Double Burden: Hypertension Prevalence and Predictors among Diabetes Patients Receiving Care at the University of Port Harcourt Teaching Hospital

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ABSTRACT

Diabetes mellitus (DM) is a chronic debilitating disease associated with the development of several comorbidities like hypertension. Among diabetics, it is documented that hypertension is a leading cause of CVD-attributable mortality. It is in light of this and other negatives—poor quality of life, financial strain, et cetera, associated with a double burden of hypertension and diabetes that the study ascertained the prevalence and predictors of hypertension among diabetes patients. An institutional-based descriptive cross-sectional design was employed to systematically sample 265 diabetic patients at the University of Port Harcourt Teaching Hospital. Data was analysed using IBM SPSS Version 25. A chi-square/Fischer's exact and multivariate logistic regression analysis were conducted to ascertain association and determine independent predictors respectively with a p-value ≤ 0.05 recorded as statistical significance. The mean age of respondents was 60.17±10.13 with 54.0% being female. Among the patients, 50.6% had hypertension. A multivariate logistic regression analysis revealed that hypertension risk was higher for diabetes patients who had a family history of diabetes (AOR = 0.34; p = 0.046), were overweight (AOR = 0.45; p = 0.045), or obese (AOR = 0.18; p < 0.001), were past smokers (AOR = 0.11; p = 0.003), earned > ₦50,000 (AOR = 0.25; p = 0.002), or experienced moderate stress (AOR = 0.34; p = 0.046). It is evident that the prevalence of hypertension among diabetes patients at was high and predicted by several factors including smoking, stress, and high body mass index. It is thus important that interventions and clinical recommendations target these factors for better treatment outcomes.

Keywords: Diabetes mellitus, hypertension, comorbidity, prevalence, predictors

INTRODUCTION

Diabetes mellitus (DM) is a chronic debilitating disease characterized primarily by the body's inability to produce or utilize insulin necessary for the regulation of blood glucose level (Kumar et al., 2020; World Health Organization, 2024). According to the World Health Organization, in 2022, an estimated 830 million people were living with diabetes mellitus worldwide. In Africa, a 2019 report ranked Nigeria as the second nation with the highest number of people (2.7 million adults aged 20 -79 years) living with diabetes (International Diabetes Federation, 2021) and thus at a high risk of early morbidity and mortality due to predisposition to other diseases, especially cardiovascular diseases (CVD) diseases like hypertension (Akalu & Belsti, 2020). It is well-documented that hypertension is a leading CVD-attributable cause of morbidity and mortality among diabetes patients (Akalu & Belsti, 2020).

The American Diabetes Association, defined hypertension among diabetes patients as blood pressure (BP) ≥ 140/90 mmHg, and a target BP goal of < 130/80 mmHg is reasonable (de Boer et al., 2017). Despite interventions, hypertension among diabetes patients is common in clinical practice and is said to be twice as prevalent in diabetics than in non-diabetics with patients first presenting with one condition followed by the later discovery of another, though they may be diagnosed simultaneously (Dan–Jumbo et al., 2019; Unadike et al., 2011). The comorbidity of diabetes mellitus and hypertension is increasing globally (Nouh et al., 2017).

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The literature shows a hypertension prevalence of 29.2% - 78.9% among diabetes patients with the higher prevalences occurring in low-middle income countries (Akalu & Belsti, 2020; Dan–Jumbo et al., 2019; Nouh et al., 2017; Unadike et al., 2011). A mix of both chronic diseases increases the risk of mortality by 7.2 times with a higher risk of death in developing countries, as hypertension contributes to the development and progression of micro vascular (retinopathy, nephropathy, and neuropathy) and macro vascular (atherosclerotic) complications of diabetes (Akalu & Belsti, 2020; Vargas-Uricoechea & Cáceres-Acosta, 2018).

For individuals, the double burden of diabetes and hypertension is likely to impact their health-related quality of life in all aspects (Aschalew et al., 2020; Snarska et al., 2020). Psychological, emotional, and social issues are likely more pronounced in patients with diabetes and hypertension, thus limiting their functionality and impacting their overall well-being. The high morbidity and mortality associated with comorbid diabetes and hypertension (Akalu & Belsti, 2020) reduces workforce capacity, thus negatively impact the economy of nations and overall health system.

