

# Evaluation of treatment effectiveness and 10-year cardiovascular disease risk level in hypertensive outpatients

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## ABSTRACT

Hypertension represents a substantial risk factor for the development of cardiovascular disease (CVD), stroke, and chronic kidney disease. CVD stands as the primary cause of global mortality. This study employed a prospective cross-sectional design spanning 4 weeks. Data were collected using a pro forma designed to capture patients' sociodemographic and clinical information. Prescribers' adherence to anti-hypertensive prescription guidelines, as per the JNC8 guideline, and patients' attainment of target blood pressure (BP) goals were assessed. Framingham 10-year CVD risk score estimation was employed to estimate patients' 10-year CVD risk levels. Among the patients, 51 (59.3%) had anti-hypertensive prescriptions that adhered to the JNC8 guidelines. However, a majority, 54 (62.8%), failed to achieve their JNC8 target BP goals, and 44 (51.2%) exhibited intermediate 10-year CVD risk levels. Furthermore, 71 (98.6%) of the patients did not receive the recommended statin and/or aspirin therapy, despite its necessity. An association was found between patients' achievement of JNC8 target BP goals and their 10-year CVD risk levels. The majority of patients received anti-hypertensive prescriptions that aligned with JNC8 guidelines. Nonetheless, most of them did not attain their JNC8 target BP goals and exhibited intermediate to high 10-year CVD risk levels.

## INTRODUCTION

Hypertension (HTN) is a significant factor contributing to the development of cardiovascular disease (CVD), stroke, and chronic kidney disease (CKD) [1]. CVD, the leading cause of global mortality in most regions except Sub-Saharan Africa, poses a considerable public health challenge [2]. Thus, it is crucial to accurately diagnose and manage HTN for effective prevention of CVD [3]. Various intervention studies have consistently demonstrated that measures targeting blood pressure (BP) reduction significantly decrease the risk of cardiovascular events [3,4].

Despite the wide availability of antihypertensive drugs, HTN and its associated complications continue to be a major public health problem [5]. Effective HTN treatment

lowers the patient's BP and eventually reduces the associated CVD morbidity and mortality [6]. Although guidelines exist on the treatment of HTN [7,8], studies are lacking in Nigeria on the prescriber's compliance with these guidelines. This study aimed to evaluate the treatment effectiveness and 10-year CVD risk level in hypertensive outpatients receiving care at Specialist Hospital Sokoto.

## METHODOLOGY

### Study design

This study employed a prospective cross-sectional design over a period of 4 weeks (between 1st and 28th January, 2020).

### Study location

The research was conducted in Sokoto state, North-Western Nigeria. Sokoto State's population is estimated to be close to 5.4 million [9]. A government-owned tertiary hospital (Specialist Hospital Sokoto) was used for this study. Data from hypertensive outpatients were gathered during the cardiology clinics, which are scheduled to convene every Tuesday and Thursday of each week.

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### Study population

Eighty-six hypertensive patients attending outpatient clinics at Specialist Hospital Sokoto made the population of the study.

### Eligibility criteria

Patients diagnosed with HTN and placed on anti-hypertensive medication at Specialist Hospital Sokoto were included in the study. Inclusion criteria encompassed patients in a stable medical condition capable of participating in interviews. Conversely, individuals in a critically ill state who were unable to engage in interviews were excluded from the study. Written informed consent was obtained from each patient before inclusion into the study.

### Sampling techniques

A convenience sampling technique was used and all the eligible patients who came to the clinic during the study period were enrolled.

### Study instruments

A pro forma was designed and used in the collection of the patients' sociodemographic and clinical data. The JNC8 guideline [7] was used to assess the prescribers' compliance with anti-hypertensive prescriptions and patients' achievements of the target goal BP. The Framingham 10-year CVD risk score (FRS) estimation [10] was used to estimate the patients' 10-year CVD risk level.

