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Stratified analysis of socioeconomic status, hypertension burden and drug compliance in South-Eastern Nigeria

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Abstract

Background: Despite global advances in health care, low socioeconomic status (SES) remains the greatest predictor of cardiovascular morbidity and mortality. Hypertension contributes significantly to this burden of cardiovascular diseases worldwide. This study investigated the structural impact of social determinants of health such as the level of education, occupational status, income, and family history of hypertension on hypertension prevalence and medication compliance.

Methods: Using convenience sampling, a cross-sectional study was conducted among 243 participants with baseline knowledge of hypertension in markets and consulting rooms across South-Eastern Nigeria. Data on demographics, income, education, and occupation were captured via structured questionnaires. Body mass index (BMI) and blood pressure (BP) were assessed and recorded using standardized clinical protocols. Hypertension was defined as BP of 140/90 mmHg or active treatment with antihypertensive medication and BMI was defined as underweight (BMI < 18.5 kg/m2), normal weight (18.5 kg/m2 ≤ BMI < 24.0 kg/ m2), overweight (24.0 kg/m2 ≤ BMI < 28.0 kg/m2) and obesity (>28.0 kg/m2).

Results: The study showed a significant association between low socioeconomic indicators and hypertension. Highlighted by the inverse relationship existing between the levels of education and prevalence of hypertension; a disproportionate number of hypertensive individuals only had a primary school education. This underscored the protective effect observed in those with tertiary education. Another significant association was with occupational status, as a higher prevalence of hypertension was noted among unemployed individuals and artisans, whereas business owners, self-employed individuals, and skilled professionals were largely non-hypertensive. Paradoxically, absolute income did not correlate significantly with prevalence; this finding could be attributed to a highly homogenous sample (85% earning >50,000 NGN). These socioeconomic vulnerabilities were further compounded by clinical risks, including advanced age (65–90 years), elevated BMI, and a positive family history (66.7%). Finally, while medication non-compliance drastically foreruns blood pressure control (77.1% uncontrolled vs. 19.4% in compliant peers), compliance behavior was surprisingly independent of demographic and socioeconomic factors.

Conclusion: These findings highlight the almost linear relationship between hypertension and socioeconomic factors, as identified by the significant association of lower educational level, unstable/variable income occupations (unemployment and artisan trades) and hypertension. Public health strategies must create targeted, evidence-based,

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cardiovascular screening and support systems that are readily accessible to vulnerable occupational sectors. Health policies and clinical interventions must also incorporate targeted health literacy and advocacy programs for high-risk groups to improve health outcomes.

Keywords: Hypertension; Socioeconomic Status; Educational status; Drug Compliance; Occupational Health; Health Literacy.

1. Introduction

According to the World Health Organization, cardiovascular diseases (CVDs) represent approximately 32% of all deaths and account for the leading cause of death globally [1].

With a prevalence of 1 in 4 men and 1 in 5 women, hypertension is one of the chronic diseases strongly associated with both cardiovascular morbidity/mortality and the strongest modifiable risk factor for CVDs – socioeconomic status [2–4].

Despite advances in care in the past decade, low socioeconomic status (SES) remains one of the strongest predictors of CVD-related morbidity, premature mortality and of drug compliance worldwide [3].

The prevalence of hypertension is expected to continue rising due to the spike in aging population, sedentary lifestyle, obesity rates, and the adoption of unhealthy diets [3,5]. Thus, adequate control of hypertension is critical for prevention of cardiovascular events [6].

2. Methodology

This study adopted a convenience sampling method. A total of 243 respondents were administered the questionnaire. Participants were required to meet the following inclusion criteria: (1) age 15 years or above; (2) knowledge of hypertension.

Participants' height, weight and blood pressure were measured, with body mass index (BMI) calculated by dividing body weight in kilograms (kg) by the square of height in meters (m2).

