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Archives of Community Medicine and Public Health

ISSN: 2455-5479 DOI CC By

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Dates: Received: 16 January, 2017; **Accepted:** 23 March, 2017; **Published:** 24 March, 2017

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Keywords: Hypertension; Medication adherence; Anti-hypertensive drugs; Blood pressure control; Nigeria

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Case Report

Factors Associated with Medication Adherence among hypertensive Patients in a Tertiary Health Center: A Cross-Sectional Study

Abstract

Introduction: Medication non-adherence is a major hindrance in the treatment of hypertension in Sub Saharan Africa. It is a major modifiable contributor to poor blood pressure control and complications of the disorder. An understanding of the factors that are associated with drug adherence in hypertension will contribute positively to the overall planning of public health educational programs on hypertension.

Methods: This study was cross sectional and descriptive in nature conducted in the medical outpatient clinic of Enugu State University Teaching Hospital, Enugu Nigeria. Data collection was done using a semi-structured questionnaire. The Morinsky-Green Medication adherence scale was used to estimate medication adherence. Statistical analyses was done using SPSS version 22 (IBM Corporation, New York, USA).

Results: A total of 436 patients were surveyed in this study. Most of the patients (90.1%) sometimes forget to take their medications or do not bring their medications along when they leave home (94.3%). The highest rates of non-adherence were reported in patients who were totally dependent (62.5%). High depression scores, low disability scores and the presence of peptic ulcer disease correlated with non-adherence. In regression analysis Morinsky-Green scores (R^2 = 0.04), decreased by a factor of 0.06 with a unit increase in level of dependence, by a factor of 0.09 with a unit increase in HADS depression scores and by 0.73 in those that have peptic ulcer.

Conclusions: Non-adherence is high among hypertensive patients attending tertiary care centers in the South East. Educational measures targeted towards improving adherence are needed to reduce the level of non-adherence.

Introduction

Medication non-adherence is a major hindrance in the treatment of hypertension in Sub Saharan Africa (SSA) [1-6]. It is a major modifiable contributor to poor blood pressure control and complications of the disorder [7]. Other consequences of non-adherence include increased financial burden (due to increased rate of hospitalization and loss of productivity), unwarranted change of medication, substantial negative effect on patients' quality of life and drop-out of treatment [7,8]. Globally speaking, the estimated non-adherence rates of long-term medication therapies vary widely [4-12].

Non-adherence results from the complex interplay of several factors which may be grouped into patient-centered factors, therapy-related factors, healthcare system factors, social and economic factors, and disease related factors [9]. Currently, there are no data on adherence to anti-hypertensive medications in the South-East Nigeria. An understanding of the factors that are associated with drug adherence in hypertension will contribute positively to the overall planning of public health educational programs on hypertension.

The main aim of this study was to determine the prevalence of medication non-adherence among hypertensive patients and its correlates among patients attending medical outpatient clinic in Enugu south East Nigeria.

Patients and Methods

Setting

This study was cross sectional and descriptive in nature.

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It was conducted in the medical outpatient clinic of Enugu State University Teaching Hospital, Enugu Nigeria. Enugu is the capital of Enugu state, an educational, governmental, industrial and trade centre located in South East Nigeria. Its work force consists mainly of civil servants, business men/women, industrialists, artisans, and students. Rural dwellers in the state are mainly farmers.

At the time of the study, Enugu State University Teaching Hospital had 350 beds distributed among the various specialties with 50 inpatient beds for adult admissions for medical cases. Hypertensive cases are primarily treated by the cardiologists/clinical pharmacologist; however, many non-complicated cases are also treated by non-cardiologists other specialties. All consecutive consenting patients with hypertension were recruited. In all cases hypertension was considered the primary diagnosis and any other disorder a co-morbidity. Cases of acute febrile illness or cough lasting less than 3 weeks were not included as comorbidities. Only cases of hypertension diagnosed by the supervising consultants were included in the study. Exclusion criteria were refusal to participate. Ethical clearance was obtained from the ethics committee of the Enugu State University Teaching Hospital. (NREC/05/01/2008B-FWA00002458-1RB00002323, May 28 2013). Ethical conduct was maintained during data collection and throughout the research process. Informed consent was obtained from each study participant. Study duration was 6 months (June to November 2013).

