

**SCREENING OF HYPERTENSION AND DIABETES IN AN UNDERSERVED  
POPULATION THROUGH COMMUNITY OUTREACH; A CASE OF RURAL  
COMMUNITY IN ENUGU STATE, NIGERIA**

**ABSTRACT**

**Introduction**

Hypertension and Diabetes are the commonest co-morbidity of each other and are among the leading cause of the burden of non-communicable diseases in developing countries. It is important to identify patients with these conditions early in the disease process. This study was to determine the prevalence of elevated Blood Pressure (BP) and elevated Fasting Blood Sugar (FBS) as **ell** as relate it to the characteristics of the study participants in a rural community in Enugu State, Nigeria.

**Methods**

Community based cross-sectional study in form of outreach was done. The study was conducted over 1 week period. among participants aged 18 years and above. **Proforma** was used in collecting information on characteristics of participants including age, sex and occupation. Measurements of BP, FBS and BMI were done. Chi square test and Binary Logistic Regression were used for analysis.

**Results**

Majority of participants were aged > 45 years 127(56.7%), and females 139(62.1%),Mean(SD) 46.89((21.84) Elevated BP 55(24.6%), elevated FBS 42(18.8%), both elevated BP and FBS. 13(5.8%). higher proportion of those aged > 45 years had elevated BP 51(92.7%) and elevated FBS 37(88.1%). More Females had elevated BP 35(63.6%) and elevated FBS 28(66.7%).Predictors were; age >45 years for elevated BP (AOR 18.4; 95% CI 5.7-59.5) and for have elevated FBS (AOR 8.9; 95% CI 3.0-26.5).

32 **Conclusion**

33 Prevalence of raised BP and FBS as well as co-morbid condition was high It was more among  
34 females and older age. Age was a predictor of both raised BP and FBS. This calls for  
35 interventional **programmes** to help cub this rising burden of in rural communities

36

37 **Keywords;** Raised Blood Pressure, raised Blood sugar, Screening, Outreach, rural community

38

39 **INTRODUCTION**

40 Non-communicable diseases (NCD), mainly cardiovascular diseases like Hypertension, diabetes,  
41 cancer and chronic respiratory diseases, are responsible for approximately 68% (38 million) of  
42 the 56 million deaths that occurred globally during 2012.<sup>1</sup> Nearly 80% of these NCD deaths (29  
43 million) occurred in low- and middle-income countries (LMICs).<sup>1</sup> In addition, the African  
44 region of the world is experiencing a double epidemic of both communicable and non-  
45 communicable diseases. It is reported that in sub-Saharan Africa, the burden of NCDs could  
46 exceed that of infectious diseases in the coming decades.<sup>2</sup>

47 Hypertension and diabetes are among the leading cause of the burden of non-communicable  
48 diseases in developing countries. Both have significantly contributed to medical morbidity and  
49 mortality. Hypertension is the commonest co-morbidity of diabetes and verse versa. They share  
50 genetic predisposition, medical risk factors, and environmental influences as etiologic factors,  
51 and are interrelated. Both conditions exert a huge financial burden on individuals, families,  
52 communities and the health system of any country.<sup>3</sup> Worldwide, Diabetes caused at least USD  
53 727 billion dollars in health expenditure and 12% of total spending on adults in 2017.<sup>4</sup>  
54 Exacerbating the situation is the increase in westernised lifestyle patterns such as tobacco and

55 alcohol consumption alongside the reduction of physical activity and the changes in dietary  
56 intake.<sup>2</sup>

57 The World Health Statistics 2012 report that one in three adults globally has a raised Blood  
58 Pressure (BP) and one in 10 adults have diabetes.<sup>5</sup> The raised BP causes around half of all deaths  
59 from stroke and heart disease.<sup>5</sup> The percentage of deaths attributed to raised blood glucose in  
60 those aged 20–69 years in LMICs was 60.5% in men and 45.6% in women.<sup>2</sup> There was doubling  
61 in the prevalence of diabetes between 1980 and 2014. Approximately 425 million adults (20-79  
62 years) were living with diabetes in 2017 and is projected that by 2045 this will rise to 629 million.<sup>4</sup>  
63 The diabetes statistics of the International Diabetic Federation (IDF) showed that Nigeria has the  
64 highest number of people living with diabetes and impaired fasting glucose in Africa.<sup>6</sup>  
65 Hypertension is also the commonest cardiovascular disease reported in the country.<sup>7</sup> Studies in  
66 Nigeria have reported that the prevalence of diabetes varies across different zones of the country  
67 but ranges from 2.2 - 9.8%.<sup>8-11</sup> Also studies have reported varying prevalence rates of  
68 hypertension in various parts of the country.<sup>8,12,13</sup>

