# Trends in General Medicine

# Prevalence and Awareness of Hypertensive Retinopathy Among Hypertensive Adults in Southeast Nigeria

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# ABSTRACT

**Background:** Hypertension is a leading risk factor for cardiovascular disease worldwide. Low- and middle-income countries, including Nigeria, appear to be worst hit, with relatively higher number of cases and limited awareness, treatment, and control rates, in contrast with the trend in developed countries. The retina is the only site in the human body where blood vessels can be visualized directly with the help of an ophthalmoscope. Since hypertension has its effects on all the vessels of the human body, retinal examination and assessment of vascular changes can provide valuable information. Awareness of hypertensive retinopathy varies considerably in different regions and countries of the world.

**Method:** The study design was a hospital-based cross sectional descriptive survey of hypertensive adults aged 40 years and above, and of both sexes who were attending 21 health facilities in both urban and rural areas of Imo State, southeast Nigeria. The aim was to determine the prevalence and awareness of hypertensive retinopathy among the participants. Twenty one health facilities were sampled, with 382 participants.

**Results:** The prevalence of hypertensive retinopathy was 83.2% in the study, and was statistically significant (p=0.001). Awareness of hypertensive retinopathy stood at 20.7%, while 79.3% were unaware.

**Conclusion:** There is need for increased public health education to increase the awareness of hypertension and its complications. Hypertension control programmes need to be established in communities in the state, and more community-based screening programmes for cardiovascular disease risk factors and non-communicable diseases need to be carried out.

# Keywords

Hypertension, Damage Blood Vessels, Plasma Proteins.

# Introduction

Blood is distributed by the heart to all parts of the body through blood vessels, and blood pressure is created by the force of blood pushing against the walls of blood vessels (arteries) as it is pumped by the heart. Hypertension, also known as high or raised blood pressure, is a condition in which the blood vessels have persistently raised pressure. The higher the pressure, the harder the heart has to pump [1].

Hypertension (high blood pressure) by definition is when the pressure in the blood vessels is 140/90 mmHg or higher. The world health organization estimates that 1.28 billion adults aged 30-79 years worldwide have hypertension, with most of them (twothirds) living in low- and middle-income countries.1Hypertension (HTN) is a leading risk factor for cardiovascular disease (CVD) worldwide [2,3]. Low- and middle-income countries (LMICs), including Nigeria, appear to be worst hit, with relatively higher number of cases and limited awareness, treatment, and control rates, in stark contrast with the trend observed in developed countries [4,5]. An estimated 46% of adults with hypertension are unaware that they have the condition. Risk factors for hypertension can be modifiable or non-modifiable [1]. The modifiable risk factors include unhealthy diets (excessive salt consumption, a diet high in saturated fat and trans fats, low intake of fruits and vegetables), physical inactivity, consumption of tobacco and alcohol, and being overweight or obese. Non-modifiable risk factors include a family history of hypertension; age over 65 years and co-existing diseases such as diabetes or kidney disease.

If not detected and controlled, hypertension can damage blood vessels in multiple organs in the body, leading to complications like heart attack, stroke, heart failure, kidney disease or failure, vision loss, sexual dysfunction, and atherosclerosis [6]. In Nigeria, HTN is the most frequently diagnosed CVD risk equivalent, with HTN-related complications accounting for approximately a quarter of emergency admissions in urban hospitals [7,8]. The Nigerian population's mean blood pressure is higher than that of populations in Europe and the United States [9]. In a previous work [10], it was reported that one in four adult Nigerians is hypertensive and that HTN unawareness is a likely contributor to deaths from CVD in the country [11,12].

#### **Hypertensive Retinopathy**

The retina is the only site in the human body where blood vessels can be visualized directly with the help of an ophthalmoscope. Since hypertension has its effects on all the vessels of the human body, retinal examination and assessment of vascular changes can provide valuable information [13].

An acute, severe rise in BP is an important factor in the pathophysiology of hypertensive retinopathy. Normally, vasoconstriction occurs in response to an increase in BP. When there is a severe elevation of BP in a relatively short period of time, the autoregulatory mechanism fails, resulting in focal dilation of vessels and transmission of high BP to the endothelium. This mechanical stress damages the endothelium, causing increased vascular permeability, leakage of plasma proteins, and deposition of fibrinogen in vessel walls, thus activating mediators of intravascular coagulation and cell proliferation. It produces a vicious cycle of fibrin deposition and tissue ischemia, leading to fibrinoid necrosis of vessels [14].