Study design

A semi structured questionnaire was used to collect data on selected socio-demographic characteristics and lifestyle behaviors including smoking, drinking and use of herbal drugs. Measurements of weight, height were carried out and recorded. Three 3 blood pressure measurements over the last 3 clinic visits were averaged. Fasting blood glucose was also recorded.

Minimal sample size was calculated using the formula $n = Z^2 (pq)/e^2$ where n = required sample size, p = 0.495 (non adherence rate reported in Nigeria), q =1-p, e = desired confidence interval.

$n = (1.96)^2 (0.495*0.505)/(0,05)^2 = 0.96030396/0.0025 = 384$.

The minimum sample size of 384 was selected.

Definition of terms

Hypertension was defined as a systolic blood pressure (SBP) of ≥140 mmHg and/or diastolic blood pressure (DBP) of ≥90 mmHg and/or use of an anti-hypertensive drug therapy or based on medical records of the subjects. Medical co-morbidities were defined using standard criteria or past medical history diagnosed by a qualified personnel (doctors). Level of education was the individual's highest educational (formal) attainment. Tobacco use was defined as the use of (any or all) cigarettes, snuff and chewing tobacco in the past 4 weeks. Alcohol use was defined as the consumption of any alcoholic beverage (beer, gin, stout, local brew) (greater than 14 units for females and 21 units for males in a week. Occupation was defined as the primary job which takes at least 50% of the working hours in a week. An artisan was defined as skilled manual labourers such as masons, mechanics, tailors, welders, metal workers and other crafts.

Study instruments

Anxiety and depressive symptoms were explored using the Hospital Anxiety and Depression Score questionnaire (HADS) [13]. The HADS questionnaire is a self-assessment scale containing 14 items developed to detect states of depression, anxiety and emotional distress. Scores for each subscale (anxiety and depression) range from 0 to 21 with scores categorized as follows: normal 0–7, mild 8–10, moderate 11–14, and severe 15–21. The HADS is brief and simple to use and was completed by the patients themselves with help from the investigators.

Level of Physical disability was estimated using the modified Barthel Index of Activities of Daily Living (BADL) score [14]. BADL score was used to measure functional disability by quantifying patient's performance in 10 activities of daily life. These activities were grouped according to self-care (feeding, grooming, bathing, dressing, bowel and bladder care, and toilet use) and mobility (ambulation, transfers, and stair climbing) depending on what the patient was actually able to do. Sum the patient's scores for each item. Total possible scores range from 0–100, with lower scores indicating increased disability. Direct testing of the patient was done or with the help of their care giver when necessary.

The Morinsky-Green Medication adherence scale [15] was used to estimate medication adherence. Answers consistent with adherence were scored as 0 and answers consistent with non-adherence were scored as 1. For the purpose of the index study the scores are tallied and graded into high adherence (0-2), medium adherence (3-5) and low adherence (6-8). Medium and low adherence were grouped as 'non-adherent' while 0-2 and 'high-adherence'.

Statistical Methods

For database management and statistical analyses, we used the SPSS version 22 (IBM Corporation, New York, USA). Data were presented in tables and figures. For continuous variables, mean values and standard deviation were calculated. Rates were expressed as percentages. Categorical values were compared using the Chi Square test or the Fisher's exact test. Mean values were compared using the independent t-test. In all, p value of < 0.05 was regarded as statistically significant. Conclusions were drawn at 95% confidence interval.

Results

A total of 436 cases (males 161(36.9%), females 275 (63.1%)) of hypertension (hypertensives) were surveyed in this study. The male to female ratio was 1:1.7. The ages ranged from 26 years to 95 years with a mean of 59.8 ± 12.8. The peak age was the 7th decade followed by the 6th decade (Table 1). Out of the 436 patients seen, 99 (22.7%) were business men and

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women, 86(19.7%) and 85(19.5%) were retired and civil/public servants/office workers. Most of the patients had a tertiary school education (completed more than 12 years of formal education) and came from within the city Table 1.

