



Evaluation of Pattern of Antihypertensive Prescriptions and Adherence to JNC-7 Guideline in National Hospital Abuja-Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To evaluate the pattern and acquisition costs of antihypertensive medications prescribed as well as adherence to JNC-7 guideline in management of hypertension.

Study Design: This is a retrospective study to assess the patterns of prescription and cost analysis of antihypertensive drugs recommended by JNC-7 guidelines.

Place and Duration of Study: Conducted at the Cardiology clinic of National Hospital Abuja-Nigeria using case notes of hypertensive patients that were seen from May, 2015 to April, 2016.

Methodology: Patients variables were collected using standardized data collection form. The average drug acquisition costs (ADAC) were calculated for each antihypertensive drug class. Adherence to the guideline was calculated as a percentage of the total number of patients' prescriptions that follow JNC-7 guideline.

Results: A total of 318 patients fulfilled inclusion criteria, out of this majority were female (53.6%). Most of the patients fall within the age group of 44-58 years. The average age of the study population was 47.05 ± 8.59 years. The mean number of drugs per prescription in the study was 1.82 ± 0.64 . There were no significant differences in the demographic data, with the exception of

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body mass index (BMI and) Age group ($P<0.05$). 44.3% of the patients were on combination therapy, while 30.5% and 25.2% were on monotherapy and fixed dose combination respectively. The most commonly prescribed antihypertensive drug class was Calcium Channel Blockers (36.76%) and most commonly prescribed fixed dose combination was that containing Calcium Channel Blockers and Angiotensin-2 Receptor Blockers (31.3%). There was significant difference in blood pressure outcome among patient on combination therapy and monotherapy as well as among patients whose prescription followed and did not follow the guideline ($P<0.05$). Adherence to the guideline occurred in 82.39% of the patients. The diuretics had the least acquisition cost in Naira (Cost per day: 5.89 ± 2.87 ; Cost per year: 2129.02 ± 1080.49) in relation to the other antihypertensives prescribed. Similarly, monotherapy had the least acquisition cost in type of therapy.

Conclusion: Calcium channel blockers were the commonly prescribed antihypertensive medications. Alpha-2 adrenergic receptor agonist had the lowest cost utilized per year. There was better blood pressure control in patients whose prescriptions followed JNC-7 guideline.

Keywords: Antihypertensives; prescriptions; patterns; monotherapy; cost.

1. INTRODUCTION

Hypertension is defined as a systolic blood pressure (SBP) of 140 mm Hg and above and or diastolic blood pressure (DBP) of 90 mm Hg in an adult aged 18 years and above [1]. The most common infectious diseases such as malaria, tuberculosis and HIV/AIDS together with childhood and maternal death are still the major causes of mortality within Nigeria and Africa as a whole [2]. Nonetheless, worldwide, the burden of hypertension and other non-communicable diseases (NCDs) is swiftly rising, and the African continent may be highly affected compared to other regions of the world [3]. The increasing number of cases of hypertension has been attributed to population growth, ageing, and modifiable risk factors such as excessive smoking and alcohol intake, sedentary life style and lack of physical exercise [4]. The United Nations and foremost public health stakeholders have affirmed NCDs a cause for worldwide concern [3,5]. Hypertension is the foremost modifiable risk factors for cardiovascular diseases (CVD), stroke and renal failure [6]. It is the second leading cause of chronic kidney disease (CKD) [7]. The proportion of the global burden of disease attributable to hypertension significantly increased from about 4.5 percent (nearly 1 billion adults) in 2000 (Kearney et al. 2005), to 7 percent in 2010 [8]. Furthermore, recent study reports have shown the prevalence of hypertension to be increasing [9]. This makes hypertension the single most important cause of morbidity and mortality globally and highlights the urgent need of action to address the problem [9].

Liu and Wang (2008), in a study conducted in Taiwan, demonstrated that in 6,536 newly-

diagnosed cases of uncomplicated hypertension, CCBs and BBs were the most prescribed antihypertensive medications [10]. Surprisingly, the prescription rate of thiazide diuretics which are the least expensive, and well-known first-line antihypertensive therapy was low (8.3% monotherapy and 19.9% overall). AIDrabah et al. (2012) observed that majority of patients in their study were prescribed monotherapy, followed by two drugs. A few others required at least three drugs. While ACEIs were the most commonly prescribed monotherapy, diuretics were the most commonly prescribed drugs in combination therapy. These researchers further observed that target BP control was not achieved in most patients which implied that monotherapy might not be sufficient for achieving adequate BP control in majority of the patients [11].