69 To reduce the prevalence and consequences of hypertension and diabetes a complimentary  
70 mixture of population-wide and individual interventions is required. Allowing persons to present  
71 at health facilities is not yielding desired result as majority of persons do not know that they  
72 have these silent killers. Likewise, there could be a huge burden of hypertension and diabetes  
73 mellitus among underserved rural dwellers in Nigeria. It is important to identify patients with  
74 these conditions early in the disease process. Periodic outreaches will contribute to early  
75 detection of persons with such conditions. Prompt and effective referral following such detection  
76 help reduce morbidity and complications associated with the diseases. This study was to  
77 determine the prevalence of elevated Blood Pressure (BP) and elevated Fasting Blood Sugar  
78 (FBS) among rural residents of a community in Enugu State, Nigeria. It also related the

79 characteristics of the study participants with elevated BP and elevated FBS in order to ascertain  
80 the risk factors associated with these conditions.

81

## 82 METHODS

### 83 3.1. Study Area

84 This was at Abor, a rural community in Udi Local government of Enugu state, South East  
85 Nigeria. The estimated population is ..... [2016 census] The community is about .....km to  
86 Enugu Metropolis They engage in farming, trading as well as civil/public services. There are no  
87 well established health facilities even though there is a primary health care facility.

### 88 Study Design and population

89 A Community based cross-sectional study in form of outreach was done. The study was  
90 conducted over 1 week period. All participants aged 18 years and above who gave informed  
91 consent were included in the study

### 92 Sampling Technique and Sample Size Determination

93 All participants who meet the inclusion criteria were recruited consecutively as they present for  
94 screening at the outreach venue throughout the period of study. A total of ..... patients  
95 were studied.

### 96 Data collection tools and method

97 1. Proforma was designed and used in collecting information on characteristics of  
98 participants including age, sex, occupation, recording BP, FBS and BMI

99 2. Measurements of BP, FBS and BMI were done using standard tools and observing  
100 standard procedure

101 **Blood pressure:** The BP was measured in the sitting position with an appropriate sized cuff  
102 encircling the left arm held at the level of the heart. This was measured using the OMRON Arm-  
103 type fully Automatic Digital Blood Pressure Monitor, Model BP - 103H. Raised BP was defined  
104 using Joint National Committee on Hypertension (JNC) 7 classification as systolic BP  $\geq$  140  
105 mmHg and/or diastolic BP  $\geq$  90 mmHg

106 **Blood sugar:** One microliter (1  $\mu$ L) of whole blood was collected and tested for blood glucose  
107 level using the Accu-chek active test strip and glucometer (Roche Diagnostics GmbH,  
108 Mannheim, Germany). Aseptic conditions were maintained throughout the procedure. Diabetes  
109 was defined as a fasting blood glucose  $>$  110 mg/dl (6.1mmol/l)

110 **Weight and height:** the weight and height of the respondents were measured using a  
111 standardized Stadiometer. Weight was measured to the nearest 0.5kg with the subject standing  
112 motionless on the calibrated scale without footwear. Height was measured with the subject  
113 standing in an erect position and head positioned so that the top of the external auditory meatus  
114 was level with the inferior margin of the bony orbit. The BMI of the subjects was calculated as  
115 weight in kilograms divided by height in meters squared.

## 116 **Data Collection and analysis**

117 Patient information were recorded by trained health workers to ensure accuracy of data.  
118 Measurements of BP and FBS were done by qualified medical doctors. IBM Statistical Package  
119 for Social Sciences Version 21 was used for data entry, editing and analysis. Results were  
120 presented in tables. Mean, Standard deviation, proportion and percentages were used as summary

121 measures where appropriate. Chi square test was used to establish associations between  
122 characteristics of participants with BP and FBS status. Binary Logistic Regression was done for  
123 variables significant variables (age). Level of confidence was at  $p < 0.05$ .

124

### 125 **Ethical consideration**

126 The Health Research and Ethics committee of University of Nigeria Teaching Hospital,  
127 Enugu gave ethical clearance. Permission was equally obtained from traditional rulers of  
128 constituents communities. Informed consent was obtained from participant,. They were  
129 ensured of voluntary participation and confidentiality of their information.

130

### 131 **Action taken**

132 Participants found to have elevated BP and/or FBS during the screening were provided education  
133 on appropriate lifestyle and dietary modifications, such as salt and fatty reduction as well as need  
134 for improved physical activity where not adequate. They were also instructed and referred to  
135 tertiary health care facilities.