Behavioral risk factors Medical History and HADS scores

Means of weight and height measurements are shown in table 1. The mean (sd) BMI was 28.7(6.6) kg/m² significantly higher in females than males. P=0.01. The mean fasting blood glucose (160.2 mg/dL) was equally high in males (154.3mg/dL) and females 171(mg/dL). P=0.13. Figure 1. More males (26.1%) than females (9.1%) of the females reported current use of tobacco. P<0.001. Overall, 72% used herbal remedies in the last 12 months, 67% were taking NSAIDs and 28.7% drank alcohol at least occasionally. Table 1. There were no statistical significant differences between mean depression and anxiety scores of males and females.

Blood pressure

The mean Systolic blood pressure (SBP) and diastolic blood pressure (DBP) are shown in table 1. There were no statistical differences between the mean SBP and DBP between males and females. Blood pressure control was achieved only in 17.2% (18.6% in males and 16.4% in females, p=0.54) of the patients Figure 1b.

Co-morbidity and barthel index of activities of daily living

During the survey a total of 131 (30%) participants had one co-morbidity and 132 (30.3%) had two co-morbidities Table 1. The frequency of various comorbidities is shown in table 2. The commonest co-morbidities were arthritis (48.6%), diabetes (42.4%) and headache (40.6%). Stroke and Parkinson's disease were more frequently found in males than females Table 2. Headache was slightly higher in females. P= 0.06. Sixty-nine patients (15.8%) reported a total of about 234 (53.7%) areas of disability giving an average of 3.4 per individual. Disability was reported more in males. P=0.04.

Adherence

Table 3 shows the responses based on the Morinsky-Green adherence scale. Most of the patients (90.1%) sometimes forget to take their medications or do not bring their medications along when they leave home (94.3%). About 88.1% cut back or stop taking their medications in the past without telling their doctors. However, 82.8% agreed that they took their medication the previous day. Just more than half said that forgetfulness is never/rarely a problem to medication adherence. Non-adherence defined as medium and low adherence in this study was 34.6% (151/436). The highest rates of non-adherence were reported in patients who were totally dependent (62.5%) although the total number of patients in this category was small. Civil servants/office workers, artisans and pensioners had rates of non-adherence higher than 34.6% average found in the study.

Out of the comorbidities considered peptic ulcer patients were the least adherent to medications (30.4%). p=0.02.

Table 1: Characteristics of participants.

Characteristic	Female	Male	Total	P-value
Anthropometrics	-	-	-	-
N,(%)	275(63.1)	161(36.9)	436(100)	<0.01
Age, years, (sd)	57.3(12.9)	64(11.1)	59.8(12.7)	<0.01
Body mass index, kg/m2 (mean sd)	29.5(6.5)	27.2(6.4)	28.7(6.6)	0.01
Age group (years) *<40*, n(%) *40-49*, n(%) *50-59* n(%) 60-69 n(%) *≥70* n(%) *Occupation* Business, n(%)	- 22(57.7) 57(22) 80(14) 68(6.3) 48(11.1) - 81(29.5)	- 2(1.2) 14(8.7) 34(21.1) 63(39.1) 48(29.8) - 18(11.2)	- 24(5.5) 71(16.5) 114(26.1) 131(30) 96(22) - 99(22.7)	-
Retired, n(%)	36(13.1)	50(31.1)	86(19.7)	
Civil/public servants/office workers, n(%)	50(18.2)	35(21.7)	85(19.5)	
Farmers, n(%)	44(16)	11(6.8)	55(12.6)	
Artisans, n(%)	18(6.5)	35(21.7)	53(12.2)	-
Unemployed, n(%)	20(7.3)	5(3.1)	25(5.7)	
Housewives, n(%)	24(8.7)	-	24(5.5)	
Others (%)	2(2.1)	7(4.3)	9(2.1)	
Level of Education				
None /Primary, n(%)	101(36.7)	75(46.6)	179(40.4)	
Secondary, n(%)	38(13.8)	25(15.5))	63(14.4)	-
Tertiary	136(49.5)	61(37.9)	197(45.2)	
Residence	-	-		
Within Enugu	179(65.1)	120(74.5)	299(68.6)	
Outside Enugu	96(34.9)	41(25.5)	137(31.4)	
Peripheral haemodynamic	-	-	-	
SBP, mmHg, mean (sd)	146.2(20.5)	145.2(23.9)	145(21.5)	0.64
DBP, mmHg, mean (sd)	86.6(21.8)	86.1(35.3)	86.4(11.9)	0.66
Blood pressure controlled	45(16.4)	30(18.6)	75(17.2)	0.54
Glucose, mg/dL(±sd)	154.3(70.6)	171(105.9)	160.2(85)	0.13
Lifestyle	-	-	-	
Current tobacco use, n (%)	25(9.1)	42(26.1)	67(15.4)	<0.01
Current alcohol use, n (%)	78 (28.4)	47(29.2)	125(28.7)	0.41
Use of herbal drugs (≤12 months)	195(70.9)	119(73.9)	314(72)	0.5
Chronic use of NSAIDS n (%)	110(68.3)	182(66.2)	292(67)	0.69
Number of comorbidities	-	-	-	
One	81(29.5)	50(31.1)	131(30)	
Two	90(32.7)	42(26.1)	132(30.3)	
Three	55(20)	32(19.9)	87(20)	
Four	12(4.4)	15(9.3)	27(6.2)	
Five None	1(0.4) 36(13.1)	1(0.6) 21(13)	2(0.5) 57(13.1)	0.99
HADS Score (mean, sd)	5.9(3.5)	6.1(3.8)	5.9(3.6)	0.51
Depression scores	2.4(2.2)	2.4(2.4)	2.4(2.3)	0.96
Anxiety scores	3.5(2.3)	3.7(2.5)	3.5(2.6)	0.33
Barthel Score (<20)	36(13.1)	6(20.5)	69(15.8)	0.04