An electronic sphygmomanometer (Omron™ 20120601350VG) was used to measure the patients' BP. An electronic glucometer (Kiptrack™ 411611924000593) was used to measure the patients' random blood sugar (RBS). Blood sample bottles, syringes, cotton wool, tourniquet, and methylated spirit were used to collect blood samples for patients' cholesterol level tests. A scale (PYROCHY™ RGZ160) was used to measure the patients' height and weight during the clinics.

### Data collection procedure

The data on the patients' sociodemographic and clinical characteristics were collected and recorded in section A of the Pro Forma. The sociodemographic data collected include age, gender, ethnicity, marital status, education status, average monthly income, and occupation. The clinical characteristics data collected include weight (kg), height (m), BP (mmHg), RBS (mmol/l), and comorbidities (diabetes, CKD, heart failure, and so on). The data on anti-hypertensives prescribed were collected from the patients' case folders. The total and high-density lipoprotein cholesterol level of the patients was assessed by sending blood samples of the patients to MEDISTOP Diagnostics Center Sokoto.

### Outcome measures

The prescribers' JNC8 guidelines compliance to anti-hypertensives prescription was accessed using the JNC8 HTN Guideline Algorithm. According to JNC8 [7], black patients of all ages with or without diabetes should be

prescribed thiazide or calcium channel blockers alone or in combination. Patients of all ages and races with CKD present with or without diabetes should be placed on angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) alone or in combination with another class. If the target goal BP is not achieved in the patients above, lifestyle reinforcement and adherence should be done, and drugs should be titrated to maximum doses or the addition of an ACEI or ARB should be considered. If the target goal BP is not achieved, reinforce lifestyle and adherence, and add a medication class not already selected (i.e., beta blocker, aldosterone antagonist, and others). If the target goal BP is still not achieved, reinforce lifestyle and medication, titrate meds to maximum doses, and add another medication and/or refer to an HTN specialist. Patients with compelling indications also have a written guideline to follow while prescribing anti-hypertensives according to JNC8 [7].

The patients' JNC8 target goal BP achievement was also assessed by the JNC8 HTN Guideline Algorithm. According to JNC8 [7] the target goal BP of patients without diabetes or CKD of  $\geq 60$  years and  $< 60$  years of age is  $< 150/90$  mmHg and  $< 140/90$  mmHg, respectively. In addition, patients of all ages with CKD with or without diabetes have a target goal BP of  $< 140/90$  mmHg.

The patients' 10-year CVD risk level was assessed using FRS estimation [10]. According to Framingham, female patients with a Framingham point of  $\leq 12$ , 13–17, and  $\geq 18$  have low, intermediate, and high 10-year CVD risk levels, respectively. While male patients with a Framingham point of  $\leq 10$ , 11–14, and  $\geq 15$  have low, intermediate, and high 10-year CVD risk levels, respectively.

The need for statin prophylactic therapy was assessed using FRS estimation [10]. According to Framingham, all patients with intermediate and high 10-year CVD risk levels with or without diabetes should be prescribed statin as prophylactic therapy.

The need for aspirin prophylactic therapy was assessed using ACC/AHA guidelines. According to the 2019 ACC/AHA recommendations, daily low-dose aspirin (75–100 mg/day) may be considered in adults 40–70 years old who have high 10-year CVD risk levels and have low bleeding risk.

### Data analysis

The data obtained was sorted, coded, and entered into the SPSS, IBM version 20.0 for Windows, and subsequently analyzed. Descriptive statistics including frequency, percentages, mean and SD were used to summarize the data. Pearson's chi-square was used to test for differences in proportions between variables at the nominal level of measurements.

## RESULTS

One-hundred and eight patients were recruited over the 4 week recruitment period. Twenty-two patients were dropped out of the study due to insufficient data, leaving a total of 86 patients for the final analysis.

