International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 1 (2014) pp. 760-770**
http://www.ijcmas.com

Original Research Article

Assessment of prevalence and associated factors of adherence to anti-hypertensive agents among adults on follow up in Adama Referal hospital, East Shoa, Ethiopia-cross sectional study

Habtamu Abera Hareri[1*], Dr.Molla Gedefaw[2], Bekel Simeng[3]

[1]Department of Nursing, College of Health sciences, Debre Markos University, Ethiopia
[2]Department of Public Health, GAMBY college of Medical Sciences, Ethiopia
[3]Department of Public Health, College of Health Sciences, Debre Markos University, Ethiopia
***Corresponding author e-mail:** habtamu.abera64@gmail.com*

A B S T R A C T

Hypertension is one of the most important chronic non communicable diseases with increasing trend worldwide. Although there is shortage of extensive data, 10.5% of the Ethiopian population has been estimated to have hypertension. Since the asymptomatic stage of the disease is serious, medications should be properly taken for life long. Hence, adherence is a serious challenge for the patients as well as for care givers. The main objective of this study was to assess the prevalence of poor adherence and factors associated to anti hypertensive treatment among patients on follow up at Adama referral hospital. A Facility based cross sectional study was conducted from March to April, 2013. Systematic sampling technique was employed to select 365 study participants. A semi structured interviewer administered questionnaire was used. Scoring method was used to classify patients' level of adherence. Data was analyzed using SPSS version 16.0 for windows. Possible associations and statistical significance was measured using Odds ratio at 95% CI, and P-value of <0.05. More than half (59.5 %) of the study participants were found to be adherent to their treatment. Age group (46-55years) AOR: 0.30 (0.142, 0.640), Lack of information AOR: 0.12, (0.258, 0.583) and presence co morbidities (AOR=0.50, (0. 290-0.893), were found to have statistically significant association with adherence. Large segment of patients in this particular setup did not seem to adhere to their antihypertensive treatment. Age, Religion, Lack of information about the nature of the disease, and its treatments, in addition, presence of co-morbidities appeared to hinder adherence.

Keywords

Hypertension; Medication; Adherence status.

Introduction

Hypertension (HTN) or high blood pressure (systolic blood pressure ≥140 mmHg and diastolic blood pressure ≥90 mmHg) is an overwhelming global challenge which ranks third as a cause of disability adjusted life-years (Kearney *et al*., 2005). Analysis of the global burden of hypertension revealed that over 25% of

the world's adult population had hypertension in 2000, and the proportion is expected to increase to 29% by 2025. The prevention and control of high blood pressure has not received due attention in many developing countries. Adherence to therapies is a primary determinant of treatment success. Poor adherence attenuates optimum clinical benefits and therefore reduces the overall effectiveness of health systems (Kearney *et al*., 2005; Chobanian *et al*., 2003; Habtamu Abera Hareri *et al.*, 2012).

Low adherence is a key factor in explaining impaired effectiveness and efficiency in the pharmacological treatment of hypertension. However, little is known about which factors determine low adherence in actual practice (Chobanian *et al*., 2003). Although there is shortage of extensive data, 10.5% of the Ethiopian population has been estimated to have HTN. Approximately 30% of adults in Addis Ababa have BP above 140/90mmHg or reported use of anti-hypertensive medications (Tesfaye *et al*., 2009).

Statement of the problem

HPN is considered a disease of high prevalence and low control, and its inadequate treatment can lead to coronary heart disease (CHD), acute myocardial infarction (AMI), peripheral vascular disease (PVD), stroke (CVA), congestive heart failure and renal failure(Chobanian *et al*., 2003). Because of these consequences it is the leading cause of morbidity and mortality among non-communicable diseases, which ranks third as a cause of disability adjusted life-year causing about 7.1 million premature deaths each year worldwide and accounts for 13% of all deaths globally (Hajjar I, Kotchen, 2003).

