







ORIGINAL PAPER

# Predictors of blood pressure levels, knowledge and practices of adult hypertensives attending a Secondary Health Care Centre in South-Western Nigeria

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## ABSTRACT

**Introduction and aim.** The prevalence of hypertension is increasing with accompanying poor control. The aim of this study was to assess the predictors of knowledge and practices of adult hypertensives.

**Material and method.** The study was a prospective (before and after) study with health education as the intervention. A simple random sampling technique with computer-generated random numbers was used to recruit 386 patients. Data were analysed using SPSS version 23. Logistic regressions were used to determine the predictors of knowledge and practices.

**Results.** Those who had tertiary education were about four times more likely to have good knowledge of hypertension than those who had secondary education (OR=0.256; 95% CI=0.106–0.617). The females were about 1.73 times more likely to have good practices of hypertension than males (OR=1.729; 95% CI=1.008–2.966). For every 1 unit increase in the body mass index, there was a statistically significant increase in diastolic blood pressure by about 0.22 units (95% CI=0.046–0.394, p=0.013). The health education had a positive impact on the blood pressure reduction.

**Conclusion.** The predictors of knowledge of hypertension, practices of hypertensives and diastolic blood pressure were level of education, sex, and body mass index respectively.

**Keywords.** blood pressure, hypertensives, knowledge, practices, predictors

## Introduction

Hypertension is defined as persistent elevated systolic blood pressure of 140 mmHg or above and/or diastolic blood pressure of 90 mmHg or above.<sup>1,2</sup> There are two main categories of hypertension. Primary hypertension which affects about 90–95% percent of the

people suffering from hypertension.<sup>3</sup> The risk of developing primary hypertension is higher in those people with family history of hypertension according to a study conducted by Iloh et al. in Eastern Nigeria.<sup>4</sup> Hypertension occurring as a result of another illness or a side effect of medication is secondary hypertension.

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In Nigeria, it is the main risk factor for stroke, heart failure, ischemic heart disease and kidney failure.<sup>5</sup> Higher prevalence of hypertension and its complications have been found in people of African descent.<sup>6</sup> Essential hypertension is a public health problem due to its asymptomatic nature, its increasing prevalence, its chronicity, associated renal, cardiovascular and neuro-vascular complications.<sup>7,8</sup> The prevalence of hypertension was reported to be 44% in Western Europe and 28% in North America.<sup>9</sup> However, Azubuike and Kurmi reported 24.2% in their study conducted in Sanga, Kaduna, Northern Nigeria.<sup>10</sup> Despite the development of new anti-hypertensives, a lot of patients are still having poor blood pressure control. It was reported that in the United States of America, 29% had their blood pressure uncontrolled.<sup>11</sup> Hypertension has been reported to affect about one billion people worldwide.<sup>12</sup>

Diabetes mellitus and hyperlipidaemia were the most common comorbid conditions of hypertension.<sup>13</sup> Controlled blood pressure is a blood pressure of less than 140/90 mmHg in hypertensives and less than 130/80 in hypertensives with diabetes mellitus and patients with chronic renal failure. The prevalence of hypertension was higher in urban areas than rural areas and this was attributable to obesity.<sup>14</sup> There has been increased burden on the healthcare system, loss to productivity and economic loss. In a review of literature, knowledge, awareness, treatment and control of hypertension were generally low with associated high load complications.<sup>9</sup> Majority of the patients were reported to have poor knowledge of hypertension and its management in another study. This would have negative impact on the treatment and control of hypertension.<sup>15</sup> The results of a study carried out in Owerri, Nigeria, revealed that adults had high level of knowledge of the theory and risk factors of hypertension. However, the level of education was a very important factor that determined the knowledge of hypertension.<sup>16</sup> According to the report of a study conducted in Ghana, hypertensive patients were said to have average knowledge of hypertension and life style modifications<sup>17</sup> Ebid et al. reported that hypertensive patients who were educated about the nature of hypertension, its complications and adherence to medications showed better control of blood pressure. And also, those informed about lifestyle modifications that included diet and physical activities had better control of hypertension.<sup>18</sup>

## Aim

The aim of this study was to assess the knowledge, attitude, practices of hypertensives and also to assess factors associated with blood pressure levels among adult hypertensives presenting to a secondary health care cen-

tre in Nigeria. This was the first study in this particular area in Nigeria.