Fundal findings in hypertension can be subdivided into three categories: hypertensive retinopathy, hypertensive choroidopathy, and hypertensive optic neuropathy [15,16]. Findings in hypertensive retinopathy include focal arteriolar constrictions and smooth muscle necrosis of the retinal arteries (which present prior to the more commonly observed retinal hemorrhages), infarctions, and exudations [15,16]. Early morphological changes are implicated in compromised retinal autoregulation, perpetuating the later manifestations of malignant hypertension [16].

Hypertensive choroidopathy is caused by functional loss of the choroid, resulting from fibrinoid necrosis of the choroid and ischemic necrosis of the retinal pigment epithelium (RPE) [17]. These physiologic alterations, which are caused in part by hyalinization of the short and long posterior ciliary arteries supplying the choroid, result in breakdown of the blood-retinal barrier and cause accumulation of sub-retinal fluid [17,18]. Severe choroidal dysfunction leads to RPE pump failure and resultant subretinal fluid accumulation with choroidal detachment and nonrhegmatogenous retinal detachment [18].

Functionally, unlike the retinal vasculature, the choroidal vasculature has few autoregulatory properties and is controlled primarily by the sympathetic nervous system. Hence, if elevated blood pressure overcomes the compensatory sympathetic response, it can damage the choroidal vasculature, whereas retinal vessels are able to tolerate much higher blood pressure while maintaining vascular tone because of autoregulatory mechanisms [19]. Other mechanisms behind this different pathophysiology are yet to be explored.

Optic nerve head swelling from hypertensive optic neuropathy manifests in the later stages of hypertensive retinopathy, with implications for high risk mortality if treatment is not initiated urgently and effectively [16]. Suggested etiologies include ischemia of the optic nerve head resulting in fluid accumulation and/or a result of significantly elevated systemic hypertension causing an increase in cerebrospinal fluid pressure and intracranial pressure leading to the appearance of hypertensive papilledema [16]. There is a documented association between optic disc swelling and high risk of patient death [20]. The three entities of retinopathy, choroidopathy, and optic neuropathy, are all manifestations of the hypertensive disease process. Coexisting involvement of these three tissue layers have implications that extend beyond the eye and warrant evaluation for acute intervention and possible hospital admission [21]. There are several grading systems for hypertensive retinopathy that have been proposed to classify its severity. The most widely cited is the Keith-Wagener-Barker [22] classification proposed in 1939 as follows:

#### Grade I: Mild generalized retinal arteriolar attenuation;

Grade II: Severe grade I and focal arteriolar attenuation (AV nipping);

Grade III: Grade II + Hemorrhages, hard exudates, cotton wool spots;

Grade IV: Grade III + Optic disc swelling.

Recently, Wong and Mitchell proposed a simplified grading system in 2017 [23] as follows:

Mild	1 or more of the following signs: generalized arteriolar				
	narrowing, focal arteriolar narrowing, arterio-venous				
	nicking, arteriolar wall opacity				
Moderate	1 or more of the following signs: retinal hemorrhage (blot-,				
	dot-, or flame-shaped), microaneurysm, cotton wool spot,				
	hard exudates				
Severe	Moderate retinopathy plus optic disc swelling				

#### **Awareness of Hypertension**

World-wide, approximately half of adults (46%) with hypertension are unaware they have the disease condition [24]. This level of awareness varies considerably in different regions and countries of the world. Generally, it is thought to be higher in developed countries, with level of awareness ranging between one-half (1/2) to two-thirds (2/3) of hypertensive patients when compared to between one-quarter (1/4) and one-half (1/2) in the developing nations [25]. The seemingly "quiet" nature of hypertension in most sufferers, contributes to the high level of unawareness among the affected subjects [26].

#### Methodology

**Study Design:** The study design was a hospital-based cross sectional descriptive survey that adopted qualitative and quantitative approaches to gathering data on the subject.

**Study Population:** The population of this study comprised hypertensive adults aged 40 years and above, of both sexes attending 21 health facilities in both urban and rural areas of Imo State, southeast Nigeria.

**Study Duration:** The study was done between January 2022 and September 2024.

**Sample Size Calculation:** The sample size determination is based on the Leslie-Kish formula [27] for prevalence studies:

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

A total of three hundred and eighty two (382) participants were thus recruited.

Sampling Method: Convenience sampling technique was adopted.

#### **Inclusion Criteria**

Adults of both sexes aged 40 years and above who were hypertensive patients of the health care facilities in Imo state who gave informed consent.

