Blood Pressure control and its determinants among outpatient Hypertensive subjects in Port Harcourt: A survey of two Teaching Hospitals

Abstract

Background. Elevated blood pressure (BP) is associated with increased cardiovascular disease mortality and all-cause mortality. Despite availability of medication for treatment of hypertension and prevention of complications, the goal of universal optimal BP control has remained elusive. This dual center study aims to assess the levelof blood pressure control in hypertensive patients and its determinants.

Methods. This was a descriptive cross-sectional study conducted in the Cardiology outpatient clinics of the Rivers State University Teaching Hospital and the University of Port Harcourt Teaching Hospital. A total of 426 previously diagnosed hypertensive subjects on follow up for at least 6 months were recruited via convenience sampling. Uncontrolled BP was defined as systolic BP of ≥140mmHg and/or diastolic BP of ≥90mmHg. Data was analysed using SPSS version 22. Bivariate logistic regression analysis was used to determine predictors of poor blood pressure control and p-values <0.05 were considered statistically significant.

Results. The mean age of the respondents was 57.89±12.17years and 237(55.6%) were women. The mean systolic BP was 139.9±17.5mmHg, whereas the mean diastolic BP was 88.2±14.4mmHg. Controlled BP was recorded in 184(43.2%) persons, while 242(56.8%) had uncontrolled BP. Factors significantly associated with uncontrolled BP were household monthly income (p=0.024), Body Mass Index (p=0.002), poor adherence to medication (p=0.001) and physical inactivity (p=0.047).

Conclusion. Uncontrolled BP was found in more than half of the patients on follow up in tertiary care. There is need to intensify health education and care of hypertensive patients as a strategy to enhance blood pressure control and mitigate cardiovascular complications.

Key words: *hypertension, blood pressure control, Nigeria, determinants*

1. Introduction

Systemic hypertension is an established cause of premature cardiovascular disease as it results in structural and functional changes to the heart and blood vessels.[1] Elevated blood pressure is associated with increased risk for total mortality, cardiovascular disease mortality, coronary heart disease mortality, myocardial infarction, heart failure, left ventricular hypertrophy (LVH), atrial fibrillation, stroke, peripheral arterial disease, and renal failure.[2] It is now recognized that the higher the level of blood pressure (BP), the higher the risk for multiple cardiovascular adverse effects and this has been described to occur in a continuous scale.[3] Early treatment and most importantly, control of hypertension can lead to a marked reduction in cardiovascular disease and other hypertension mediated target organ damage.[3]

Blood pressure control, however, remains unsatisfactory worldwide. [4,5] Studies in Africa also demonstrate this inadequacy of controlled blood pressure levels. [6,7,8] A systematic review of studies in 23 African countries[9] reported a widespread poor control of hypertension across the continent, even in those that were aware of their status and were treated. The authors from this review, stated that hypertension control rates did not exceed 45%.

A significant factor that may contribute to blood pressure control is medication adherence. Poor adherence to long-term therapies appreciably decreases the effectiveness of treatment as well as plays a major role in the control of the disease. This ultimately has adverse effects on both the patients' quality of life and health economics.[10]A medication adherence scale was developed by Morisky et al[11] and has been validated [12,13] to evaluate medication adherence in patients with hypertension, but it is now widely used in various other patient populations. The authors reported that blood pressure was controlled in 56.7% of patients

with high medication adherence compared with 44.8% and 32.8% of patients with medium and low medication adherence, respectively. [11]

Abdu et al[14] in north-western Nigeria described a low BP control rate of 27.6% and reported increasing age and presence of comorbidities as factors significantly associated with poor blood pressure control in their study population. Asgedom et al while also elucidating the significant association of poor BP control and increasing age, also noted that physical inactivity, tobacco use, and excess salt intake also contributed to uncontrolled BP. [6]

Enhancement in the management and control of hypertension in sub-Saharan Africa will need to recognize the factors which affect blood pressure control in developing countries such as Nigeria where the burden of hypertension is high.

This study aims to assess blood pressure control in hypertensive patients and describe the factors associated with blood pressure control in patients in two teaching hospitals in Rivers State, Nigeria.

2. methodology

2.1 Study design

Rivers State is one of the thirty-six states in Nigeria, located in the southernmost part of the country and there are 5 tertiary hospitals within the state. The study design was a descriptive cross-sectional study conducted in the Rivers State University Teaching Hospital which is the tertiary hospital owned and funded by the state government and the University of Port Harcourt Teaching Hospital, owned and funded by the federal government.The study site was the Cardiology clinics in both hospitals.

