sampling***

All hypertensive patients who had follow up visit from May to June, 2013 and fulfilling the inclusion/exclusion criteria were included in the study.

### ***Inclusion and exclusion criteria***

Hypertensive patients who were on follow up as outpatients, were at age of 18 or greater, and had been on medication for at least 6 months were included in the study. Hypertensive patients who were admitted to inpatient wards, pregnancy related hypertensive patients, or patients diagnosed hypertensive but not on antihypertensives were excluded from this study.

### ***Study variables***

Demographic variables (age, Sex, marital status, educational status, financial support, social support, occupation, residence, family history), disease related variables (stage of hypertension, complications), drug

related variables (duration of therapy, number of anti-hypertensive drugs) and setup related variables (distance from house of patient, frequency of follow up visits) were considered as independent variables & non-adherence to antihypertensives was considered as dependent variable.

### Data collection instrument

A structured questionnaire which contains questions descriptive of demographic status of patient, 8-item based Morisky medication adherence scale<sup>18</sup> and questions assessing the characteristics of hypertension and antihypertensive treatment were used as a data collection instrument. The self-reported measure of medication taking was developed from a previously validated four-item scale and supplemented with additional items addressing the circumstances surrounding adherence behaviour. The theory underlying this measure was that failure to adhere to a medication regimen could occur due to several factors such as “do you sometimes have problems remembering to take your medication”, “do you sometimes forget to take your medication,” and problems with the complexity of the medical regimen such as, “do you ever feel hassled about sticking to your treatment plan”. The questions were phrased to avoid the “yes-saying” bias by reversing the wording of the questions about the way patients might experience failure in following their medication regimen since there is a tendency for patients to give their physicians or other health care provider's positive answers. Each item is measuring a specific medication-taking behaviour and not a determinant of adherence behaviour. Response categories were yes/no for each item with a dichotomous response and a 5-point Likert response for the last item.

### Data collection process and quality assurance

All the necessary data were collected using the structured questionnaire. The questionnaire was presented to each patient as an interview with proper explanation. Patient medication charts were also reviewed carefully for assessing the characteristics of hypertension and antihypertensive treatment. Data collection was conducted with appropriate training of the data collectors and continuous advices to keep the quality of the data. Close supervision was made by the investigators and the collected data were checked for completeness every day.

### Data analysis

In the 8-item Morisky scale, a NO answer was allocated a score of 1, and a YES a score of 0 with an exception of question 5 for which the reverse was done. The sum of all the scores was then taken as the total score. Total score greater than 2 corresponded to low adherence; total score of 1 or 2 corresponded to medium adherence and total score of 0 corresponded to high adherence. The data were entered and analyzed using SPSS version 16 statistical package. Data cleaning was performed to check for accuracy, consistency and if there were no missed values

during entry. Frequencies, proportions and summary statistics were used to describe the study population in relation to relevant variables. Chi-square and multivariate logistic regression analyses were carried out to see the putative associations of each independent variable with the dependent variable. Odds ratio and 95% confidence interval were also used to identify the presence and strength of association. P value <0.05 was considered as significant for all of the analyses.