# **Exclusion Criteria**

- Individuals who were not willing to give informed consent
- Adults who are less than 40 years of age
- Non-hypertensives
- Hypertensive adults that have ocular conditions like cataract, corneal opacities which prevented good examination of the fundus.
- Patients with other disease conditions that can resemble hypertensive retinopathy, such as diabetic retinopathy, haematological disorders, HIV/AIDS retinopathy
- Pregnant hypertensive females

Data collection: Data was collected using these instruments:

- 1. Interviewer-administered semi-structured questionnaire
- 2. Accosson Spygmomanometer
- 3. Medical Records
- 4. Keeler direct Ophthalmoscope
- 5. Dilating eyedrop (Tropicamide)
- 6. Pen torch
- 7. Stationeries
- 8. Hand sanitizers
- 9. Stethoscope
- 10. Face masks
- 11. 1% Tropicamide

A combination of structured interview and clinical measurements/ assessments was used for data collection. The structured interview was conducted using a questionnaire that was administered by the researchers. The questionnaire was written in English. For participants who were not literate in the English language, it was translated into the local language by a linguistic expert. A pretest for standardization of the study instruments was carried out on 20 volunteers at a secondary health facility outside the study area. Contents of the questionnaire included socio-demographic characteristics of the subjects such as age, gender, marital status, educational level, occupation, questions relating to awareness of blood pressure status and certain risks factors for high blood pressure such as family history of hypertension, smoking, alcohol intake and sedentary lifestyle.

Twenty one health facilities were sampled, with 382 participants. Of the 382 participants, only 1 had incomplete data. Therefore, the sample size used was 381.

The procedure and purpose of the study was explained to the participants in a way they understood, and an informed written consent was obtained from them before any procedure was carried out on them. The procedure did not cause any harm to the participants. The participants did not make any financial contribution to the study. Funding of this study was the sole responsibility of the researcher. Visual acuity was assessed with Snellen's chart. Brachial blood pressure was measured with the manual sphygmomanometer. The anterior segment was examined with a pen torch, to rule out any gross anterior segment pathology and findings were entered into the data tool. The pupil(s) were dilated using plain Tropicamide 1% (one drop in each eye, repeated 3 times at 15-minute intervals). Fundus examination was performed in a semi-dark corner with a Keeler direct ophthalmoscope, with the patient in a reclining position. Hypertensive retinopathy was considered positive for the patient if suggestive retinal pathologies were seen in either or both eyes. Hypertensive retinopathy was classified according to Keith Wagener Barker (KWB) Grades.

**Ethical Considerations:** The study adhered to the tenets of the Helsinki declaration. Prior to commencement of the study, ethical clearance was obtained. Each consenting participant was free to withdraw at any stage and data collected from participants were kept confidential.

#### **Data Analysis Method**

Data collected was coded and entered into a data base using the International Business Machine (IBM) Statistical package for social science (SPSS) version 30.0 (Armonk, New York, USA). Data was validated by double entry and compared for missing values, and data entry errors. Any difference between the first and second file was reconciled by reviewing the questionnaire.

The result was presented in simple statistics. Data were given as frequency and percentages. Categorical variables were summarized as proportions and percentages. Comparison of variables was done using Chi-square; p values  $\leq 0.05$  was considered statistically significant.

#### **Results**

Table 1.0 shows the baseline demographic distribution of participants. A total of 381 persons participated in the study. Of this number, 192 (50.4%) were male while 189 (49.6%) were female.

Majority of the participants were in the age range of 51-60 years, accounting for 96 (25.2%). This was closely followed by those aged greater than 65 years, (77 - 20.2%) participants and by those aged 61-65 years (76 - 19.9%). Of the participants, those aged 46-50 years were fewer (58 [15.2%]), followed by the age range 40-45 with 74 (19.4%) participants.

Majority of the participants, 257 (67.5%) were married. Those who were either divorced or separated were 80 (21%), while those who were single accounted for 11.5%.

Majority of the participants were traders with 88 (23.1%) participants, followed by public servants who were 68 (17.8%), artisans 50 (13.1%), farmers 41 (10.8%), then retirees 32 (8.4%), healthcare professionals (7.3%) and others 4 (1.0%).

About half of the participants had post-secondary education (182 - 47.8%), while 130 (34.1%) had secondary education. Twenty five (6.6%) had no formal education, while 44 (11.5%) had only primary education.

While 145 (38.1%) of the participants lived in rural area, 80 (21%) lived in urban area. majority of the participants 156 (40%) were mixed dwellers.