2.2 Study population

The study population consisted of 426previously diagnosed hypertensive subjects,historically defined as mentioned in the patients' clinical records and verified as systolic BP greater than or equal to 140mmHg and/or diastolic greater than or equal to 90mmHg or currently on anti-hypertensive medication; receiving treatment for hypertension for at least 6 months attending the Cardiology clinic. Patients were recruited via convenience sampling between September 2022 and January 2023.Patients older than 18years of age who gave informed consent were recruited consecutively as subjects. Patients who did not give consent, acutely ill patients and pregnant women were excluded from the study.

2.3 Study procedure

Data was collected through review of patients' medical charts and patients' interview. A structured proformawas used to collect personal information, socio demographics and disease related variables. Comorbidities, complications of hypertension and antihypertensive medication(s) was collected from medical records of the patient. Adherence to medication was assessed using the Morisky's Medication Adherence Scale (MMAS-8). [11] A score of less than 3 was used to establish adherence while a score ≥ 3 indicatednonadherence to medication.

Height was measured to the nearest meter with a stadiometer barefooted while weight wasmeasured in kilogram using a standard weighing scale with light clothing. Overweight was defined as a BMI between 25 and 29.9 kg/m^2 while Obesity was defined as BMI ≥30kg/m^2.[15]

Blood pressure was assessed, [16] and uncontrolled blood pressure was defined as systolic blood pressure of ≥140 mmHg and/or diastolic blood pressure of ≥90 mmHg, while controlled blood pressure was defined as a systolic blood pressure of <140 mmHg and a diastolic blood pressure of <90 mmHg. [17]

2.4 Data analysis

Data was entered and analysed using into Statistical Package for Social Sciences (SPSS) version 22.Categorical variables were reported as frequencies and percentages and compared with the Chi square test.Continuous variables were reported as means ±SD, and the student t-test was used to compare means. Bivariate logistic regression analysis was applied to identify independent predictors of uncontrolled hypertension. A p value of <0.05 was considered to be statistically significant.

3. Results

Four hundred and twenty-six (426) hypertensive subjects were recruited into this study. There was a female preponderance as 237(55.6%) were women and 189(44.4%) were men, giving a female to male ratio of 1.25:1. The mean age was 57.89±12.17years with a range of 20-86 years andover half of the study population 253(59.4%) were middle aged.

The majority of the respondents were married 270 (63.4%), living with their nuclear family 262 (85.0%) and residing in an urban domicile 385 (90.4%). Tertiary level of education was attained by 168 (39.4%) of the patients while 138 (32.4%) had completed secondary education and 6 (1.4%) had no formal education. One hundred and twenty-six (29.6%) subjects were engaged in skilled/professional employment (Engineers, managers, teachers, lawyers, architects, etc) while 210 (49.3%) had nonprofessional employment (Trading, farming, catering, hair dressing, tailoring, security guards etc.) with the preponderance of these (114 persons) being traders. The remaining 90 (21.1%) were housewives, unemployed or retired. The average household monthly income was less than N100,000 in 300 (70.4%) respondents.

The duration of hypertension was greater than 5years in almost half 172 (40.4%) of the study population.Complications of hypertension were reported in 100 (23.5%) persons and the

complications included prior stroke in 30 (7.0%) patients, coronary artery disease in 29 (6.8%), heart failure in 23 (5.4%), kidney disease in 14 (3.3%) and retinopathy in 48 (11.3%) patients. Table 1 summarises the sociodemographic and clinical characteristics of the study population.

Table 1. Characteristics of study population

Variable	Frequency (%)
Sex	
Male	189(44.4)
Female	237(55.6)
Age group	
Young (18-44 years)	46(10.8)
Middle aged (45-64 years)	253(59.4)
Elderly (≥65 years)	127(29.8)
Marital status	
Single	29(6.8)
Married	270(63.4)
Widow/widower	58(13.6)
Separated	10(2.3)
Divorced	59(13.8)
Living status	
Living alone	26(6.1)
Living with nuclear family	362(85.0)
Living with extended family	38(8.9)
Educational level	
No formal education	6(1.4)
Primary education	80(18.8)
Secondary education	138(32.4)
Tertiary education	168(39.4)
Post graduate education	34(8.0)
Type of domicile	
Rural	41(9.6)
Urban	385(90.4)
Average household monthly income (Naira)	
<20,000	76(17.8)
20,000-49,000	109(25.6)
50,000-99,000	115(27.0)
100,000-199,000	71(16.7)
>200,000	55(12.9)

