Original

Prevalence of Hypertension across Geopolitical Zones in Rivers State Residents

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Abstract

Background: Hypertension, the leading cause of cardiovascular diseases and death globally, is significantly influenced by environmental factors. Despite numerous studies on the state and regional prevalence of hypertension, few have examined these statistics among different ethnic groups within cities. This study aims to assess the prevalence of hypertension across geopolitical lines in the same resident.

Method: This two-year cross-sectional study in Rivers State, aimed at assessing hypertension prevalence among various geopolitical zones. Individuals aged 18 and above had their blood pressure measured. Trained interviewers collected demographic information, anthropometric measurements, and blood pressure readings. Hypertension was defined according to the 2013 guidelines of the European Society of Hypertension/European Society of Cardiology. Descriptive statistics and subgroup analyses were used to summarize and explore variations in hypertension prevalence across different communities and geopolitical zones. Ethical approval was obtained, informed consent was received, and participant confidentiality was maintained throughout the study.

Results: One thousand, one hundred and sixteen people (1116) participated in the survey. 469(42.06%) males. The overall prevalence of hypertension in the study population was 30.7%. The prevalence was higher in the urban community 35.17, in indigenes from the south-south geopolitical zone 33.97%, in the males 33.5%, and in the married population 35.04%.

Conclusion: The etiology of hypertension is multifactorial, place of residence and interplay with ethnicity, may be as crucial as ethnicity and genetics. Notable differences were observed among rivers state residents from South-Eastern zone compared to those in their native states, suggesting the role of diet, lifestyle, and social factors.

Keywords: Hypertension, Geopolitical Zones, Prevalence, Rivers State, Urban, Rural.

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Introduction

Rivers State, located in the South-South geopolitical zone of Nigeria, has become a significant destination for internal migration. Several factors contribute to this trend, including economic opportunities, educational institutions, and healthcare facilities.

Rivers State, with a total population of approximately 7,492,366 in 2023, is the 7th most populous state in Nigeria.[1] The population is distributed between urban and rural areas, with a significant portion residing in urban centers like Port Harcourt. The rural areas, while less densely populated, contribute to the state's diverse demographic and cultural landscape.[1]

Rivers State serves as a hub for oil and gas activities, hosting numerous multinational companies, refineries, and petrochemical industries. Job opportunities in these sectors draw people from neighboring states and beyond, contributing to its cosmopolitan character. Modern infrastructure, including airports, seaports, and well-connected road networks, further enhances its appeal.[1,2]

Moreover, Rivers State is an educational hotspot, home to University of Port Harcourt, Rivers State University and Ignatius Ajuru University of Education, and research centers. Its cosmopolitan nature fosters cultural exchange, attracting individuals from diverse backgrounds. Access to good healthcare facilities, shopping centers, restaurants, and recreational spaces has made it a haven for both indigenes and non-indigenes. The exact percentage of indigenes versus non-indigenes can varies.[2,3]

The prevalence of hypertension in Nigeria varies across different studies. A meta-analysis of community-based studies conducted between 1980 and 2013 revealed an overall prevalence of approximately 28.9%, using a blood pressure cutoff of ≥140/90 mmHg. This prevalence can be further categorized into urban (30.6%) and rural (26.4%) populations.[4]

Interestingly, Nigeria's geopolitical zones exhibit significant variations in hypertension rates. The South-South zone stands out with a relatively higher prevalence.[5] Several factors contribute to this disparity: namely genetic predisposition, diet; traditional diets in this region often include high salt intake, which can elevate blood pressure. Furthermore urbanization, stress, and sedentary lifestyles contribute to hypertension. More environmental factors include exposure to pollution, industrial activities, and lifestyle changes may impact blood pressure.[6,7]

The South-West Geopolitical Zone also reports a relatively high prevalence of hypertension, accounted for by factors like urbanization. Lagos for example (in the South-West) experience rapid urban growth, leading to lifestyle changes and increased stress[8,9]. Diets of residents are rich in processed foods, high salt content, and low potassium contribute to hypertension. Also, sedentary lifestyle and rising obesity rates in urban areas are associated with hypertension.