## 136 **RESULTS**

137 **Table 1: Characteristics of participants**

<b>Variables</b>	<b>Frequency</b>	<b>Percent(%)</b>
<b>Age (Yrs)</b>		
≤ 45	97	43.3
>45	127	56.7
<i>Mean(SD)</i>	<i>46.89(21.84)</i>	
<b>Gender</b>		
Female	139	62.1
Male	85	37.9

<b>Occupation</b>		
Civil/public servant	63	28.1
Trading	30	13.4
Farming	40	17.9
Skilled worker	18	8.0
Unemployed/student	73	32.6
<b>BMI</b>		
<18.5	66	29.5
18.5-24.9	99	44.2
25-29.9	57	25.4
≥30	2	.9

138  
139 Table 1 shows that majority of participants were aged > 45 years 127(56.7%) with mean age of  
140 46.89 SD of 21.84 were females 139(62.1%), unemployed/students 73(32.6%) followed by  
141 Civil/public servants 63(28.1%) and 99(44.2%) had BMI of 18.5-24.9 mg/m<sup>2</sup>

142

143 **Table 2: Screening status of participants**

<b>Variables</b>	<b>Frequency</b>	<b>Percent(%)</b>
<b>Blood pressure (BP)</b>		
Normal	169	75.4
Elevated	55	24.6
<b>Fasting Blood Sugar (FBS)</b>		
Normal	182	81.3
Elevated	42	18.8
<b>Both BP and FBS</b>		
No	211	94.2
Elevated	13	5.8

144

145

146 Table 2 shows that 55(24.6%) of participants had elevated Blood Pressure, 42(18.8%) had  
 147 elevated Fasting Blood Sugar while 13(5.8%) both have elevated BP and FBS.

148 **Table 3: Blood pressure and Fasting Blood Sugar disaggregated by Characteristics of**  
 149 **participants**

Variables	Blood pressure		Fasting Blood Sugar	
	Normal Freq(%)	Elevated Freq(%)	Normal Freq(%)	Elevated Freq(%)
<b>Age (Yrs)</b>				
≤ 45	93(55.0)	4(7.3)	92(50.5)	5(11.9)
>45	76(45.0)	51(92.7)	90(49.5)	37(88.1)
<b>Gender</b>				
Female	104(61.5)	35(63.6)	111(61.0)	28(66.7)
Male	65(38.5)	20(36.4)	71(39.0)	14(33.3)
<b>Occupation</b>				
Civil/public servant	41(24.3)	22(40.0)	44(24.2)	19(45.2)
Trading	26(15.4)	4(7.3)	24(13.2)	6(14.3)
Farming	26(15.4)	14(25.5)	33(18.1)	7(16.7)
Skilled worker	14(8.3)	4(7.3)	17(9.3)	1(2.4)
Unemployed/student	62(36.7)	11(20.0)	64(35.2)	9(21.4)
<b>BMI</b>				
<18.5	54(32.0)	12(21.8)	56(30.8)	10(23.8)
18.5-24.9	77(45.6)	22(40.0)	81(44.5)	18(42.9)
25-29.9	37(21.9)	20(36.4)	43(23.6)	14(33.3)
≥30	1(0.6)	1(1.8)	2(1.1)	0(0.0)

150  
 151 Table 3 shows that higher proportion of those aged > 45 years had elevated Blood pressure  
 152 51(92.7%) and elevated FBS 37(88.1%). More Females had elevated Blood pressure 35(63.6%)  
 153 and elevated FBS 28(66.7%).. More Civil/public servants had elevated Blood pressure  
 154 22(40.0%) and elevated FBS 19(45.2%). Higher proportion of those that had BMI of 18.5-  
 155 24.9 had elevated Blood pressure 22(40.0%) and elevated FBS 18(42.9%).



156 **Table 4: Relationship of Characteristics of participants with Blood Pressure and Fasting**  
 157 **Blood Sugar**

