

Predictors of Blood Pressure Control at a General Out-Patient Clinic of a Tertiary Hospital, in North Central of Nigeria

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ABSTRACT

Though antihypertensives lower blood pressure and reduce cardiovascular complications, blood pressure control is still a challenge globally. This implies that there are multiple factors, apart from medications, that can predict blood pressure control. The aim of this study was to determine the predictors of blood pressure control in order to improve on the management of hypertension in healthcare settings. The study was a cross-sectional study of adult hypertensive patients attending the General Out-patient Clinic (GOPC) of Federal Medical Centre Makurdi. Using a systematic sampling technique, 304 patients were recruited for the study. An interviewer administered questionnaire was used to obtain information on socio-demographic characteristics, perceived family support, medication adherence, anthropometric and blood pressure measurement. Data was analyzed using SPSS version 20. Chi square test was used to determine the relationship between categorical variables; multivariate logistic regression was used to determine the independent predictors of blood pressure control. The level of significance was set at $p < 0.05$. One hundred and fifty (49.3%) participants had controlled blood pressure. The independent predictors of controlled blood pressure were age ≥ 50 years, tertiary level of education, high monthly income, hypertension with absence of co-morbidity, perceived family support, adherence to medication, normal Body Mass Index (BMI) and normal Waist-Hip-Ratio (WHR). Respondents within the age group 50 years and above, with tertiary level of education, earning higher monthly income with absence of co-morbidity are more likely to achieve blood pressure control. Those with strong family support that encourages adherence to antihypertensive medications and have normal BMI and WHR are also more likely to achieve blood pressure control.

Keywords: Predictors of blood pressure control, General out-patient clinic.

INTRODUCTION

Hypertension is a global problem affecting both the developed and developing countries worldwide¹. The study by NCD risk factor collaboration revealed that the number of adult with uncontrolled blood pressure

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doubled from 331 million women and 317 million men in 1990 to 626 million women and 652 million men in 2019². Blood pressure is not controlled when the systolic blood pressure is 140mmHg or higher and diastolic blood pressure is 90mmHg or higher³. The mortality associated with uncontrolled blood pressure had increased steadily by 1.6% per year between 1990 and 2015 with the greatest impact on low and middle income countries^{4,5}. An estimated 74.7 million individuals live with hypertension in sub-Saharan Africa where control rate had not improved despite accomplishments of blood pressure control in the developed world^{2,5,6}. In Nigeria, the study by Akinlua et al conducted on adults 18 years and above revealed that the prevalence of hypertension ranges from 2.1% to 47% with variation across the different geopolitical zones⁷. Overtime, the population growth, lifestyle changes and aging had been the driver of increased global burden of hypertension⁸. There is multiple health benefits associated with blood pressure control^{8,9}. Lowering of blood pressure by 2mmHg reduces the risk of cardiovascular disease by up to 10% and the lowering of the systolic blood pressure by 20mmHg reduces the risk of stroke and coronary heart disease by 50%⁹. Antihypertensive medications are known to lower blood pressure and reduce the cardiovascular complications associated with hypertension^{8,9}. However, less than half of hypertensive patients on antihypertensive medication had their blood pressure controlled⁹. These imply that there are multiple factors apart from medications that can predict blood pressure control^{9,10}. The outcome of the study by Chow et al revealed that illiteracy, poverty, gender and living in a low-income country could impact on blood pressure control¹¹. There is no study at present to validate the predictors of blood pressure control for necessary intervention in a primary care setting in Benue state, North-Central of Nigeria. This study aimed to unravel the predictors of blood pressure control. The knowledge obtain from this study would

enhance our management of hypertensives in Primary Health Care setting in North-Central region of Nigeria.

MATERIALS AND METHODS

Study setting and design

The study was conducted at the General Out-Patients' Clinic (GOPC) of the Federal Medical Center Makurdi, Benue State in Nigeria over a period of four months. The GOPC attends to all patients on an out-patient basis irrespective of the disease type, age, gender or social class excluding those who need emergency health care services. About 3,700 patients attended the GOPC on a monthly basis of which 360 were hypertensive patients. This was a hospital based descriptive cross-sectional study. The Leshlie-Kish formula was used to determine the minimum sample size for the study¹² $N = Z^2pq/\delta^2$ Where N = Minimum sample size Z = constant at 95% confidence level = 1.96 p = 27.1% (0.271) prevalence of hypertension in Nigeria in a study by Akinlua and colleagues⁷ q = 1-p (i.e. 1-0.271) = 0.729 δ = desired precision at 5% = 0.05 $N = (1.96)^2 \times (0.271 \times 0.729) / (0.05)^2$ N = 304 The minimum sample size of 304 subjects was recruited for the study.