Participants were categorized into underweight (BMI < 18.5 kg/m2), normal weight (18.5 kg/m2 ≤ BMI < 24.0 kg/ m2), overweight (24.0 kg/m2 ≤ BMI < 28.0 kg/m2) and obesity (>28.0kg/m2) based on their BMI.

Blood pressure was measured by auscultation of the Korotkoff sounds at the non-dominant arm using a mercury sphygmomanometer, as previously described. Participants rested in a seated position for at least five minutes, and observers obtained two consecutive BP readings at 30–60 seconds intervals, with the average of two readings utilized for analysis.

Standard cuffs with a 12 × 24 cm inflatable portion were used. In instances where the upper arm circumference exceeded 31 cm, larger cuffs with 15 × 35 cm bladder were used. Quality control measures were applied to ensure good quality measurement of BP by training observers to avoid odd readings, consecutive identical readings and zero end-digit preference.

Hypertension was defined according to the 2013 guidelines of the European Society of Hypertension/European Society of Cardiology as systolic BP ≥ 140 mmHg, diastolic BP ≥ 90 mmHg or self-report treatment of hypertension using antihypertensive medications.

The investigators collected baseline data from participants through questionnaire surveys, which included demographic characteristics viz age, sex, level of education, occupation and income.

Data was entered into Microsoft Excel and checked for completeness and accuracy. Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations (± SD), were used to summarize categorical and continuous variables. The results were represented in tables, bar charts, and pie charts. The chi-square ($\chi 2$) test was used to assess the association between independent variables (sociodemographic characteristics, family history of hypertension and drug compliance) and presence of hypertension. A p-value <0.05 was considered statistically significant.

3. Result

A total of 243 respondents were included in the study. The mean age was 54.82 ± 15.12 years. Most respondents were aged 41– 65 years (56.4%), with an almost equal sex distribution; 124 females (51.0%) and 119 males (49.0%). Most respondents had secondary education (56.4%).

The largest occupational group were business/self-employed respondents (32.9%), followed by professional/skilled workers (26.3%) and artisans (18.9%). Most respondents earned ₦50,000–₦99,999 monthly (65.8%). This is represented in table 1

Table 1 Sociodemographic and Clinical Characteristics of Respondents

Variable	Frequency (n)	Percentage (%)
Age Category		
15–40 years	44	18.1
41–65 years	137	56.4
65–90 years	62	25.5
Total	243	100.0
Mean ± SD	54.82 ± 15.12 years	
Sex		
Male	119	49.0
Female	124	51.0
Total	243	100.0
Education Level		
No formal education	2	0.8
Primary	52	21.4
Secondary	137	56.4
Tertiary	52	21.4
Total	243	100.0
Occupation Classification		
Student	12	4.9
Unemployed	40	16.5
Artisan	46	18.9
Business/Self-employed	80	32.9
Professional/Skilled	64	26.3
Retired	1	0.4
Total	243	100.0
Income Level		
< ₦20,000	5	2.1
₦20,000–49,999	24	9.9
₦50,000–99,999	160	65.8

₦100,000–149,999	36	14.8
> ₦150,000	18	7.4
Total	243	100.0

3.1. Clinical characteristics of respondents

Overall, 84 respondents (34.6%) were known hypertensives, while 159 (65.4%) were not (Figure 1). Among those with known hypertension, most had been hypertensive for 0–5 years (58.3%). Only a small proportion had hypertension for more than 10 years. The Mean duration of hypertension was 6.92 years with standard deviation of 6.09 years.

Family history of hypertension was present in 107 respondents (44.0%).