<b>BLOOD PRESSURE</b>				
	<b>Normal</b>	<b>Elevated</b>	$\chi^2$ (p value)	<b>AOR (95% CI of AOR)</b>
<b>Variables</b>	<b>Freq(%)</b>	<b>Freq(%)</b>		
<b>Age (Yrs)</b>				
≤ 45	93(95.9)	4(4.1)	38.547(<0.001)	1
>45	76(59.8)	51(40.2)		18.36(5.66-59.54)
<b>Gender</b>				
Female	104(74.8)	35(25.2)	0.078(0.781)	NA
Male	65(76.5)	20(23.5)		
<b>Occupation</b>				
Civil/public servant	41(65.1)	22(34.9)		
Trading	26(86.7)	4(13.3)	11.648(0.020)	NA
Farming	26(65.0)	14(35.0)		
Skilled worker	14(77.8)	4(22.2)		
Unemployed/student	62(84.9)	11(15.1)		
<b>BMI</b>				
<18.5	54(81.8)	12(18.2)		
18.5-24.9	77(77.8)	22(22.2)	5.850(0.119)	NA
25-29.9	37(64.9)	20(35.1)		
≥30	1(50.0)	1(50.0)		
<b>FASTING BLOOD SUGAR</b>				
	<b>Normal</b>	<b>Elevated</b>		
<b>Age (Yrs)</b>				
≤ 45	92(94.8)	5(5.2)	20.757(<0.001)	1
>45	90(70.9)	37(29.1)		8.92(3.00-26.52)
<b>Gender</b>				
Female	111(79.9)	28(20.1)	0.467(0.494)	NA
Male	71(83.5)	14(16.5)		
<b>Occupation</b>				
Civil/public servant	44(69.8)	19(30.2)		
Trading	24(80.0)	6(20.0)	9.487(0.050)	NA
Farming	33(82.5)	7(17.5)		
Skilled worker	17(94.4)	1(5.6)		
Unemployed/student	64(87.7)	9(12.3)		
<b>BMI</b>				
<18.5	56(84.8)	10(15.8)		
18.5-24.9	81(81.8)	18(18.2)	FT(0.454)	NA
25-29.9	43(75.4)	14(24.6)		
≥30	2(100.0)	0(0.0)		

158 Table 4 shows that there were statistically significant association of blood pressure with age ( $\chi^2 =$   
159 38.547,  $p < 0.001$ ), Occupation ( $\chi^2 = 11.648$ ,  $p = 0.020$ ). However there were no statistically  
160 significant association of blood pressure with gender ( $\chi^2 = 0.078$ ,  $p = 0.781$ ). and BMI ( $\chi^2 = 5.850$ ,  
161  $p = 0.119$ ). Also, there were statistically significant association of Fasting blood sugar with age  
162 ( $\chi^2 = 20.757$ ,  $p < 0.001$ ). However there were no statistically significant association of blood  
163 pressure with gender ( $\chi^2 = 0.467$ ,  $p = 0.494$ ), Occupation ( $\chi^2 = 9.487$ ,  $p = 0.050$ ) and BMI (FT,  $p$   
164  $= 0.454$ ).

165 Those aged  $>45$  years were about 18 times (AOR 18.4; 95% CI 5.7-59.5 likely to have elevated  
166 BP than those aged  $\leq 45$  years. Also those aged  $>45$  years were about 9 times (AOR 8.9; 95% CI  
167 3.0-26.5 likely to have elevated BP than those aged  $\leq 45$  years.

## 168 **DISCUSSION**

169 Hypertension and Diabetes are the commonest co-morbidity of each other. They share genetic  
170 predisposition, medical risk factors, environmental influences as etiologic factors, and are  
171 interrelated.<sup>14</sup> Both elevated Blood Pressure and elevated Fasting Blood Sugar occur more with  
172 advancing age. Result from this study reported that majority of participants were aged  $> 45$  years  
173 and females. This is expected as most rural areas are inhabited by retired workers and older  
174 persons due urban migration in the country for greener pasture. Majority being were females can  
175 be partly explained by the better health seeking behavior of females compared to males.

176 It was also noted that generally, 24.6% of participants had elevated Blood Pressure, 18.8% had  
177 elevated Fasting Blood Sugar and 5.8% had both elevated BP and FBS. The reported prevalence  
178 for elevated Blood Pressure was lower than the 42.0%, 44.5% and 46.4% reported respectively  
179 different studies in South Eastern Nigeria.<sup>15-17</sup> It is similar to reports from other studies.<sup>12,13</sup> The

180 observed differences may be due differences in sampling technique and location of the study as  
181 most of those previous studies were in urban areas whose life style is different from rural  
182 communities. However, these finding is revealing as it shows that hypertension, DM and co  
183 morbid condition are of high prevalence in rural communities in Nigeria. This calls for  
184 interventional programmes including; aggressive health education, enlightenment campaigns and  
185 community surveillance programmes to help cub this rising burden of in rural communities.