Study population

The inclusion criteria were patients aged 18 years and above, diagnosed as having primary hypertension and attending the GOPC of Federal Medical Centre Makurdi, and had been on antihypertensive medication for at least three months. Those who were very ill and required urgent attention and pregnant women were excluded from the study. A systematic random sampling technique was used to select the participants. On average, 360 hypertensive patients are seen every month with an average of 12 patients with primary hypertension seen daily at the GOPC. This translated to 60 within a five-day working week and 960 over the four months of the study (February

May). The sampling interval was determined by dividing the sample frame (960) by the number of participants to be recruited (304), which gave a sampling interval of 3. Every working day the first patient was selected by ballot from the first three patients listed in the daily GOPC register. Subsequently, every third eligible patient was selected until the 304 participants were recruited over four months.

Study protocol

The authors recruited assistants for the study. These were a nurse and three community health extension workers. The nurse was trained to carry out the systematic sampling and selection of those who were eligible for the study and triaging them to the authors consulting rooms. The three community health extension workers were selected from the three common languages Tiv, Idoma and Igede to serve as interpreters of the questionnaire from English to the respective languages. A pilot study was conducted at the cardiovascular clinic. The purpose of the study was made known to the patients and those who consented appended their signature or thumb print if they could not read or write below the consent form. The interviewer administered questionnaire was used to obtain information from 30 adult hypertensives selected by simple random technique. The clarity of the questions in the three common languages was assessed. The reliability and the validity of the questionnaire were assessed and necessary adjustment was made before finally adopting the tool for the study.

Data collection

Questionnaire was used to obtain information on socio-demographic characteristics, perceived family support and medication adherence. Anthropometric and blood pressure was also measured.

Perceived family support was determined using the perceived family support scale. A score of ≥ 11 points

suggested strong family support and those with a score of ≤ 10 points had weak family support¹³. The eight-item modified Morinsky adherence scale was used for the measurement of medication adherence. Scores of ≥ 6 suggested good adherence and scores of ≤ 5 were regarded non adherence¹⁴. This was followed by measurement of the systolic and diastolic blood pressure. The anthropometric measurement was determined by taking the body weight of the respondents. The weighing scale (ZT-120 health scale) was placed on a hard surface. The zero-mark calibration was ensured before each measurement. The patient was asked to remove their foot wears and empty their pockets of all accessories like cell phones and keys. The respondents were asked to stand at the center of the scale platform immobile with weight distributed evenly to their feet. The weight was recorded to the resolution of the scale to the nearest 0.1kg¹⁵. The investigator's eye was placed directly at the scale to avoid error due to parallax. The height of the respondent was measured by using the standiometer (ZT-120 health scale). The respondents were asked to remove their head gear, caps and foot wears. Their occiputs, buttocks and heels were against the vertical board of the standiometer. They were asked to look straight to ensure that the line of sight was parallel with the floor. The head piece of the standiometer was lowered to their hair. The respondent height was recorded to the resolution height of the rule to the nearest 0.1cm¹⁵. The Body Mass Index (BMI) was calculated as the ratio of the weight in kilograms and height in meter square (kg/m^2). BMI of < 8.5 (underweight), 18.5-24.9 (normal), 25-30 (overweight) and > 30 (obesity). The waist circumference was measured with an inelastic tape as the horizontal level at the midpoint between the iliac crest and the lower costal margin with minimal clothes on, the hip circumference was also measured as the horizontal level of maximum circumference around the buttock to the nearest 0.5cm¹⁵. The waist-hip-ratio was calculated a waist