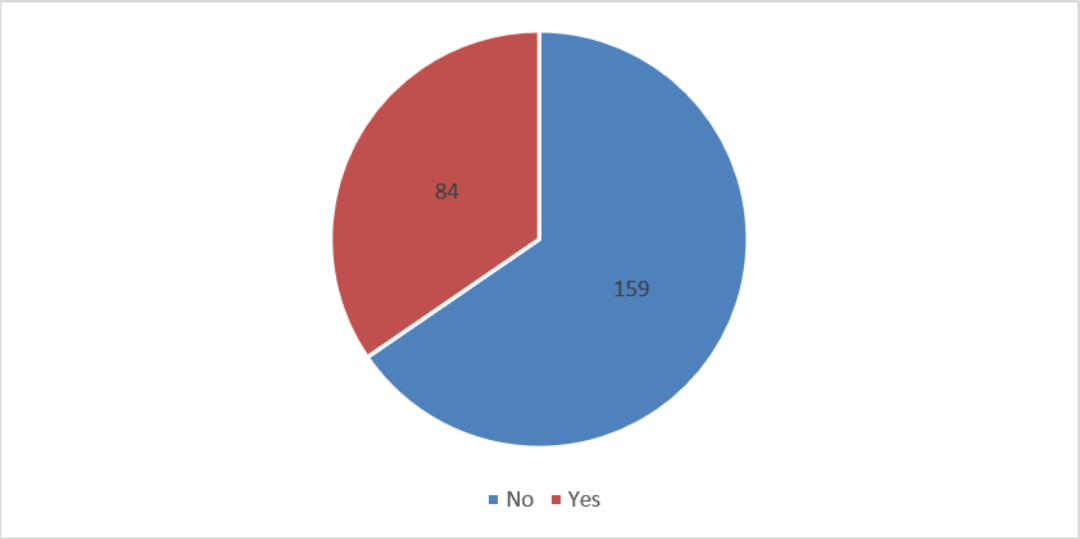

Figure 1 Distribution of participants according to known hypertension status

Table 2 Clinical Characteristics of Respondents

Variable	Frequency (n)	Percentage (%)
Known Hypertension		
No	159	65.4
Yes	84	34.6
Total	243	100.0
Duration of Hypertension Category (n=84)		
0–5 years	49	58.3
6–10 years	25	29.8
11–15 years	2	2.4
16–20 years	6	7.1
>20 years	2	2.4
Total	84	100.0
Mean ± SD	6.92 ± 6.09 years.	
Family History of Hypertension		
No	136	56.0

Yes	107	44.0
Total	243	100.0

3.2. Anthropometric characteristics of respondents

The mean weight, height, and BMI of respondents were 65.86 ± 11.02 kg, 163.73 ± 8.32 cm, and 24.58 ± 3.85 kg/m^2, respectively. Most respondents (65.8%) had a normal BMI. (Table 3)

Table 3 Anthropometric characteristics of respondents

Variable	Value
Weight (kg), Mean ± SD	65.86 ± 11.02
Height (cm), Mean ± SD	163.73 ± 8.32
BMI (kg/m^2), Mean ± SD	24.58 ± 3.85
BMI Category	n (%)
Underweight (<18.5 kg/m^2)	1 (0.4)
Normal weight (18.5–24.9 kg/m^2)	158 (65.8)
Overweight (25.0–29.9 kg/m^2)	61 (25.4)
Obese (≥30 kg/m^2)	20 (8.3)
Total	240 (100.0)

3.3. Blood pressure characteristics

The mean systolic blood pressure was 125.23 ± 13.04 mmHg, while the mean diastolic blood pressure was 75.98 ± 11.60 mmHg. The mean arterial pressure was 92.40 ± 11.23 mmHg. Based on blood pressure control classification, the majority of respondents (78.2%) had controlled blood pressure.