## RESULTS

### Socio-demographic characteristics

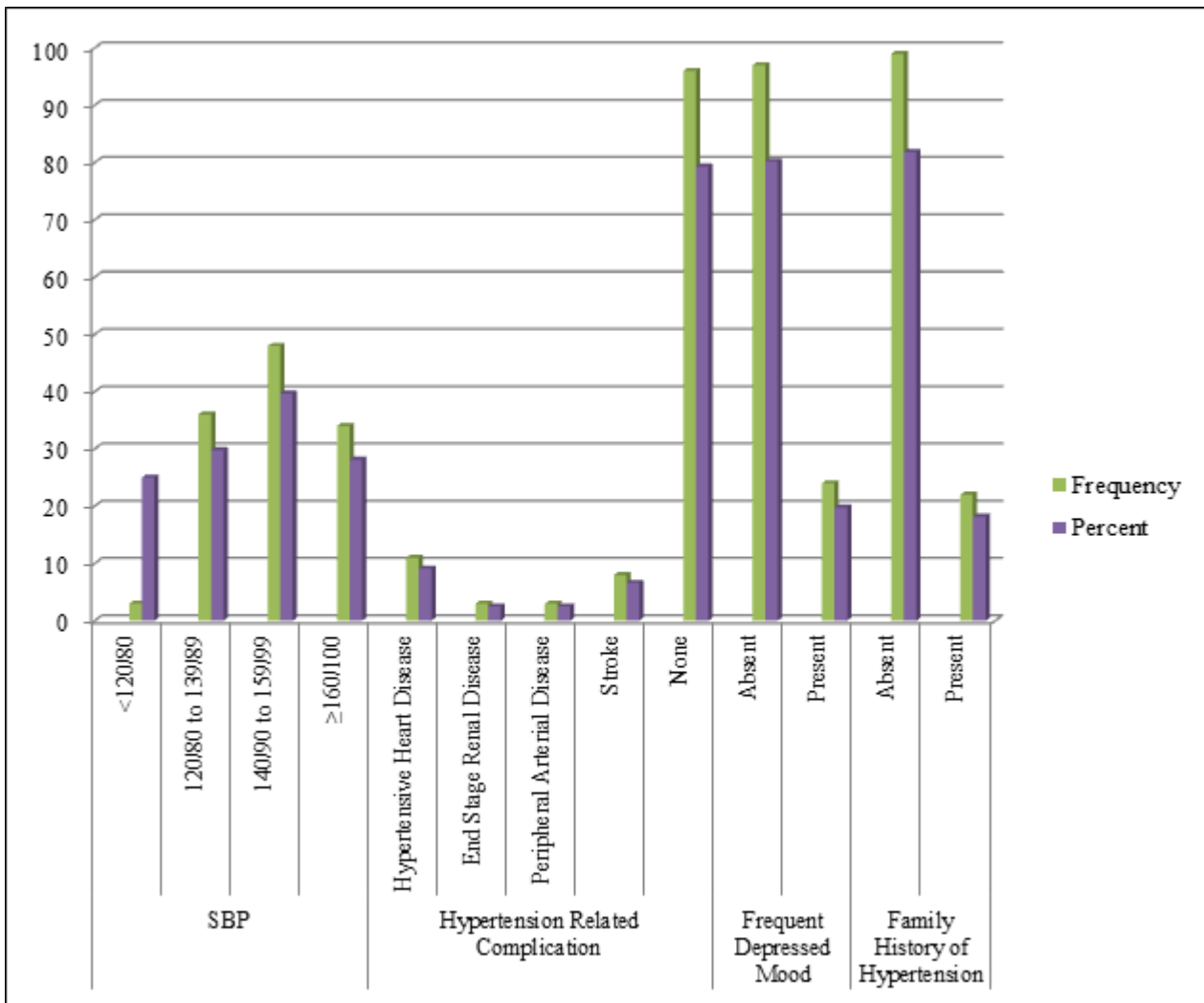
**Table 1: Socio-demographic characteristic of the study participants, May-June, 2013 (n=121).**

Variables	Frequency	Percent (%)
<b>Setting of follow up</b>		
MGH	85	70.2%
ARH	36	29.8%
<b>Range of age among patients</b>		
<40	13	10.7%
40-49	22	18.2%
50-59	41	33.9%
>60	45	37.2%
<b>Sex of the patient</b>		
Female	75	62.0%
Male	46	38.0%
<b>Education status</b>		
Illiterate	82	67.8%
Primary or below	22	18.2%
Intermediate and secondary	12	9.9%
graduate n above	5	4.1%
<b>Marital status</b>		
Single	8	6.6%
Married	86	71.1%
Divorced or widowed	27	22.3%
<b>Family support on adherence</b>		
Absent	79	65.3%
Present	42	34.7%
<b>Occupation of the patient</b>		
Retired	9	7.4%
Unemployed	41	33.9%
House wife	30	24.8%
Teacher	2	1.7%
Farmer	15	12.4%
Employed	16	13.2%
Others	8	6.6%
<b>Residence</b>		
In Mekelle	96	79.3%
Outside Mekelle	25	20.7%
<b>Medication payment</b>		
Self	41	33.9%
Family	29	24.0%
Welfare/charity	41	33.9%
Employer	10	8.3%

A total of 121 study participants were interviewed of which 75 (62.0%) were female and 46 (38.0%) were males. The mean age of respondents was  $54.7 \pm 12.7$  years. Of the study population, 85 (70.2%) had follow up in MGH. Forty five (37.2%) of the participants were at the age of above 60 years and 82 (67.8%) were illiterate. A large proportion of the subjects, 86 (71.1%), were married and 41 (33.9%) of the total study population were unemployed while 30 (24.8%) were housewives. Ninety six (79.3%) of the study participants were from Mekelle city. Seventy nine (65.3%) of the subjects lack family support on adherence and 41 (33.9%) pay their medication expenses by themselves (Table 1).