186 Based on Gender, 25.2% females and 23.5% males had elevated Blood Pressure, 20.1% females  
187 and 16.5% males had elevated Fasting Blood Sugar, 5.0% females and 7.1% males had both  
188 elevated BP and FBS. More Females equally had elevated Blood pressure 63.6% and elevated  
189 FBS 66.7%. The higher prevalence among females were also documented in previous similar  
190 studies 12,20-23. However, there was discordance with many other previous reports. A study  
191 involving review of studies on hypertension over five decades reported a prevalence ranging  
192 from 8% to 46.45%, but with similar prevalence in men and women.<sup>13</sup> A Meta analysis of the  
193 prevalence of hypertension from population based studies in south western Nigeria reported a  
194 similar prevalence ranging from 12.4% to 34.8% with a higher prevalence in men than women.<sup>12</sup>  
195 Another study documented prevalence of HTN of 22% (25.9% in males and 20% in females).  
196 Similarly other studies had similar findings of higher prevalence among males.<sup>18-21</sup> The findings  
197 from this study can partly be explained by fact that women are generally more likely than men to  
198 say they are unwell.

199 Findings also show that those aged >45 years were about 18 times likely to have elevated BP  
200 than those aged  $\leq$  45 years as well as about 9 times likely to have elevated BP than those aged  $\leq$   
201 45 years. Also Higher proportion of those aged > 45 years had elevated Blood pressure 92.7%  
202 and elevated FBS 88.1%. A study done in Mali documented that OR increases with age from

203 2.06 (30–44 years) to 7.25 (60 and more).<sup>22</sup> This is similar to finding in other studies in Africa.<sup>23-</sup>  
204 <sup>25</sup> In Ibadan South West Nigeria, logistic regression analysis revealed that hypertension was  
205 significantly associated with being in age groups 30-49 years (OR 2.258, 95% CI: 1.311 - 3.884),  
206  $\geq 50$  years (OR 7.145, 95% CI: 3.644 - 14.011).<sup>26</sup> In the United States, the estimated percentage  
207 of people aged 20 years or older having diagnosed or undiagnosed diabetes in 2005-2008 was  
208 increasing with age. In the age group of 20-44 years, it was estimated about 3.7% people had  
209 diabetes; while in the age group 45-64 years the number increased to 13.7%; and the highest  
210 percentage of 26.9% was found in the age group of  $\geq 65$  years.<sup>27</sup> The study done in Bali showed  
211 that the prevalence of raised blood sugar and DM were nearly two-fold and more than two fold  
212 higher in the elderly than in the younger age group respectively.<sup>28</sup> A study done in China  
213 documented Fasting and random plasma glucose level increased by 0.15 mmol/L, while 2-hour  
214 post-prandial plasma glucose level increased by 0.26 mmol/L per decade-increase in age.<sup>29</sup>  
215 Several reviews have stressed that age is the strongest risk factor for CVD like Hypertension. In  
216 the United States, CVD was the leading cause of death for persons 65 years of age and over in  
217 2007, which accounted for 28% of deaths in this age group.<sup>30</sup>

218 These findings from current study could possibly be as a result of participants' occupation and  
219 residence. Almost all rural dwellers engage in minor farming even if is around their houses  
220 Since a high proportion of participants were farmers and traders, trekking long distances to the  
221 farm or the farm work itself constituted increased physical activity. Sedentary lifestyle which is a  
222 key modifiable factor for both diseases may be rare in these rural communities Age of  
223 participants may equally be a factor as these conditions are more with advancing age which is  
224 where majority of respondents belong to. The implication of this finding is that since most  
225 people with these conditions are not aware that they have the disease, there is the likelihood that

226 they die suddenly with their relatives ascribing it to supernatural things. Then for others that may  
227 present at health facility, they are likely to come when complications of their condition has  
228 occurred.

229 The number of elderly population has increased worldwide. Recently it has been increasing  
230 sharply in the developing countries and this has impacted on the prevalence of metabolic  
231 diseases (impaired fasting glycemia, DM) and Cardio vascular Diseases including Hypertension.  
232 This may be related directly with age or aging process itself or indirectly through several other  
233 age-related risk factors. Some of such factors include; central obesity, mitochondrial dysfunction,  
234 lipid metabolisms disorders, inflammation,  $\beta$ -cell dysfunction, insulin resistance and metabolic  
235 syndrome.<sup>28,31</sup>

## 236 **CONCLUSION**

237 Prevalence of raised BP and FBS as well as co-morbid condition was high and in line with  
238 findings from other studies. It was more among females and older age. Age was a predictor of  
239 both raised BP and FBS. It shows that hypertension, DM and co morbid condition are emerging  
240 danger even in rural communities in Nigeria. This calls for interventional programmes including  
241 mouth outreaches, aggressive health education, enlightenment campaigns and community  
242 surveillance programmes to help cub this rising burden of in rural communities

## 243 **CONFLICT OF INTEREST**

244 Authors declare no conflict of interest

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