The study ascertained the prevalence and predictors of hypertension among diabetes patients receiving care at the University of Port Harcourt Teaching Hospital, so as to better triage, care and control hypertension among diabetic.

METHODS

Study Area

The study was conducted in the University of Port Harcourt Teaching Hospital (UPTH)—a 500-bed tertiary health facility located in Rivers State, Nigeria. The facility attends to over 200,000 patients per annum with approximately 300 diabetes patients cared for in the facility on a monthly basis.

Study Design

An institutional-based descriptive cross-sectional study design was used to ascertain the prevalence and predictors of hypertension among diabetic patients receiving treatment at the University of Port Harcourt Teaching Hospital

Study Population

The study comprised of diabetes mellitus patients age ≥ 35 years who have received care for at least one year at the University of Port Harcourt Teaching Hospital

Sample Size

The Fischer's formula (Charan & Biswas, 2013) ($n = \frac{Z_{1-\alpha/2}{}^2 P(1-P)}{d^2}$) for cross-sectional studies was used to estimate the sample size. Notably, n = minimum sample size; z = standard normal variate at 95% confidence interval which is equivalent to 1.96; p = 0.789 (proportion of diabetic patients with hypertension as recorded in a prior study(Dan–Jumbo et al., 2019)); 1-p = 0.211; d = level of precision set at 0.05. Therefore, $n = \frac{1.96^2 \times 0.789 \times 0.211}{0.05^2}$ which when approximated equals 256. Assuming a 10% non-response rate, the minimum sample size = 281 patients

Sampling Procedures

A systematic random sampling technique was employed to select study participants. Since endocrine clinics held every Wednesday, 25 patients were systematically sampled from the number of patients scheduled for the week. After calculation of the weekly nth term, $\text{nth term} = \frac{\text{total number of weekly patients}}{\text{expected sample size}}$, the first participant was selected randomly by balloting from the list of diabetic patients. Subsequently participants were recruited by addition of the nth term.

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Data Collection Procedures

Data collection was carried out by the researchers and two research assistants trained for three days on study aims, questionnaire administration, and patients' privacy and confidentiality. Only consenting patients were asked questions contained in the study questionnaire and had their heights and weights measured. Weight, height, and blood pressure measurement was taken by nursing staff on duty.

Study Instruments

An interviewer administered questionnaire consisting of two sections vis-à-vis sociodemographic profile and risk factors was utilized in collecting data from patients. The questionnaire was workshopped among experts in the field for face and content validity. Also, questionnaire was administered to a few diabetes patients at the Rivers State University Teaching Hospital to ensure questions were comprehendible. To ensure reliability, key segments of the questionnaire like the stress segment was adopted from the ISMA stress measuring scale which is both reliable and valid for measuring stress.

Data analysis

Data collected using a structured interviewer administered questionnaire were entered into IBM (SPSS) version 25, coded, and analysed. The data was described using mean and standard deviation for continuous data, and frequency and percentage for categorical data. To ascertain the association between dependent and independent variables, a chi-square test/Fisher's exact test was employed. Univariate and multivariate logistic regression analysis was employed to determine the predictors of hypertension among diabetic patients. A p-value of ≤ 0.05 was reported as statistically significant.

RESULTS

A total of 265 patients were reached out of the estimated 282 giving a response rate of 93.9%

Profile of patients

As shown in Table 1, the mean age of diabetes patients receiving care at UPTH was 60.17±10.13 with 36.6% of them aged between 57 – 67. Also highlighted is that 130 (49.1%) had tertiary education, 195 (73.6%) were married, 143 (54.0%) were women, 110 (45.1%) earned above ₦50,000, and 51.4% of them were of the Igbo ethnicity.