Variable	Frequency	Percentage
Age		
40-45	74	19.4
46-50	58	15.2
51-55	48	12.6
56-60	48	12.6
61-65	76	19.9
>65	77	20.2
Gender		
Male	192	50.4
Female	189	49.6
Marital Status		
Single	44	11.5
Married	257	67.5
Separated/Divorced	80	21
Widowed		
Occupation		
Farmer	41	10.8
Artisan	50	13.1
Trader	88	23.1
School Teacher	56	14.7
Healthcare Professional	28	7.3
Community/Religious leader	14	3.7
Public Service	68	17.8
Retired	32	8.4
Others	4	1
Level of Education		
No formal Education	25	6.6
Primary Education	44	11.5
Secondary Education	130	34.1
Post-Secondary Education	182	47.8
Where have you lived most of your life?		
Rural	145	38.1
Urban	80	21
Mixed	156	40.9

**Table 2.0:** Prevalence of Hypertensive Retinopathy Grades Among the

 Study Population.

Hypertensive	Retinopathy		
Yes (%)	No (%)	Total (%)	X <sup>2</sup> p-value
0(0)	64 (100)	64 (16.8)	81.02 (0.001) <sup>s</sup>
150 (47.3)	0 (0)	150 (39.4)	
106 (33.4)	0 (0)	106 (27.8)	
36 (11.4)	0 (0)	36 (9.4)	
25 (7.9)	0 (0)	25 (6.6)	
	Hypertensive           Yes (%)           0(0)           150 (47.3)           106 (33.4)           36 (11.4)           25 (7.9)	Hypertensive Retinopathy           Yes (%)         No (%)           0(0)         64 (100)           150 (47.3)         0 (0)           106 (33.4)         0 (0)           36 (11.4)         0 (0)           25 (7.9)         0 (0)	Hypertensive Retinopathy           Yes (%)         No (%)         Total (%)           0(0)         64 (100)         64 (16.8)           150 (47.3)         0 (0)         150 (39.4)           106 (33.4)         0 (0)         106 (27.8)           36 (11.4)         0 (0)         36 (9.4)           25 (7.9)         0 (0)         25 (6.6)

<sup>s</sup>Chi square test

Table 2.0 shows the prevalence of hypertensive retinopathy among the study population. Three hundred and seventeen (317) participants, representing 83.2% of the study population had hypertensive retinopathy. This finding was statistically significant (p = 0.001). Grade 1 hypertensive retinopathy had the highest prevalence 47.3% (150), followed by grade 2 hypertensive retinopathy with 33.4% (106). Thirty-six participants, representing 11.4% of the study population had grade 3 hypertensive retinopathy, closely followed by grade 4 hypertensive retinopathy with 7.9% [25]. Retinopathy for each grade category was equal in both eyes.

<b>Table 3.0:</b>	Awareness	of Hyperte	ension and	its eye com	plications
				2	

Variable	Response					
Awareness of Hypertension and Its complications	Yes (%)	No (%)	Total (%)	X <sup>2</sup> p-value		
Yes	67 (21.1)	12 (18.8)	79 (20.7)	0.070 (0.79)		
No	250 (78.9)	52 (81.3)	302 (79.3)			
If yes, level of aware	ness?					
High	16 (23.9)	4 (33.4)	20 (25.3)	5.05 (0.08)		
Low	43 (64.2)	4 (33.3)	47 (59.5)			
Average	8 (11.9)	4 (33.3)	12 (15.2)			
If yes, what is the source of awareness?						
Health worker	45 (67.2)	8 (66.7)	53 (67.1)	10.74 (0.013) *		
Internet	4 (6)	4 (33.3)	8 (10.1)			
Colleagues	4 (6)	0 (0)	4 (5.1)			
Seminar/Workshop	14 (20.9)	0 (0)	14 (17.7)			
Are you aware that hypertensive retinopathy is caused by elevated blood pressure?						
Yes	56 (83.6)	12 (100)	68 (86.1)	2.29 (0.13)		
No	11 (16.4)	0 (0)	11 (13.9)			
Are you aware that	hypertension	can cause c	hanges in vis	ion		
Yes	56 (83.6)	12 (100)	68 (86.1)	2.29 (0.13)		
No	11 (16.4)	0 (0)	11 (13.9)			
Are you aware that hypertension can cause blindness?						
Yes	56 (83.6)	12 (100)	68 (86.1)	2.29 (0.13)		
No	11 (16.4)	0 (0)	11 (13.9)			

Table 3.0 depicts the questions analysed in the questionnaire for awareness of retinopathy. Of the 381 participants, 79 (20.7%) were aware of hypertension, while 302 (79.3%) were not aware of hypertension (see Figure 1.0 below). Those that were aware of hypertension were asked to grade their level of awareness into low, intermediate and high level of awareness. Forty-seven (59.5%) had low level of awareness, 12 (15.2%) had average level of awareness, while 20 (25.3%) had high level of awareness. Of those who were aware of hypertension, 53 (67.1%) heard it from health workers. 14 (17.7%) from seminars or workshops, 8 (10.1%) from internet, while 4 (5.1%) heard it from their colleagues. Sixty-eight (86.1%) were aware that hypertension could cause reduction in vision and blindness, while 11 (13.9%) were unaware it could lead to blindness.



