

Research Article

# Understanding the Influence of Psychosocial Factors and Multimorbidity on Patient Outcomes in Severe Hypertensive Patients Attending Health Institutions in Southeastern Nigeria

Sylvia Oluchi Nwaike<sup>1,\*</sup> , Ebenezer Obi Daniel<sup>2</sup> , Sheriff Lamidi<sup>3</sup>,  
Michael Olabode Tomori<sup>1</sup>, Michael Avwerhota<sup>4</sup>, Israel Olukayode Popoola<sup>5</sup>,  
Adebanke Adetutu Ogun<sup>6</sup>, Aisha Oluwakemi Salami<sup>1</sup>, Olukayode Oladeji Alewi<sup>1</sup>

<sup>1</sup>Department of Public Health, Texila American University, Georgetown, Guyana

<sup>2</sup>Department of Public Health, Swansea University, Swansea, United Kingdom

<sup>3</sup>Department of Epidemiology and Medical Statistics, College of Medicine, University of Ibadan, Ibadan, Nigeria

<sup>4</sup>Department of Public Health, Atlantic International University, Hawaii, United States of America

<sup>5</sup>Department of Epidemiology and Community Health, University of Ilorin, Ilorin, Nigeria

<sup>6</sup>Department of Policy, Governance, Liaison, and Support, International Organization for Migration, Abuja, Nigeria

## Abstract

Hypertension is a prevalent problem worldwide and it is an important risk factor for a variety of health conditions. Severe hypertension (180+ systolic or 110+ diastolic) is associated with a two-fold increase in relative risk of death. Interventions to date fail to achieve sustained improvement in blood pressure, particularly in regional areas of high social disparity. Growing evidence points to multiple psychological, social and morbidity factors as contributors to the onset of and trajectory of hypertension. The main objective of this study is to examine the association of psychosocial factors and multimorbidity with response to treatment and treatment outcomes in the management of severe hypertensive patients providing additional knowledge and recommendations to improve their quality of care. We conducted cross-sectional research, using interview self-administered semi-structured questionnaires. Data collected was transcribed, coded, and analyzed thematically. Findings were presented in tables, charts, and in narrations as appropriate. Results: There was a significant association between age of the patients and response to treatment in severe hypertension. Overweight/obesity was noted to be significantly associated with response to treatment. In this study, the burden of psychosocial factors and multimorbidity's in the management of severe hypertension is highlighted. There is a need for effective monitoring and surveillance to monitor progress in reducing the prevalence of severe hypertension and in increasing the awareness for the treatment and management of hypertension.

## Keywords

Psychosocial Factors, Multimorbidity, Severe Hypertension, Treatment Outcome

\*Corresponding author: [nwaikesylvia@gmail.com](mailto:nwaikesylvia@gmail.com) (Sylvia Oluchi Nwaike)

Received: 5 April 2024; Accepted: 18 April 2024; Published: 10 May 2024



Copyright: © The Author(s), 2024. Published by Science Publishing Group. This is an **Open Access** article, distributed under the terms of the Creative Commons Attribution 4.0 License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## 1. Introduction

Hypertension is a prevalent cardiovascular long-term condition worldwide and is associated with a high rate of multimorbidity and psychosocial factors. Multimorbidity (MM) increases with age, ethnicity, and social deprivation. Previous studies have yielded conflicting findings as regards the relationship between multimorbidity and blood pressure control. [1] Hypertension (HTN) is the single most crucial factor driving the high rates of CVD-related mortality and health care expenditures [2] While research shows that its management is improving, we still lack a comprehensive understanding of the factors that contribute to the disease onset, trajectory of progression and patient outcomes. A significant body of evidence supports the role of psychosocial factors (i.e., occupational stress) as primary risk factors for HTN. [2] As a result, Hypertension guidelines recommend psychosocial intervention to prevent or delay the onset of HTN. [3]. The prevalence of comorbidity among people with hypertension is more common than those individuals with a normal blood pressure. [4] Multimorbidity is a frequent and important factor to consider as it results in the increasing complexity of care associated with severe hypertension requiring more complex strategies to achieve effective care.