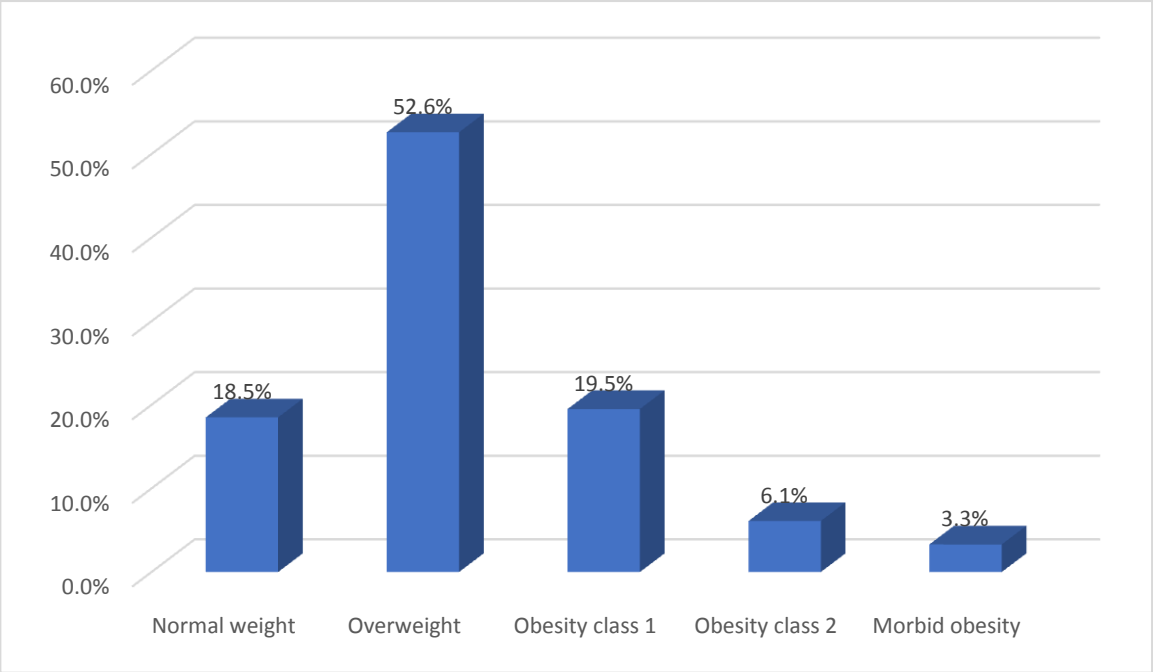
Duration of hypertension	
Less than 1 year	97(22.8)
1-4years	157(36.9)
≥5years	172(40.4)
Complications of hypertension	
Present	100(23.3)
Absent	326(76.5)

Whereas 83 (19.5%) were living with diabetes mellitus, only 40 (9.4%) had dyslipidaemia. Also, only 86(20.2%) persons admit to current significant alcohol ingestion while 15 (3.5%) smoke cigarettes.

Using the Morisky's Medication Adherence Scale 8 (MMAS-8), 262(61.5%) respondents were not adherent to their medication while 164 (38.5%) reported medication adherence.