circumference (cm)/Hip circumference (cm). The normal in male was 1.0 and for female 0.8. Blood pressure was measured by auscultatory method using an Accosson® mercury sphygmomanometer with an appropriately sized cuff and a 3M Littman®. The subject was seated for about 5 minutes before reading of blood pressure was taken on either the left or right arm supported at the level of the heart with the leg uncrossed. The first and fifth Korotkoff sounds marked the systolic and diastolic blood pressure respectively. Measurements were to the nearest 2mmHg and the average of two readings separated by an interval of at least two minutes was recorded. Blood pressure of ≤ 140/90 mmHg was considered controlled. Data were analyzed using SPSS version 20 (Chicago IL USA). Descriptive statistics were generated for each study variable; and were summarized by frequencies and percentages. Chi-square was used to test associations between blood pressure control and each independent variable. The level of statistical significance was set at p<0.05 at 95% CI. Logistic regression analysis of all the significant variables (p<0.05) from the Chi-square analysis was performed to identify independent variables predicting blood pressure control in the study. Odds ratio (OR) and 95% CI for the predictor variable were calculated

RESULTS

Table 1: Socio-demographic and physical characteristics of the study population.

Variables	Frequency	Percentage
Age (years)		
<40	55	18.1
40-49	65	21.4
50-59	92	30.3
≥60	92	30.3
Gender		
Male	111	36.5
Female	193	63.5
Body Mass Index (BMI)		
Normal	103	33.9
Overweight	92	30.2
Obese	109	35.9
Waist Hip Ratio (WHR)		
Normal	111	36.5
Abnormal	193	63.5
Blood pressure status		
Controlled	150	49.3
Uncontrolled	154	50.7

Overall, there were 304 respondents. Most of the respondents were aged 50 years and above, 184 (60.6%); females constituted a higher proportion, 193 (63.5%) compared to males, 111 (36.5%) giving a male: female ratio of 1:1.7. Table 1 showed that about a third of the respondents 103(33.9%) had normal BMI (≤24.9) and less than half of the respondents 111(36.5%) had normal (WHR). The proportion of respondents with controlled blood pressure was 150 (49.3%).

Table 2: Association between respondents' socio-demographic and other clinical characteristics

Variables	Blood pressure status		χ^2	df	p-value
	Controlled n (%)	Not controlled n (%)			
Age (years)					
<40	25 (67.6)	12 (32.4)	8.58	3	0.004
40-49	49 (59.0)	34 (41.0)			
50-59	58 (63.0)	34 (37.0)			
≥60	72 (78.2)	20 (21.8)			
Gender					
Male	77 (69.4)	34 (30.6)	9.34	1	0.002
Female	153 (79.3)	40 (20.7)			
Level of education					
No formal education	78 (60.5)	51 (39.5)	5.59	3	0.030
Primary	37 (63.8)	21 (36.2)			
Secondary	31 (70.5)	13 (29.5)			
Tertiary	58 (79.5)	15 (20.5)			
Estimated monthly income (naira)					
Low	79(48.2)	85(51.8)	8.53	2	0.040
Moderate	38(46.3)	44(53.7)			
High	40(69.0)	18(31.0)			
Hypertension with co-morbidity					
Present	15(44.1)	19(55.9)	6.410	1	0.001
Absent	255(94.4)	15(5.6)			
Perceived Family Support					
Strong	121(51.1)		16.7	1	<0.001
Weak	29(31.5)	63(68.5)			
Adherence to medication					
Adherence	128(66)	66(34)	16.7	1	<0.001
Non adherence	22(20)	88(80)			
Body Mass Index (BMI)					
Normal	88(85.4)	15(14.6)	13.8	2	0.001
Overweight	40(43.5)	52(56.5)			

Table 2 showed a significant association between blood pressure status and the following socio-demographic characteristics: Age ($\chi^2=8.58, p=0.004$), gender ($\chi^2=9.34, p=0.002$), level of education ($\chi^2=5.59, p=0.030$), estimated monthly income ($\chi^2=8.53, p=0.040$). There was also a statistically significant relationship between blood pressure control and Hypertension with absent of co-morbidity ($\chi^2=6.410, p=0.001$). The relationship between blood pressure control status with perceived family support and medication adherence was also statistically significant: ($\chi^2=16.7, p<0.001$), ($\chi^2=59.4, p<0.001$). Table 2 also revealed a statistically significant relationship between blood pressure status and anthropometric measurement: Body Mass Index ($\chi^2=13.8, p<0.001$), Waist Hip Ratio ($\chi^2=12.4, p<0.001$).