**Table 1.** Sociodemographic and clinical characteristics of the patients.

Variable	n (%)	Mean $\pm$ SD
Age (years)		53.9 $\pm$ 11.6
Gender		
Male	24 (27.9)	
Female	62 (72.1)	
Ethnicity		
Hausa/Fulani	82 (95.3)	
Yoruba	2 (2.3)	
Igbo	0 (0)	
Others	2 (2.3)	
Marital status		
Single	3 (3.5)	
Married	59 (69.4)	
Divorced	1 (1.2)	
Widowed	22 (25.9)	
Educational status		
No formal education	58 (67.4)	
Primary	16 (18.6)	
Secondary	7 (8.1)	
Tertiary	5 (5.8)	
Average monthly income		
<₦30,000	46 (60.5)	
₦30,000–₦100,000	26 (34.2)	
>₦100,000	4 (5.3)	
Employment status		
Employed	13 (16.0)	
Self-employed	53 (65.4)	
Unemployed	4 (4.9)	
Retired	5 (6.2)	
Student	2 (2.5)	
House wife	4 (4.9)	
Mean systolic BP		155.7 $\pm$ 26.0
Mean diastolic BP		93.6 $\pm$ 14.9
Mean RBS		7.9 $\pm$ 4.7
Mean HDL-C		4.2 $\pm$ 1.3
Mean total cholesterol		10.0 $\pm$ 2.9

HDL-C= High Density Lipoprotein Cholesterol.

**Sociodemographic and clinical characteristics of the patients**

The mean age of the patients was 53.9  $\pm$  11.6 years. The majority of the patients were female 62 (72.1%) and Hausa/Fulani 82 (95.3%). Most of the patients 59 (69.4%) were married and 58 (67.4%) had no formal education. The majority of the patients 53 (65.4%) were self-employed and 46 (60.5%) reported earning an average of less than ₦30,000 monthly. Diabetes was the only comorbidity presented by 22 (25.6%) of the patients. The mean diastolic blood pressure (DBP), RBS, and total cholesterol were 93.6  $\pm$  14.9 mmHg, 7.9  $\pm$  4.7 mmol/l, and 10.0  $\pm$  2.9 mmol/l, respectively. Details of

**Table 2.** JNC8 guidelines compliance, target goal BP achievement, 10-year CVD risk level, and prescription of the needed prophylactic therapy.

Variable N = 86	n (%)
JNC8 guidelines compliance	
Complied	51 (59.3)
Not complied	35 (40.7)
Target goal BP achievement	
achieved	32 (37.2)
Not achieved	54 (62.8)
10-year CVD risk level	
High	28 (32.6)
Intermediate	44 (51.2)
Low	14 (16.3)
Prescription of the needed prophylactic therapy	
Statins	
Needed and prescribed	1 (1.2)
Needed but not prescribed	74 (86.0)
Not needed but prescribed	-
Aspirin	
Needed and prescribed	1 (1.2)
Needed but not prescribed	27 (31.4)
Not needed but prescribed	5 (5.8)

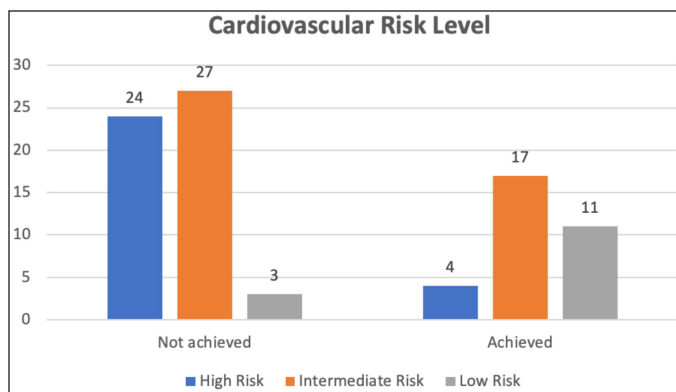
the sociodemographic and clinical characteristics of the patients can be seen in [Table 1](#) below.