Similarly, the availability of hypertension management guidelines and evidence showing that hypertension is a major public health concern, nevertheless many physicians fail to assess blood pressure routinely, and in those with diagnosis of hypertension, they do not start treatment or titrate the dosage of antihypertensive medications effectively [12]. Studies conducted in USA and Malaysia concluded that physicians are not adhering to evidence-based practice guidelines, which could be possible explanation for poor blood pressure control [13]. A study conducted in USA revealed that only 50% of adults with hypertension have their blood pressure under control [14]. Ardery et al. (2007) concluded that, guideline adherence among providers was nearly 54%, and there was no significant improvement over time [15]. The study was conducted in 6 community clinics in Iowa. Despite the fact that the JNC has been

publishing evidence-based guidelines since 1977, there are still a number of providers that remain unaware or unfamiliar with the JNC guidelines. A significant number of providers are also using much higher blood pressure thresholds than the recommended 140/90 mm Hg to diagnose and treat hypertension [16,17]. In one study, some providers didn't initiate therapy for their patients unless the SBP was greater than 160 mm Hg or the DBP was more than 95 mm Hg [16].

In Nigeria, the first hypertension management guideline was published in 1996, since then it has not been reviewed and updated [18]. Also, the 2008 Standard Treatment Guidelines (STGs) has not been updated and the guidelines consider BBs as superior to ACEIs and ARBs in managing hypertension without compelling indication (FMOH, 2008). The lack of updated guidelines perhaps compelled Odili et al. (2008) to use international guidelines such as WHO/ISH, and ESH in the evaluation of the role of physicians in the overall management of hypertension and their adherence to treatment guidelines in a study conducted in University of Benin Teaching Hospital in southern part of the country [19]. The study concluded that Physicians fairly complied with the stated guidelines. However, they did not appear to recommend lifestyle modification to their patients. Practice guidelines serve as useful tools for clinical decision making. They also help to reduce the variation in practice, guide appropriateness and measure quality of care.

The per capita income in Nigeria as at 2012 was \$2700.00 (two thousand seven hundred US Dollars). Also the minimum monthly wage is =N=18000.000 (eighteen thousand Naira equivalent of US\$120.00 (one hundred and twenty US Dollars at an exchange rate of =N=150 to the Dollar as at year 2012). These figures are low and if a big percentage of this monthly income is spent on buying medicines for the management of hypertension, it leaves a very little amount for other expenses [20]. The implication of this may be that patients may prioritize their spending and forego the purchase of the medications in order to buy food and other essential supplies for the family. The cost of prescription medications is thought to be a barrier for many patients to access the healthcare they need.

Jackson and co-workers observed that applying JNC-7 guidelines to clinical practice helped in achieving better BP control. Blood pressure

control before the JNC-7 cohort was 40.8% vs. 49.3% after JNC-7 cohort ($P<0.0001$) [21]. In another study by Abdulameer et al. (2012) 85.30% of the prescriptions were in accordance to guidelines. It was observed that the treatment approach for cardiac complicated hypertension followed JNC-7 guidelines, except the lack of add-on therapy practice (ARBs, aldosterone antagonist) [13].

2. MATERIALS AND METHODS

2.1 Study Design

A retrospective cross-sectional study was carried out at the cardiology clinic of NHA using data collection form. The case notes of hypertensive patients that were seen from May, 2015 to April, 2016 at the Cardiology clinic were used

2.2 Study Population

All hypertensive patient case notes with diagnosis of only hypertension and hypertension with co-morbidities of diabetes and ischemic heart diseases that have attended the MOPD clinic of NHA within the study period.

2.3 Study Criteria

2.3.1 Inclusion criteria

1. Adult male and female patients diagnosed of hypertension aged 18 years and above.
2. Hypertensive patients with co-morbidity of diabetes mellitus and/or ischemic heart disease. Study findings in Nigeria, have shown the co-morbidity of type-2 diabetes mellitus and ischemic heart diseases to be very common in hypertension [20,22].

2.3.2 Exclusion criteria

1. Hypertensive patients with co-morbidities other than diabetes mellitus and/or ischemic heart disease.
2. Patients less than 18 years old.
3. Pregnant women.
4. Lactating mothers.