## Material and methods

The study was conducted at the State Hospital, Oyo, Nigeria, to assess the knowledge, attitude and practices of hypertensive patients. Oyo is a town located in Oyo central senatorial zone of Oyo State in the South-Western zone of Nigeria. The study was carried out at the Medical outpatient clinic of the Hospital. It has about 170 beds capacities with various speciality units, paramedical and outpatient services. Patients are referred to the Hospital from other Hospitals around Oyo town.

The study was a prospective (before and after) study of patients with uncontrolled hypertension. Respondents were recruited from April 2015 to July 2015. A simple random sampling technique with computer-generated random numbers was used to recruit the patients. The study population was composed of adults 18 years to 70 years with an established diagnosis of hypertension and already on treatment and follow up for a year. Ethical approval was granted by the Ethical Committee of the Oyo State Ministry of Health, Ibadan, Nigeria. Written informed consents were obtained from eligible patients before administration of the questionnaires and examinations. Privacy and confidentiality of the respondents were guaranteed by anonymity of respondents. The Committee's reference number is AD 13/479/.

## Definition of hypertensive patients

Hypertensive patients were those with systolic blood pressure  $\geq 140$  mmHg and diastolic  $\geq 90$  mmHg diagnosed a year previously or patients on drugs for hypertension for at least a year.

Inclusion criteria included patients who were 18–70 years with uncontrolled hypertension. Exclusion criteria included patients with severe hypertension, systolic  $>180$  mmHg, diastolic  $>110$  mmHg, who would need immediate adjustment of treatment; hypertensives with renal insufficiency, hyperkalemia, pregnant women, lactating women and patients with diabetes mellitus. This group of patients were excluded so that they would not pass through the rigours of the study and they were not part of the study targets.

## Sample size estimation

The Sample size was estimated using the formula:<sup>19</sup>

$$n = (Z^2pq)/d^2$$

Quoting  $n$  = minimum sample size  
 $Z_\alpha$  = the standard normal deviate, usually set at 1.96, which corresponds to the 95% confidence level. The prevalence of controlled hypertension was 34.5% for Nigeria.<sup>13</sup>

From the same study, the prevalence of uncontrolled hypertension was 65.5%.

$$P = 0.655$$

$$q = 1.0 - p = 0.345$$

d = degree of accuracy desired usually set at 0.05.

$$n = (1.96)^2(0.655)(1 - 0.655) / (0.05)^2 =$$

$$= (1.96)^2(0.655)(0.345) / (0.05)^2 =$$

$$= (3.84)(0.226) / (0.05)^2 = 347$$

$$q = 1/1-f$$

q is the adjustment factor

f = non response rate, if f = 10%

$$q = 1/0.9 = 1.11$$

$$n = 1.11 \times 347 = 385.5 = 386$$

For the purpose of this study, a minimum 386 patients were recruited.

### *The intervention*

During recruitment of the patients at first visit, they were counselled about the nature of hypertension, associated morbidities, drugs and compliance with management. They were told about lifestyle modifications that included diet and physical exercises. Attaining blood pressure targets of less than 140/90 mmHg was stressed to the respondents.<sup>20</sup> The counselling was repeated before the assessment of blood pressure during the periods of follow-up. The blood pressures were taken at four-week intervals for two months.

### *Measurement of blood pressure*

A standard mercury sphygmomanometer (Accosson, London) was used, and systolic blood pressure and diastolic blood pressure were taken as Korotkoff sound phases I and V respectively. The measurements were taken with the patient in a seated position with their arms supported at heart level, after five minutes of rest, after abstinence from food, nutritional supplements, caffeinated beverages and smoking for a minimum of two hours before the appointment at approximately the same time and day of the week. The cuff was applied to the exposed upper arms and was rapidly inflated to 30 mmHg above the level at which the pulse disappeared and then deflated gradually. The mean of two measurements was calculated for systolic blood pressure and diastolic blood pressure separately.