**Clinical, medication and adherence characteristics**

The clinical characters studied were Spot Blood Pressure (SBP), hypertension Related Complications, frequent depressed mood, and family history of hypertension. A greater portion of the subjects 48 (39.7%) had SBP of 140/90 to 159/99 which is of stage I hypertension. Among the 25 (20.7%) patients who developed hypertension related complications, 11 (9.1%) developed hypertensive heart disease. Twenty four (19.8%) of the study participants had frequent mood of depression and 22 (18.2%) of them had a family history of hypertension (Figure 1).



**Figure 1: Clinical characteristics of the study participants, May-June, 2013 (n=121).**

More than half of the study subjects, 70 (57.9%), had an antihypertensive regimen containing 2 drugs. The last follow up visit of 52 (43%) patients was before 1 month or less, followed by 47 (38%) patients with last follow up visit 2 months ago. Greater portion of patients, 53

(43.8%), had been on antihypertensive medication for 1 to 3 years, followed by 43 (38.8%) patients who had been on medication for  $\geq 3$  years. Sixty (49.6%) of the study subjects were initially diagnosed as hypertensive through checkup for hypertension related symptoms and only 2

(1.7%) of the patients were diagnosed via regular checkup (Figure 2). Of the 121 study subjects, 64 (52.9%) were adherent, 25 (20.7%) were moderately

adherent while 32 (26.4%) were non-adherent to their anti-hypertensive medication (Figure 3).