2.4 Sample Size and Sampling Method

2.4.1 Sample size calculation

The sample size was determined using the formula for estimating a single population proportion [23], and considering prevalence of

hypertension in Nigeria to be 25.1% [5]. A sample size of 286 was at and adding 10% attrition rate the required sample size was adjusted to 318.

2.4.2 Sampling method

Selection of patient folders was done by the principal investigator. A systematic random sampling procedure was adopted among patient folders from May, 2015 to April, 2016. The sampling frame was defined as a function of cumulative total number of hypertensive patients seen over a 12 months period (N) divide by the sample size (n). Since the minimum sample size had been adjusted to 318, the sampling fraction therefore was determined as:

$(N/n) = 600/318 = 1.9 \approx 2$. The first folder from the month of May, 2015 was selected and subsequently every other folder was selected thereafter until the required sample size (318) was attained.

2.5 Data Collection

Demographic data, diagnoses and drug prescribed were collected using data collection form (Appendix: I) from medical records of patients who attended the MOPD clinic during the study periods.

2.5.1 Prescribed antihypertensive medications

The antihypertensive drugs were classified into six therapeutic drug classes using JNC-7 guideline: (1) Beta-blockers (BBs), (2) Calcium-channel blockers (CCBs), (3) Diuretics (D), (4) Angiotensin-converting enzyme inhibitors (ACEIs), (5) Angiotensin-receptor blockers (ARBs) and (6) Alpha-2 Adrenergic receptor agonist (A₂AA).

Monotherapy was defined as the use of one antihypertensive medication. Patients who were prescribed more than one medication in one combination were defined as receiving fixed dose combination (FDC). While receiving more than one antihypertensive in different pills was defined as receiving combination therapy [24].

2.5.2 Drug cost

The individual drug cost was obtained from the Pharmacy Department (National Hospital Abuja) and entered into the data collection form against the prescribed antihypertensive medications. The average drug acquisition costs (ADAC, the cost

of buying the drugs) was calculated for each drug class on a daily and annual bases and the percentage expenditure cost (%EC) also, was determined, using the following equations [13].

$$a. \text{ADAC (daily)} = \frac{\text{Total daily cost of drug class}}{\text{Number of prescriptions of the drug class}}$$

$$b. \text{ADAC (Annual)} = \text{ADAC (daily)}$$

$$c. \%EC = \frac{\text{EC of the drug class}}{\text{Total EC of all prescriptions}} \times 100$$

Where EC is expenditure cost.

2.5.3 Adherence to JNC-7 guideline

Adherence to the guideline report by the panel appointed to the Seventh Joint National Committee (JNC-7) for the management of Hypertension was expressed as a percentage of the total number of patient [13]. The percentage adherence was calculated as follows:

1. The first step was to specify the treatment guideline for each group of patients:
 - a. Hypertension only (use of D or CCB, ACEI, ARB as a first-line therapy or added onto another drug therapy).
 - b. Hypertension with Diabetes mellitus (use of an ACEI or ARB as a first-line therapy or added onto another antihypertensive drug therapy).
 - c. Hypertension with Ischemic heart disease (use of a BB or CCB as a first-line therapy or added onto another antihypertensive drug therapy).
 - d. Hypertension with Ischemic heart disease and Diabetes mellitus (use of an ACEI or ARB and BB or CCB as a first-line therapy or added onto another antihypertensive drug therapy).
2. In the second step, percentage of adherence (%A) to the specified guidelines was calculated:

$$\%A = \frac{\text{Total number of cases that followed the guideline}}{\text{Total number of prescriptions}} \times 100$$

2.6 Validation of Study Instrument

The designed data collection form was pretested in the hospital. The pretesting was undertaken with 10% of the sample size (later discarded) before the actual data collection took place. This was done in order to ensure that necessary data were collected.

2.7 Data Management and Analysis

The data were entered in excel and exported to statistical package for social sciences (SPSS) computer software version 20.0 and analyzed using Independent *t*-test, Paired *t*-test, Chi-square Anova and Tukey HSD post-hoc test. Significant difference was considered at $P < 0.05$.

2.8 Ethical Approval

Ethical approval was obtained from the Research and Ethics Committee of National Hospital.