Table 3: Logistic regression of independent variables predicting blood pressure status

Variables	Adjusted odds ratio (aOR)	95% confidence interval (CI)	p-value
Age			
<40	1.62	0.73-3.56	0.748
40-49	0.97	0.69-3.57	0.641
50-59	7.98	0.14-0.18	0.030
≥60	1.00		
Level of Education		2.56-6.78	0.032
Tertiary	3.33		
Below tertiary	1.00		
Estimated monthly income(Naira)		7.04-10.43	0.002
> High			
Low to moderate	3.18		
	1.00		
Hypertension with co-morbidity			
Absent		5.67-12.78	0.003
Present	7.45		
	1.00		
Perceived family Support		3.05-14.3	0.001
Strong	12.5		
Weak	1.00		
Adherence to medication		7.56-13.7	0.001
Adherence	6.78		
Not Adherence	1.00		
Body Mass Index(BMI)		2.45-6.76	0.043
Normal	3.78		
Overweight	2.56		
Obese	1.00		
Waist Hip ratio(WHR)		6.34-8.43	0.032
Normal	6.51		
Abnormal	1.00		

Note: Hosmer-Lemeshow goodness of fit test: $\chi^2 = 11.54$, $df = 8$, $p = 0.17$

Table 3 revealed the independent predictors of blood pressure status: Age ≥50 years ($p = 0.030$, $aOR = 7.98$, $95\% CI = 0.14-0.18$), Tertiary level of education ($p = 0.032$, $aOR = 3.33$, $95\% CI = 2.56-6.78$), Higher monthly income (Naira) ($p = 0.002$, $aOR = 3.18$, $95\% CI = 7.04-10.43$), hypertension with absence of co-morbidity ($p = 0.003$, $aOR = 7.45$, $95\% CI = 5.67-12.78$), perceived family support ($p = 0.001$, $aOR = 12.5$, $95\% CI = 3.05-14.3$), adherence to medication ($p = 0.001$, $aOR = 6.78$, $95\% CI = 7.56-13.7$), normal Body Mass Index (BMI) ($p = 0.043$, $aOR = 3.78$, $95\% CI = 2.45-6.76$) and normal Waist-Hip-Ratio (WHR) ($p = 0.032$, $aOR = 6.51$, $95\% CI = 6.34-8.43$)

DISCUSSION

This study determined the predictors of blood pressure control at the General Out-patient Clinic of the Federal Medical Centre Makurdi. The blood pressure control rate was 49.3%. The finding in this study was similar to that of the study in Sokoto, North East of Nigeria and Abeokuta, South West of Nigeria

with blood pressure control rate of 47.6% and 46.4% respectively^{10,16}. The high rate of blood pressure control in the Nigerian studies was because they were hospital based and hypertensive patients in the neighbourhood community accesses health care services in the facility where the study was carried out. The study by Kayima et al revealed that control rates in Africa had been uniformly low not exceeding 45%. The least recorded was 8% in Egypt and the highest in Tunisia and Algeria with control rates of 24% and 37% respectively¹⁷. Higher proportions of 58.9%, 63.1% and 67.7% had been reported in India, Chile and England respectively^{18,20}. This high proportion could be attributed to clients having a better understanding of adherence to medication, availability of resources and trained professionals who usually recommends appropriate choice of medications for blood pressure control. Those belonging to age group 50 years and above had their blood pressure controlled compare with younger age groups as revealed in this study. Other studies in North East Nigeria, Ethiopia, Turkey and United State of America also concurred with the finding in this study^{9,10,21,22}. The older age group with increased health challenges have better health seeking behaviour. Their frequent visit to health facilities availed them the opportunity for close monitoring of blood pressure. However, the study by Lemessa et al in Ethiopia and Mirzaei et al in Iran where blood pressure control was more in the younger age groups compared with the older age group contradict the finding in this study^{23,24}. The explanation could be that the anatomical and physiological changes that occurred with aging present a dilemma in the control of blood pressure in the elderly compare with younger age groups. Respondents with higher level of education had their blood pressure controlled in this study. The finding by Anyabolu et al in Nigeria, Tapela et al in United Kingdom, Mirzaei et al in Iran and Kes et al in Turkey also agreed with the finding in this study^{20,21,24,25}. The increase in awareness and