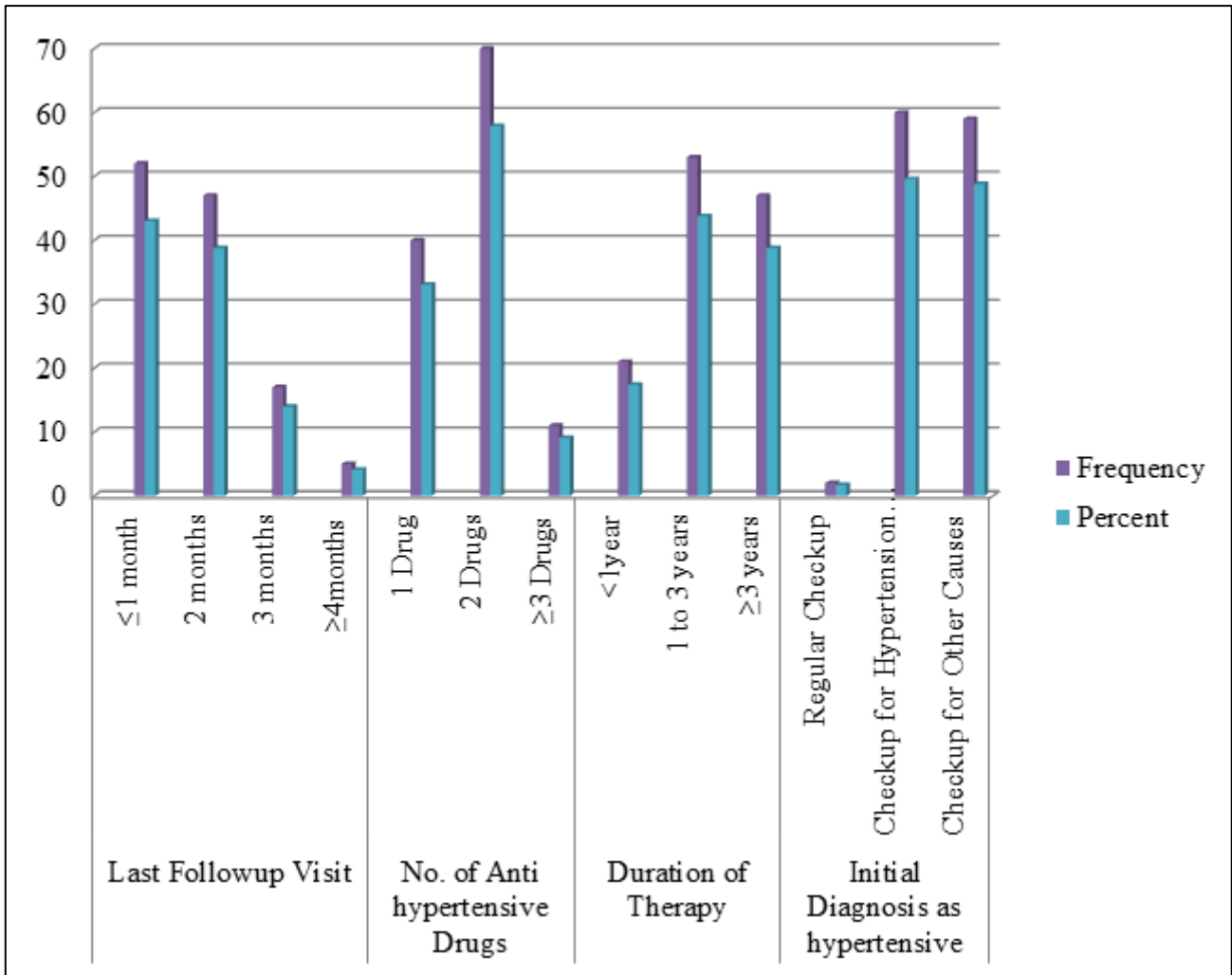


Figure 2: Medication and follow up characteristics of the study participants, May-June, 2013 (n=121).

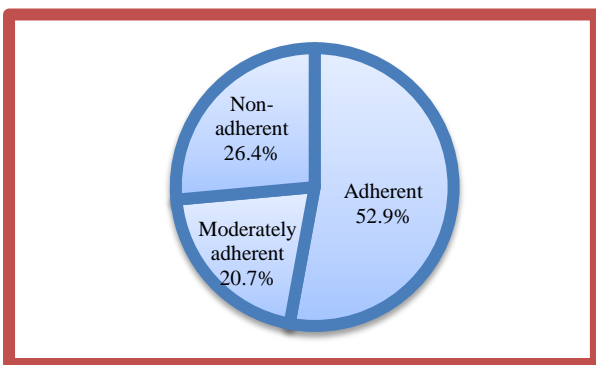


Figure 3: Adherence characteristics of the study participants, May-June, 2013 (n=121).

**Factors affecting adherence to antihypertensive medications**

Among the demographic characteristics, the setting in which patients had their follow up (P value = 0.000), presence of family support (P value = 0.000), their residence (P value = 0.008), and who pay their medication expenses (P value = 0.008) were significantly related with adherence (Table 2).

**Table 2: Significance of the association between demographic characteristics and adherence to antihypertensive medication of the study participants, May-June, 2013 (n=121).**

Variables	P value
<b>Setting of follow up</b>	
MGH	0.000
ARH	
<b>Range of age among patients</b>	
<40	0.562
40-49	
50-59	
>60	
<b>Sex of the patient</b>	
Female	0.702
Male	
<b>Education status</b>	
Illiterate	0.818
primary or below	
Intermediate and secondary	
graduate n above	
<b>Marital status</b>	
Single	0.50
Married	
Divorced or widowed	
<b>Family support on adherence</b>	
Absent	0.000
Present	
<b>Occupation of the patient</b>	
Retired	0.231
Unemployed	
House wife	
Teacher	
Farmer	
Employed	
Others	
<b>Residence</b>	
In mekelle	0.008
Outside mekelle	
<b>Medication payment</b>	
Self	0.008
Family	
wale fare/charity	
Employer	

From the clinical and medication related factors, the spot blood pressure of the patients (P value = 0.000), hypertension related complications (P value = 0.000), family history of hypertension (P value = 0.008), frequent mood of depression (P value = 0.008) were found to have association with adherence (Table 3).

Upon multinomial logistic regression analysis, the absence of family support (AOR = 0.170, 95%CI = 0.030-0.905) decreased adherence (Table 4), being at the prehypertension class of blood pressure (AOR = 0.052,

95%CI = 0.003-0.242) was also showed to decrease adherence to antihypertensive medications. Living in Mekelle city (AOR = 0.184, 95%CI =0.024-0.597) had an inverse relation with adherence. People who developed hypertensive heart disease (AOR = 21.737, 95%CI = 1.568-418.428) were 21 times more non-adherent to their antihypertensive therapy than the other population (Table 5).