3. RESULTS

3.1 Patient Demographic Characteristics

Out of 318 folders selected based on the selection criteria, 46.4% were male and 53.6%

female. The difference in their ages was not statistically significant ($P > 0.05$) (Table 1).

3.2 Patients' Average Blood Pressure with Mean Number of Anti-hypertensives per Prescription

Both systolic blood pressure (SBP) and diastolic blood pressure (DBP) were not significantly different at baseline ($p > 0.05$). There was a significant reduction in systolic and diastolic blood pressure in both sexes ($p < 0.05$) after initiation of treatment (Table 2).

3.3 Antihypertensive Medications Prescribed at the Cardiology Clinic

Calcium Channel Blockers (CCBs) were commonly prescribed and least prescribed were Alpha-2 adrenergic receptor agonists (A_2AA) (Table 3).

Table 1. Demographic characteristics of the studied population

Variables	Male	Female	All patients
Gender (%)	148(46.4)	170(53.6)	318(100)
Age-group (years)			
29-43	46(31.1)*	70(41.2)*	116(36.5)
44-58	93(62.8)*	73(42.9)*	166(52.2)
≥59	9(6.1)*	27(15.9)*	36(11.3)
Mean age in years (±SD)	47.3 (±8.3)	46.9 (±8.9)	47.1 (±8.6)
Median Age (years)	49	48	49
BMI in kg/m² (±SD)	30.80 (±4.5) [‡]	29.26 (±6.9) [‡]	29.98 (±5.9)
Level of Education			
Some Levels of Education	22(6.9)	17(5.4)	39(12.3)
Secondary	18(5.7)	29(9.1)	47(14.8)
Tertiary	91(28.6)	108(33.9)	199(62.6)
Postgraduate	17(5.4)	16(5.0)	33(10.3)

Note: *There is significant difference when Age group values are compared between genders using chi-square, $P = 0.001$. [‡]=There is significant difference when mean BMI value of males and females are compared using independent *t*-test, $P = 0.02$. BMI- Body Mass Index, SD- Standard deviation

Table 2. Patients' average blood pressure with mean number of antihypertensive medications prescribed to each of 318 hypertensive studied patients

Gender	PrTSBP mmHg (±SD)	PTSBP mmHg (±SD)	PrTDBP mmHg (±SD)	PTDBP mmHg (±SD)	Number of antihypertensives per prescriptions
Male	161.2 (±13.8)	130.8 (±14.7)*	96.1 (±8.5)	81.9 (±7.1) [†]	1.77 (±0.6)
Female	160.3 (±14.1)	131.7 (±16.0) [‡]	96.8 (±8.4)	82.9 (±8.2) [†]	1.86 (±0.7)
Mean BP	160.7 (±13.9)	131.3 (±15.4)	96.5 (±8.5)	82.4 (±7.7)	1.82 (±0.6)

Note: SD= Standard deviation; * $P < 0.05$, PrTSBP vs PTSBP in males (paired *t*-test); [†] $P < 0.05$, PrTSBP vs PTSBP in females (paired *t*-test); [‡] $P < 0.05$, PrTDBP vs PTDBP in males (paired *t*-test); [†] $P < 0.05$, PrTDBP vs PTDBP in females (paired *t*-test); PrTSBP=Pretreatment systolic blood pressure; PrTDBP=Pretreatment diastolic blood pressure; PTSBP=Post-treatment systolic blood pressure; PTDBP=Post treatment diastolic blood pressure

Table 3. Antihypertensive medications prescribed among the 318 hypertensive studied patients

Types of antihypertensives prescribed	No. prescriptions	%
Beta blockers		8.71
Atenolol	32	5.57
Metoprolol	7	1.22
Bisoprolol	5	0.87
Carvedilol	5	0.87
Propranolol	1	0.17
CCBs		36.76
Amlodipine	153	26.66
Nifedipine	58	10.10
Diuretics		22.30
Hydrochlorothiazide	101	17.60
Spironolactone	7	1.22
Moduretic	20	3.48
ACEIs		14.46
Lisinopril	61	10.63
Ramipril	15	2.61
Enalapril	7	1.22
ARBs		13.59
Losartan	2	0.35
Valsartan	43	7.49
Telmisartan	24	4.18
Candesartan	9	1.57
A₂AA		4.18
Methyldopa	24	4.18
Total	574	100.00