Analysis of the global burden of hypertension revealed that over 29% of the world's adult population had hypertension in 2000 (Mafunda *et al*., 2006), and has shown a rapid increase in prevalence affecting significant numbers of individuals in Sub- Saharan Africa (*Kuller*, 2007; Saman *et al*., 2007), Available data shows an overall prevalence of 5-20% in this region (Tesfaye *et al*., 2009). Although there is shortage of extensive data, 10.5% of the Ethiopian population has been estimated to have HTN. Approximately 30% of adults in Addis Ababa have BP above 140/90mmHg or reported use of anti-hypertensive medication (Tesfaye *et al*., 2009).

Studies worldwide indicate that despite the availability of effective medical therapy, over half of all hypertensives do not take any treatment (EInkster *et al*., 2006) and more than half of those on treatment have blood pressures over 140/90 mmHg threshold (Falaschetti, 2004). The World Health Organization (WHO) describes poor adherence as the most important cause of uncontrolled blood pressure and estimates that 50–70% of people do not take their antihypertensive medication as prescribed (Mant and McManus, 2006).
Generally, antihypertensive therapy should be maintained indefinitely (Mensah, 2008). However, findings in clinical practice have raised concerns about under treatment and non adherence to antihypertensive treatment hampering the effectiveness of these medications (Ezzati *et al*., 2002). Poor adherence has been attributed to unnecessary over-prescription of drugs, substantial worsening of diseases, avoidable increases in hospital admission rates, longer hospital stays, leading to a significant medical burden (Ogden *et al*., 2000; Osterberg and

Blaschke, 2005). It also compromises the efforts of the health care system, policy makers and health care professionals in improving the health of populations. As a result, substantial numbers of patients do not get the maximum benefit of medical treatment, resulting in poor health outcomes, lower quality of life increased health care costs and erodes public confidence in health systems (Balkrishnan, 2005). Hence, Measures are required at a population level to prevent the development of hypertension and to improve awareness, treatment and control of hypertension in the community.

WHO defines adherence as "the extent to which a person's behavior—taking medication, following a diet, and / or executing lifestyle changes-corresponds with agreed recommendations from a health care provider"(Hajjar and Kotchen, 2003). Adherence is dependent on numerous factors and has been shown to vary from 0 to 100% in different populations studied (World Health Organization, 2003; Haynes *et al*., 2002). Factors such as age (World Health Organization, 2003; Haynes *et al*., 2002). gender (Hassan *et al*., 2006 ; Ambaw *et al*., 2012), religion(Ambaw *et al*., 2012),) marital status(Habtamu Abera Hareri *et al.2012*) low socioeconomic status and severity of disease (Haynes *et al*., 2002), treatment comlexity (World Health Organization, 2003; Hassan *et al*., 2006), side effects of medication (Hassan *et al*., 2006; Osterberg and Blaschke, 2005), patient's inadequate understanding of the disease and importance of the treatment, Co-morbid medical conditions (Osterbergand Blaschke, 2005; Ambaw *et al*., 2012), lack of social support (Lennon *et al*., 2001), poor patient-provider relationship (Wang *et al*., 2002), cost, forgetfulness (Almas *et al*., 2006). Distance from health care set up (Ambaw *et al*. 2012), duration of hypertension and its treatment are found to influence adherence behaviour.

Clearly, interventions to improve adherence with antihypertensive agents are needed, if such interventions are to be successfully designed, targeted, & cost effective, it is critical to understand the complex reasons for non adherence and to identify those that are modifiable (Hyans). In Ethiopia, particularly in the study area, little is known about the adherence status and associated factors. Considering that HTN is a difficult disease for adherence to treatment due to the required change in lifestyle habits and active participation of the individual in antihypertensive medication therapy (Acta Paul Enferm, 2012), we consider that the knowledge about adherence and these factors and their relationships can guide facilitating actions for greater adherence Therefore, this study was conducted to assess the prevalence and factors contributing to medication adherence among adult patients with hypertension on follow up in Adama referral hospital, East Showa, Ethiopia.