**Table 3: Significance of the association between clinical and medication related characteristics and adherence to anti-hypertensive medication of the study participants, May-June, 2013 (n=121).**

Variables	N (%)	P values
<b>SBP</b>		
<120/80	3 (25%)	0.000
120/80 to 139/89	36 (29.8%)	
140/90 to 159/99	48 (39.7%)	
≥160/100	34 (28.1%)	
<b>Hypertension related complications</b>		
Hypertensive heart disease	11 (9.1%)	0.000
End stage renal disease	3 (2.5%)	
Peripheral arterial disease	3 (2.5%)	
Stroke	8 (6.6%)	
None	96 (79.3%)	
<b>Depressed mood</b>		
Absent	97 (80.2%)	0.008
Present	24 (19.8%)	
<b>Family history of hypertension</b>		
Absent	99 (81.8%)	0.008
Present	22 (18.2%)	
<b>Last follow up visit</b>		
≤1 month	52 (43%)	0.074
2 months	47 (38.8%)	
3 months	17 (14%)	
≥4 months	5 (4.1%)	
<b>No. of anti-hypertensive drugs</b>		
1 drug	40 (33.1%)	0.289
2 drugs	70 (57.9%)	
≥3 drugs	11 (9.1%)	
<b>Initial diagnosis as hypertensive</b>		
Regular check up	2 (1.7%)	0.909
Checkup for hypertension related symptoms	60 (49.6%)	
Checkup for other causes	59 (48.8%)	
<b>Duration of therapy</b>		
<1 year	21 (17.4%)	0.612
1 to 3 years	53 (43.8%)	
≥3 years	47 (38.8%)	

Table 4 shows strength of the association of factors with moderate adherence in reference to adherence of the study participants.

**Table 4: Strength of the association of factors with moderate adherence in reference to adherence of the study participants, May-June, 2013 (n=121).**

Variables	Adherence to antihypertensives		AOR (95% CI)
	Adherent	Moderately adherent	
<b>SBP</b>			
<120/80	3	0	
120/80-139/89	25	9	0.660 (0.042-1.434)
140/90-159/99	25	10	0.733 (0.130-2.557)
≥160/100	11	6	1.00
<b>Depressed mood</b>			
Absent	58	18	0.266 (0.054-1.467)
Present	6	7	1.00
<b>Family history of HTN</b>			
Absent	58	19	0.327 (0.052-4.253)
Present	6	6	1.00
<b>Family support on adherence</b>			
Absent	51	10	0.170 (0.030-0.905)
Present	13	15	1.00
<b>Residence</b>			
In Mekelle	56	21	0.750 (0.038-2.270)
Outside Mekelle	8	4	1.00
<b>Hypertension related complications</b>			
Hypertensive heart disease	1	3	9.833 (0.438-83.948)
End stage renal disease	0	2	
Peripheral arterial disease	0	2	
Stroke	4	0	
None	59	18	1.00
<b>Expense</b>			
Self	27	3	0.389 (0.022-2.367)
Family	8	10	4.375 (0.157-19.824)
Wale fare/charity	22	10	1.590 (0.153-7.695)
Employer	7	2	1.00
<b>Setting</b>			
MGH	55	15	0.245 (0.202-17.163)
ARH	9	10	1.00

Strength of the association of factors with non-adherence in reference to adherence of study participants (Table 5).

**Table 5: Strength of the association of factors with non-adherence in reference to adherence of the study participants, May-June, 2013 (n=121).**

Variables	Adherence to antihypertensives		AOR (95% CI)
	Adherent	Non-adherent	
<b>SBP</b>			
<120/80	3	0	
120/80-139/89	25	2	0.052 (0.003-0.242)
140/90-159/99	25	13	0.336 (0.104-1.520)
≥160/100	11	17	1.00
<b>Depressed mood</b>			
Absent	58-	21	0.0197 (0.075-2.638)
Present	6	11	1.00
<b>Family history of HTN</b>			
Absent	58	22	0.227 (0.065-3.243)
Present	6	10	1.00
<b>Family support on adherence</b>			
Absent	51	19	0.373 (0.241-10.226)
Present	13	13	1.00
<b>Residence</b>			
In Mekelle	56	18	0.184 (0.024-0.597)
Outside Mekelle	8	14	1.00
<b>Hypertension related complications</b>			
Hypertensive heart disease	1	7	21.737 (1.568-418.428)
End stage renal disease	0	1	
Peripheral arterial disease	0	1	
Stroke	4	4	3.105 (0.022-7.961)
None	59	19	1.00
<b>Expense</b>			
Self	27	11	2.852 (0.120-19.600)
Family	8	11	9.625 (0.589-198.994)
Wale fare/charity	22	9	2.864 (0.091-14.623)
Employer	7	1	1.00
<b>Setting</b>			
MGH	55	15	0.144 (0.061-3.292)
ARH	9	17	1.00

