

# Prescribing pattern and utilization of antihypertensive drugs and blood pressure control in adult patients with systemic hypertension in a rural tertiary hospital in Nigeria

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**Abstract:** Background: Hypertension is a major public health concern globally and is associated with high morbidity and mortality in sub-Saharan Africa. Although antihypertensive therapy is effective in lowering blood pressure, a large proportion of patients do not have optimal blood pressure control. Aims: To describe the prescribing pattern and utilization of antihypertensive drugs and assess blood pressure control in a rural reference tertiary hospital in Nigeria. Methods: We conducted a cross-sectional study of 212 adult patients with hypertension attending the cardiology clinic of the Federal Medical Centre, Ido-Ekiti, Nigeria, between February 2012 and July 2012. Anthropometric, clinical and therapeutic data were collected using a pre-tested pro forma. Data analysis was done using SPSS 16.0 software (IBM, Chicago, IL, US). P value < 0.05 (two-sided test) was considered to be statistically significant. Results: We study 212 adults with hypertension, 48.1% of whom were male and the male-to-female ratio was 0.9. The mean age ( $\pm$  SD) of the patients was 61.5 $\pm$ 15.1 years. Thirty two (15.1%), 95 (44.8%), 67 (31.6%) and 18 (8.5%) patients were on mono-, dual-, triple- and quadruple therapy respectively. Diuretics (84.9%) and calcium channel blockers (56.6%) were the most frequently used antihypertensive drugs. Blood pressure was controlled in only 45.3% of patients. Dual- and triple-therapy produced more patients with controlled blood pressure (dual-therapy, p=0.30; triple-therapy, p=0.11). Conclusions: Our study showed that diuretics were the most frequently prescribed class of antihypertensive drugs in our rural tertiary hospital as in many studies from urban centres in Nigeria and sub-Saharan Africa. Consistent with the global trend, the rate of controlled blood pressure among hypertensive patients was low, with combination therapy achieving control in more patients.

**Keywords:** Hypertension, Antihypertensive Drugs, Prescribing Pattern, Blood Pressure Control, Sub-Saharan Africa, Adherence

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## 1. Introduction

Hypertension (HT) is a common disease globally and the number one risk factor for cardiovascular disease in sub-Saharan Africa (1). It is a major public health concern and is associated with high morbidity and mortality (2-4). The prevalence of HT has been increasing worldwide and it has been estimated that it will increase to 29.2% by 2025

representing about 1.56 billion people (3). In Nigeria, studies have reported prevalence from 12% to 36.6% (5-9). It has been well established that antihypertensive therapy is effective in lowering blood pressure (BP) and preventing HT-related clinical events (10-12). However, majority of hypertensive patients will require at least two antihypertensive drugs for optimal control (13-14). Unfortunately, a large proportion of patients with HT do not have optimal blood pressure control (15-18). This is often

due to a complex interplay of a number of factors such as inadequate adherence to drugs and instructions on lifestyle modifications, poor compliance with treatment guidelines on the part of prescribing doctors and lack of appropriate antihypertensive drugs (15-20). There have been several studies in Nigeria on antihypertensive pharmacotherapy, compliance with guidelines and blood pressure control.<sup>14, 21-25</sup> However, most of these studies were done in urban settings where there is better health infrastructure, more skillful manpower and improved literacy and higher socioeconomic condition of patients. The objective of the study was to describe the prescribing pattern of antihypertensive drugs and assess blood pressure control in a rural reference tertiary hospital in Nigeria so as to better understand the pattern of antihypertensive care and potential opportunities for improvement in hypertension management.

## 2. Materials and Methods

We conducted a cross-sectional study of 212 adult patients with HT attending the cardiology clinic of the Federal Medical Centre (FMC), Ido-Ekiti, Nigeria between February 2012 and July 2012. FMC is a reference tertiary hospital situated in rural Ido-Ekiti, south-west Nigeria. The research protocol was approved by the Research Ethics Committee of the hospital and both oral and written consent was obtained from all the patients who participated in the study. Consecutive patients attending the cardiology clinic who met the study criteria were enrolled. The inclusion criteria were: age 18 years and above; patients who have used antihypertensive drug(s) for not less than 6 months and consent from patient to participate in the study. Patients with heart failure (HF) were excluded from the study.