### *Data collection and analysis*

A structured interviewer administered questionnaire was administered to consenting patients. This is a questionnaire that assesses Knowledge, Attitudes and Practices of hypertensives. It is a validated instrument used in a previous study in Nigeria.<sup>21</sup> The Cronbach alpha coefficient is 0.82.<sup>22</sup>

### *Knowledge score*

The knowledge of hypertension was assessed on a scale of 0-29. The responses were scored 0-2 irrespective of

the responses been true or false. Also, for the last two questions, correct answers were scored one irrespective of the response been yes or no, while incorrect answers were scored zero. Analysis showed the mean score to be 19. Scores were totalled and categorised into two groups. Patients with knowledge scores less than 19 were classified as having poor knowledge while those with knowledge scores of 19 and above were classified as having good knowledge.

### *Attitude score*

Attitudes were assessed with total scores ranging from 0-18. The responses to the statements were scored 0-2 depending on the answers. Statistical analysis showed the mean score to be 16. Scores were totalled and categorised into two groups. Respondents with attitude scores less than 16 were classified as having poor attitude while those with attitude score of 16 and above were classified as having good attitude.

### *Practice score*

The practices were assessed with total scores ranging from eight to 35. Statistical analysis showed the mean score to be 23. Scores were totalled and categorised into two groups. Respondents with scores of less than 23 were classified as having poor practices while those with scores of 23 and above were classified as having good practices.

A pre-test of the questionnaire was done on 40 patients to identify potential problems, and amendments were done where necessarily.

### *Statistical analysis*

The dependent variables were knowledge, attitudes, practices and blood pressure. The independent variables included socio-demographic factors and socio-economic factors. Data were analysed using SPSS software version 23 from IBM Corporation, New York, United States. Frequency tables and diagrams in form of charts were used for relevant variables. Chi-square test was used to analyse the association between categorical variables and logistic regressions were used to determine the predictors of knowledge and practices of hypertensives. A p-value of  $\leq 0.05$  was considered to indicate statistical significance.

## **Results**

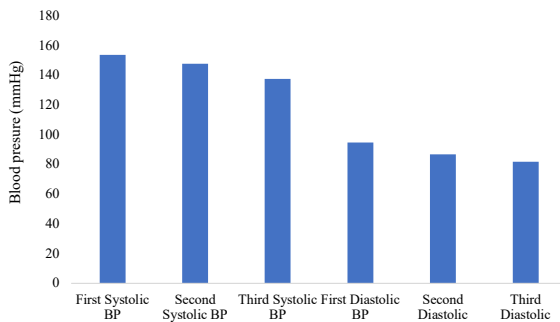
Table 1 shows the distribution of knowledge, attitude and practice scores of the respondents. More than half, 205 (53.1%) of the respondents had poor knowledge scores. Majority of the respondents 274 (71%) had good attitude towards management of hypertension while majority of the respondents 236 (61.1%) also had good practice scores.

**Table 1.** Distribution of respondents' knowledge, attitude and practice scores (n=386)

	Frequency (n)	Percentage (%)
<b>Knowledge scores</b>		
Poor knowledge	205	53.1
Good knowledge	181	46.9
<b>Attitude scores</b>		
Poor attitude	112	29
Good attitude	274	71
<b>Practice scores</b>		
Poor practice	150	38.9
Good practice	236	61.1

**Effect of health education on blood pressure over time**

Figure 1 shows the distribution of mean values of three clinic blood pressure measurements at intervals of four weeks. A reduction in blood pressure was observed over time.



**Fig. 1.** Distribution of mean values of Blood pressure over 2 months at intervals of 4 weeks

**Table 2.** Association of knowledge of hypertensives with selected variables\*

Association of knowledge of hypertension with selected variables				
Variable	Poor (n)	Good (n)	$\chi^2$	p
<b>Education</b>				
No formal education	114 (61%)	73 (39%)	36.55	0.0001*
Primary	55 (63.2%)	32 (36.8%)		
Secondary	27 (45%)	33 (54.2%)		
Tertiary	9 (17.3%)	43 (82.7%)		
<b>Age</b>				
< 45 years	19 (50%)	19 (50%)	2.267	0.324
45-54 years	64 (48.5%)	68 (51.5%)		
55 years above	122 (56.5%)	94 (43.5%)		
<b>Sex</b>				
Male	28 (43.8%)	36 (56.2%)	1.257	0.553
Female	177 (55%)	145 (45%)		