## DISCUSSION

In this study, a majority of the participants, 62.0%, were females. This goes in line with studies done in Malaysia<sup>19</sup> in which females were 62.8 % of the sample population. In a study done in Nigeria<sup>20</sup>, the females were even more dominant (71.9%). The mean age of respondents in this study was 54.7 while 71.2% of the study subjects were of age  $\geq 50$ . Similarly, in the study done in Malaysia,<sup>19</sup> mean age was 57.8 and 69.2% of the study subjects were at age of  $\geq 50$  years.

With regard to educational status, 67.8% of the populations in this study were illiterate which goes in line with the study done in Nigeria<sup>20</sup> in which 82.4% were illiterate. In the contrary, 91.6% of the study subjects in the study conducted in Malaysia<sup>19</sup> had attended some sort of formal education to at least primary level. A large proportion of the subjects 71.1% were married. This was higher than that in a study conducted in Gondar, Ethiopia<sup>12</sup> in which 60.7% were married and lower than the study in Nigeria<sup>20</sup> in which 78.4% were married.

In our study, 65.3% of the subjects were found to lack family support on adherence and 33.9% pay their medication expenses by themselves while 33.9% of the subjects were depicted to get their medication for free. Availability of Support System in a study done in Pakistan<sup>21</sup> was 54% which was greater support for adherence than that in this study. However the payment of medication expenses in the study in Pakistan<sup>21</sup> was somewhat similar; that was, 38% of the patients were determined to pay their medication by themselves while 37% of them get medication expense covered by family.

A greater portion of the subjects in this study (39.7%) had SBP of 140/90 to 159/99 which is higher than a study done in Brazil<sup>22</sup> in which 30.4% of the uncontrolled hypertensive patients were in the same blood pressure (BP) range and lower than that reported from a study done on Military Healthcare Providers of the northeast United States<sup>23</sup> in which 43% of the patients had a blood pressure in the range 140-159 mm Hg systolic or 90-99 mm Hg diastolic. Similarly, in a study done in Gondar, Ethiopia<sup>12</sup>, more than half (53.4%) of the study subjects had uncontrolled blood pressure.

More than half of the subjects (57.9%) had an anti-hypertensive regimen containing 2 drugs while a study done in Brazil<sup>22</sup> revealed that 56.9% of the subjects had an anti-hypertensive regimen of only 1 drug. Greater portion of patients (43.8%) in this study had been on antihypertensive medication for 1 to 3 years. Similarly, in the study conducted in Ghana, in more than half of the patients (53%), disease conditions were between one and three years old. In this study the prevalence of short duration of therapy was attributed to the fact that most hypertensive patients do not live long with their disease condition, most probably due to development of disease complications resulting from non-adherence to

medications. It was also reasoned that the hypertensive patients could have been retired and have relocated or changed a health facility.<sup>8</sup> However, in another study that was done in Brazil,<sup>22</sup> more than half (55%) of the study subjects had been receiving treatment for more than three years.

Almost half (49.6%) of the study subjects were initially diagnosed as hypertensive through checkup for hypertension related symptoms and only 2 (1.7%) of the patients were diagnosed via regular checkup. This might be an indication that patients start anti-hypertensive therapy after the disease reaches its symptomatic stage. This makes it harder to control BP or prevent complications. This is even more exaggerated in the study done in Pakistan<sup>21</sup> in which majority of the patients (70.8%) discovered their disease during medical checkup for symptoms related to hypertension and/or its complications.