Objectives

General objective

To assess the magnitude of adherence and associated factors with antihypertensive treatment among adults on follow up at Adama Hospital, 2013 G.C.

Specific objectives

To measure the magnitude of adherence with anti hypertensive treatment among adults on follows up at Adama Hospital.

To identify factors associated with adherence to anti hypertensive treatment among adults on follow up at Adama Hospital.

Materials and Methods

Study Setting

The study setting was Adama referral hospital, east showa, Oromia National Regional State, Ethiopia. Based on figures from the Central Statistical Agency in 2007 Ethiopia (CSA), this town has a total population of 220,212, an increase of 72.25% over the population recorded in the 1994 census. Adama referal Hospital is a teaching as well as regional referral Hospital under ministry of education of Ethiopia. The referral Hospital is meant to serve 5 million people as per the three tier system of the National Ministry of Health. Chronic illness care is one of the services the Hospital provides to the population both within and outside of Adama town. There were 972 patients on antihypertensive treatment at the chronic illness follow-up care unit.

This descriptive study was a questionnaire-based cross sectional analysis. A systematic sampling method to select 389 patients was employed from March 2013 to April 2013 to examine the level of Adherence with the antihypertensive drug treatment. All adult cases of hypertension who were on follow up at Adama referral hospital who started taking anti hypertensive drug treatment from which data was collected and 389 participants were included. Every other two patients from the registration list were interviewed to obtain vital information regarding the topic of interest. All adults with hypertension who were started medication treatment and those all on follow up at Adama referral hospital were included.

Respondents who scored above mean for medication adherence questions (among the 9 questions with highest score 4 and minimum 1), the mean was executed from the distribution. Hence, individuals with score of: below mean of the distribution were non adherent and above or equals to mean of the distribution were taken as adherent.

The outcome variables of the study was adherence status and the independent variables were: Age, ethnicity, gender, education, marital status, religion, Presence of co-morbidities, distance, dosage frequency, duration of treatment, number of medications, coverage of drug cost, information about HTN and its treatment, treatment complexity, medication side effects, income and social support, Lack of accessibility to healthcare, long waiting time for clinic visits, and unhappy or unsatisfied clinic visits. Factors included were social & economic factors, Health care related factors, therapy related factors and presence of co-morbidities and knowledge towards antihypertensive agents. Three data collectors were selected from health institutions from the surrounding health care settings to avoid the issue of bias and were professionally nurses and one supervisor was assigned and a brief orientation was provided for them before data collection was initiated. The collected data after compilation was analyzed using SPSS version 16.0 for windows and odds ratio and chi square tests were used to assess the statistical association where 95% CI and P value for logistic regression analysis was used to see the relative effect of the independent variable over the dependent variable.

Before data collection to conduct this study ethical clearance was requested and approval was obtained from D/ Markos University (DMU) health sciences college research and publication office. And the letter was submitted to Adama referral hospital medical director office prior to the beginning of undertaking the study in the area. All the study participants were informed about the purpose of the study, their right to refuse is maintained. Ethical conduct is maintained during data collection and throughout the research process. To ensure confidentiality anonymous type interview was followed.

Results and Discussion

Patient demographic and clinical characteristics

A total of 365 hypertensive patients were interviewed, making the response rate of 94% compared to the calculated sample size of 389 with 10% non response rate. Socio demographic Characteristics of the study sample are presented in Table 1. As shown in the table the study participants consisted of 187(51.2%) females. Majority of the participants 149(43.6%) were orthodox by religion and 234(64.1%) were married, Out of the total participants 158(43.3%) attained tertiary educational level and 113(31.0%) participants were governmental employed. About 20(6%) of participants have income ≥3000 Ethiopian Birr (ETB) and 181(49.6%) did not have regular income and live with support from others.