P-values are for the sex differences. Peripheral systolic and diastolic blood pressure were the average of 3 consecutive measurements.

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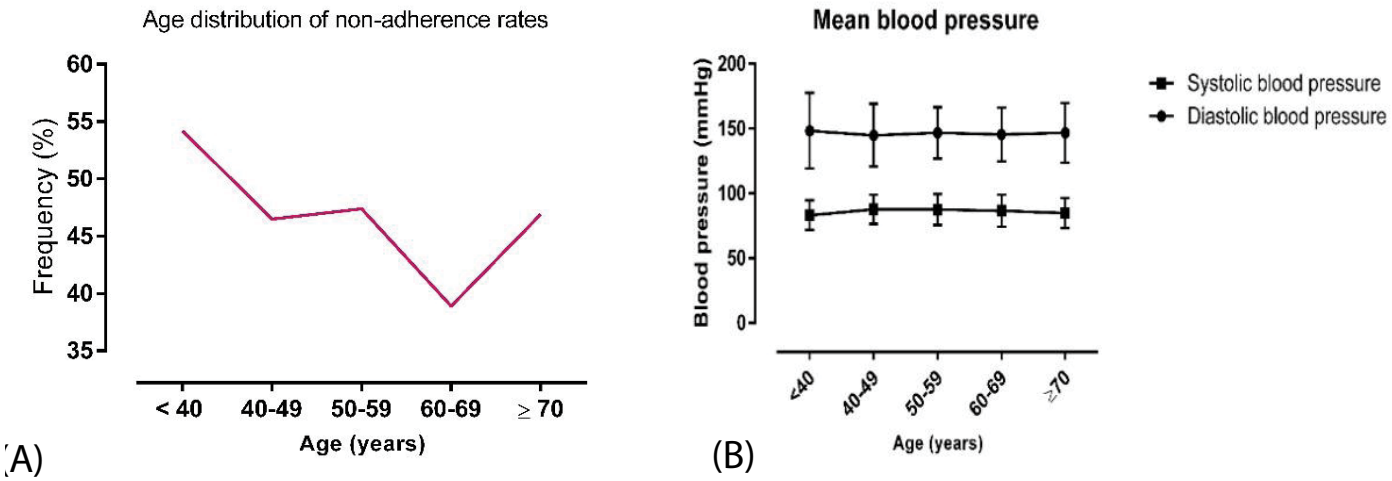

Figure 1a,b:

Table 2: Sex distribution of comorbidities in the population*.