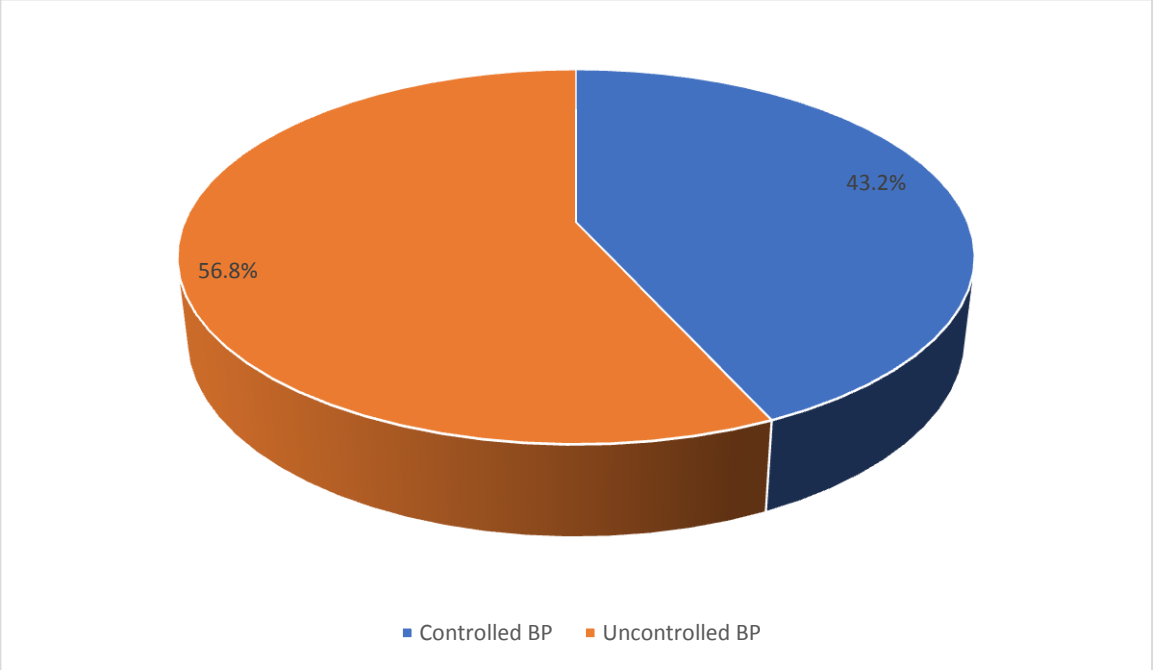
The mean BMI of the respondents was 28.9±5.3kg/m^2 with a range of 20.28 to 58.43kg/m^2 and while 224 (52.6%) persons were overweight, 123 (28.9%) were obese (figure 1).

Figure 1. Body mass index classification of the study population



The systolic blood pressure among the cases ranged from 100mmHg to 190mmHg with a mean of 139.9 ± 17.5mmHg, while the mean diastolic blood pressure among the cases was 88.2 ± 14.4mmHg with the values ranging from 63mmHg to 130mmHg. Systolic BP was ≥140mmHg in 232(54.5%) persons while diastolic BP was ≥90mmHg in 205(48.1%) persons. Controlled blood pressure was recorded in 184(43.2%) persons, while 242(56.8%) had uncontrolled blood pressure.

Figure 2. Blood pressure control of the study population



Over two thirds of patients (69.4%) who had poor BP medication adherence had uncontrolled BP. Controlled BP however was recorded in more participants with tertiary level of education (42.9%), participants who exercised regularly (71.7%) and participants who had not developed complications of hypertension (71.7%) as illustrated in table 2.

Table 2.Relationship between patients' characteristics and their BP control status

Variable	Controlled BP frequency (%) N=184	Uncontrolled BP frequency (%) N=242	χ^2	p value
Sex				
Male	85(46.2)	104(43.0)	0.44	0.508
Female	99(53.8)	138(57.0)		
Age group				
Young	25(13.6)	21(8.7)	5.59	0.061
Middle aged	98(53.3)	155(64.0)		
Elderly	61(33.2)	66(27.3)		
Educational level				
No formal education	0(0)	6(2.5)	22.04	<0.001
Primary education	46(25.0)	34(14.0)		
Secondary education	42(22.8)	96(39.7)		
Tertiary education	79(42.9)	89(36.8)		
Post graduate education	17(9.2)	17(7.0)		
Average household monthly income (Naira)				
<20,000	22(12.0)	54(22.3)	16.30	0.003
20,000-49,000	39(21.2)	70(28.9)		
50,000-99,000	58(31.5)	57(23.6)		
100,000-199,000	40(21.7)	31(12.8)		
>200,000	25(13.6)	30(12.4)		
Duration of hypertension				
<1year	47(25.5)	50(20.7)	2.852	0.240
1-4years	60(32.6)	97(40.1)		
≥5years	77(41.8)	95(39.3)		
Adherence to medication				
Yes	90(48.9)	74(30.6)	14.84	<0.001
No	94(51.1)	168(69.4)		
Regular physical activity				
Yes	73(39.7)	68(28.1)	6.324	0.012
No	111(60.3)	174(71.9)		
Complications of hypertension				
Present	52(28.3)	48(19.8)	4.131	0.042
Absent	132(71.7)	194(80.2)		
BMI category				

Normal weight	50(27.2)	29(12.0)	19.98	0.001
Overweight	80(43.5)	144(59.5)		
Obesity class 1	33(17.9)	50(20.7)		
Obesity class 2	14(7.6)	12(5.0)		
Morbid obesity	7(3.8)	7(2.9)		

Binary logistic regression was carried out to assess the effect of sociodemographic and clinical characteristics on uncontrolled blood pressure. Average household monthly income (p=0.024), BMI category (p=0.002), poor adherence to medication (p=0.001) and physical inactivity (p=0.047) were significantly associated with uncontrolled BP whereas educational level (p=0.102) and the presence of hypertensive complications (p=0.362) were not.