Information, Medication and clinical characteristics of respondents

The mean blood pressure of the total 365 participants with hypertension on follow up at Adama referral hospital was 149/97mmHg. Majority of the respondents 342(93.7%) have been told about their disease, 350(95.5%) were informed about their medication, out of which only 111(30.4%) have very well understood the information provided to them about their medication. The most frequently reported co-morbid condition was diabetes 152(41.6%), nearly half, 166(45.5%) respondents were hypertensive for two – four years or and 212(58.1%) were on anti hypertensive treatment for less than two years (Table 2).

Anti hypertensive therapy related reasons provided as a barrier

Out of the total 365 participants 198(54.2) responded yes for duration of treatment to be a barrier to be adherent to their anti hypertensive treatment, with regard to cost of anti hypertensive drugs more than half, 202(55.3%) of participants reported cost is not a barrier to adhere to their treatment, majority of the participants 275 (75.3%) responded that fear of side effects associated with anti hypertensive medications do not have impact on their adherence behavior to such agents (table 3).

Factors significantly and independently associated with adherence and poor adherence status.

The association of selected socio-demographic, clinical and other characteristics on adherence status was investigated using both the bivariate and multivariate logistic regression technique. Accordingly, variables considered in the bivariate analysis were: age, sex, marital status, religion, educational status, income, employment status, presence of co-morbidities, distance, duration of treatment, information about their

medication and Patient provider relationship. Explanatory variables with p value up to 0.2 were included in the multiple logistic regressions. Finally, age, religion, information towards their medication and presence of co morbidity, remained to be significantly associated with adherence to treatment of HTN (Table 4).

Adherence

Out of the total 365 participants only 217(59.5%) were adherent to medication regimen where as the remaining were not. Respondents with age group (46-55) were 70% less likely to be adherent as compared to younger & older age groups (AOR=0.30, 95%CI = (0.142, 0.640, P=0.002). With regard to religion Muslim followers were 3 times more likely to be adherent to their treatment as compared to orthodox followers (AOR= 3.20, 95%CI=1.69, 6.08, P=0.001). Respondents who were not at all understood the information about their medication by self response were 88% less likely to be adherent to their medication as compared to those who understood the information very well (AOR=0.12, 95%CI= 0.258, 0.583, P=0.008). Respondents with co morbidities were 50% less likely to be adherent compared to clients with no co morbidity (AOR=0.50, 95%CI=0. 290-0.893, P=0.019).

The major objective of the study was to assess the prevalence of adherence and associated factors to antihypertensive treatment among patients with follow up at Adama referral hospital in eastern Ethiopia. Literature indicates that adherence is one of the most important reasons for uncontrolled hypertension, serious complications and wastage of health care resources. Several factors, which may be patient or health system related, continue to militate against compliance behavior (Kearney *et al*., 2005; Ambaw *et al* ., 2012).

The results of the present study showed that from the total study participants 217(59.5%) were adherent to medication regimen, where as the rest were not. Thus, it is significantly lower compared to expected index of 80% medication adherence (In Hypertensive Patients In Lusaka, Zambia, 2010), Hence, it is encouraging to note that this study reports a lower adherence as compared to what has been reported previously in local studies conducted at university of Gondar hospital & black lion hospital, Addis Ababa, 64.6% & 69.5% respectively.(Ambaw *et al*., 2012; Habtamu Abera Hareri *et al.,* 2012). This could be due to measurement of adherence based on different criteria in the two studies, along with variation in the subset of population which served as the study sample.

Among the studies conducted on various populations of the world, using a similar cut-off, the adherence observed in the present study was lower than what has been reported in a similar study in Pakistan (77%) (Saman *et al*., 2007) and Zambia (83%) (Mweene *et al*), this might be due to better access and care to patients in these countries. This could also be related to low level of education and low level of awareness related to risk of hypertension complications.