	Males	Females	Total	p-value
Arthritis	77(47.8)	135(49.1)	212(48.6)	0.8
Diabetes	63(39.1)	122(44.6)	185(42.4)	0.29
Stroke	34(21.1)	28(10.2)	62(14.2)	**<0.01**
Headache	56(34.8)	121(44)	177(40.6)	0.06
Heart Failure	17(10.6)	20(7.3)	37(8.5)	0.24
Parkinson's disease	14(8.7)	6(2.2)	20(4.6)	**<0.01**
Peptic Ulcer	10(6.2)	17(6.2)	27(6.2)	0.51
Chronic liver disease	5(3.3)	7(2.5)	12(2.8)	0.13
Chronic Cough	5(3.3(	5(1.8)	10(2.3)	0.55
Renal Failure	-	3(1.1)	3(0.7)	0.67#
Dementia	3(1.9)	3(1.1)	6(1.4)	0.5
Asthma	6(3.7(	3(1.1)	9(2.1)	0.24#
Tuberculosis	2(1.2)	1(0.2)	3(0.7)	0.28#
Epilepsy	1(0.6)	3(1.1)	4(0.9)	0.63
Sickle Cell Disease	1(0.6)	-	1(0.2)	0.19#
Total	294	481	775	

*More than one comorbidity may be found in a patient.

Alcohol users were also non-adherent to medications Table 3. The age distribution of non-adherence is shown in Table 4 and Figure 1a. Non-adherence decreased from 54.2% at < 40 years to 38.9% at 60-69 years and increased to 46.9% after 70 years.

Regression analysis

In bivariate correlation analysis (Table 5), high depression scores on HADS and the presence of peptic ulcer disease positively correlated with Morinsky-Green scores (lower adherence) while Barthel scores negatively correlated with Morinsky-Green scores suggesting that adherence decreased as level of dependence increased. In regression analysis (Table 5), Morinsky-Green scores (R^2 = 0.04), decreased by a factor of 0.06 with a unit increase in level of dependence (Barthel scores). It also increased by a factor of 0.09 with a unit increase in HADS depression scores and by 0.73 in those that have peptic ulcer.

Discussion

Non-adherence to medication is determined by several factors and potentially a modifiable risk factor for cardiovascular complications of hypertension [1-7]. Improving medication adherence has the potential to reduce the economic burden of hypertension in an already impoverished region of the world. In the index study, the rate of non-adherence was 34.7%, significantly higher in patients with higher depression scores in HADS, lower BADL scores (higher disability), current alcohol users and those with peptic ulcer disease. High HADS-D scores, low BADL scores and presence of peptic ulcer diseases not only correlated with adherence scores but were also significant predictors.

The rate of non-adherence (34.7%) among hypertensives in the index study was lower than 66.7% reported from Boima et al. [4], but within the range of 32.7-49.3% reported in previous studies in Nigeria [2,3,16]. Outside the continent patients' adherence to anti-hypertensive therapy vary between 50% and 70% [9]. Methodological differences and population characteristics may account for the wide range of findings. Nevertheless, collecting data from a referral center in patients with multi-morbidity places some hospital bias on our findings. Furthermore, the rates of tobacco and alcohol use were higher than previously reported [17]. The use of these products may worsen adherence as reported by previously [6].

Medical comorbidities were common among our patients especially the elderly. Comorbidities increase pill load leading to drug fatigue and hence non-adherence to medications. Studies suggest that adherence does not seem to correlate with the number of drugs prescribed but the number of dosing times every day of all prescribed medications [2-4,8-12]. All co-morbidities reported in this study were chronic illnesses that could warrant prolonged and frequent use of medications. A meta-analysis found a significant difference in medication

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adherence rate between patients taking antihypertensive medication once daily and twice daily [18,19]. Although long use of medication may compromise adherence, some studies suggest that compliance may improve over time as patients get accustomed to their medications [9]. The significant rate of non-adherence in people with peptic ulcer disease may be attributed to frequent abdominal pains or some of the factors suggested above. If these patients do not eat at regular intervals they may skip their medications. In this study, there was a very high rate of non-adherence in those who were dependent in agreement with previous studies [20,21]. Patients with disability depend on others for help (relations) in taking medications and may miss their drugs if help is not readily available.