Table 1: Demographic characteristics of diabetes patients receiving care at UPTH

VARIABLES	Frequency N=265	Percent (%)
AGE		
35 – 45	24	9.1
46 – 56	76	28.6
57 – 67	97	36.6
68 and above	68	25.7
Mean ± SD	60.17±10.13	
EDUCATION		
No Formal	19	7.2

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Primary	44	16.6
Secondary	72	27.2
Tertiary	130	49.1
GENDER		
Male	122	46.0
Female	143	54.0
MARITAL STATUS		
Single	16	6.0
Married	195	73.6
Widowed	54	20.4
MONTHLY INCOME		
≤ ₦10,000	42	15.8
₦10,001 - ₦20,000	21	7.9
₦20,001 - ₦30,000	42	15.8
₦30,001 - ₦40,000	35	13.2
₦40,001 - ₦50,000	15	5.7
≥ ₦50,0001	110	41.5
GEOPOLITICAL ZONE		
South-South	125	47.2
South-East	105	39.6
South-West	20	7.5
North Central	15	5.7
ETHNICITY		
Ijaw	31	11.7
Ikwerre	56	21.1
Igbo	136	51.4
Others	42	15.8

Prevalence of Hypertension among Diabetes Patients

Figure 1 shows that 134 (50.6%) of diabetes patients receiving care at the University of Port Harcourt Teaching Hospital were comorbid for hypertension

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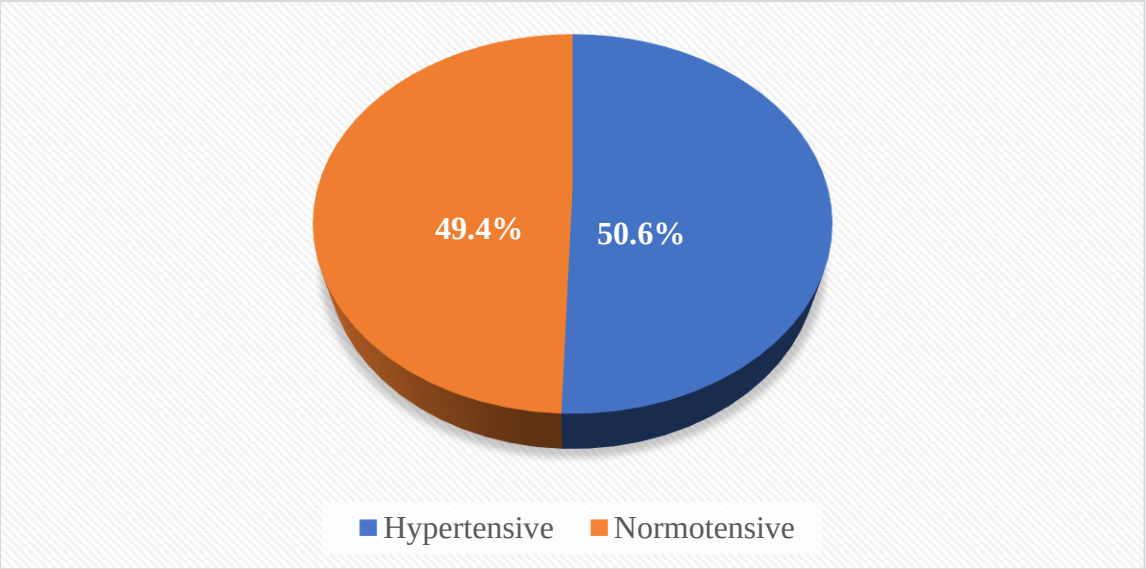

Figure 1: prevalence of hypertension among diabetes patients receiving care at UPTH

Socio-demographic factors associated with blood pressure status

As shown in Table 2, a chi-square test for the association revealed that blood pressure status among diabetes patients was associated with educational level (χ^2 = 11.583; p = 0.009) of diabetic patients and their monthly income status (χ^2 = 17.683; p = 0.003) were statistically significantly associated with their hypertension status.

Table 2: Chi-square analysis of socio-demographic factors associated with blood pressure status

	BP STATUS			
	Hypertensive	**Normotensive**	**χ^2**	**p-value**
AGE				
35 – 45	14 (58.3)	10 (41.7)	2.784	0.426
46 – 56	33 (43.4)	43 (56.6)		
57 – 67	53 (54.6)	44 (45.4)		
≥ 68	34 (50.0)	34 (50.0)		
EDUCATION				
No Formal	8 (42.1)	11 (57.9)	11.583	0.009*
Primary	13 (29.5)	31 (70.5)		
Secondary	37 (51.4)	35 (48.6)		
Tertiary	76 (58.5)	54 (41.5)		
GENDER				
Male	64 (52.5)	58 (47.5)	0.324	0.569
Female	70 (49.0)	73 (51.0)		
MARITAL STATUS				