Table 3 Blood Pressure Characteristics of Respondents (n = 243)

Variable	Value
Systolic Blood Pressure (mmHg), Mean ± SD	125.23 ± 13.04
Diastolic Blood Pressure (mmHg), Mean ± SD	75.98 ± 11.60
Mean Arterial Pressure (mmHg), Mean ± SD	92.40 ± 11.23
Blood Pressure Control Status	n (%)
Controlled	190 (78.2)
Uncontrolled	53 (21.8)
Total	243 (100.0)

3.4. Use of antihypertensives and compliance

Less than one-third of respondents (71, 29.2%) reported using antihypertensive medications, while 172 (70.8%) were not on treatment. Among the 71 respondents receiving antihypertensive therapy, medication compliance was nearly evenly distributed, with 50.7% being compliant and 49.3% being non-compliant (Figure 2). This finding suggests that although only a minority of respondents were on treatment, approximately half of those receiving therapy adhered adequately to their prescribed medications (Table 4).

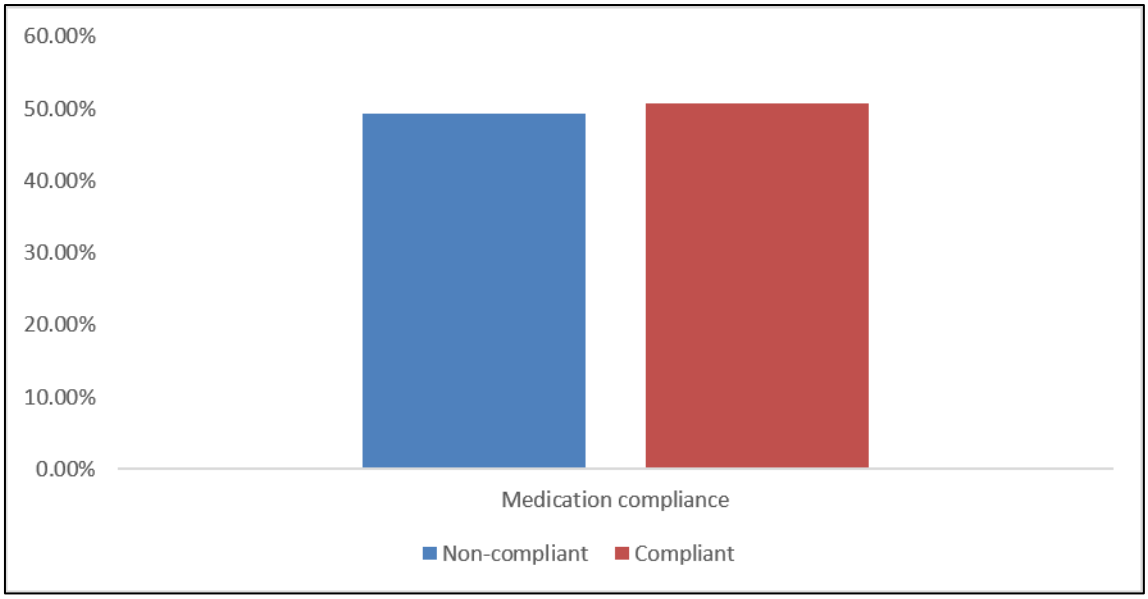

Figure 2 Distribution of Medication Compliance Among Respondents on Antihypertensive Medication (n = 71)

Table 4 Use of antihypertensive medication and compliance

Variable	**n (%)**
Use of Antihypertensive Medication (n = 243)	
No	172 (70.8)
Yes	71 (29.2)
Total	243 (100.0)
Medication Compliance (n = 71)	
Non-compliant	35 (49.3)
Compliant	36 (50.7)
Total	71 (100.0)

3.5. Association Between Participant Characteristics and Known Hypertension Status

Table 5 shows the association between sociodemographic/clinical characteristics and known hypertension status. Age category was significantly associated with known hypertension status ($\chi^2 = 33.127$, $p < 0.001$). Respondents with known hypertension were older (aged 65–90 years) compared to those without hypertension.

Education level was also significantly associated with known hypertension status ($\chi^2 = 10.673$, $p = 0.014$). A higher proportion of respondents with known hypertension had only primary education compared with those without hypertension (31.0% versus 16.4%). Tertiary education was less common among respondents with known hypertension.