\*Significant at 5% level of significance

Table 2 shows association of levels of education with knowledge of hypertensives. A higher proportion of patients with no formal education (61.0%) and a higher proportion of patients with primary education (63.2%)

had poor knowledge of hypertension. However, a little bit above average of those with secondary school education (54.2%) and higher proportion of respondents with tertiary education (82.7%) had good knowledge of hypertension. The association was statistically significant ( $\chi^2=36.254$ ,  $p=0.0001$ ).

**Logistic regression analysis of good knowledge of hypertension on selected variables**

Table 3 shows the Logistic regression analysis of good knowledge of hypertension on selected variables. After adjusting for other variables, the predictors of good knowledge of hypertension was the level of education. Those who had tertiary education were about four times more likely to have good knowledge of hypertension compared with those who had secondary education (OR=0.256; 95% CI=0.106–0.617).

**Table 3.** Logistic regression analysis of good knowledge of hypertension on selected variables\*

Variable	Odd ratio	95% CI	p
<b>Educational level</b>			
No formal education	0.134	0.062–0.291	0.0001*
Primary	0.122	0.053–0.282	0.0001*
Secondary	0.256	0.106–0.617	0.002*
Tertiary	1		

\*Significant at 5% level of significance, predictors: level of education, dependent variable: knowledge of hypertension

**Table 4.** Association of attitudes of hypertensives with selected variables

Association of attitudes of patients with hypertension with selected variables				
Variable	Poor (n)	Good (n)	$\chi^2$	p-value
<b>Education</b>				
No formal education	61 (32.6%)	126 (67.4%)	2.512	0.476
Primary	23 (26.4%)	64 (73.6%)		
Secondary	16 (26.7%)	44 (73.3%)		
Tertiary	12 (23.1%)	40 (76.9%)		
<b>Age</b>				
< 45 years	13 (34.2%)	25 (65.8%)	1.257	0.553
45-54 years	41 (31.1%)	91 (68.9%)		
55 years above	58 (26.9)	158 (73.1%)		
<b>Sex</b>				
Male	15 (23.4%)	49 (76.6%)	1.159	0.297
Female	97 (30.1%)	225 (69.9%)		

**Association of attitudes of hypertensives with selected variables**

Table 4 shows association of attitudes of patients with hypertension with selected variables. A higher proportion of patients who were less than 45 years (65.8%)

had good attitude toward hypertension. Also, a higher proportion of those with secondary school education (73.3%) and higher proportion of respondents with tertiary education (76.9%) had good attitudes toward hypertension. The association was not statistically significant ( $\chi^2=2.512, p=0.476$ ).

**Association of practices of hypertensives with selected variables**

Table 5 shows association of practices of patients with hypertension with selected variables. A higher proportion of patients who were less than 45 years (73.7%) had good practices toward hypertension. Also, a higher proportion of those who were females (63.4%) had good practices toward hypertension compared with a lower proportion who were males (50%). The association was statistically significant ( $\chi^2=4.007, p=0.045$ ).

**Table 5.** Association of practices of patients with hypertension with selected variables

Association of practices of patients with hypertension with selected variables				
Variable	Poor (n)	Good (n)	$\chi^2$	p-value
<b>Education</b>				
No formal education	74 (60.4%)	113 (39.6%)	4.659	0.201
Primary	26 (29.9%)	61 (70.1%)		
Secondary	26 (43.3%)	34 (56.7%)		
Tertiary	24 (46.2%)	28 (53.8%)		
<b>Age</b>				
< 45 years	10 (26.3%)	28 (73.7%)	2.792	0.257
45-54 years	53 (40.2%)	79 (59.8%)		
55 years above	87 (40.3%)	129 (59.7%)		
<b>Sex</b>				
Male	32 (50%)	32 (50%)	4.007	0.045*
Female	118 (36.6%)	204 (63.4%)		

**Logistic regression analysis of good practices of hypertensives on selected variables**

Table 6 shows the logistic regression analysis of good practices of patients with hypertension on selected variables. After adjusting for other variables, the predictor of good practices of hypertensives was sex. The females were about 1.7 times more likely to have good practices of hypertension compared with males (OR=1.73; 95% CI=1.008-2.966).