### 2.1. Data Collection

Pre-tested pro forma was used for collection of data which included bio-demographical data such as age, sex, level of formal education, occupation, anthropometric measurements, clinical and therapeutic data. Some clinical and therapeutic data such as initial systolic blood pressure (SBP), diastolic blood pressure (DBP) and antihypertensive drugs were extracted from the case file of the patients. Adherence to antihypertensive drugs was determined using patient report and pill counting.

#### *Measurements and Definitions*

Blood pressures (BP) were measured using a mercury column sphygmomanometer and a cuff of appropriate size for each participant. A standardized protocol was followed, in which SBP and DBP were measured on the left arm after participants had been seated for at least five minutes. The cuff was positioned at the heart level and deflated at 2 mm/s and the blood pressure was measured to the nearest 2mmHg using phase I and V (disappearance) Korotkoff sounds to identify SBP and DBP, respectively. Three measurements were done after five minutes of rest and at one to two minutes intervals (26).

BP in HT was defined as controlled when both SBP and

DBP were < 140mmHg and <90mmHg respectively (26, 27). World Health Organization (WHO) definition of adherence is “the extent to which a person’s behavior in taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider”. In the study, adherence was categorised into “good adherence” or “poor adherence”. Poor adherence was any situation that fell short of the total use antihypertensive drugs as prescribed by the physicians.

### 2.2. Data Analysis

The data collected was doubly entry into SPSS 20.0 software (IBM, Chicago, IL, US) and analysed. Descriptive statistics were described using means and standard deviations, frequencies and percentages. Bivariate analysis was done using Student *t* test, Fischer’s exact test and chi square as appropriate. P value < 0.05 (two-sided test) was considered to be statistically significant.

## 3. Results

The characteristics of the patients are displayed in Table 1. There were 102 (48.1%) and 110 (51.9%) male and female respectively with male to female ratio of 0.9. Eighty six (40.6%) of the patients had postsecondary education while 57(26.9%) had no formal education. Majority (82.5%) of the patients had monthly income lower than Nigerian Naira (NGN) 50, 000 (300 United States Dollars (USD)).

**Table 1.** Socio-demographic characteristics of the patients.

Characteristics	n	%
Age		
Mean	61.5	
Standard Deviation	15.1	
Range	24-92	
Gender		
Male	102	48.1
Female	110	51.9
Education		
No	57	26.9
Primary	42	19.8
Secondary	27	12.7
Post-secondary	86	40.6
Occupation		
Artisans	24	11.3
Civil servants	49	23.1
Farmers	28	13.2
Traders/self employed	38	17.9
Unemployed/dependants	73	34.4
Income (monthly)		
≤NGN9, 999	67	31.6
NGN10, 000-NGN49, 999	108	50.9
NGN50, 000-NGN99, 999	24	11.3
≥NGN100, 000	13	6.1

**Table 2.** Patients with controlled blood pressure and pattern of antihypertensive drug utilization.

Pattern of antihypertensive drug utilization Patients with controlled blood pressure P value	(n)	n	%
Mono therapy (32)	11	34.4	
Dual therapy (95)	44	46.3	0.30
Triple therapy (67)	35	52.2	0.02
Quadruple therapy (18)	6	33.3	0.80
Total (212)	96	45.3	

Of the 212 patients, 32 (15.1%), 95 (44.8%), 67 (31.6%) and 18 (8.5%) were on mono-, dual-, triple- and quadruple therapy respectively. Diuretics (D) (84.9%) were the most frequently used antihypertensive drug followed by calcium channel blockers (CCB) (56.6%), either as a single drug or in combinations with others. Angiotensin receptor blockers (ARB) and  $\alpha$  adrenergic blockers ( $\alpha$ B) were rarely used. BP was controlled in 96 (45.3%) of the patients. The proportion of patients with controlled BP in different patterns of antihypertensive drug utilization is shown in Table 2. Triple therapy produced the highest proportion of patients with controlled BP (Table 2). Also, when all the patterns of drug utilization were compared, there were more patients with controlled BP in dual- and triple-therapy groups than in mono-therapy (dual-therapy,  $p=0.30$ ; triple-therapy,  $p=0.02$ , quadruple-therapy,  $p=0.80$ ).