Failure to adhere to medications can lead to poor blood pressure control and

Table.1 Socio demographic characteristic of the study participants (n = 365), Adama referral hospital, east Showa Ethiopia, 2013

Variable	Category	Frequency	Percent (%)
Age	18—35	15	4.1
	36-45	60	20.5
	46-55	114	51.8
	>55	176	48.2
Sex	Male	176	48.8
	Female	187	51.2
Educational status	Illiterate	76	20.8
	Primary school	64	17.5
	Secondary school	67	18.4
	Tertiary school	158	43.3
Religion	Orthodox	159	43.6
	Muslim	98	26.8
	Catholic	20	5.5
	Protestant	88	24.1
Work status	Government employee	113	31
	Privet business	106	29
	Unemployed	35	9.6
	Retired	34	9.3
Monthly income	No regular income	181	49.6
	<999 Et br	43	11.8
	1000-1999 Eth br	42	11.5
	1999-2999 Et br	79	21.6
	> or =3000 eth br	20	5.5

Table.2 Information, Medication and clinical characteristics of respondents (n=365) Adama referral hospital,East Showa Ethiopia, 2013

Variable	Category	Number	Percent (%)
Duration with hypertension?	Less than two years	95	26
	Two to four years	166	45.5
	Five or more years	104	28.5
taking medications for HPN	Yes	360	98.6
	No	5	1.4
Duration of taking medicine for HPN.	less than two years	212	58.1
	two to four years	109	29.9
	five or more years	44	12.1
Provided information about your medicine.	Yes	350	95.9
	No	15	4.1
How well do you understand the information provided about your medicine?	Not at all	12	3.3
	Somewhat	242	66.3
	Very well	111	30.4
Présence of co morbidity	Yes	252	69.0
	No	113	31.0

Table.3 Therapy related factors (reasons) as a barrier (n=365). Adama Referral hospital, East Showa Ethiopia, 2013

Variable Barriers	Category	Number	Percent (%)
Cost of drugs	Yes	163	44.7
	No	202	55.3
Treatment comlexity	Yes	20	5.5
	No	345	94.5
Duration of treatment	Yes	198	54.2
	No	166	45.5
Fear of side effect	yes	90	24.7
	No	275	75.3
Rout of taking medication	Yes	160	43.8

Table.4 Association of adherence by selected characteristics, among hypertensive patients on follow up cases in Adma referral hospital, East showa, Ethiopia, 2013.

Variable	Adherence Status		P value	COR	AOR	CI (95%)
	Adherent	Poor adherent				
Age						
18-35	10	5	.004			
36-45	26	34	0.557		1.49	(0.392,5.680)
46-55	61	53	0.002	0.304	0.30	**(0.142,0.640*)**
>55	120	56			**1.00**	
Religion						
Orthodox	109	50			**1.00**	
Muslim	56	42	0.001	3.12	3.20	(**1.693,6.081*)**
Catholic	9	11	0.384		0.60	(0.1971, 1.8 71)
Protestant	43	45	0.218		1.53	(0 .776-0.046)
Income (ETB)						
<999	117	64	**0.177**		**1.00**	
1000-1999	12	30	0.237		0.95	(.147, 1.425)
2000-2999	44	35	0.001		0.59	(0.028,0.361)
>3000	16	4	0.055	0.508	0.314	(0.096,1.025)
Information towards						
Not at all	2	10	0.008	0.22	**0.42**	**(0.258, 0.583*)**
Some how	146	96	0.74		**1.00**	
Very well	69	42				
Presence of Co morbidity						
Yes	166	86	0.019	0.427	0.50	**(0. 290, 0.893*)**
No	51	62			**1.00**	

Note: - ** statistically significant * variables with p value of greater than 0.2 in crude analysis omitted from entering in to the model.

increased risk of cardiovascular complications. This study is comparable to a study conducted in Malaysia (44.5%) (Youssef and Moubarak, 2002). Age was found to be significantly and independently associated with adherence in this study. Patients (46-55 years) presented lower levels of adherence compared to those in younger & older age groups. This may be related to the fact that HTN is a silent disease and, thus, leads to certain reluctance in middle aged individuals regarding the control of the disease, who only give importance to adequate treatment when there is a worsening of symptoms. This finding is consistent with the study done in Brazil (Sabate,2003).