Only 52.9% were adherent while 20.7% were moderately adherent and 26.4% were non adherent. This was similar to the study conducted in Malaysia<sup>19</sup> in which 53.4% were adherents. It was however reported that from the study done in Gondar,<sup>12</sup> (64.6%) were adherent and from the study done in Nigeria, which was based on patients' self-report adherence rating, (67.7%) of the patients adhered strictly to their medications while only (32.3%) were poor adherents.

It should be noted that not only patients who were completely non-adherent were in problem. Patients who were partially or moderately adherent need to be focused on. As explained in the study done in Ghana<sup>8</sup> patients who were partially adherent were those who take many doses but not regularly enough to control their disease. This level of adherence is even more dangerous as it might lead the patient not to think the medications are working.

In this study, presence of hypertension related complications was shown to decrease adherence. People who developed hypertensive heart disease were 21 times more non-adherent to their antihypertensive therapy than the other population. In the contrary, in the study from Pakistan,<sup>21</sup> a greater proportion of the cases suffering from hypertension related complications were adherent. Other studies also show the relationships between adherence to antihypertensive therapy and cardiovascular complications of hypertension.<sup>24</sup>

Absence of family support (AOR=0.170, 95%CI = 0.030-0.905) was reported in this study to have a strong negative effect on adherence. Similarly, the study from Pakistan stated that increasing self-reliance in old age has been shown to decrease adherence. In the Pakistani population, a better social support structure ensured by the common extended family system, reduces self-reliance and could be the reason for better adherence in this age group. It is usual for other family members to



take full responsibility of the medication routine of the families' patients.<sup>21</sup>

Surprisingly, people living in Mekelle city were found to have lower adherence than those living outside Mekelle. In the study conducted in Gondar<sup>12</sup> the multivariate logistic regression showed that as the distance from the hospital decreased, the adherence to treatment of hypertension got improved (AOR = 2.02, 95% CI = 1.19-3.43). This contradiction might be due to the fact that majority of the patients in this study were residents of Mekelle which might exaggerate the non-adherents in this group. However, it cannot be ignored that living in Mekelle might make patients to take the easy availability of health facilities for granted and not to strictly follow up and refill their medication on time.

Although medication related factors like number of antihypertensive drugs were reported not to associated with adherence in this study, it is reported to affect adherence in the study done in Brazil in which, patients with higher adherence were taking 3 or more anti-hypertensive medications daily (70.6%) and 7 or more anti-hypertensive pills daily (54.6%).<sup>25</sup> However it is usually generalised that increasing complexity of medication regimen results in lower treatment adherence.

The SBP of the patients was found to have strong association with adherence to antihypertensive therapy. Specifically, patients at the prehypertension class of blood pressure (AOR = 0.026, 95%CI = 0.003-0.242) were less adherent to their medications. This can be because their state will make them less symptomatic and makes them feel like they don't even need medication. On the contrary, it is reported from the study done in Gondar<sup>12</sup> that those who have controlled hypertension had a significantly higher chance of being adherent to their treatment (AOR = 2.93, 95% CI = 1.73-4.96). On its top, only 2.5% of the patients in our study had SBP in the normal range (<120/80) all of which were adherent to their medication.

## CONCLUSION

Only around half of the participants of this study were adherent to their medications. A quarter of them were completely non-adherent and the rest were moderately adherent. The absence of family support and being at the prehypertension class of blood pressure were shown to decrease adherence to antihypertensive medications. Living in Mekelle city had an inverse relation with adherence. People who developed hypertensive heart disease were 21 times more non-adherent to their antihypertensive therapy than the other population.

## Recommendations

The health care professionals should be adequately trained and resourced to offer proper counseling to hypertensive patients on their medication and disease

conditions. Pharmaceutical care protocols and guidelines for anti-hypertensive medication counseling should be developed and implemented. On its top, the attitude of pharmacists and pharmacy staff towards professional responsibilities must be re-oriented to provide patient centered services.

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## Acronyms and Abbreviations

AIDS: Acquired Immune-Deficiency Syndrome  
 AOR: Adjusted Odds Ratio  
 ARH: Ayder Referral Hospital  
 BP: Blood Pressure  
 CI: Confidence Intervals  
 HIV: Human Immune-deficiency Virus  
 MGH: Mekelle General Hospital  
 MMAS: Morisky Medication Adherence Scale  
 mmHg: Millimetre Mercury  
 SBP: Spot Blood Pressure  
 WHO: World Health Organization

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