Previous studies have examined few psychosocial factors, which limits the ability to fully capture the extent to which psychological conditions predicts BP outcomes [5] In a study conducted, psychosocial and socioeconomic factors, as well as physical factors, is said to influence blood pressure control in moderate and severe essential hypertension. [6] Previous studies have yielded conflicting findings about the relationship between MM and blood pressure (BP) control. [1, 7] Hypertension is the single most important factor driving the high rates of cardiovascular disease (CVD)-related mortality and health care expenditures [8] There is no doubt that hypertension has a complex multifactorial aetiology, involving genetic factors, dysfunction in a few biochemical and physiological regulatory processes, and lifestyle factors including diet, physical exercise, and body weight. Psychosocial factors must be placed within this broader context and can be seen as part of the risk profile of the individual. [12]

Although the aetiology of hypertension has been widely studied during the last decades, it remains far to be completely understood, as it results from a complicated interaction of genetic and several environmental risk factors. Furthermore, the development of HTN is associated with several demographic, lifestyle, and psychosocial variables [13, 14] Risk factors, such as psychosocial ones and mental disorders, have also been investigated by several authors, nevertheless the relation with HTN results less clear and, sometimes, controversial [15-17] While research shows that HTN management is improving, we still lack a comprehensive understanding of the factors that contribute to the disease onset, trajectory of

progression and patient outcomes. Despite evidence on the effectiveness of lifestyle measures and antihypertensive medication, hypertension management remains challenging [10] Understanding of the complexity in managing hypertension demands a comprehensive approach considering the individual, and structural factors and how their interaction affects patients. [11] This study sought to evaluate the association between psychosocial factors and multi-morbidities and how it affects the treatment outcomes in severe hypertensive patients.

## 2. Methods

### 2.1. Study Setting

This research was conducted in two tertiary health institutions in Enugu state, South-eastern Nigeria. For this study, the University of Nigeria Teaching hospital and the Enugu state University Teaching hospitals were used. Enugu State is considered the heart of Igboland, the cultural region of south-eastern Nigeria and is noted to have the tenth highest Human Development Index in Nigeria.

### 2.2. Data Collection Methods

This study employed a hospital based comparative cross-sectional study. Data collection was done using Interviewer-administered semi-structured questionnaires which was completed by the respondents.

### 2.3. Study Participants

The study population comprised of patients attending the cardiology outpatient clinic with focus on hypertensive patients and particularly those with severe hypertension in both hospitals.

### 2.4. Sampling Frame

A two-stage sampling technique was used. The rationale for using this sampling method was to ensure the right study participants in both tertiary institutions were recruited for the study. Sampling size determination was carried out using an appropriate formula for estimating the sample size. The first stage was stratified sampling and in the second stage, simple random sampling technique was used in the selection of participants. The selection of participants was from patients attending the cardiology outpatient department of both tertiary hospitals during the study duration making a total of 733 participants as highlighted in Table 1.

**Table 1.** Number of respondents by Tertiary hospital.

Stage One	UNTH Cardiology outpatient Hypertensive patients (Feb-May 2023) Classification into mild, moderate, severe.		ESUSTH Cardiology outpatient Hypertensive patients (Feb-May 2023) Classification into mild, moderate, severe	
	Random selection	Severe HTN n= 489	Random selection	Severe HTN n= 244

## 2.5. Ethical Considerations

The research approval was obtained from the Health Research and Ethics Committee of the University of Nigeria Teaching Hospital Enugu and the Enugu State University Teaching hospital prior to the commencement of the data collection. Participants were made to give their consent or otherwise to the study. Only participants who consented were involved in this study and their anonymity, privacy and confidentiality was respected.

## 2.6. Data Analysis

The Data was analysed both manually and with Statistical Package for Social Sciences (SPSS) version 23 software program. It was then, presented in form of tables and pie charts. Ninety-five percent (95%) confidence limit was applied in all the statistical tests. For the analysis of the qualitative study, a content analysis approach was utilized in the analysis of the qualitative data collected. The texts were converted to codes and then, a visualizable analysis of the collected data was made. The BMI was classified using WHO classification of BMI. Multiple Logistics regression was used to quantify effect of associated factors with response to treatment while adjusted from demographic characteristics. Furthermore, Binary Logistics Regression was used to quantify the impact of response to treatment on outcome of the treatment.