**Table 3.** Pattern of antihypertensive drug utilization.

Pattern of antihypertensive drugs	n	%
Mono-therapy		
D	17	8.0
CCB	9	4.2
ACEI	3	1.4
ARB	3	1.4
Dual-therapy		
D+CCB	40	18.9
D+ACEI	39	18.4
D+ $\alpha$ MD	3	1.4
CCB+ACEI	13	6.1
Triple-therapy		
D+CCB+ACEI	36	17.0
D+BB+ACEI	12	5.7
D+BB+ARB	8	3.8
D+ACEI+ $\alpha$ MD	7	3.3
CCB+ACEI+ $\alpha$ MD	4	1.9
Quadruple-therapy		
D+CCB+ACEI+ $\alpha$ MD	8	3.8
D+CCB+ARB+ $\alpha$ MD	5	2.4
D+CCB+ACEI+BB	4	1.9
D+CCB+ACEI+ $\alpha$ B	1	0.5

D=Diuretics; CCB=Calcium channel blockers; ACEI=Angiotensin converting enzyme inhibitors; ARB=Angiotensin receptors blockers; BB=Beta blockers;  $\alpha$ B=Alpha blockers;  $\alpha$ MD=Alpha methylidopa

**Table 4.** Frequency of classes of antihypertensive drugs.

Classes of antihypertensive drugs	n	%
D	180	36.6
CCB	120	24.4
ACEI	127	25.8
ARB	13	2.6
BB	24	4.9
$\alpha$ MD	27	5.5
$\alpha$ B	1	0.2

D=Diuretics; CCB=Calcium channel blockers; ACEI=Angiotensin converting enzyme inhibitors; ARB=Angiotensin receptors blockers; BB=Beta blockers;  $\alpha$ B=Alpha blockers;  $\alpha$ MD=Alpha methylidopa

## 4. Discussion

The mean age of the patients in this study was  $61.5 \pm 15.1$  years. This is consistent with other reports that HT is mostly a disease of the middle age and the elderly people (14, 21, 22, 28, 29). There were more females than males in our study with a male to female ratio of 0.9, less than one. Although this finding agrees with the reports of some studies (14, 22, 23, 29-31), however, it is in contrast with the finding of a prevalence study of HT in the general population in Nigeria (32). This may be due to poor attitude of males not accessing health care early and not keeping clinic follow-up appointments (33). In the study, majority of the patients did not have more than secondary education and had monthly income lower than NGN50, 000 (300USD). This shows that they are socioeconomically disadvantaged, a condition that may be a critical factor in the management and outcome of their HT. Busari *et al* (15) reported that patients' level of education and economic status affect prescribing pattern of antihypertensive drugs by doctors and adherence to these drugs.

Diuretics either singly or in combination with other classes of antihypertensive drugs were the most used in this study. This finding corroborates reports from other studies in Nigeria (14, 21-23, 29). However, there are other studies who reported low use of diuretics in contrast to the finding of our study (11, 25, 30). The high use of diuretics in our study agrees with the recommendations of the JNC 7 (34), WHO/ISH 2003 (35) and ESH/ESC Guidelines (27, 36, 37).

The general recommendation established by JNC 7 and 2010 Institute for Clinical Systems Improvement (ICSI) is the preference for thiazide diuretics as the initial drug in the absence of compelling indications (34, 38). In uncomplicated HT, diuretics either alone or combined with other classes, should be used for the pharmacologic treatment of most cases. Thiazides are inexpensive and randomized clinical trials have documented that they are effective at lowering BP & improving cardiovascular outcomes. They may be particularly beneficial for patients aged 55 years or older with HT or CVD risk factors and for patients aged 60 years or older with isolated systolic HT (39). For example, the SHEP trial found that chlorthalidone stepped-care therapy for 4.5 years was associated with a longer life expectancy at 22-year follow-up in patients with isolated systolic HT which is