This study revealed that 3.2% and 7.4% had abnormal HADS scores for depression and anxiety. Depression and anxiety among hypertensives have been described in the continent [22,23], and may play a central role in shaping the burden of non-adherence in hypertension. In this study HADS depression scores positively correlated with higher Morinsky scores (non-adherence) and was also a predicator of non-adherence. This similar to previous studies [2-5,24]. Evaluation for symptoms of depression and appropriate management of the depression may improve medication adherence among hypertensives in sub-Saharan Africa and should be encouraged.

An important patient-centered factor that affects adherence is patient's age. There was no significant correlation between adherence and age. In most other studies, non-adherence was also reported to be higher in younger patients [3,25,26]. Younger patients may not be as concerned about their health compared with the older patients [4] hence may not be regular in taking their medications. Overall, studies on

Table 3: Distribution of Morinsky- Green adherence scores.

Questions	Yes	No
1) Do you sometimes forget to take your pills?	393(90.1)#	43(9.9)*
2) Thinking over the past two weeks, were there any days when you did not take your medicine?	325(74.5)#	111(25.5)*
3) Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?	- 384(88.1)#	- 52(11.9)*
4) When you travel or leave home, do you sometimes forget to bring along your medicine?	411(94.3)#	25(5.7)*
5) Did you take all your medicine yesterday?	361(82.8)*	75(17.2)
6) When you feel like your symptoms are under control, do you sometimes stop taking your Medicine?	- 69(15.8)# -	- 367(84.2)* -
7) Do you ever feel hassled about sticking to your treatment plan?	12(2.8)#	424(97.2)*
8) How often do you have difficulty remembering to take all your medicine? ___A. Never/rarely ___B. Once in a while ___C. Sometimes ___D. Usually ___E. All the time	- 241(55.1)* 114(26.1)# 54(12.4)# 24(5.5)# 3(0.7)#	- - - - - -

*values scored 0
#values scored 1.

Table 4: Distribution of adherence in different groups.

	High Adherence	Medium Adherence	Low Adherence	Total	p-value*
Gender					
Males	78(48.8)	48(29.8)	35(21.7)	161(36.9)	
Females	138(50.2)	75(27.3)	62(22.5)	275(63.1)	0.85
Marital status					
Single	67(48.9)	**40(29.2)**	30(21.9)	137(31.4)	
Married/widowed	149(49.8)	83(27.8)	67(22.4)	299(68.6)	0.77
Level of Education					
Less than 6 years	95(54)	43(24.4)	38(21.6)	176(40.4)	
7-12 years	32(50.8)	24(38.1)	7(11.1)	63(14.4)	
>12 years	89(45.2)	56(28.4)	52(26.4)	197(45.2)	0.35
Residence					
Urban	144(48.2)	90(30.1)	65(21.7)	299(68.6)	
Rural	72(52.6)	33(24.1)	32(23.4)	137(31.4)	0.34
Social Status					
Moderate Income	68(46.9)	43(29.7)	34(23.4)	89(20.4)	
Low income	105(52)	55(27.2)	42(20.8)	202(46.3)	
Unemployed/ retired	43(48.3)	25(28.1)	21(2.6)	92(32.3)	0.91
Age group					
<40	11(45.8)	4(16.7)	9(37.5)	24(5.5)	
40-49	34(47.9)	20(28.2)	17(23.9)	71(16.3)	
50-59	54(47.4)	34(29.8)	26(22.8)	114(26.1)	
60-69	70(53.4)	40(30.5)	21(16)	131(30)	
≥ 70	47(49)	25(26)	24(25)	96(22)	0.52
No of comorbidities					
Hypertension alone	30(52.6)	15(26.3)	12(21.1)	57(13.1)	
One	61(46.6)	38(29)	32(24.4)	131(30)	
Two	69(52.3)	37(28)	26(19.7)	**132(30.3)**	
Three	40(46)	27(31)	20(23)	87(20)	
Four	14(51.9)	**6(22.2)**	7(25.9)	27(6.2)	
Five	2(100)	-	-	**2(100)**	**0.5**
Disability					
Independent	181(49.3)	107(29.2)	107(29.9)	**367(84.2)**	
Mild dependence	15(60)	5(20)	5(20)	**25(5.7)**	
Moderate/severe	17(47.2)	11(30.6)	8(8.2)	**36(8.3)**	
Total dependence	3(37.5)	**-**	5(62.5)	**8(1.8)**	**0.13**
Depression Scores					
0-7	212(50.2)	**120(28.4)**	90(21.3)	**422(96.8)**	
8-10	2(18.2)	**2(54.5)**	7(63.6)	**11(2.5)**	
>10	2(66.7)	**1(33.3)**	-	**3(0.7)**	**0.04**
Anxiety Scores					
0-7	201(49.8)	**112(27.7)**	91(22.5)	**404(92.7)**	
8-10	13(43.3)	**11(36.7)**	6(20)	**30(6.9)**	
>10	2(100)	**-**	-	**2(0.5)**	**0.29**
Total	285(65.4)	139(31.9)	12(2.8)	436(100)	