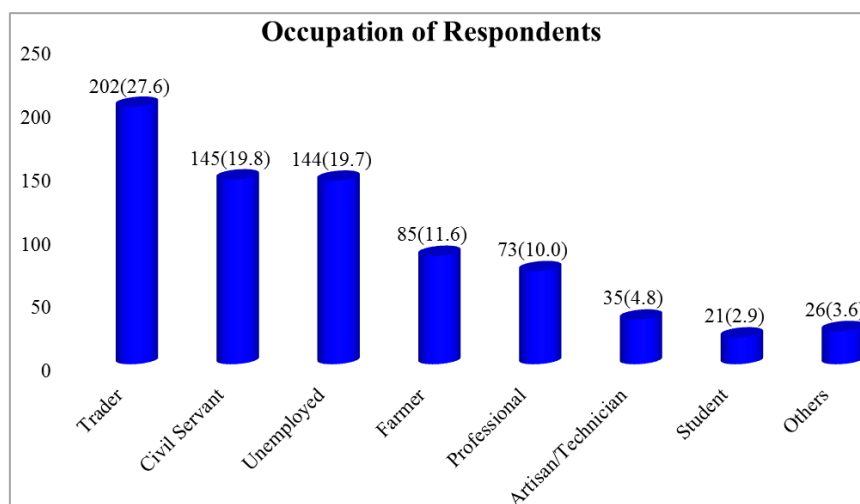
## 3. Results

A total of 733 respondents attending cardiology outpatient clinics were administered semi-structured questionnaire by seven-7 trained research assistants in two tertiary health facilities in Enugu state Nigeria. The content of the questionnaire was adapted from previous similar studies. The questionnaire was in six 6 sections. The first section assessed their socio-demographic characteristic, the second assessed their psychosocial characteristics, The third assessed their health status with emphasis on the presence comorbidities and multi-morbidities, the fourth addressed factors affecting their access and response to treatment, the fifth assessed their perceived response to treatment and the last section reviewed the outcomes following treatment received over the study period between February-August 2023. Our report shows closeness in gender participation among the respondents (Male 48%,

Female 52%). It was observed that 10% of respondents were aged 15-45years, 38% were 46-60 years old and more than half (52%) of respondents were above 60years. Few, 6% of respondents had no formal education, 26% had primary education, secondary (29%) and tertiary (39%). Most, 71% of respondents were married and 97% were Christians. It was observed that most of the respondents were traders (27.6%) followed by civil servants (19.8%).

**Table 2.** Socio-demographic Characteristics.

Characteristics	N	Percentage (%)
Age		
15-45years	76	10.4
46-60years	274	37.5
>60years	381	52.1
Sex		
Female	382	52.3
Male	349	47.7
Highest Educational Status		
No Formal Education	41	5.6
Primary Education	188	25.7
Secondary	214	29.3
Tertiary	288	39.4
Marital Status		
Divorced	7	1.0
Married	520	71.1
Separated	5	0.7
Single	49	6.7
Widowed	150	20.5
Religion		
Christianity	707	96.7
Islam	13	1.8
Others	7	1.0
Traditional	4	0.5

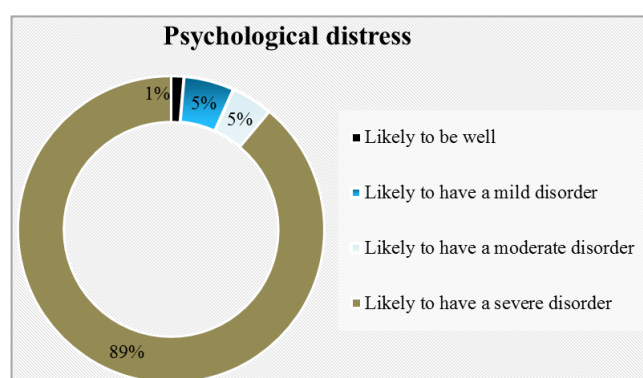


**Figure 1.** Occupation of Respondents.

It was observed that most of the respondents were traders (27.6%) followed by civil servants (19.8%), unemployed (19.7%), farmers (11.6%), professional (10.0%), artisans (4.8%) and the least category was student (2.9%) while the rest (3.6%) sourced their livelihood from other means.

### 3.1. Psychosocial Characteristics of Respondents

For psychosocial characteristics, 9 in 10 respondents had at least one child, 6% ever experienced domestic violence, about 45% had friend/family that died in the past 12 months. Also, 3 in 10 respondents felt depressed about life situation, 6% of respondents/family members were diagnosed of depression, of which 11% were admitted while medication was prescribed to 42%. Psychologically, 59% of respondents were tired for no good reason, 68% almost nervous and 81% were so nervous that nothing could calm it down. Most times, majority of respondents felt hopeless (90%), fidgety (71%), so restless (80%), depressed (90%), worthless (91) and 65% mostly felt that everything was an effort while 83% felt so sad that nothing could cheer it up all the time.



**Figure 2.** Psychological distress.

Overall, most (89%) of the respondents were likely to have a severe psychological distress, it was moderate and mild among 5% each while only 1% were likely to be well.