**Table 6.** Logistic regression analysis of good practices of patients with hypertension on selected variables\*

Variable	Odd Ratio	95% CI	p-value
Female	1.729	1.008–2.966	0.047*
Male	1		

\*Significant at 5% level of significance, predictor: sex, dependent variable: practices of hypertensives

**Relationship of blood pressure levels, body mass index and age**

The association of body mass index with first diastolic blood pressure was positive, weak in strength and statistically significant (Tab. 7,  $p=0.013$ ).

**Table 7.** Relationship of blood pressure levels, body mass index and age\*

Relationship between blood pressure levels and body mass index		
	First diastolic blood pressure	First Systolic blood pressure
<b>Body mass index</b>		
Pearson correlation	0.126	0.071
p-value	0.013*	0.163
<b>Age</b>		
Pearson correlation	0.106	0.064
p-value	0.037*	0.213

\*Significant at 5% level of significance

**Linear regression for the first diastolic blood pressure on significant variables**

As shown in table 8, for every 1 unit increase in body mass index, there was a statistically significant increase in Diastolic blood pressure by about 0.249 units (95% CI=0.072-425,  $p=0.006$ ).

**Table 8.** Linear regression for the first diastolic blood pressure on significant variables\*

ANOVA TABLE					
Model	Sum of squares	Degree of freedom	Mean square	F	Significant
1 Regression	1214.066	2	607.33	6.065	0.003*
Residual	38336.65	383	100.096		
Total	39550.72	385			

Linear regression for the first diastolic blood pressure on significant variables					
Variable	Regression coefficient (B)	Standard Error for B	95% CI for B	p-value	T
Age	0.120	0.062	0.091–0.82	0.054	0.93
BMI	0.249	0.090	0.072–0.425	0.006*	2.77

\*Significant at 5% level of significance, predictor: body mass index, dependent variable: diastolic blood pressure

**Discussion**

The prevalence of hypertension is increasing especially in developing countries with accompanying poor control and increasing burden on the healthcare system.<sup>23</sup> Visco and colleagues reported that older age, family history of hypertension, female sex and high blood pressure levels were predictors of difficult to control hypertension.<sup>24</sup> Another study showed that blacks had poorer control of blood pressure than whites and Hispanics.<sup>25</sup> The results of this study showed that majority of the respondents had poor knowledge of hypertension and its management. Health education given to this co-

hort of hypertensives was in the right direction to improve their knowledge of hypertension. This was similar to what, was described by Busari et al. and Iyalomhe in their studies where they reported that the majority of hypertensive patients had poor knowledge of their disease with an important negative impact on adherence to medications.<sup>15,21</sup> Shaikh et al. and Oladapo et al. also reported that a significant number of hypertensive patients had poor knowledge of hypertension.<sup>26,27</sup> Besides, Chiazor and Oparah reported that most patients were using thiazide diuretic for the treatment of hypertension. Patients' knowledge of hypertension was below average hence they should be educated on hypertension and its current management using drugs and lifestyle changes.<sup>28</sup> However, in a study conducted in Ghana, Marfo et al. reported that patients with hypertension had average knowledge of hypertension and life style modifications.<sup>17</sup> In a work done in Lagos, it was found that knowledge of antihypertensive therapy was good, however, adherence to therapy was poor and forgetfulness was the major reason for poor adherence. Good knowledge of hypertension and its management does not necessarily translate to good adherence to anti-hypertensive therapy. Therefore, hypertension can be best controlled when patients are adherent to their treatment regimen, involve themselves in physical activity regularly and adherent to other lifestyle modifications.<sup>29</sup>