Respondents who have not at all understood the information provided about their medication are 88% less likely to be adherent as compared to those who understood the information very well. This finding is in line with a study conducted in Pakistan (Saman, 2007); Zambia (Mweene *et al*) and university of Gondar Ethiopia (Ambaw *et al*., 2012). Right knowledge about HTN and its treatment creates a clear understanding and avoids confusion about the treatment and the disease condition. This is due to the fact that people are more likely to be convinced after sufficient information pertaining to their disease, medication regimen and associated risks is supplied. Hence it is worth mentioning that health care professionals are responsible at providing valuable and relevant information to their clients so as to raise consciousness and stimulate action which help to overcome the problem of poor adherence.

Co-morbidities can precipitate the health status of the patient and make them fail to adhere to their antihypertensive treatment. This study showed that the existence of co morbidities among HTN patients had significant associations on adherence behavior. Patients with co morbidities were less likely to be adherent to their treatment than those with no co morbidities. Patients with more number of co morbidities could suffer from serious complications and complex treatment regimens which were favorable conditions not to adhere to their medications. This study is in line with the study done in Pakistan (Saman, 2007), Zambia (Mweene *et al*), university of Gondar, Ethiopia (Ambaw *et al*., 2012). This can be explained by the fact that, co morbidities lead to multiple drug usage which potentially poses fear of side effects, lack of motivation & might make them feel hopeless. Hence, could also urge them to stop their treatment.

Limitations of the study

The primary measure of adherence to medication was self report, which may not provide a true picture of actual adherence. Particularly influenced by recall and social desirability biases which potentially have under estimated or over estimated the level of adherence reported in the study.

In conclusion, More than half of the study participants were found to be adherent to their treatment. However, it is found to be significantly lower compared to expected index of 80% medication adherence. The study identified middle age, lack of awareness, co morbidity, and religion to be the strongest factors affecting medication adherence amongst patients on follow up at Adama referral hospital. This information provides baseline data to help improve and address the issues of adherence in hypertensive patients seen in Adama referral hospital.

Recommendation

Future studies are recommended to confirm these findings, as adherence to medication predicts better outcomes and indicators of poor adherence to a medication regimen are a useful resource for physicians to help identify patients who are most in need of interventions to improve adherence.

It is worth valuing recommendation of implementing health education campaigns to increase awareness about the risk factors, natural history, Complications and treatment of hypertension. Global events, such as World Hypertension Day, could be used as a forum to highlight these issues. Patient support groups can be employed to help the poor-adherent. Patients who have suffered complications due to poor-adherence could be requested to voluntarily share their experiences. Print and audiovisual media would be very helpful in dissemination of information. Most importantly, physicians & Nurses have to pay special attention to patient education and counseling when treating hypertensive patients

References

Acta Paul Enferm. Factors associated with adherence to antihypertensive treatment in a primary care unit : 2012;25(Special Issue 1):27-34.

Almas A, Hameed A, Ahmed B, Islam M 2006. Compliance to antihypertensive therapy JCPSP 16: 23–26.

Ambaw *et al*. Adherence to antihypertensive treatment and associated factors among patients on follow up at University of Gondar Hospital, Northwest Ethiopia, 2012, 12:282.(PubMed)

Balkrishnan R: The importance of medication adherence in improvingchronic-disease related outcomes: what we know and what we need tofurther know. Med Care 2005, 43(6):517–520.

Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr: Jones DW, Materson BJ, Oparil S, Wright JT Jr, *et al*: Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension 2003, 42(6):1206–1252.

Ezzati M, Lopez AD, Rodgers A, Vander HoornS, Murray CJ. Selected major risk factors and global and regional burden of disease. *Lancet*. 2002;360:1347–1360.

Falaschetti E 2004. Blood pressure. In: Sproston K, Primatesta P, eds. Health Survey for England 2003 TSO: London. pp 181–220.