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Single	7 (43.8)	9 (56.3)	1.503	0.472
Married	103 (52.8)	92 (47.2)		
Widowed	24 (44.4)	30 (55.6)		
MONTHLY INCOME				
≤ 10,000	11 (26.2)	31 (73.8)	17.683	0.003*
10,001 - 20,000	14 (66.7)	7 (33.3)		
20,001 - 30,000	20 (47.6)	22 (52.4)		
40,001 - 50,000	5 (33.3)	10 (66.7)		
≥ 50,0001	62 (56.4)	48 (54.4)		
GEOPOLITICAL ZONE				
South-South	62 (49.6)	63 (50.4)	1.041	0.791
South-East	56 (53.3)	49 (46.7)		
South-West	10 (50.0)	10 (50.0)		
North Central	6 (40.0)	9 (60.0)		
ETHNICITY				
Ijaw	10 (32.3)	21 (67.7)	6.811	0.078
Ikwerre	25 (44.6)	31 (55.4)		
Igbo	75 (55.1)	61 (44.9)		
Others	24 (57.1)	18 (42.9)		

Association between other factors and blood pressure status of diabetes patients

According to a chi-square test for the association, as shown in Table 3, the blood pressure status of diabetic patients was associated with patients' family history of hypertension ($\chi^2 = 3.944$; $p = 0.047$),family history of diabetes ($\chi^2 = 10.911$; $p = 0.001$), body mass index ($\chi^2 = 20.393$; $p < 0.001$), smoking status ($\chi^2 = 18.373$; $p < 0.001$) and stress level ($\chi^2 = 26.225$; $p < 0.001$).

Table 3: Chi-square analysis of other factors associated with blood pressure status among diabetes patients

	BP STATUS		χ^2	p-value
	Hypertensive	**Normotensive**		
FH HYPERTENSION				
No	73 (45.6)	87 (54.4)	3.944	0.047*
Yes	61 (58.1)	44 (41.9)		
FH DIABETES				

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No	72 (42.9)	96 (57.1)	10.911	0.001*
Yes	62 (63.9)	35 (36.1)		
BODY MASS INDEX				
Normal	39 (35.8)	70 (64.2)	20.393	< 0.001*
Underweight	13 (81.3)	3 (18.8)		
Overweight	43 (54.4)	36 (45.6)		
Obese	39 (63.9)	22 (36.1)		
ALCOHOL USE				
Non-drinker	73 (47.1)	82 (52.9)	2.487	0.288
Past drinker	43 (53.1)	38 (46.9)		
Current drinker	18 (62.1)	11 (37.9)		
SMOKING STATUS				
Never Smoked	112 (47.9)	122 (52.1)	18.373[f]	< 0.001*
Past Smoker	22 (84.6)	4 (15.4)		
Current Smoker	0 (0.0)	5 (100.0)		
STRESS LEVEL				
Mild Stress	25 (28.4)	63 (71.6)	26.225	< 0.001*
Moderate Stress	92 (62.6)	55 (37.4)		
Severe Stress	17 (56.7)	13 (43.3)		

FH = family history; BP = Blood pressure; f = Fischer's exact; *significant.

Predictors of hypertension among diabetic patients

A multivariate logistic regression as shown in Table 4 shows that diabetics patients were more likely to develop hypertension if they had a family history of diabetes (AOR [95% CI] = 0.34 [0.12 – 1.00] p = 0.046), are overweight (AOR [95% CI] = 0.45 [0.21 – 0.98] p = 0.045), or obese (AOR [95% CI] = 0.18 [0.07 – 0.47] p < 0.001), are past smokers (AOR [95% CI] = 0.11 [0.03 – 0.47] p = 0.003), earn > ₦50,000 (AOR [95% CI] = 0.25 [0.77 – 0.82] p = 0.002), or experience moderate stress (AOR [95% CI] = 0.34 [0.12 – 1.00] p = 0.046). However, being underweight reduced the risk (AOR [95% CI] = 0.67 [0.13 – 1.35] p = 0.001)

Table 4: Logistic regression analysis of predictors of hypertension among diabetes patients