The South-East zone shows a lower prevalence of hypertension compared to the South-South and South-West. Traditional diets in this region emphasize plant-based foods[10-12], which may have protective effects against hypertension. Active lifestyles and engagement in physical labor may contribute to better blood pressure control. Cultural norms related to food preparation and consumption may also influence health outcomes.

The northern zones; North-Central, North-East, and North-West Geopolitical Zones: generally, report lower prevalence of hypertension[13-16]. Diets in these regions often include whole grains, legumes, and less processed foods. Genetic variations may play a role.

Living in a different city from your indigenous community can indeed influence blood pressure, and the impact can be multifaceted[16-20]. Ethnicity and environmental factors intersect to affect the prevalence of hypertension: Ethnicity plays an important role in determining susceptibility to hypertension. Certain genetic variations are more common in specific ethnic groups, affecting blood pressure regulation, in addition, there is a variability in salt sensitivity across ethnic groups, some exhibit greater sensitivity to dietary salt (sodium), furthermore, Renin-Angiotensin System is influenced by genetic differences which regulates blood pressure.

On the other hand, moving from a rural to an urban environment often involves lifestyle shifts.[21-24] Urban areas usually have higher stress levels, sedentary lifestyle as urban dwellers may engage in less physical activity. Ready access to processed foods high in salt and unhealthy fats can impact blood pressure. These factors collectively contribute to higher hypertension prevalence in urban settings.
Remotely but worthy of note are social factors associated with hypertension Urban living can lead to social isolation, affecting mental health and stress levels. Research suggests that social isolation can negatively impact mental health and increase stress levels, both of which are factors in regulating blood pressure. Social

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connections play a crucial role in maintaining cardiovascular health.[25] For instance, studies have shown that when individuals move from highly segregated neighborhoods—which often suffer from poverty and lack of resources—to less segregated, more resource-abundant areas, there is a measurable improvement in their blood pressure. Specifically, this change can lead to a modest yet significant reduction in systolic blood pressure among Black adults.[26,27] This highlights the interconnectedness of social environments and physical health, showing that improvements in social conditions can directly benefit cardiovascular health.

Combining genetic insights with lifestyle modifications and addressing environmental factors is crucial for effective hypertension management. both ethnicity and environmental factors significantly influence hypertension prevalence. Understanding these interactions can guide public health efforts to reduce disparities and promote better cardiovascular health.
The study set out to assess differences in the prevalence of hypertension across geopolitical zones in Residents of Rivers State relative to values from the different geopolitical zone.

Method

Study Design

This prospective cross-sectional community-based study, set out to assess the prevalence of hypertension among participants from different geopolitical residing in Rivers State, Nigeria. The study spanned a two-year period.

Sample Size

The sample size for estimating the prevalence of hypertension in Rivers State.[28]
Given parameters:

- Population size (N): 5,198,716
- Prevalence of hypertension (p): 30% (expressed as 0.30)
- Confidence level (α): 95% (expressed as 0.95)
- Margin of error (e): 5% (expressed as 0.05)

We can use the formula for sample size calculation:
[n = \frac{{Z^2 \cdot p \cdot (1 - p)}}{{e^2}}]
where:

- (Z) is the standard normal distribution value corresponding to the desired confidence level (for a 95% confidence level, (Z = 1.96)).
- (p) is the estimated prevalence of hypertension.
- (e) is the margin of error.

Let's compute the sample size:

[n = \frac{{1.96^2 \cdot 0.30 \cdot (1 - 0.30)}}{{0.05^2}}]
[n \approx 385]
the recommended sample size for estimating hypertension prevalence in Rivers State is approximately 385.