There was significant association between occupation and known hypertension status, ($\chi^2 = 18.778$, $p = 0.002$). Known hypertension was more common among unemployed respondents and artisans, while respondents without hypertension were more commonly business/self-employed or professional/skilled workers.

Family history of hypertension was significantly associated with known hypertension status, ($\chi^2 = 26.686$, $p < 0.001$). Most respondents with known hypertension had a positive family history (66.7%), compared with 32.1% among those without hypertension.

BMI category was also significantly associated with known hypertension status, (χ^2 = 12.167, p = 0.007). Overweight and obesity were more common among respondents with known hypertension than those without hypertension.

However, sex, χ^2 = 0.253, p = 0.615, and income level, χ^2 = 5.326, p = 0.255, were not significantly associated with known hypertension status.

Table 5 Association Between Sociodemographic and Clinical Characteristics and Known Hypertension Status Among Respondents

Variable	No HTN n (%)	Known HTN n (%)	Total	χ^2	p-value
Age Category				33.127	<0.001
15–40 years	40 (25.2)	4 (4.8)	44		
41–65 years	95 (59.7)	42 (50.0)	137		
65–90 years	24 (15.1)	38 (45.2)	62		
Total	159 (100.0)	84 (100.0)	243		
Sex				0.253	0.615
Male	76 (47.8)	43 (51.2)	119		
Female	83 (52.2)	41 (48.8)	124		
Total	159 (100.0)	84 (100.0)	243		
Education Level				10.673	0.014
No education	2 (1.3)	0 (0.0)	2		
Primary	26 (16.4)	26 (31.0)	52		
Secondary	90 (56.6)	47 (56.0)	137		
Tertiary	41 (25.8)	11 (13.1)	52		
Total	159 (100.0)	84 (100.0)	243		
Occupation				18.778	0.002
Student	11 (6.9)	1 (1.2)	12		
Unemployed	17 (10.7)	23 (27.4)	40		
Artisan	27 (17.0)	19 (22.6)	46		
Business/Self-employed	57 (35.8)	23 (27.4)	80		
Professional/Skilled	47 (29.6)	17 (20.2)	64		
Retired	0 (0.0)	1 (1.2)	1		
Total	159 (100.0)	84 (100.0)	243		
Income Level				5.326	0.255
<₦20,000	3 (1.9)	2 (2.4)	5		
₦20,000–49,999	20 (12.6)	4 (4.8)	24		
₦50,000–99,999	98 (61.6)	62 (73.8)	160		
₦100,000–149,999	25 (15.7)	11 (13.1)	36		
>₦150,000	13 (8.2)	5 (6.0)	18		
Total	159 (100.0)	84 (100.0)	243		

Family History of HTN				26.686	<0.001
No	108 (67.9)	28 (33.3)	136		
Yes	51 (32.1)	56 (66.7)	107		
Total	159 (100.0)	84 (100.0)	243		
BMI Category				12.167	0.007
<18.5	1 (0.6)	0 (0.0)	1		
18.5–24.9	115 (73.2)	43 (51.8)	158		
25–29.9	31 (19.7)	30 (36.1)	61		
>30	10 (6.4)	10 (12.0)	20		
Total	157 (100.0)	83 (100.0)	240		

Blood pressure control differed significantly by known hypertension status ($\chi^2 = 41.316$, $p < 0.001$). Among respondents with known hypertension, only 46 (54.8%) had controlled blood pressure. This indicates that nearly half of the respondents who were already aware of their hypertensive status still had poor blood pressure control.