Key to Abbreviation; CCBs- Calcium channel blockers, ACEIs- Angiotensin converting enzyme inhibitors, ARBs- Angiotensin II receptor antagonists, A₂AA- Alpha-2 adrenergic receptor agonists

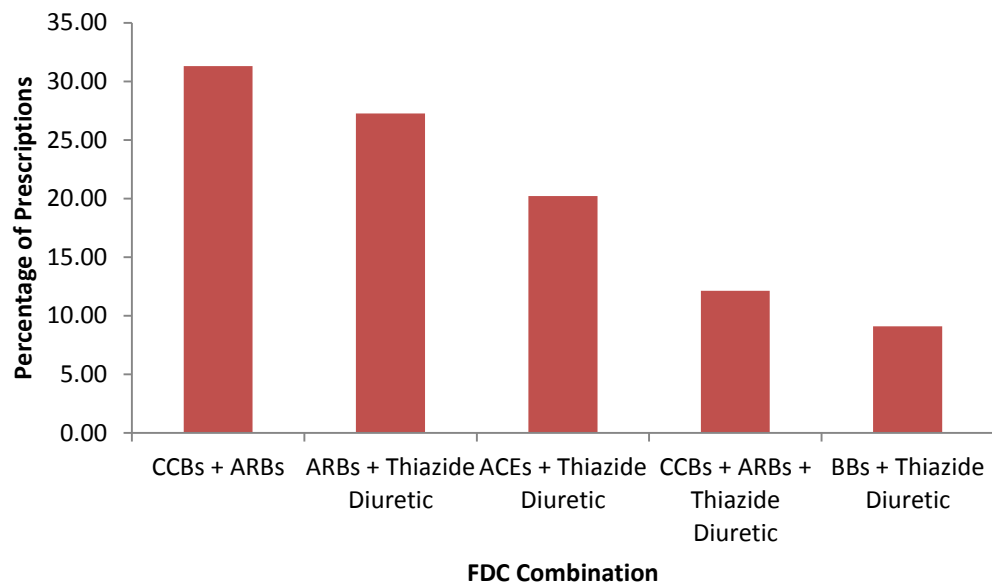


Fig. 1. The bar chart showed the percentage of antihypertensive medications prescribed as Fixed Dose Combination (FDC) among the studied hypertensive patients in the cardiology clinic, National Hospital Abuja

3.4 Proportion of Antihypertensives Prescribed as Fixed Dose Combination to the Studied Patients

The trend in fixed dose combination (FDC), revealed CCBs+ARBs to be the most prescribed (31.31%) followed by ARBs+Thiazide diuretic (27.27%). Others include ACEs+Thiazide diuretics, CCBs+ARBs+Thiazide diuretics and BBs+Thiazide diuretics all at 20.20%, 12.12% and 9.09% in the order given (Fig. 1).

3.5 Gender Distribution of Blood Pressure Stages among the Studied Hypertensive Patients

Only 1.6% of the patients were pre-hypertensive at diagnosis and 80% of the patients were female. Also, 28.9% of the studied patient had stage-1 hypertension, out of which 53.3% were males. However, 55.7% of the stage-2 hypertensive patients were female (Table 4).

3.6 Diagnosis and Prescriber Adherence to JNC-7 Guideline with Blood Pressure Outcome in the 318 Studied Hypertensive Patients in the Cardiology Clinic, National Hospital Abuja

Patients' blood pressure after commencement of therapy based on prescribed antihypertensives using JNC-7 guideline is shown below (Table 5).

3.7 Drug Acquisition (Daily and Annual) Costs of the Different Anti-hypertensive Drugs and Type of Therapy Prescribed in the Cardiology Clinic, National Hospital Abuja

The drug utilization and costs of different antihypertensive agents incurred per day as well as per year were represented in (Table 6). The diuretics had least acquisition cost (Cost per day:

Table 4. Gender distribution of stages of hypertension according to JNC-7 treatment guideline among the 318 studied hypertensive patients

BP category	SBP/DBP (mmHg)	Male (%)	Female (%)	Total no of patients (%)
Pre Hypertension	120-139/80-89	1(20)	4(80)	5(1.6)
Stage-1 Hypertension	140-159/90-99	49(53.3)	43(46.7)	92(28.9)
Stage-2 Hypertension	≥160/100	98(44.3)	123(55.7)	221(69.5)

Note: BP= Blood Pressure; SBP= Systolic blood pressure; DBP= Diastolic blood pressure