typically common among black elderly hypertensive patients (40). In the Antihypertensive and Lipid-lowering Treatment to Prevent Heart Attack Trial (ALLHAT), thiazide diuretics were more effective than ACE inhibitors in black patients (41). Thus, the high use of diuretics, particularly thiazides, in our study setting where the mean age was  $61.5 \pm 15.1$  years, is very appropriate (42). ARB and  $\alpha$ B were rarely used in this study either as a single agent or in combination therapy. For ARB, this may be due to relative high cost of the drugs in this class when compared with other classes of antihypertensive drugs and when viewed on the rural setting of this study where majority of the patients are elderly and socioeconomically disadvantaged. As regard  $\alpha$ B, this class of antihypertensive drugs enjoys little visibility and does not have much relevance in JNC 7 (34). It is generally neither an initial drug nor one of the drug class recommendations for compelling indications based on various clinical data. Their long-term effects on morbidity and mortality do not seem superior to placebo. They should not be used as monotherapy for treating HT due to an increased risk of HF and contraindicated in patients with autonomic dysfunction (34, 35).

In our study, only one patient used  $\alpha$ B while Olarewaju *et al* (14) also reported no patient on this class of antihypertensive drugs.

In our study, 84.9% of patients were on two or more antihypertensive drugs. This finding is similar to the one reported by Olarewaju *et al* (88.7%) and Tamuno *et al* (84%) (14,29). More than 50% of patients with HT will require more than one drug, either as two separate prescriptions or as a fixed dose combination, for blood pressure control (34). Several conditions, including the stage of HT, presence of comorbidities and end organ damage, demand the use of multidrug antihypertensive therapy, which advantageously, may be used at lower doses to avoid the adverse effects that may occur with higher doses of a single drug. These conditions are common among hypertensive patients in sub-Saharan Africa (29, 33). BP was controlled in only 45.3% of patients. Although this proportion is arithmetically low, however, when compared with findings from studies both in Nigeria and outside, it is higher than 29%, 30.5%, 34.5%, and 36% reported by Etuk, *et al* (22), Odili, *et al* (33) Tamuno, *et al* (29) and Salako, *et al* (31) respectively. The difference may be due to the setting of the study. While our study was done in a rural tertiary facility, other studies mentioned above were carried out in facilities located in urban communities. Several studies have attested to rural versus urban differences in BP levels throughout sub-Saharan Africa (43-46). However, the major features of rural communities in sub-Saharan Africa which are socio-economical disadvantages, lower literacy, and dilapidated health infrastructure are also found in the so-called urban areas.

The proportion of patients with controlled BP was higher in those on dual- and triple-therapy groups than in monotherapy, although the difference was not statistically significant (dual-therapy,  $p=0.30$ ; triple-therapy,  $p=0.11$ ). As aforementioned, most patients with HT require therapy with

two or more antihypertensive drugs. Although, mono-therapy would be desirable because of increased compliance, lower cost and fewer adverse effects or drug interactions, combination therapy for HT is more effective and well tolerated as proven by several studies (47-50).

Our study also showed that only 44.7% of the patients had good adherence to antihypertensive drugs. This is higher than 32.1% reported by Busari *et al* in the same facility about 5 years before. The improvement might be a reflection of the progressive upgrading of the service delivery in the facility with increasing human capacity building and recruitment, and enhanced health system infrastructure. However, the good adherence to antihypertensive drugs of 48.5% is within a wide range of reported rates of 35-97% (51, 52). This wide range of adherence rates might be due to differences in study design, patient selection, definition of adherence outcome(s) and statistical modeling. In our study, significantly more patients with good adherence to antihypertensive drugs achieved controlled BP than patients with poor adherence (59.6% versus 40.1%,  $p = 0.01$ ). Poor adherence with antihypertensive drugs is a major factor for low rate of blood pressure control among patients with HT, and this may lead to target organ damage and increased cardiovascular risk (53-55).

## 5. Conclusions

The study showed that diuretics were the most frequently prescribed class of antihypertensive drugs in our rural tertiary hospital as in many studies from urban centres in Nigeria and sub-Saharan Africa. As expected in a resource-constraint setting and near absence of effective health insurance system, more costly classes of drugs such as ARB were rarely used. Consistent with the global trend, the rate of controlled BP among hypertensive patients was low, with combination therapy achieving control in more patients. Good adherence to antihypertensive drugs was a significant factor for achieving BP control. There is need for effective measures to improve adherence to antihypertensive drugs among patients with HT.