Habtamu Abera Hareri *et al.* : Assessments of Adherence to Hypertension Medications and Associated Factors among Patients Attending Tikur Anbessa Specialized Hospital Renal Unit, Addis Ababa, Ethiopia 2012.

Hajjar I, Kotchen TA: Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988–2000. JAMA 2003, 290 (2):199–206.

Hassan NB, Hasanah CI, Foong K, Naing L, Awang R, *et al*. (2006) Identification of psychosocial factors of noncompliance in hypertensive patients.J Hum Hypertens 20: 23–29.

Haynes RB, McDonald HP, Garg AX (2002) Helping patients follow prescribed treatment: clinical applications. JAMA 288: 2880–2883.

hyans RB. Determinants of compliance: the disease and the mechanics of treatment in. hyans RB, Taylor

D,sackett D,eds.compliance in health care.baltimore: John Hopkins University press; 19 79.

In Hypertensive Patients In Lusaka, Zambia: Medical Journal of Zambia, Vol. 37, No. 3 2010..

Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. Lancet. 2005;365(9455):217– 223. [PubMed]

Kuller LH, Epidemic hypertension in sub S a h a r a n A f r i c a : H y p e r t e n s i o n 2007:50:1004:1005.

Lennon C, Hughes CM, Johnston GD, McElnay JC. 2001. Identification of psychosocial factors which influence patient adherence with antihypertensive medication. Int J Pharm Pract 9: R8.

M D Mweene *et al* : Factors Associated With Poor Medication Adherence

Mafunda J, Rufaro C, Ndambakuwa Y, Nyarango P, Kosia A, Chifamba J, *et al*: Emerging non-communicable disease epidemic in Africa: preventive measures from the WHO Regional Office for Africa: Ethnicity and disease.2006 16(2)521-526.

Mant J, McManus RJ .2006. Does it matter whether patients take their antihypertensive medication as prescribed? The complex relationship between adherence and blood pressure control. J Hum Hypertens 20: 551–553.

MEInkster, Donnan PT, MacDonald TM, Sullivan FM, Fahey T (2006)Adherence to antihypertensive medication and association with patient andpractice factors. J Hum Hypertens 20: 295–297.

Mensah GA, Epidemiology of stroke and high blood pressure in Africa. Heart 2008 94: 697- 705

Ogden LG, He JA, Lydick E, Whelton PK (2000) Long-term absolute benefit of lowering blood pressure in hypertensive patients according to the JNC VI risk stratification. Hypertension 35: 539–543.

Osterberg L, Blaschke T .2005. Drug therapy: Adherence to medication. New England Journal of Medicine 353: 487–497.

Osterberg L, Blaschke T .2005. Drug therapy: Adherence to Medication.N Engl J Med 353: 487–97.

Sabate E. 2003. Adherence to long term therapies: Evidence for action. Geneva, Switzerland: WHO; 35(3); 207.

Saman K.H, Afridi MA, Abbas K, Sajwani RA, Saleheen D,Frossard PM *et al*. Factors associated with adherence to antihypertensive treatment in Pakistan Plos One 2007 issue 3.

Tesfaye F, Byass P, Wall S. Population based prevalence of high blood pressure among adults in Addis Ababa: uncovering a silent epidemic. BMC Cardiovasc Disord. 2009;9:39. (PUBMED)

Wang PS, Bohn RL, Knight E, Glynn RJ, Mogun H, *et al*. 2002. Noncompliance with antihypertensive medications: the impact of depressive symptoms and psychosocial factors. J Gen Intern Med 17: 504–511.

World Health Organization. Chapter XIII Hypertension in Adherence to Long-Term Therapies-Evidence for Action. 2003. pp. 129–136. Available: http://www.emro.who.int/ncd/Publications/adherence_report.pdf.

Youssef RM, Moubarak II .2002. Patterns and determinants of treatment compliance among hypertensive patients. East Mediterr Health J 8: 4–5.