The association between the level of education and knowledge of hypertension was investigated in this study. The results showed that the higher the level of education the higher the knowledge of hypertension. The predictor of good knowledge of hypertension was the level of education. It shows that those who had higher levels of Western education were more likely to have better knowledge of hypertension. This was corroborated by a study conducted in Owerri, Nigeria, by Kate et al. which revealed that higher level of education was associated with good knowledge of hypertension. Adults with tertiary education had higher important difference in the level of knowledge of concept and the risk factors of hypertension compared with adults in other levels of education.<sup>16</sup> Another study conducted in Ibadan revealed poor overall knowledge of cardiovascular diseases and its risk factors but respondents who had more years of formal education had good knowledge of cardiovascular diseases and their risk factors.<sup>27</sup>

The attitudes of patients with hypertension were assessed in this study and it was found that majority of the patients had good attitudes towards hypertension and its management. This should assist patients in the control of their blood pressure. The practices of patients with hypertension were also assessed in this study, and it was shown that majority of the respondents had good practices towards hypertension and its management. However, some aspects of the practices were not satis-

factory. Most of the respondents consult their doctors at their convenience not according to appointments and most of them check their blood pressures every three months. Besides, majority of the respondents did not do adequate physical exercises and were not doing enough to reduce their salt intake. All these would lead to poor control of hypertension. The predictor of good practices of the hypertensives was female sex. The females were more likely to have good practices than males. In a study conducted in Baghdad, Iraq, health education on physical exercise, diet, other lifestyle modifications and adherence to pharmacotherapy had impact on blood pressure control.<sup>30</sup> This was similar to the findings of this study which showed that health education had impact on blood pressure reduction over time. The results of a study conducted in Shagamu, Nigeria showed that the determinants of knowledge of hypertension included family history, co-morbidities and educational level. Also, majority of the respondents had good knowledge of hypertension.<sup>31</sup> This was similar to the findings of this study which showed that educational level was a predictor of knowledge of hypertension. Age, obesity, self-perception of good health and low level of education were reported as predictors of isolated systolic hypertension, isolated diastolic hypertension and hypertension in a study conducted among apparently healthy individuals in South-Eastern Nigeria.<sup>32</sup> This was similar to the findings of this study which showed that Body mass index was a predictor of diastolic blood pressure.

#### *Implication of the study to research and clinical practice*

Health care workers would have to update themselves on hypertension and health educate the patients especially those with lower levels of education and men on hypertension and its management. Also, patients have to be counselled on lifestyle modifications as a form of therapy for secondary prevention in the management of hypertension.

#### *Limitations of the study and future research*

This study was an intervention (before and after) study, there was no comparison group and no randomisation into groups, therefore, large scale randomised controlled trials would be necessary. The study was hospital based making secondary generalisation difficult, although the hospital serves a very big population. Also, the study was an experimental study with health education as the intervention, so causal relationships could be established to some extent.

#### **Conclusion**

The predictor of good knowledge of hypertension was the level of education, and the predictor of good practices was female sex. In addition, the predictor of diastolic blood pressure levels was the body mass index.

The health education had a positive impact on the blood pressure reduction over time. Health care workers would have to educate patients on the management of hypertension including lifestyle modifications. This study was able to determine the predictors of knowledge and practices of hypertensives which were rare from the previous studies.

## Declarations

### Funding

The project was self-funded.

### Author contributions

Conceptualization, I.A.A., M.D.D. and J.O.A.; Methodology, I.A.A., M.D.D., J.O.A. and O.P.I.; Formal Analysis, I.A.A., M.D.D., J.O.A. and O.P.I.; Data Curation, I.A.A., M.D.D., J.O.A. and O.P.I.; Writing – Original Draft Preparation, I.A.A., M.D.D., J.O.A. and O.P.I.; Writing – Review & Editing, I.A.A., M.D.D., J.O.A. and O.P.I.; Project Administration, I.A.A., M.D.D. and J.O.A.

### Conflict of interests

The authors declare no competing interests.

### Data availability

The datasets generated during and/or analysed during the current study are not publicly available due to the caveat for ethical approval that the responses of the respondents would be kept confidential. However, they would be available from the corresponding author on reasonable request.

### Ethics approval

Ethical approval was granted by the Ethical Committee of the Oyo State Ministry of Health, Ibadan, Nigeria. Written Informed consents were obtained from eligible patients before administration of the questionnaires and examinations. Privacy and confidentiality of the respondents were guaranteed by anonymity of respondents. The Committee's reference number is AD 13/479/.

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