adherence to antihypertensive medication could explain the high proportion of blood pressure control in the highly educated population. In our study, the rate of blood pressure control was high among respondents with high monthly income. The finding from this study concurred with that of Ibrahim *et al* in Southwest Nigeria, Banigbe *et al* in North central Nigeria, Schutte *et al* in Australia, and Attaei *et al* in Canada^{26,29}. Low-income earners are constrained financially hence; achieving controlled blood pressure becomes difficult as they are not able to afford antihypertensive medication and keep to follow up appointments. Contrary to the finding in this study, the report by European society of cardiology revealed that Japanese that are high income earners tend to have uncontrolled blood pressure because of their lifestyles³⁰. Absence of co-morbidity was also a significant attribute noticed in respondents with control blood pressure control in this study. This finding is in consonant with the study by Aniedi in Akwa Ibom South Eastern Nigeria, Tosheme *et al* in Ethiopia and Okai *et al* in Ghana^{9,31,32}. It is plausible that hypertension co-existing with other disease conditions makes blood pressure control more challenging. Respondents with strong family support also had controlled blood pressure as revealed in this study. The study by Ekundayo *et al* in Ekiti State, Southwest of Nigeria and Daniel *et al* in Makurdi North central of Nigeria concurred with the finding from this study^{33,34}. Other studies from Indonesia, India and Australia also agreed that family support was a strong predictor of blood pressure control^{35,37}. A strong family support provides a measure of emotional, financial and supportive care that improves the self-worth of hypertensive patients hence motivating blood pressure control. Adherence to medication had contributed immensely to the gap between population control goals and currently observed control levels³⁸. The finding in this study also revealed that medication adherence was also a significant predictor of blood pressure control. The

study by Ojo *et al* in the South-west of Nigeria, Biambo *et al* in North-west of Nigeria and Daniel *et al* in North-central Nigeria also agreed with the finding in this study^{10,16,34}. Studies in Iran, India and Indonesia are also in consonant with the outcome of this study,^{18,35,39} Those with normal BMI had their blood pressure controlled. The study in Sokoto, Port-Harcourt and Ibadan in Nigeria also concurred with the finding in this study^{40,42}. The findings by Linderman *et al* in mainland China and Hossain *et al* in India also was in parallel with the outcome in this study.^{43,44} Waist-Hip Ratio (WHR) was also a significant predictor of blood pressure control in this study. Those with normal (WHR) had improved blood pressure control when compared with hypertensive respondents with abnormal (WHR). The outcome in this study agreed with that of Adeoye *et al* in Ibadan, and Adegoke *et al* all in Southwest of Nigeria^{42,44}. Other studies in South Africa, Ethiopia, Canada and Nepal are also in consonant with the outcome of this study^{46,49}. The study had some limitations. The interviewer-administered questionnaire relied on the honesty of those being interviewed and may not adequately reflect the complex aspect of some variables like family support and medication adherence of the respondents. The study was hospital-based. It was only a reflection of the picture of blood pressure control status of those receiving health care services at Federal Medical Centre Makurdi, which may not be a true reflection of the situation among hypertensives in the community

CONCLUSION

Blood pressure control rate in this study was low though not as low as in other African countries. Age group 50 years and above, respondents with higher level of education, high monthly income and absence of co-morbidity were significant predictors of controlled blood pressure. Other predictors of blood pressure control revealed in this study include strong

family support, medication adherence, normal Body Mass Index (BMI) and normal Waist-Hip-Ratio (WHR).

Competing interest

The authors declare no competing interest.

Ethical considerations

Ethical approval was obtained from the Health and Research Ethics Committee of Federal Medical Center Makurdi. Informed consent was also obtained from the respondents before their enrollment in the study.

Authors' contribution

David Aondona Daniel, Nndunno Asheku Akwaras made substantial contribution to conception and design of the study; David Aondona Daniel, Nndunno Asheku Akwaras and Matthew Ngbede Ocheifa were involved in data collection and collation. All authors were involved in data analysis and interpretation, drafting of manuscript and revising it critically for intellectual content. The final manuscript had been read and approved by all the authors.

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