Table 5. Diagnosis and prescriber adherence to JNC-7 Guideline with blood pressure outcome in the 318 studied hypertensive patients

Diagnosis	No of prescriptions following guideline	BP after commencement of therapy following guideline (mean ± SD)	No of prescriptions not following guideline	BP after commencement of therapy not following guideline (mean ± SD)	Total adherence (%)
HT	149	129.8 ± 6.8 83.1 ± 7.5 [†]	44	141 ± 5.5* 85.8 ± 6.5 [†]	77.20
HT + DM	70	128.2 ± 9.3* 79.2 ± 6.1	7	135.7 ± 2.9* 82.9 ± 1.9	90.91
HT + IHD	27	124.4 ± 8.5* 82.4 ± 4.5 [†]	2	143 ± 2* 87 ± 3 [†]	93.10
HT + DM + IHD	16	125.3 ± 8.4 80.1 ± 5.7 [†]	3	133.7 ± 2.6 88 ± 2 [†]	84.21
Total	262		56		82.39

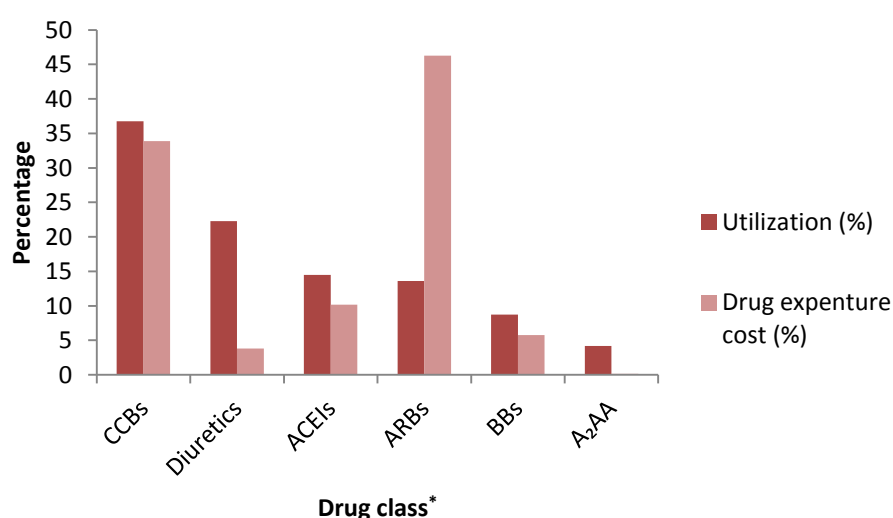
Note: BP-Blood pressure in mmHg (systolic and diastolic).

*= There is significant difference when mean systolic BP following treatment based on guideline and not based on guideline are compared using independent t-test among the hypertensive patient categories, $P=0.0001$ (HT); $P=0.038$ (HT+DM); $P=0.005$ (HT+IHD). [†]= There is significant difference when mean diastolic BP following treatment based on guideline and not based on guideline are compared using independent t-test among the hypertensive patient categories, $P=0.03$ (HT); $P=0.024$ (HT+IHD); $P=0.033$ (HT+DM+IHD). H- Hypertension; DM- Type-2 diabetes mellitus; IHD- Ischemic heart disease

Table 6. Drug acquisition costs (daily and annual) of antihypertensive drug class and type of therapy prescribed among the 318 studied hypertensive

Drug Class	No of prescriptions	Average daily acquisition cost per prescription (mean \pm SD)	Average annual acquisition cost per prescription (mean \pm SD)
CCBs	211	34.5 \pm 8.9	12592.0 \pm 3259.5
Diuretics	128	6.4 \pm 5.7	2325.0 \pm 2073.5
ACEIs	83	26.3 \pm 2.2	9610.5 \pm 806.7
ARBs	78	127.4 \pm 45.8	46515.6 \pm 16698.8
BBs	50	24.7 \pm 8.9	9015.5 \pm 3259.5
A ₂ AA	24	15.0 \pm 2	5475.0 \pm 730
Type of therapy			
Monotherapy	97	35.4 \pm 10.1	12928.3 \pm 3682.9 [†]
Combination therapy	141	134.8 \pm 19.2	49183.8 \pm 7004.4 [†]
Fixed Dose Combination	80	114.2 \pm 19.7	41675.7 \pm 7194.2 [†]