Participant Selection

Participants were recruited from various mobile clinics operating in different communities across Rivers State. Careful consideration was given to ensure representation from both rural and urban areas. The rural communities included Ahoada, Emuohia, Egbellu Ozodo, Etche, and Dighriga in Abua, while the urban communities were Npkolu, Mgbuoba, Onne, Rumuodumaya, Rumosi, and Rumuekini

Inclusion Criteria

Individuals aged 18 years and above were eligible for inclusion.
Participants were required to have their blood pressure properly measured using a well-calibrated Aneroid sphygmomanometer.

Data Variables Collected

Data was collected by trained interviewers comprising of medical personnel, into a data entry proforma. The following data variables were collected for each participant:
Demographic Information: Age, Sex, Marital status, Occupation, Original geopolitical zone (from where they moved to Rivers State)
Anthropometric Measurements: Weight, Height, Body mass index (BMI) calculated using weight and height
Blood Pressure Measurements: An average of two blood pressure readings was obtained for each participant. Hypertension was defined according to the 2013 guidelines of the European Society of Hypertension/European Society of Cardiology: Systolic blood pressure (BP) ≥ 140 mmHg, Diastolic BP ≥ 90 mmHg and lower values in patients who reported treatment of hypertension using antihypertensive medications.[28]

Statistical Analysis

Descriptive statistics were used to summarize demographic characteristics, anthropometric measurements, and blood pressure values. Prevalence rates of hypertension were calculated based on the defined criteria. Subgroup analyses were performed to explore variations across different communities, rural/urban settings, and geopolitical zones.

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Ethical Considerations

The study adhered to ethical guidelines, Ethical approval was obtained from the elders and the Community Development Cooperation Chairpersons, informed consent was received from all participants. Confidentiality of participant information was maintained throughout the study.

Results

A total of 1,116 individuals participated in the mobile clinic across different communities in Rivers: 54.5% of these individuals resided in rural areas, while 45.5% lived in urban communities. The rural communities included Ahoada, Emuohia, Egbellu Ozodo, Etche, and Dighriga in Abua, while the urban communities were Npkolu, Mgbuoba, Onne, Rumuodumaya, Rumosi, and Rumuekini. Twenty states were captured in this study from five major geopolitical zones: South South (70.7%) South-East (24.6%) South West, North Central and North West. (see Table 3 Below).

The female population accounted for 58.1% were females, with 78.7% of the individuals married. 20.3% were single and a small percentage (1.1%) were widowed. Table 1 below shows.

The mean values of their clinical parameters (Table 1) with age as 43.30 ± 15.62 years, the mean BMI was 26.16 ± 5.61kg/m², mean systolic blood pressure is 131.37 ± 24.40 mmHg, the mean diastolic blood pressure was 80.30 ± 13.56 mmHg. mean blood sugar level was 6.51± 3.46 mmol/L.

Table 1: Cardiovascular Parameters of Study population

Variables	Mean ± SD
Age	43.30 ± 15.62
BMI	26.16 ± 5.61
SBP	131.37 ± 24.40
DBP	80.30 ± 13.56
Blood Sugar	6.51 ± 3.46

A comparison of variables between males and females showed that the mean age for both groups was approximately 43.30 ± 15.62 years, with no statistically significant difference in age. The mean BMI was 26.16 ± 5.61 kg/m², with females having a significantly higher BMI than males. The mean systolic blood pressure (SBP) was 131.37 ± 24.40 mmHg, with females exhibiting significantly higher SBP compared to males. Conversely, males had slightly higher diastolic blood pressure (DBP) than females, and this difference was also statistically significant. The mean blood sugar level was 6.51 ± 3.46 mmol/L, with no significant difference between males and females. The prevalence of hypertension in the study population was 30.7% with prehypertension (individuals with a systolic BP of 120 to 139 mm Hg or diastolic BP of 80 to 89 mm Hg) 27%. The prevalence was higher in the urban community (35.17%) against the rural community (27.14%), in the south-south geopolitical zone (33.97%), in the males (33.5%), and in the married population (35.04%) see Table 5.