## References

- [1] Gaziano TA. Economic burden and the cost-effectiveness of treatment of cardiovascular diseases in Africa. *Heart*. 2008; 94 (2):140-4.
- [2] Kearney PM, Whelton M, Reynolds K, Whelton PK, He J. Worldwide prevalence of hypertension: a systematic review. *J Hypertens*. 2004; 22(1):11-9.
- [3] Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet*. 2005; 365(9455):217-23.
- [4] Le Heuzey JY, Guize L. Cardiac prognosis in hypertensive patients. *Am J Med*. 1988; 84: 65-8.
- [5] Akinkugbe OO. The epidemiology of hypertension in Africa. In: Akinkugbe, ed. *Cardiovascular diseases in Africa*. Ciba-Geigy, 1976: 91-100.

- [6] Adedoyin RA, Mbada CE, Balogun MO, Martins T, Adebayo RA, Akintomide A., *et al.* Prevalence and pattern of hypertension in a semi-urban community in Nigeria. *Eur J Cardiovasc Prev Rehabil.* 2008; 15(6):683-7.
- [7] Ofuya Z. The incidence of hypertension among a select population of adults in the Niger Delta region of Nigeria. *Southeast Asian J Trop Med Public Health* 2007; 38(5): 947-9
- [8] Oladipo B, Akinkungbe. Current epidemiology of hypertension in Nigeria. *Archives of Ibadan Medicine* 2001; 1(1): 4- 8.
- [9] Oladapo OO, Falase AO, Salako L, Sodiq O, Shoyinka K, Adedapo K. A prevalence of cardiometabolic risk factors among a rural Yoruba south-western Nigerian population: a population-based survey. *Cardiovasc J Afr.* 2010; 21(1):26-31.
- [10] Neal B, MacMahon S, Chapman N. Effects of ACE inhibitors, calcium antagonists and other blood-pressure lowering drugs. Results of prospectively designed overviews of randomized trials. *Blood Pressure Lowering Treatment Trialists' Collaboration.* *Lancet* 2000; 356; 1955-64.
- [11] Pasty BM, Smith NL, Siscovick DS, Koepsell TD, Weiss NS, Heckberk SR *et al.* Health outcomes associated with antihypertensive therapies used as first line agents. A systematic review and meta-analysis. *JAMA* 1997; 277: 739-45
- [12] Lemougoum D, Seedat YK, Mabadeje AFB, Mendis S, Bovet P, Onwubere B *et al.* Recommendation for prevention, diagnosis and management of hypertension and cardiovascular risk factors in sub Saharan Africa. *J Hypertension* 2003; 21: 1993-2000,
- [13] Cushman WC, Ford CE, Cutler JA, Margolis KL, Davis BR, Grim RH, *et al.* Success and predictors of blood pressure control in diverse North American settings. The Antihypertensive and Lipid-lowering Treatment to Prevent Heart Attack Trial (ALLHAT). *J Clin Hypertens* 2002; 4:339-40.
- [14] Olanrewaju TO, Aderibigbe A, Busari OA, Sanya EO. Antihypertensive drug utilization and conformity to guidelines in a sub- Saharan African hypertensive population. *International Journal of Clinical Pharmacology and Therapeutics* 2010; 48(1): 68-75.
- [15] Busari OA, Olarewaju TO, Desalu OO, Opadijo GO, Jimoh AK, Agboola SM, Busari OE, *et al.* Impact of knowledge, attitudes and practices on hypertension on compliance with antihypertensive drugs in a resource-poor setting. *TAF Preventive Medicine Bulletin* 2010; 9(2):87-92.
- [16] Psaty BM, Manolio TA, Smith NL, Heckbert SR, Gottdiener JS, Burke GL, *et al.* Time trends in high blood pressure control and the use of antihypertensive medication in older adults. The Cardiovascular Health Study. *Archives of Internal Medicine* 2002; 162: 2325-32.
- [17] Marques-Vidal P, Tuomilehto J. Hypertension awareness, treatment and control in the community. Is the 'rule of halves' still valid? *J Human Hypertens* 1997; 11: 213-20.