Use of antihypertensive medication was also significantly associated with known hypertension status ($\chi^2 = 189.869$, $p < 0.001$). Most respondents with known hypertension, 84.5%, were on antihypertensive drugs, while 15.5% were not on treatment. None of the respondents without known hypertension reported being on antihypertensive medication. (Table 6)

Table 6 Association Between Blood Pressure Control, Antihypertensive Medication Use, and Known Hypertension Status Among Respondents

Variable	**No HTN n (%)**	**Known HTN n (%)**	**Total**	**χ^2**	**p-value**
BP Control				41.316	<0.001
Uncontrolled	15 (9.4)	38 (45.2)	53		
Controlled	144 (90.6)	46 (54.8)	190		
Total	159 (100.0)	84 (100.0)	243		
On Antihypertensive Drugs				189.869	<0.001
No	159 (100.0)	13 (15.5)	172		
Yes	0 (0.0)	71 (84.5)	71		
Total	159 (100.0)	84 (100.0)	243		

3.6. Association Between Medication Compliance and Sociodemographic and Clinical Characteristics

Medication compliance was significantly associated with blood pressure control among respondents on antihypertensive medication ($\chi^2 = 23.674$, $p < 0.001$). A higher proportion of non-compliant respondents had uncontrolled blood pressure compared with compliant respondents (77.1% vs 19.4%). In contrast, blood pressure control was more common among compliant respondents than non-compliant respondents (80.6% vs 22.9%). No statistically significant association was observed between medication compliance and age category, sex, occupation, income level, duration of hypertension, family history of hypertension, or BMI category. This is shown in table 7 below

Table 7 Association Between Medication Compliance and Participant Characteristics Among Respondents on Antihypertensive Medication (n = 71)

Variable	Non-Compliant n (%)	Compliant n (%)	χ^2	p-value
Age Category			5.269	0.072
15–40 years	0 (0.0)	2 (5.6)		
41–65 years	14 (40.0)	21 (58.3)		
65–90 years	21 (60.0)	13 (36.1)		
Sex			0.347	0.556
Male	17 (48.6)	20 (55.6)		
Female	18 (51.4)	16 (44.4)		
Occupation Classification			6.319	0.097
Unemployed	12 (34.3)	10 (27.8)		
Artisan	6 (17.1)	10 (27.8)		
Business/Self-employed	13 (37.1)	6 (16.7)		
Professional/Skilled	4 (11.4)	10 (27.8)		
Income Level			7.512	0.111
< ₦20,000	1 (2.9)	0 (0.0)		
₦20,000–49,999	1 (2.9)	3 (8.3)		
₦50,000–99,999	30 (85.7)	23 (63.9)		
₦100,000–149,999	3 (8.6)	7 (19.4)		
> ₦150,000	0 (0.0)	3 (8.3)		
Duration of Hypertension			3.476	0.482
0–5 years	22 (62.9)	17 (47.2)		
6–10 years	10 (28.6)	12 (33.3)		
11–15 years	1 (2.9)	1 (2.8)		
16–20 years	1 (2.9)	5 (13.9)		
>20 years	1 (2.9)	1 (2.8)		
Family History of Hypertension			0.006	0.937
No	11 (31.4)	11 (30.6)		
Yes	24 (68.6)	25 (69.4)		
BMI Category			2.954	0.228
18.5–24.9 kg/m^2	17 (48.6)	18 (51.4)		
25–29.9 kg/m^2	16 (45.7)	11 (31.4)		
>30 kg/m^2	2 (5.7)	6 (17.1)		
Blood Pressure Control			23.674	<0.001*
Uncontrolled	27 (77.1)	7 (19.4)		
Controlled	8 (22.9)	29 (80.6)		

4. Discussion

Over the past two decades, a large body of evidence has underscored the powerful role of social determinants in shaping health outcomes across diverse populations. Medical care alone does not determine health status; rather, health is influenced by a complex interplay of social, economic, psychological, environmental, genetic, and epigenetic factors [7].

4.1. Age as Risk Factor

Our study revealed a significant association between age and hypertension status. Respondents with known hypertension were older (65–90 years) compared to those without hypertension, confirming age as a strong predictor of hypertension. This finding is consistent with prior studies in Uganda, Nigeria and Kirschbaum's analysis on the association of socioeconomic status with hypertension in 76 low- and middle-income countries, as they each attest to a higher prevalence among older individuals [7–9].