Table3. Bivariate logistic regression analysis to identify factors associated with uncontrolled blood pressure in the study population

Variable	Adjusted Odds ratio (95% CI)	p value
Educational level		
No formal education	1.013 (0.792-1.295)	0.921
Primary education	0.734 (0.281-1.914)	0.527
Secondary education	1.751 (0.681-4.504)	0.245
Tertiary education	1.062 (0.448-2.517)	0.891
Post graduate education	Reference	
Average household monthly income (Naira)		
<20,000	1.896 (0.789-4.560)	0.153
20,000-49,000	1.415 (0.632-3.168)	0.399
50,000-99,000	0.683 (0.318-1.468)	0.329
100,000-199,000	0.761 (0.334-1.731)	0.514
>200,000	Reference	
Adherence to medication		
Yes	Reference	0.001
No	2.04 (1.38-3.10)	
Regular physical activity		
Yes	Reference	0.047
No	1.55 (1.006-2.373)	
Complications of hypertension		
Present	1.25 (0.774-2.019)	0.362
Absent	Reference	

BMI category		
Normal weight	Reference	
Overweight	0.375 (0.111-1.267)	0.114
Obesity class 1	1.069 (0.335-3.412)	0.910
Obesity class 2	1.304 (0.385-4.412)	0.669
Morbid obesity	0.542 (0.132-2.224)	0.395

4. Discussion

This study provides important insight into the socio-demographic and clinical characteristics which determine blood pressure control in our study participants. Hypertension is highly prevalent and affects a significant proportion the global population and despite availability of several medications for treating hypertension, optimal blood pressure control in hypertensive patients often remains difficult.[18] Understanding the predictors of poor blood pressure control is important in improving outcomes as well as reducing cardiovascular risks. The burden of hypertension in Nigeria is variable depending on the type of study. Higher prevalence has been observed in most of the hospital-based studies which might be due to the patient population,increased availability of manpower as well as more accurate diagnostic infrastructures.[19]This study population was mostly middle aged with female preponderance comparable to what was observed in similar studies. [20,21] Age and gender are important factors in blood pressure control. Aging causes stiffness and loss of vascular elasticity, which results in the increase in peripheral resistance and hypertension while the effects of female hormones protect women of childbearing age. [22]

Interestingly, our study further revealed that half of the participants had lived with hypertension for more than 5 years, with complications present in about 23.5% of them. Stroke and coronary heart disease were the commonest findings among them. A similar trend was equally reported by Fentaw et al in another observational study.[18]

This study observed BP control rate of 43.2% which was relatively high compared with the lower rates reported in various local studies. [23,24]However, compared to another similar study design that was conducted in the African sub-region,[25] the proportion of uncontrolled blood pressure in our cohort was very high. Respondents recruited from the cardiology medical outpatient clinics are more likely to have various cardiovascular complications as well as other causes of secondary hypertension which might make blood pressure control more difficult. Other local studies reported a higher control rate of 53.3% compared to ours. [7,26] A striking finding in this study was the high prevalence of uncontrolled blood pressure among the study participants attending the Cardiology outpatient clinic which underscores the need to emphasize and probably evolve more effective strategies, even amongst specialist Cardiologists, specifically targeting optimal blood pressure control among patients with hypertension.

Two-third of the study participants did not adhere to antihypertensive treatment on Morisky's Medication Adherence scale (MMS-8).[11]Nonadherence contributes significantly to poor blood pressure control. Hypertension is a chronic non-communicable disease that requires lifelong treatment. Most anti-hypertensive medications work by dilating the vessels triggering a reduction in the blood pressure value and indirectly stemming cardiovascular complications.[2] Reasons for poor drug adherence are multiple and may be mostly due to medication cost, pill burden, medication unavailability, and depression amongst others.Ezeala et al [27] reported high depression scores, low disability scores and presence of co-morbidities such as peptic ulcer disease significantly correlated with nonadherence to antihypertensive medications.A similar study conducted in Ethiopia [25] reported a low prevalence (11.4%) of non-adherence compared to our finding, however, the study included participants with co-morbidities such as diabetes mellitus, which probably enhanced adherence in their patients for fear of developing more severe cardiovascular complications.