Note: Drug costs are in naira (NGN); *=There is significant difference between average annual acquisition costs of drug class, when; drug classes are compared using ANOVA test, $P=0.001$. †=There is significant difference between average annual acquisition costs of type of therapy, when modes of therapy are compared using ANOVA, $P=0.002$

**Fig. 2. The bar chart showed the utilization and expenditure patterns of antihypertensive medications in the cardiology clinic, National Hospital Abuja**

Note: *=There is significant difference when percentage drug utilization and percentage drug expenditure cost are compared with the antihypertensive drug class prescribed to the patients using chi-square, $P=0.001$

NGN6.4 \pm 5.7; Cost per year: NGN2325.0 \pm 2073.5) in relation to the other antihypertensive drug classes prescribed. The most expensive were the angiotensin II receptor blockers ($P<0.05$). Also, comparing the acquisition costs of modes of therapy, lower costs were incurred with monotherapy followed by fixed dose combination (FDC) while combination therapy was the most expensive ($P<0.05$) (Table 6).

3.8 Drug Utilization and Expenditure Cost

Alpha-2 adrenergic receptor blockers had the least percentage expenditure cost (0.14%) then

diuretics (3.79%) with the corresponding percentage utilization of 4.18% and 22.3% respectively. ARBs had the highest percentage expenditure cost (46.27%) then CCBs (33.88%) (Fig. 2).

4. DISCUSSION

The findings of our study revealed a mean age that was lower than reported result from previous studies done in northern and southwestern Nigeria [25,26], but however significantly higher than reported findings of Egbi and co-workers in

a study conducted in Bayelsa State, Niger-Delta region of the country [27]. Most of the patients were below 59 years of age (Table 1), which was in some way similar to findings of Abdulameer and co-workers [13]. This could be due to the fact that most of the patients in the study center were active civil or public servants that have not attained mandatory retirement age of 60years. The prevalence of hypertension was seen more in females compared to males (1.15:1), which corresponds to the findings of Camara et al. (2015), and Musinguzi and Nuwaha (2013) [28,29]. The studies were conducted in urban and rural settings of republic of Guinea and Uganda respectively. The difference in gender prevalence may be due to the fact that males do not regularly keep clinic appointments [30], or it may be a reflection of poorer awareness of BP status among men [31].

The mean number of antihypertensive drugs per prescription in this study (Table 2) was lower than reported values from studies conducted in other developing countries (2.2–3.8 drugs per prescription) such as Jordan, Malaysia [13,32]. This may be due to the use of fixed dose combination in our study center. Most patients presented to the hospital with a mean blood pressure (BP) consistent with the stage 2 hypertension classification (Table 2). This is similar to the finding of studies done in Ilorin, Nigeria and Eastern Central Region of Portugal [33,34]. In about 70% of the studied population the pretreatment BP classifications were in stage 2 category. This is disturbing because the risk of cardiovascular diseases is doubled in these patients [35]. Therefore, blood pressure control is highly important in preventing the development cardiovascular diseases, stroke and renal failure. The patients in the pre-hypertension, who were placed on drugs, were so treated probably because of the presence of comorbidities. This is in keeping with the treatment guidelines which state that the presence of co-morbidities in pre-hypertension necessitates the use of drugs [19]. Also, in this study, blood pressure at diagnosis and after treatment appeared to be the same in both sexes (Table 2). However, a study conducted in University of Benin Teaching Hospital revealed a significantly higher diastolic blood pressure at diagnosis [19].

The finding that CCBs were the most commonly prescribed drug in this study (Table 3), agrees with reports of studies conducted outside Nigeria [36,37]. This was not the case in a study done in Lagos, Nigeria where thiazide was the most

commonly prescribed antihypertensive [38]. The Lagos study result may probably have been influenced by ALLHAT study findings released in 2002. The ALLHAT study had emphasized the use of thiazide-like diuretic in its recommendations, and this has been reported to increase prescription pattern of the drug by physicians [39,40]. The difference in the level of thiazide use in this study and the Lagos study, could be due to the influence of JNC-8 treatment guidelines, which suggest that diuretics or calcium channel blockers (CCBs), are suitable as initial drug treatment of hypertension in blacks, either as monotherapy or in combination therapy [1]. Also, the fixed dose combination (FDC) of CCBs and ARBs was the most prescribed in this study because such combination reduces pill burden and increases adherence [41]. It has also been suggested that FDC are often less expensive than multiple dosage regimen or high dose monotherapy [42]. A study in India showed a similar trend among patients attending a cardiology clinic, in which most of them were on multiple therapies with two combined antihypertensive [36].