Risk Factors	**B**	**COR (95% CI)**	**p-value**	**AOR (95%CI)**	**p-value**
Educational					
No Formal	Ref				
Primary	0.575	3.36 (1.61 - 7.00)	0.332	1.78 (0.55 - 5.75)	0.928

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Secondary	0.285	1.33 (0.75 - 2.38)	0.046	0.75 (0.33 - 1.72)	0.280
Tertiary	0.218	1.10 (0.26 - 4.01)	0.071	1.24 (0.31 - 5.01)	0.758
Monthly Income					
≤ ₦10,000	Ref				
₦10,001 – ₦20,000	-0.037	0.64 (0.24 - 1.73)	0.211	1.04 (0.27 - 4.03)	0.731
₦20,001 - ₦30,000	1.089	1.42 (0.70 - 2.90)	0.088	2.97 (0.94 - 9.44)	0.065
₦30,001 - ₦40,000	0.64	0.76 (0.35 - 1.67)	0.476	1.90 (0.63 - 5.72)	0.256
₦40,001 - ₦50,000	1.078	2.58 (0.83 - 8.06)	0.066	2.94 (0.72 - 12.07)	0.135
≥ ₦50,001	-1.383	1.23 (0.54 - 4.88)	0.031*	0.25 (0.77 - 0.82)	0.021*
FH Hypertension					
No	Ref				
Yes	-0.128	0.061 (0.37 - 0.99)	0.049*	0.88 (0.31 - 2.47)	0.808
FH Diabetes					
No	Ref				
Yes	1.073	0.42 (0.25 - 0.71)	0.003*	0.34 (0.12 - 1.00)	0.046*
Body Mass Index					
Normal	Ref				
Underweight	-2.696	0.13 (0.04 - 0.48)	0.001*	0.67 (0.13 - 1.35)	0.001*
Overweight	0.799	0.47 (0.26 - 0.84)	0.003*	0.45 (0.21 - 0.98)	0.045*
Obese	1.708	0.31 (0.16 - 0.60)	0.001*	0.18 (0.07 - 0.47)	< 0.001*
Smoking Status					
Never Smoked	Ref				
Past Smoker	2.236	0.17 (0.06 - 0.50)	0.003*	0.11 (0.03 - 0.47)	0.003*
Current Smoker	2.123	1.42 (0.96 - 2.12)	0.612	1.81 (0.52 - 2.33)	0.999
Stress Level					
Mild	Ref				
Moderate	0.868	0.24 (0.13 - 0.42)	0.012*	0.42 (0.19 - 0.95)	0.036*
Severe	-0.434	0.30 (0.13 - 0.72)	0.035*	0.64 (0.20 - 2.14)	0.476

COR = crude odds ratio; AOR = adjusted odds ratio; FH = family history

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DISCUSSION

Owing to the complexity and seemingly common occurrence of hypertension among diabetes patients, the study ascertained the prevalence and predictors of hypertension among diabetes patients receiving care at the University of Port Harcourt Teaching Hospital, Rivers State, Nigeria.

Prevalence of hypertension among diabetes patients

As highlighted in the literature, diabetes patients possess a high risk of developing hypertension which subsequently triggers the development of major causes of death like renal, cardiac and cerebral dysfunctions. The prevalence of hypertension among diabetes patients is twice higher when compared to the non-diabetic population (Anizor & Azinge, 2015). In the current study, over half of the study participants had hypertension. This is in agreement with the reports of studies conducted in Delta state Nigeria where it was reported that 57.4% of diabetes patients suffered from hypertension (Anizor & Azinge, 2015). Though slightly higher than the 47.6% prevalence rate of a Sudanese study (Abdelbagi et al., 2021), and lower than the prevalence rate of 71.8% documented by Almalki et al. (2020) in their Saudi Arabian study, it is clear that hypertension is a common comorbidity among the diabetic population. A double burden of hypertension and diabetes limits the functionality of the sufferers has negative effects on the economy, especially when it involves the working age, and increases the risk of mortality (Akalu & Belsti, 2020; Aschalew et al., 2020; Snarska et al., 2020). Thus, checks for hypertension among diabetics should be routine, and incorporate educational materials, as knowledge has been documented to be a prerequisite to the performance of behaviours that help protect an individual from developing certain illnesses and diseases.