Adherence is further likely to be better in climes that operate universal health coverage for their citizens, unlike in Nigeria where treatment is mostly sponsored by individuals.The authors [25] concluded that numerous factors contribute to medication non-adherence among older patients which include high pill burden from other co-morbidities, depression and cognitive impairment. Nonadherence to BP medication was observed in more than two-third of the participants that had poor blood pressure control, thus contributing to higher blood pressures and eventually, cardiovascular complications.

About half of the hypertensive patients in a hospital based cross-sectional study in Kenya by Aberhe at al., [20] had uncontrolled hypertension and predictors of poor blood pressure control were age, non-adherence to treatment, lack of physical activities and obesity.Controlled BP was recorded in more participants with tertiary level of education, participants who exercised regularly and participants who had not developed complications of hypertension.

In this study, variables associated with blood pressure control included Body Mass index (BMI)status, physical inactivity and average monthly household income while educational status and presence of complications of hypertension was not significantly associated with blood pressure control.The significant association between Body Mass Index and blood pressure control was also described in a similar study that was conducted in South Africa in which obesity was observed to be a strong predictor of blood pressure control.[28] The relationship between body weight and blood pressure control is well established,[29] and it plays a major role in the pathophysiology of several cardiovascular conditions. As the total body weight increases, there is a corresponding increase in the volume of blood required to perfuse tissues to supply oxygen and nutrient. Structural changes in the heart and function, such as left ventricular hypertrophy, also results which significantly reduces the efficiency of the heart function, thus leading to hypertension and associated complications.[1] Obesity is

also associated with insulin resistance which results in hyperinsulinemia, the later causes sodium retention leading to hypertension. Other mechanisms by which obesity predisposes to hypertension include inflammation, activation of sympathetic nervous system and Renin Angiotensin-Aldosterone System (RAAS).[29]Weight loss has been shown to have a positive impact on blood pressure control and should be encouraged through a healthy diet and regular aerobic exercise.

Our study also observed a significant relationship between exercise and blood pressure control. The role of exercise in blood pressure control cannot be underestimated. Exercise helps strengthen heart muscles and improve function whereas sedentary lifestyle predisposes to endothelial dysfunction, inflammation and ultimately contributes to hypertension.[30,31]

Although presence of complications was not associated with blood pressure control in our cohort, it is well established fact that cardiovascular complications such as stroke and peripheral arterial disease have additional influence on blood pressure control.[18] It is not clear why presence of complications did not predict blood pressure control in our study. In patients with complications of hypertension, optimal blood pressure control is important for secondary prevention of atherosclerotic cardiovascular disease as well as to retard the progress of end organ damage.[2] A plausible explanation could be the influence of poor medication adherence on blood pressure control as almost two thirds of the patients were not adherent to their medication despite the presence of these complications.

In this study, multivariate analysis showed that poor medication adherence, physical inactivity and obesity were significant contributors to poor blood pressure control.These findings are almost consistent across various studies [20,25] that focus on blood pressure and associated variables, with poor medication adherence being a common denominator to most of them. Thus, in an effort to address the issue of poor blood pressure control among

hypertensive patients, factors that affect adherence should be thoroughly interrogated. Other factors such as obesity and lack of exercise should not be left out.

5. Conclusion

This study has provided useful information on how the relationship between the participants' socio-demographic and clinical characteristics overall impact on blood pressure control. Thus, these findings bring to limelight the need to address modifiable risk factors such as medication adherence, physical activity, and BMI as strategies for ensuring optimization of blood pressure control among persons living with hypertension. These findings can further be translated to actionable plans that can be utilized by health care workers to design targeted interventions to help improve blood pressure control optimization in hypertension.

Limitations

We acknowledge that the study has certain limitations. The cross-sectional design is inadequate to establish causality and potential biases associated with self-reported data. Thus, longitudinal design and clinical trials may be needed to further establish causality and provide evidence –based interventions for optimal blood pressure control in our environment

Ethical approval

Ethical approval was given by the Hospital's Health Research and Ethics Committee (RSUTH/REC/2022226).

Consent

Informed documented consent was obtained from all individual participants included in this study

Conference disclaimer:

Some part of this manuscript was previously presented and published in the conference: NCS LAGOS 2023 in LAGOS, USA Web Link of the proceeding:

https://ncslagos2023.org/

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