The ranking in terms of cost from the highest to the lowest was: ARB > CCB > ACEI > BBs > D > A₂AA (Fig. 1). Therefore, the antihypertensive acquisition cost analysis showed that ARBs had the highest drug cost compared to utilization followed by CCBs. The explanation of high cost is that, the use of innovator drugs adds more cost on drug expenditure per prescription that is available in National Hospital. Similarly, result of cost evaluation showed that diuretics had the lowest cost per day (CPD) -NGN (6.37 ± 5.68) and cost per year (CPY) -NGN (2325 ± 2073.5) followed by alpha₂ adrenergic agonists (Table 6). These results were comparable with other studies which evaluated the cost effectiveness of the available antihypertensives in India and Malaysia [13,43]. The use of thiazides as a first-choice therapy would result in substantial cost savings due to their favorable price [44]. The comparison of acquisition cost of therapy types showed that monotherapy was least costly compared to fixed dose combination (FDC) and combination therapy (Table 6). This finding was supported by results of other studies which observed that patients on three or four drug regimens had significantly higher treatment costs [41,45]. Furthermore, there was a decrease in the treatment costs of hypertension with a coexisting disease in cases where the guideline was not followed (Table 5), indicating inadequate treatment. In contrast, in the treatment of

essential hypertension, there was an increase in costs in cases where the guidelines were not followed, which indicates that more expensive drugs were prescribed instead of the first-line treatment consisting of cheaper drugs such as diuretics. Similar findings had been reported somewhere [13]. The outcomes from this study have shown that adherence to JNC-7 guideline is associated with better blood pressure outcome at a lower cost. However, the study did not evaluate patient adherence and other factors contributing to blood pressure control in addition to pharmacotherapy. There is need of future research that incorporate strategies such as patient incentives and phone call follow up to improve patient adherence.

5. CONCLUSIONS AND RECOMMENDATION

Calcium channel blockers were the commonly prescribed antihypertensive medications. Alpha-2 adrenergic receptor agonist had the lowest cost utilized per year. There was better blood pressure control in patients whose prescriptions followed JNC-7 guideline. Consequently, prescribing antihypertensive medications using JNC-7 hypertension management guideline recommendations is associated with better blood pressure outcomes. Hence, it is good to follow the guideline while prescribing antihypertensive medications to hypertensive patient.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.


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APPENDIX 1 (ETHICAL APPROVAL)



NATIONAL HOSPITAL
(Established by Act No 36 of 1999).

BOARD CHAIRMAN:

Ag. DIRECTOR OF ADMINISTRATION
Alh. Y. O. Sadiq, Bsc (Soc), Msc (Soc), AHSAN, MNIPR

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DIRECTOR OF CLINICAL SERVICES/CMAC
Dr. Oluseyi Oniyangi, MBBS, FWACP, (Pead) FIPNA

NHA/ADMIN/236/V.VII

20th July, 2016

RE: AN EVALUATION OF PATTERNS OF ANTIHYPERTENSIVES USE AND ADHERENCE TO GUIDELINES IN HYPERTENSIVE MANAGEMENT IN NATIONAL HOSPITAL ABUJA NIGERIA. NHA/EC/042/2016

Health Research Ethics Committee (HREC) Assigned number: NHA/EC/042/2016

Name of Principal Investigator: Pharm. Abdullahi Yusuf

Address of Principal Investigator: Department of Pharmacy & Pharmacy Practice
Faculty of Pharmaceutical Science
ABU, Zaria.

Date of Receipt of Valid Application: 15th June, 2016

Notice of Approval

This is to inform you that the research described in the submitted protocol, the consent forms, and other changes stated in the submitted research protocol addendum have been reviewed and given full approval by the Institutional Review Board (IRB) Committee, National Hospital Abuja.

This approval dates from 20th July, 2016 to 19th July, 2018. If there is delay in starting the research, please inform the HREC National Hospital Abuja so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the HREC. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit to your research site without previous notification.

Dr. Oluseyi Oniyangi
(DCS/CMAC)

For: Chairman, HREC, National Hospital

Signature
Ag. NHA
20/7/16

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