*p-value for adherence (high adherence) and non-adherence (medium +low adherence).

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age and adherence has been contradicting and varied with the age group studied [9]. Similar to the index study some have reported a non-significant correlation in adherence with age [26-28] (Table 6,7).

The effect of gender and marital status on adherence may bi-directional [9]. While some studies documented positive effect on adherence others did not. Similar to the index study several other studies did not find a relationship between gender and adherence [29,30]. The positive effect of marital status on adherence may be related to the ability of the individual to create social networks [9,29]. The social support inherent in marriage could be the reason why married patients were more compliant to medication than single patients [29]. However, marital status was not found to be related to patient's adherence in the index study similar to previous studies [31,32].

Item by item analysis of Morinsky-Green scores shows that forgetfulness, travelling, worry over side effects were the most common reasons for non-adherence. Forgetfulness is a widely reported factor that causes non-adherence [1,3-6,8-12]. Adherence is usually better with medications that require less frequent administration especially for frequent travelers [19]. In the index study, about 94.3% of the patients sometimes do not travel with their medications. With changing lifestyles and ever busy schedules especially in younger patient; drug regimens should be made to suit individual lifestyles.

A Japanese study in elderly home-care recipients found an association between meal frequency and compliance. Suggesting that timing drugs with regular meals may decrease non-adherence [33].

Table 5: Distribution of adherence by occupation and co morbidity.

Job description	High Adherence	Medium Adherence	Low Adherence	Total	p-value*
Business	54(54.5)	23(23.2)	22(22.2)	99(22.7)	0.73
Office workers	42(49.4)	22(25.9)	21(24.7)	85(19.5)	0.5
Artisans	23(43.4)	19(35.8)	11(20.8)	53(12.2)	0.73
Retired	39(45.3)	26(30.2)	21(24.4)	86(19.7)	0.42
Farmers	30(54.5)	14(25.5)	11(20)	55(12.6)	0.28
Housewives/ unemployed	24(49)	15(30.6)	10(20.4)	49(11.2)	0.35
Others	4(44.4)	4(44.4)	1(11.1)	9(2.1)	0.52
Diabetes	34(18.4)	52(28.1)	99(53.5)	185(42.4)	0.11
Arthritis	49(23.1)	55(25.9)	108(50.9)	224(51.4)	0.74
Stroke	12(19.4)	17(27.4)	33(53.2)	62(14.2)	0.61
Headache	43(24.3)	56(31.6)	78(44.1)	177(40.6)	0.06
Heart Failure	8(21.6)	10(27)	19(51.4)	37(8.5)	0.64
Parkinson's disease	7(31.8)	3(13.6)	12(54.5)	22(5)	0.96
Peptic Ulcer	9(39.1)	7(30.4)	7(30.4)	23(5.3)	**0.02**
Use of alcohol	51(40.8)	43(34.4)	31(24.8)	125(28.7)	**0.02**
Use of tobacco	37(55.2)	17(25.4)	13(19.4)	67(15.4)	0.59
Use of local herbs	158(50.3)	91(29)	65(20.7)	314(72)	0.5
Total	285(64.5)	139(31.9)	12(2.8)	436(100)	

*p-value for adherence (high adherence) and non-adherence (medium +low adherence).