- [18] Primates P, Brookes M, Poulter NR. Improved hypertension management and control. Results from the Health Survey for England 1998. *Hypertension* 2001; 3: 827-832.
- [19] Okano G J, Rascati K L, Wilson J P, Remund D D, Grabenstein J B, Brixner D I. Patterns of antihypertensive use among patients in the US Department of Defense database initially prescribed an angiotensin converting enzyme inhibitor or calcium channel blocker. *Clin Therapeutics* 1997; 19:1433-35.
- [20] Monae M, Bohn R L, Gurwitz J H, Glynn R J, Levin R, Avorn J. The effects of initial drug choice and comorbidity on antihypertensive therapy compliance: results from a population-based study in elderly. *Am J Hypertens* 1997; 10: 697-704.
- [21] Ekwunife OI, Ubaka CM. Drug utilization of antihypertensive therapy among patients with compelling indications in two hospitals in south-eastern Nigeria. *J Pharm Pharmacol Res* 2011; 2(1): 25-28
- [22] Etuk, K, Isezuo SA, Chika A, Achuje A, Ali M. Prescription pattern of antihypertensive drugs in a tertiary health institution in Nigeria. *Ann Afr Med* 2008; 7: 128-132
- [23] Yusuff KB, Balogun OB. Physicians' prescribing of antihypertensive combinations in a tertiary care setting in southwest Nigeria. *J Pharm Pharmacol Sci* 2005; 8: 235-242
- [24] Alebiyus CO. Antidiabetics/ antihypertensives prescription profile in OSUTH, Sagamu and environment. *Niger J Clin Pract* 2004; 7(1): 15-20.
- [25] Amira CO, Okubadejo NU. Antihypertensive pharmacotherapy in a developing economy: pattern, acquisition costs and conformity to international guidelines in a tertiary-care setting. *J Human Hypertens* 2006; 20: 894-897.
- [26] Mancia G, De Backer G, Dominiczak A, Cifkova R, Fagard R, Germano G *et al.* The Task Force for the Management of Arterial Hypertension of the European Society of Hypertension and of the European Society of Cardiology. 2007 Guidelines for the management of arterial hypertension. *Eur Heart J* 2007; 28: 1462-1536.
- [27] Guidelines Committee 2003. European Society of Hypertension-European Society of Cardiology guidelines for the management of arterial hypertension. *J Hypertens* 2003; 21:1011-1053.
- [28] Potchoo Y, Goe-Akue E, Damorou F, Massoka B, Redah D, Guissou IP. Effect of Antihypertensive Drug Therapy on the Blood Pressure Control among Hypertensive Patients Attending Campus' Teaching Hospital of Lome, Togo, West Africa. *Pharmacology & Pharmacy*, 2012; 3; 214-223
- [29] Tamuno I, Babashani M. Blood pressure control among hypertensive patients in a tertiary health care facility in Northern Nigeria. *Research Journal of Medical Sciences* 2012; 6(1): 26-32
- [30] Katibi IA, Olarinoye JK. Antihypertensive therapy among hypertensive patients as seen in the middle belt of Nigeria. *Ann Afr Med* 2004; 3: 177-180
- [31] Salako BM, Ayodele OE, Kadiri S, Arije A. Assessment of blood pressure in a black African population. *Cardiol Trop* 2002; 9: 3-6
- [32] National Expert Committee on Noncommunicable Diseases. Noncommunicable disease in Nigeria-final report of a national survey, Lagos, Nigeria: Federal Ministry of Health and Social Services; 1997.
- [33] Odili VU, Oghagbon EK, Ugua NA, Ochei UM, Aghomo OE. Adherence to international guidelines in the management of hypertension in a tertiary hospital in Nigeria. *Trop J*