Table 2: Descriptive Statistics of Hypertensive Population

Variable	Mean ± Std. Deviation (units)
Age	52.15 ± 15.34 (years)
BMI	27.36 ± 6.21 (kg/m²)
SBP	160.09 ± 20.75 (mmHg)
DBP	91.20 ± 14.82 (mmHg)
Blood Sugar	6.81 ± 3.52 (mmol/L)

Table 3: Demographic Characteristics and Hypertension status

Category	Frequency	Percent%	Hypertensives (%)
Hypertension	343	30.7	
Normotensives	472	42.3	
Prehypertension	301	27.0	
Community Type			
Rural	508	45.5	27.14
Urban	608	54.5	35.17
Geopolitical Zones			
North Central	17	1.5	17.65
North West	1	0.1	-
South East	274	24.6	22.26
South South	789	70.7	33.97
South West	35	3.1%	31.43
Sex			

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Category	Frequency	Percent%	Hypertensives (%)
Female	648	58.1	28.70
Male	468	41.9	33.55
Marital Status			
Married	878	78.7	35.04
Single & widowed	238	20.3	14.71
Widow	12	1.1	
Total	**1116**		

Table 4: Demographics Comparison of Hypertensive Vs. Non-Hypertensive Population

Variables	Mean ± Std. Deviation (units)	T	Df	Sig. (2-tailed)
AGE(Hypertensives) –AGE (non-hypertensives)	14.31 ± 20.05 (years)	11.42	255	0.00
BMI(Hypertensives) - BMI (non-hypertensives)	2.18 ± 8.11 (kg/m²)	4.78	316	0.00
SBP(Hypertensives) - SBP (Non-hypertensives)	48.81 ± 23.03 (mmHg)	39.08	339	0.00
DBP(Hypertensives) - DBP (Non-hypertensives)	16.81 ± 18.06 (mmHg)	17.17	339	0.00
BLOOD SUGAR(Hypertensives) - BLOOD SUGAR (non-hypertensives)	0.67 ± 4.37 (mmol/L)	1.88	148	0.06

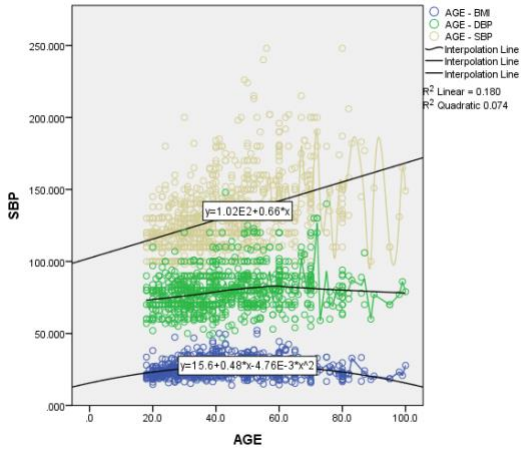

Figure 1: A plot of Age against BP, BMI

Discussion

The study recruited a population of 1116 residents in Rivers State from the rural and the urban communities. The high population of Rivers State indigenes is expected, and the population of South Easterners goes to show the string marital and trade ties that exist between the Rivers State indigenes and neighboring states.

A higher percentage of women attended the mobile clinics buttresses the fact that women have a better health seeking attitude relative to me. Through life women are pruned to be more conversant and comfortable with the hospital and healthcare facilities as childbirth compels them to be. From the population studied there were no significant differences in age, between the males and females. Women however had significantly higher systolic blood pressures than their male counterparts while the males showed significantly higher diastolic blood pressure. Most studies have reported higher blood pressures in men.[30] The higher BMI in the female relative to male s may account for these differences.

The age and body mass indices were significantly higher in the hypertensive population, relative to the non-hypertensive group. Age and obesity are established risk factors for hypertension. However, there was no significant difference in blood glucose between the hypertensive and non-hypertensive population.