Table 6: Single correlation coefficients.

Variable	Adherence (p-value)
Age	0.06(0.21)
Sex (1 male, 2 female)	0.01(0.9)
Level of education (1, primary/none, 2 secondary, 3 Tertiary)	0.07(0.18)
Residence (1 urban, 2 rural)	-0.06(0.24)
Marital Status (1 single, 2 widowed/separated/married)	-0.02(0.69)
Blood pressure control (1 controlled, 0 no)	0.00(0.94)
Arthritis (0 none, 1 yes)	0.01(0.85)
Diabetes (0 none, 1 yes)	-0.09(0.08)
Stroke ((0 none, 1 yes)	-0.04(0.4)
Headache (0 none, 1 yes)	0.09(0.07)
Heart Failure (0 none, 1 yes)	-0.02(0.63)
Peptic Ulcer (0 none, 1 yes)	0.11(0.02)*
Parkinson Disease (0 none, 1 yes)	-0.00(0.96)
Herbal medicine (1 yes, 0 no)	0.05(0.31)
Alcohol (1 yes, 0 no)	0.07(0.15)
Tobacco (1 yes, 0 no)	0.03(0.59)
Blood pressure (0 controlled, 1 not controlled)	-0.03(0.49)
Depressive symptoms	0.14(<0.01)*
Anxiety Symptoms	0.05(0.28)
Barthel index scores	-0.11(0.02)*

Values are single correlation coefficients (*P*-value).
*Significant p-values

Table 7: Multiple Regression analysis.

Characteristic	Adherence R^2=(0.04) B(SE)	p- value
Depressive symptoms	0.09 (0.03)	<0.01
Peptic Ulcer	0.73(0.33)	0.03
Barthel Score	-0.06(0.02)	0.01

P-values for covariables to enter and stay in the models were set at 0.05

About 90.1% patients in our study stop their medication when they had concerns about potential adverse effects of antihypertensives. These concerns may include not only effects, but as fear of dependence and drug-drug interactions [9,29,34,35]. The effect of side effects on compliance may beexplained in terms of physical discomfort, skepticism about the efficacy of the medication, and decreasing the trust in physicians.

Several studies have reported that formal education significantly improves adherence [4,36]. However, the extent to which level of education remains controversial and at best equivocal with some studies reporting better adherence in patients with lower levels of education [30,35] while like the index study others reported no association [25,29]. It is expected that patients with higher educational level should have better knowledge about hypertension and its treatment and therefore be more compliant. However, DiMatteo [37] found that even highly educated patients may not understand their conditions or believe in the benefits of being compliant to

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their medication regimen suggesting that patients with lower educational level might have more trust in physicians' advice.

Our study did not find any significant difference between medication adherence and levels of income. This is in keeping with previous studies [4,32,38-40]. One explanation may be few high-income earners patronize public health institutions like ESUTH although other factors such high levels of poverty may be contributory. Unlike in the index study, other studies have reported significant rates of non-adherence among those that use herbal remedies [9, 32].

Strengths of our study include the large number of outpatients studied and the use of simple, easy to use instrument to assess medicationadherence, depression and disability. The study also sought to correlate adherence to disability and comorbidity which has not been undertaken in our region.

Limitations: This was a hospital-based study, therefore patients on multiple medications may be over represented. This may affect this study in two possible ways. Firstly, level of adherence may be lower than what may be obtainable in the community. Secondly, patient oriented health education in tertiary hospitals may have a positive impact on adherence levels thus suggesting the possibility of better adherence among these patients. A more objective measure such as urine antihypertensive drug assay have been advocated to demonstrated level of adherence.

Notwithstandingthese shortcomings, and in view of the external consistency of our data with those of similar studies, our results may well be a representative of the actual condition of patients with chronic medical disorders especially hypertension in our region and can be used to formulate local health policies, at least for the age groups studied.

Conclusions

There is a high rate of non-adherence among hypertensive patients attending tertiary care centers in the South East. Measures targeted towards improving adherence like information on the benefits of medication adherence and modalities of coping with disabilities should be developed for these centers. There is also the need to involve mental health practitioners in the care of such patients.

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