**JNC8 guidelines compliance, target goal BP achievement, 10-year CVD risk level, and reception of the needed prophylactic therapy**

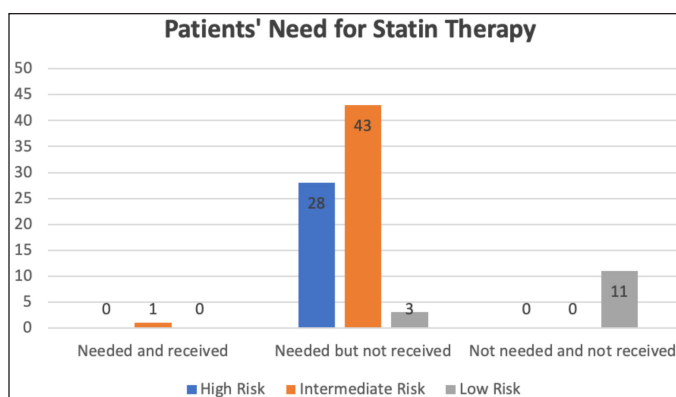
A total of 51 (59.3%) of the patients' anti-hypertensive medication, complied with the JNC8 guidelines. The majority 54 (62.8%) of the patients did not achieve their JNC8 target goal BP. More than half 44 (51.2%) of the patients had an intermediate 10-year CVD risk level. Only 1 (1.3%) and 1 (3.6%) of the patients who needed the statin and aspirin therapy, respectively, received it. Details of JNC8 guidelines compliance, target goal BP achievement, 10-year CVD risk level, and reception of the needed prophylactic therapy can be seen in [Table 2](#) below.

**Association between JNC8 target goal BP achievement and 10-year CVD risk level**

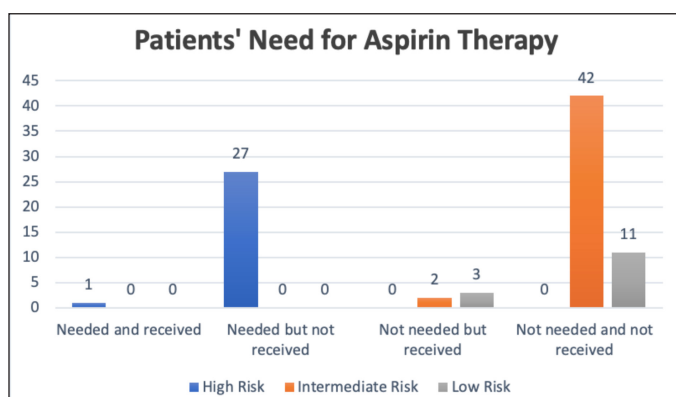
Majority of the patients 27 (50.0%) and 24 (44.4%),  $p < 0.001$  who did not achieve their JNC8 target goal BP had intermediate and high 10-year CVD risk levels, respectively. A total of 11 (12.8%) and 17 (19.8%),  $p < 0.001$  of the patients who achieved their JNC8 target goal BP had low and intermediate 10-year CVD risk levels, respectively. There was a significant association between the patients' achievement of their JNC8 target goal BP and 10-year CVD risk level at  $p < 0.05$  ([Fig. 1](#)).



**Figure 1.** Association between the patients' JNC8 target goal BP achievement and 10-year CVD risk level.



**Figure 2.** Association between the patients' prescription of the needed statin therapy and 10-year CVD risk level.



**Figure 3.** Association between the patients' prescription of the needed aspirin therapy and 10-year CVD risk level.

#### Association between reception of the needed statin and aspirin therapy and 10-year CVD risk level

A total of 28 (38.9%) and 43 (59.7%),  $p < 0.001$  patients who did not receive the needed statin therapy had high and intermediate 10-year CVD risk levels, respectively. On the other hand, 27 (96.4%) of the patients who did not receive the needed aspirin therapy had high 10-year CVD risk levels (Figs. 2 and 3).

## DISCUSSION

The majority of patients were in the middle age group, female, married, and lacked formal education, aligning with similar demographics found in previous studies [11,12]. A survey in Nigeria conducted by Odili *et al.* [12] involved the retrieval and assessment of 501 patient case records for adherence to treatment guidelines. The findings indicated a higher prevalence of HTN among women, with an average systolic blood pressure of  $163.7 \pm 21.9$  mmHg and an average DBP of  $100.1 \pm 13.2$  mmHg.