The index study gave a general prevalence of hypertension for Rivers State residents as 30.7%, with a higher prevalence amongst the males, married and residents from urban communities. Across geopolitical zones the Rivers State residents from the South-South geopolitical zone (33.97%) had the highest prevalence for hypertension, followed closely by the prevalence of hypertension amongst the residents from the South West geopolitical Zones (31.43%) and South East (22.26%). The prevalence was also higher in the males, married and residents from urban communities.

Rivers State has recorded a significant increase in the prevalence of hypertension from 8.5% in 1995 to 32.5% in 2020 highlighting the impact of hypertension on the region.[5] A 2023 study among company workers in Rivers State reported a hypertension prevalence of 33.4%[31].

The Index Study gave general prevalence of hypertension among Rivers State residents as 30.7%.

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This is slightly lower than the 2023 study's 33.4% among company workers, suggesting a higher prevalence in this specific occupational group. However, it is comparable with the 1995-2020 study, which gave a hypertension prevalence of 32.5% by 2020, which is comparable to the index study's findings. These comparisons indicate a consistent and concerning trend of high hypertension prevalence in Rivers State, underscoring the importance of ongoing public health interventions and research.

Though previous studies have not explored the prevalence of hypertension across geopolitical zones using one location or residents in a state, it's important to note that the prevalence of hypertension amongst the South - South geopolitical zone (Akwa Ibom, Cross Rivers, Delta State, Edo State and Rivers State) has been studied in various research efforts. A systematic review published in 2015 reported that the prevalence of hypertension in the South-South zone ranged from 16.4% to 47.2%[32] depending on the specific population and diagnostic criteria used and a 2017 nationwide survey found that the age-standardized prevalence of hypertension in the South-South zone was 38.1%, this is higher than 33.9% seen in the index study, however. there was no age standardization in the index study. In addition, index study assessed hypertension amongst residents of Rivers State across geopolitical zones, while the nationwide survey assessed residents in the respective states of the geopolitical zones. This may go to explain the place of environmental factors like available diet, exposure and other factors contribute to the development of hypertension. The index study provides valuable insights into the prevalence of hypertension for Rivers State residents from different geopolitical zones in Rivers State. It shows that hypertension is more prevalent amongst residents from the south-south and south-west states, which could be attributed to various factors such as ethnicity, lifestyle, diet, and environmental factors.

Residents of Rivers State from the South South region exhibited higher blood pressure readings and tended to be older, suggesting a potential correlation between age and hypertension in this area. This finding highlights the importance of considering age as a significant factor in hypertension prevalence within this population.

Interestingly, the body mass index (BMI)(Fig. 4) was similar across all geopolitical zones, indicating that BMI may not be a significant differentiating factor in hypertension prevalence in these regions. This suggests that other factors, such as genetic predisposition, lifestyle choices, and environmental influences, might play a more critical role in the development of hypertension in this study population.

Further research is needed to explore these factors in greater detail, particularly how age and other non-BMI-related factors contribute to hypertension. Understanding these nuances can help in developing targeted interventions and public health strategies to effectively manage and reduce hypertension in diverse populations.

In the South-Eastern states of Nigeria, which include Abia, Anambra, Ebonyi, Enugu, and Imo, several studies have examined the prevalence of hypertension. Notably, an Abia State study reported a prevalence of 31.0%[32], while an urban community study in Imo State found a higher percentage of hypertension with 56.9% in males and 48.0% in females.[33] However, another figure for a rural community in Imo State had a lower prevalence of 27.6%.[34] Another study from a different eastern rural community in Enugu State reported a similar prevalence rate of 27.6% for hypertension,[35] and a study from different communities in Anambra State yielded a prevalence of hypertension as 22.81%.[36]

Interestingly, the index study revealed the prevalence of hypertension for southeasterners residing in Rivers State of 22.26%. Although this figure is lower than Abia State's prevalence and the urban population in Imo State, it aligns more closely with the rural Imo State population and the figures observed in Enugu and Anambra. It is important to note that many of the south-eastern participants in the index study were from Imo and Abia states, with only a small representation from Anambra and Enugu. Given the relatively lower prevalence of hypertension among Imo State and Abia State indigenes residing in Rivers State, it becomes essential to explore environmental factors, change in diet and the place of social factors like acceptance and inclusiveness that may contribute to these variations across the eastern states.