Predictors of hypertension among diabetes patients

So many factors play an important role in the development of hypertension among diabetic patients. Among them, are the sociodemographic, environmental, and clinical characteristics of diabetic individuals. According to the current study, a multivariate analysis showed that those who were past smokers, had a family history of diabetes, were overweight or obese, and perceived moderate life stress were likelier to develop hypertension. With regards to smoking, the current report agrees with the reports of Husain et al. (2014) who stated that smoking either past or present is a driver for the development of hypertension among diabetic patients. Smoking which is known to induce endothelial dysfunction and early atherogenesis is linked to a variety of cardiovascular disturbances, and its role in the development of hypertension is not a questionable one (Messner & Bernhard, 2014). The study further corroborates the findings of the other studies as regards BMI. For example Anizor & Azinge (2015) noted that overweight and obese status were significant risk factors for the development of hypertension among diabetics. The primary justification why overweight and obesity are deterministic of hypertension development among diabetes patients in Nigeria is because the living standard is poor with over 2/4 of the population leaving below the minimum wealth index (World Bank Group, 2025). What that posits for the population is that dietary habits are likely to revolve around cheap and common carbohydrate and fat-rich foods. The current study however showed that those who earned ≥ 50,001 were more likely to develop hypertension as compared to those who earned ≤ 10,000. While this can be attributed to the possibility of those in the higher income range patronizing petty habits like alcohol consumption that is rigged with an increased likelihood for hypertension development, it begs the question: “does starvation/fasting which is preeminent among people of low income a protective factor against hypertension among diabetics?” Abdelbagi et al. (2021) also highlighted in their study that diabetes patients who are employed and likely to fall into the high-wealth category were 1.98 times more likely to be hypertensive in comparison to those who were unemployed. These factors are not exclusive to any region, and thus demands actions if diabetes patients must overcome the overwhelming burden of morbidity and mortality.

Strengths And Limitations

The strength of the study lies in its utilization of validated tools and instruments like the ISMA stress scale. However, due to the use of cross-sectional design which does not account for cause-effect relationships careful interpretation of factors and determinants is required. Also, subjectively measuring family history, alcohol use and smokig status is likely to have caused an overestimation or underestimation of the true fact.

RECOMMENDATIONS/FUTURE DIRECTIONS

Owing to the findings of this research, diabetes patients should follow recommended dietary and behavioural protocols, and keep to their appointments as first line mechanisms for routine blood pressure checks. Similarly, government and non-governmental organziations should develop and implement effective, culturally acceptable health awarenes programs aimed at improving the knowledge base of diabetes patients as regards the dangers of developing other comorbid conditions. Also they should develop and roll-out poverty alleviation programs which will not only strengthen and enable diabetic patientsto extinguish distance as a driver for missed appointments, and improve health services through the establishment of accessible health facilities run by compassionate staff and fuly funded to offer services when/if required

CONCLUSION

Hypertension has continuously affected the human population, caused harm, and increased the rate of morbidity and mortality. Worse is its almost effortless combination with diabetes mellitus. This study showed that the prevalence of hypertension among diabetic patients was high. While this report is troubling, it is a call for the strengthening of efforts aimed at educating patients, thus enabling them to adopt healthy lifestyles and compliance with their medication, to avert end-organ complications known to increase morbidity and mortality.

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Authors Contribution

Jecinta Ekoji: Conceptualization, article drafting, data collection

Inumanye Ojule: Data collection, and article review and update

Meredith Chiwenkpe Asuru: Data analysis, interpretation, and article review and update

Conflict Of Interest

The researchers declare no conflicting interest

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This research was primarily funded by the researchers.

Ethical Considerations

Ethical clearance for the research was gotten from the University of Port Harcourt Research Ethics Committee (UPH/CEREMAD/REC/MM84/025) and University of Port Harcourt Teaching Hospital Ethics Committee (UPTH/ADM/90/S.II/VOL.XI/1399). Following the 1964 Declaration of Helsinki and its later amendments, only consenting patients were interviewed, privacy and confidentiality of patients' data were ensured by not collecting personal identifying information and making data available to only researchers. Also, voluntariness and beneficence to the participants was accounted for.

Data Availability

Not applicable owing to respondents' consent criterion.

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