- Pharmaceut Res 2008; 7: 945-952.
- [34] Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure: the JNC 7 Report, JAMA 2003; 289: 2560-2571
- [35] World Health Organization, International Society of Hypertension Writing Group 2003. World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. J Hypertens 2003; 21: 1989-1992
- [36] O'Riordan M. New European Hypertension Guidelines Released: Goal Is Less Than 140mmHg for All. Medscape (serial online). Available at <http://www.medscape.com/viewarticle/806367>. Accessed July 30, 2013
- [37] Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Bohm M, et al. 2013 ESH/ESC Guidelines for the management of arterial hypertension.. 23<sup>rd</sup> European Meeting on Hypertension and Cardiovascular Protection. Available at <http://www.esh2013.org/wordpress/wp-content/uploads/2013/06/ESC-ESH-Guidelines-2013.pdf>. Accessed July 30, 2013
- [38] Institute for Clinical Systems Improvement (ICSI). Hypertension diagnosis and treatment. Bloomington, Minn: Institute for Clinical Systems Improvement (ICSI); 2010.
- [39] Whelton PK, Appel LJ, Sacco RL, Anderson CA, Antman EM, Campbell N, et al. Sodium, blood pressure and cardiovascular disease: further evidence supporting the American Heart Association Sodium Reduction Recommendations. Circulation 2012; 126(24): 2880-2889
- [40] Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. Final results of the Systolic Hypertension in the Elderly Programme (SHEP). SHEP Cooperative Research Group. JAMA 1991; 265(24): 3255-64
- [41] The ALLHAT Officers and Coordinators for the ALLHAT Collaborative Research Group. Major outcomes in high risk hypertensive patients randomized to angiotensin converting enzyme inhibitor or calcium channel blockers versus diuretic: the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). JAMA 2002; 288: 2981-2997
- [42] Kostis JB, Cabrera J, Cheng JQ, Cosgrove NM, Deng Y, Pressel SL, et al. Association between chlorthalidone treatment of systolic hypertension and long term survival. JAMA 2011; 306(23): 2588-2593
- [43] Seedat YK. Hypertension in developing nations in sub Saharan Africa. J Human Hypertens 2000; 14: 739-747
- [44] Mokhobo KP. Arterial hypertension in rural societies. East Afr Med J 1976; 53: 440-444
- [45] Oviasu VO. Arterial blood pressures and hypertension in a rural Nigerian communities. Afr J Med Sci 1978; 7: 137-143
- [46] Mbanya JC, Minkoulou EM, Salah JN, Balkau B. The prevalence of hypertension in rural and urban Cameroun. Int J Epidemiol 1998; 27: 181-185
- [47] Benz JR, Black HR, Graff A, Reed A, Fitzsimmons S, Shi Y. Valsartan and hydrochlorothiazide in patients with essential hypertension. A multiple dose, double-blind, placebo controlled trial comparing combination therapy with monotherapy. J Hum Hypertens 1998; 12(12): 861-6
- [48] Pool JL, Glazer R, Weinberger M, Alvarado R, Huang J, Graff A. Comparison of valsartan/hydrochlorothiazide combination therapy at doses up to 320/25 mg versus monotherapy: a double-blind, placebo-controlled study followed by long-term combination therapy in hypertensive adults. Clin Ther. 2007; 29(1): 61-73
- [49] Glorioso N, Thomas M, Troffa C, Argiolas G, Patel S, Baek I, Zhang J. Antihypertensive efficacy and tolerability of aliskiren/amlodipine single- pill combinations in patients with an inadequate response to aliskiren monotherapy. Curr Vasc Pharmacol. 2012; 10(6): 748-55
- [50] Pfeiffer D, Rennie N, Papst CC, Zhang J. Efficacy and tolerability of aliskiren/amlodipine single-pill combinations in patients who did not respond fully to amlodipine monotherapy. Curr Vasc Pharmacol. 2012; 10(6): 773-80
- [51] Vrijens B, Vincze G, Kristanto P, Urquhart J, Burnier M. Adherence to prescribed antihypertensive drug treatments: longitudinal study of electronically compiled dosing histories. BMJ 2008; 336: 1114. Doi: <http://dx.doi.org/10.1136/bmj.39553.670231.25>. Accessed 1 November 2013.
- [52] Hyre AD, Krouset-Wood MA, Muntner P, Kawasaki L, DeSalvo KB. Prevalence and predictors of poor antihypertensive medication adherence in an urban health clinic setting. J Clin Hypertens 2007; 9: 179-186.
- [53] Fitz-Simon N, Bennett K, Feily J. A review of studies of adherence with antihypertensive drugs using prescription databases. Ther Clin Risk Manag 2005; 1(2): 93-106
- [54] Waeber B, Burnier M, Brunner HR. Compliance with antihypertensive treatment. Clin Exp Hypertens 1999; 21: 973-85
- [55] Burnier M. Medication adherence and persistence as the cornerstone of effective antihypertensive therapy. Am J Hypertens 2006; 19: 1190-6
- [56] World Health Organization. Adherence to long-term therapies. Geneva: WHO; 2003, pg 79