From the results of this study, more than half of the patients received antihypertensive medication that complied with their individual JNC8 guidelines, but the majority of the patients did not achieve their individual JNC8 target goal BP which might have translated to high and intermediate CVD risk in these patients. This may be due lack of adherence to antihypertensive medication. Similar findings were reported by Sessoms *et al.* [13] where they assessed adherence to the national treatment guidelines for HTN in individuals of African-American descent. The study concluded that the overall provider adherence to national guidelines was good (75%) [14]. Furthermore, Heneghan *et al.* [15] conducted a study to investigate the extent to which general practitioners were cognizant of prevailing HTN treatment guidelines and their practical integration into clinical settings. The findings indicated a commendable level of awareness regarding these recommendations. However, it was evident that there existed specific constraints and measures that needed to be implemented to improve the actual utilization of the guidelines, particularly when they deviated from observed clinical outcomes. The researchers concluded that achieving enhanced adherence to these guidelines necessitates a proactive healthcare workforce aligned with the scientific foundation supporting such guidance [14]. A commendable level of compliance with treatment guidelines was also reported in a study in Malaysia by Ahmad *et al.* [15].

On the other hand, a study carried out in Nigeria by Ale *et al.* [16] centered on assessing the awareness of HTN treatment guidelines among primary-care prescribers and its association with the diagnosis of HTN [17]. The study's findings indicated a noticeable disparity between the recommendations outlined in the guidelines and the actual implementation of HTN care in Nigeria. Therefore, awareness and training may improve HTN care and reduce the disease prevalence [17].

Additionally, more than half of the patients had intermediate 10-year CVD risk levels. All patients who had intermediate and high 10-year CVD risk levels needed prophylactic therapy with statins as recommended [10]; however, only one patient was prescribed the needed statin. Furthermore, all patients with a high 10-year CVD risk level need prophylactic treatment with aspirin as stated in the AHA/ACC guideline, but only one patient received the needed aspirin prophylactic therapy. This may be due to a lack of information available to the prescribers on the 10-year CVD risk level of their patients. A similar finding was reported by Cederholm *et al.* [17], where only 15% achieved BP B



140:90 mmHg, implying a low proportion in optimal control with the use of the current treatment target. More than half of the hypertensives had multiple cardiovascular risk factors, and one-third had 20% 10-year CHD risk.

There are some limitations in this study. First of all, this study is prone to selection bias due to the convenience sampling and data collection procedure. Furthermore, a small sample size of the study would limit the generalizability of the findings to diverse contexts.

## CONCLUSION

It was discovered from the findings that although the majority of the patients' antihypertensive medication complied with the JNC8 guideline, most of the patients did not achieve their JNC8 target goal BP. In addition, the majority of the patients had intermediate to high 10-year CVD risk, needed statin and/or aspirin prophylactic therapy, and were not prescribed the needed prophylactic therapy. Future efforts should focus on enhancing healthcare provider education, implementing patient education and adherence strategies, integrating routine cardiovascular risk assessments, and encouraging prescriber adherence to guideline recommendations for prophylactic therapies.

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## AUTHOR CONTRIBUTIONS

All authors made substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be an author as per the International Committee of Medical Journal Editors (ICMJE) requirements/guidelines.

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## CONFLICTS OF INTEREST

The authors report no financial or any other conflicts of interest in this work.

## INFORMED CONSENT

The written informed consent was obtained from each patient before inclusion into the study.

## ETHICAL APPROVALS

Ethical approval was granted by the Hospital Ethics and Research Committee of Specialist Hospital Sokoto (Approval No. SHS/SUB/133/VOL1). Strict measures were

in place to ensure the preservation of patient confidentiality and anonymity throughout the course of the study and beyond.

## DATA AVAILABILITY

All data generated and analyzed are included in this research article.

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