4.2. Socioeconomic Factors [Education, Occupation, Income]

Education level was significantly associated with hypertension in our study. A higher proportion of respondents with known hypertension had only primary education, while tertiary education was less common among hypertensive individuals. This supports findings from Luo, who reported that higher educational attainment was protective against hypertension, reducing risk by up to 46% when compared to illiterate populations [10]. As low socioeconomic status has been consistently linked to higher morbidity and premature mortality, as well as reduced access to preventive services and therapies [5]; our findings reinforce the importance of education as a determinant of health literacy and hypertension awareness.

Our study did not show a significant relationship between income and the prevalence of hypertension. These findings are in contrast to those of Antignac et al for most countries in sub-Saharan Africa, where the income was inversely related to hypertension prevalence [6]. However, these results might be influenced by the populace interviewed, as about 85% of our respondents earned more than 50,000 NGN.

Occupation was also significantly associated with hypertension in our study. Known hypertension was more common among unemployed respondents and artisans, while those without hypertension were more likely to own businesses, be self-employed or professional/skilled workers. This study buttresses Madu's findings that unemployment is linked to poorer adherence and adverse health outcomes [5].

4.3. Other factors [Obesity, Family history]

Obesity and elevated BMI further compounded the risk for hypertension, as overweight and obesity were significantly more common among respondents with known hypertension. These results align with broader West African data, which highlight obesity, physical inactivity, and dietary transitions as key contributors to hypertension prevalence [7].

Additionally, family history emerged as a strong predictor in our sample, with 66.7% of hypertensive respondents reporting a positive family history compared to 32.1% among non-hypertensive individuals. This highlights the interplay of genetic predisposition and social factors in shaping hypertension risk, a correlate of the findings across several countries in west Africa [11].

4.4. Adherence and Access to Care

Medication compliance was significantly associated with blood pressure control in our study. Non-compliant respondents were far more likely to have uncontrolled blood pressure (77.1%) compared to compliant respondents (19.4%). This finding highlights the critical role of adherence in hypertension management, consistent with studies that showed a significant increase in blood pressure control in patients monitored for drug compliance [3].

Our study, however, found no significant association between compliance and age, sex, occupation, income, family history, or BMI, suggesting that adherence may be more strongly influenced by behavioral and psychosocial factors than by demographic characteristics.

It must, however, be noted that this study utilized a convenience sampling method and thus might not be an adequate representation of the population it was taken from.

5. Conclusion

In the past two decades, a substantial body of evidence has demonstrated the profound influence of social determinants in shaping health outcomes across diverse settings and populations. This paper has attempted to show the significant and pivotal role that socioeconomic and demographic factors like age, education, occupation, family history, and BMI play as determinants of health, using hypertension as a case-in-point. This study also underscores drug compliance as the bedrock for effective control of hypertension.

For better health outcomes, policies aimed at improving education, reducing unemployment, and enhancing access to healthcare are essential. Prevention and control strategies must extend beyond clinical interventions and encompass broader determinants of health. Public health interventions should also prioritize high-risk groups, including older adults, individuals with obesity, those with low educational attainment, and those with a family history of hypertension.

Compliance with ethical standards

Disclosure of conflict of interest

The authors, Fab-Emerenini Eziokwu Bright, Mmesoma Chinenye Nweke, Bankole Sarah Iteoluwakiisi, Ikemefuna Chinedu Ikemefuna, Anayo Stellamaris Adaobi, Emmanuel Udenze Ekenechukwu, Okoye Obianuju Vivian and Okonkwo Gabriel Uchechukwu have no conflicts of interest regarding the study. All funding was paid for, out-of-pocket, by the authors.

Statement of informed consent

Informed consent was obtained from all participants prior to data collection. To ensure confidentiality, all personal identifiers were removed from the dataset, and the study adhered to the ethical principles of the Declaration of Helsinki.

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