Figure 1: Percentage awareness and unawareness of hypertension and its complications.

#### Discussion

In this study, the prevalence of hypertensive retinopathy among the study population was very high, 83.2% (317). Grade 1 hypertensive retinopathy had the highest prevalence of 57%. Other studies in India [28], and Iran [29] found prevalences of hypertensive retinopathy of 30.6% to 33.9%. In a study performed in 2001 on 800 hypertensive patients, the prevalence of grade 1 and grade 2 retinopathies among hypertensive patients was 46%and 32%, respectively, and only a few patients (<2%) showed grade 3 and grade 4 abnormalities [30]. In our study we have also found similar result, grade 1 hypertensive retinopathy had the highest prevalence (53%) while grade 4 hypertensive retinopathy had the lowest prevalence (7.9%).

A prevalence of 30% was noted in Tanzania, in Africa [31]. The high prevalence of hypertensive retinopathy in this study could be attributed to lack of awareness of the ocular complications of hypertension.

In a review of 407 patients with retinal diseases in Ile-Ife (Southwest) by Onakpoya et al. [32], hypertensive retinopathy was responsible for 12% of cases. In Ibadan, hypertensive retinopathy is the 9th commonest cause of retinal diseases and responsible for 4.6% of cases [33]. It is also responsible for 7.7% of all retinal/optic nerve disorders and 0.1% of ocular disorders in a rural community in northern Nigeria. In Enugu (South East), hypertensive retinopathy is responsible for 13% of vitreo-retinal diseases in a tertiary healthcare facility [34]. Emerging data from hospital studies show that hypertension or its complications is the commonest NCD in Nigeria [35]. In 1961, hypertension related illnesses contributed to 8.8% of all medical admission in Lagos [36]. Abengowe et al. [37] reported 9.3% in Kaduna in 1980. Recent data from the country indicated a rate of 28% in Port-Harcourt [36] and 21% in Benin City [38].

The awareness of hypertension status among hypertensives in this study was 20.7%. In a review35 of studies on hypertension in Nigeria over five decades in terms of prevalence, awareness and treatment and complications, hypertension awareness ranged from 3.5% in Sokoto to 30% in Nsukka [39-43]. There was no remarkable gender difference. In a systematic review44 of 53 studies (covering a population of 78,949 Nigerians) on the prevalence of HTN in Nigeria, hypertensive awareness (expressed as a percentage of HTN cases in the country) increased to 29% compared to a previously pooled awareness rate of 17.4% [10]. This rate was noted to be higher than rates recorded in some other African countries (Gabon, Uganda, and Kenya), which ranged from 9% to 12% [9,45]. Heterogeneity across studies was noted to be high, reflecting variations in population structures, blood pressure measurement protocols, and overall study designs. However, an awareness rate of 77.7% was observed in a study in Cameroun [46]. This study [47] had a relatively fewer number of participants, despite being a population based study, and this could have accounted for the higher awareness figure observed. Our rate of 20.7% was higher than that observed in Enugu (7.2%)[48], southeast Nigeria. The awareness rate observed in our study

may be reflective of the heterogenous nature of our participants in terms of gender, urban versus rural dwelling, occupation, marital status, level of education, etc. It may also be explained by the fact that being a hospital-based study, most of the patient are likely to have better health seeking behavior. Overall, more work needs to be done in curbing the morbidity and mortality associated with hypertension.

#### Conclusion

The prevalence of hypertensive retinopathy in this study was 83.2%. An awareness level of 20.7% was also observed. The government should strengthen primary health services all over the state to enable universal access to health care. Additionally, there is a need to encourage health promotion in the population as a means of primary prevention. There is also a need for increased public health education to increase the awareness of hypertension and its consequences. Hypertension control programmes need to be established in communities in the state, and more community-based screening programmes for cardiovascular disease risk factors and NCDs need to be carried out. Lastly, health workers should also use every contact with a patient to screen for hypertension.

# Limitations of the Study

This study was a hospital-based study and as such, the findings cannot be extrapolated to the general population.

Most of the responses were subjective. An objective assessment will give a clearer picture.

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