A previous study[37] showed a variation amongst the Southwestern, Nigerian population with highest crude prevalence of hypertension amongst the Ikire (38.6%), and the least amongst the Opok at 20.4%. the index study recruited only a small proportion of its population (31) from Southwestern geopolitical zone, however the prevalence of hypertension seen in the study population at 31.43% falls within the range from the southwestern geopolitical zone. Further buttressing the fact that hypertension is a significant health concern in the South-West region of Nigeria and perhaps suggesting that

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south westerners are not so adaptive to new environments in diet and perhaps other lifestyles.

Marriage, male sex, and urban dwelling all play a role in hypertension prevalence, but the specific mechanisms are multifaceted. Research suggests that married individuals tend to have better health outcomes, including lower blood pressure, compared to unmarried individuals.[38] Social support, companionship, and shared responsibilities within a marriage may contribute to stress reduction and healthier lifestyle choices, which can impact blood pressure. However, the Nigerian economy has had a significant impact on marriages resulting in delayed and late marriages, age has been associated with marriage and the economy further impacts as poor socioeconomic status poses a threat to most homes and is an important stressor. Males generally have a higher prevalence of hypertension compared to females. Urban areas often have higher stress levels, sedentary lifestyles, and increased exposure to pollution. These factors can elevate blood pressure and contribute to the higher prevalence of hypertension in urban populations.

Implications of the findings of this study

The findings of the study will stimulate interest in peculiar environmental factors that both either ameliorate or cause hypertension and also a closer look at the socio-cultural practices that may contribute to the high prevalence of hypertension in our various communities.

Strengths and Limitations of the Study

One of the strengths of this study is its diverse sample population, which included participants from various rural and urban communities across Rivers State. This broad representation enhances the generalizability of the findings. The prospective cross-sectional design provides a snapshot of hypertension prevalence, allowing for the identification of current trends and potential risk factors. Additionally, the geopolitical focus of the study highlights regional differences and potential cultural or environmental influences on hypertension, offering valuable insights for targeted interventions. The study also collected extensive data, including demographic information, anthropometric measurements, and blood pressure readings, providing a thorough understanding of the participants' health profiles.

However, the study has limitations. Despite the calculated sample size of 385, the actual population recruited was 1116, with a relatively small representation from some geopolitical zones, which may limit the ability to draw definitive conclusions for these groups. The cross-sectional design does not establish causality, necessitating longitudinal studies to determine cause-and-effect relationships between hypertension and various risk factors. Finally, while the study explores the influence of ethnicity and place of residence, it does not delve deeply into other potential contributing factors, such as genetic predispositions or specific environmental exposures, which could provide a more comprehensive understanding of hypertension etiology.

Conclusion

The etiology of hypertension is multifactorial, with significant factors including place of residence and its interplay with ethnicity. These factors may be as crucial as ethnicity and genetics in understanding hypertension. Therefore, it is essential to explore how these elements affect hypertension and incorporate them into our strategies to combat the condition.

Notable differences were observed among residents of Southeastern Rivers State compared to those from other southeastern states. Factors such as diet, lifestyle, and social aspects like inclusiveness and acceptance may contribute to these variations. Additionally, the relatively small population size in this study remains a limitation and may explain the lower values observed. Further research with larger sample sizes is needed to better understand these influences and develop more effective interventions.

Declarations

Ethical Consideration: Approval was received from all the community leaders and Community Development Chairmen and consent received from all participants.

Authors' Contribution: The lead author conceptualized the topic; other authors were involved in the funding and development. All authors read through and agreed on the final copy for submission.

Conflict of interest: Authors declare no conflict of interest

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