### 3.2. Co-Morbidities and Multimorbidity

Our respondents reported several co-morbidities, diabetes was the highest, 18% followed by Osteo/Rheumatoid Arthritis (16%), Ulcer/stomach disease (15%), back pain (10%) and the least was liver disease (1.2%). It was reported that 8% of respondents were diagnosed with hypertension less than one year ago, 2-3 years (16%), 4-5 years (24%) and 52% had been managing hypertension for the past 6 years or above. 11% of the respondents were obese, 32% had overweight and 54% had normal weight while only 3% were underweight. Majority (51.8%) of respondents had been hypertensive for over 6 years.

**Table 3.** Self-reported co-morbidity and history of hypertension.

Characteristics	N	Percentage (%)
Anemia /other blood disease	11	1.5
Back pain	71	9.7
Cancer	15	2.1
Diabetes	130	17.8
Heart Disease	64	8.8
Kidney disease	32	4.4
Liver Disease	9	1.2
Lung disease	21	2.9
Osteo/Rheumatoid Arthritis	120	16.4
Ulcer/stomach disease	109	14.9

Characteristics	N	Percentage (%)
Other Medical conditions	149	20.3
Years diagnosed with Hypertension		
Less than 1 year	58	7.9
2-3 years	119	16.3
4-5 years	175	23.9
6 years and above	379	51.8

Majority (67%) agreed that the treatment worked for them, 64% received help they came for, 62% were being well informed on their treatment protocol, symptoms had subsided among 69%, BP was under control among 58%, 62% had not reported any new symptom and 59% of the respondents had not had a very high BP in the past two weeks.

Treatment outcomes show that 19% of the respondents experienced unwanted or adverse side effects of medications, 8% developed multi-morbidity, 4% had heart failure, 16% still had severe hypertension and 3% had evidence of end organ damage.

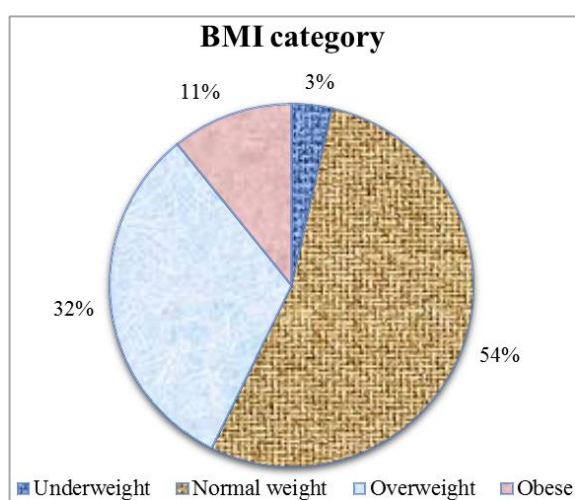


Figure 3. Body Mass Index (BMI) of Respondents.

It was observed that 11% of the respondents were obese, 32% had overweight and 54% had normal weight while only 3% were underweight.

### 3.3. Response to Treatment and Outcomes

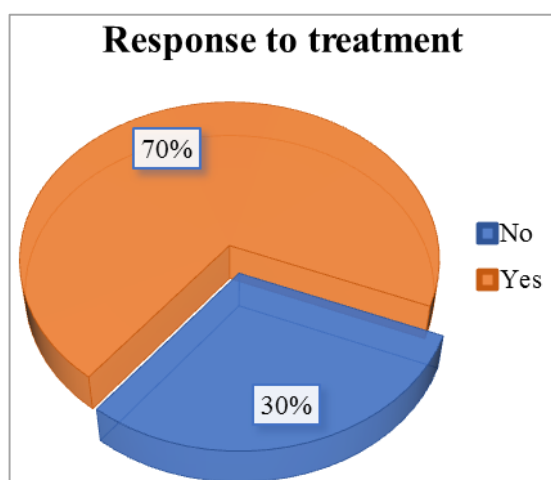


Figure 4. Response to Treatment (Overall, 7 in 10 respondents responded to treatment).

Table 4. Treatment outcome in 6 months.

Outcomes	N	%
Respondent experienced any unwanted or adverse side effects of medications	108	18.5
Respondent had ischemic heart disease, myocardial infarction, Cerebrovascular disease, atrial fibrillation, peripheral artery disease or chronic renal disease	48	8.2
Respondent had heart failure	22	3.8
Respondent blood pressure reading of above 190/120 mmHg	96	16.4
Respondent with evidence of end organ damage	18	2.5

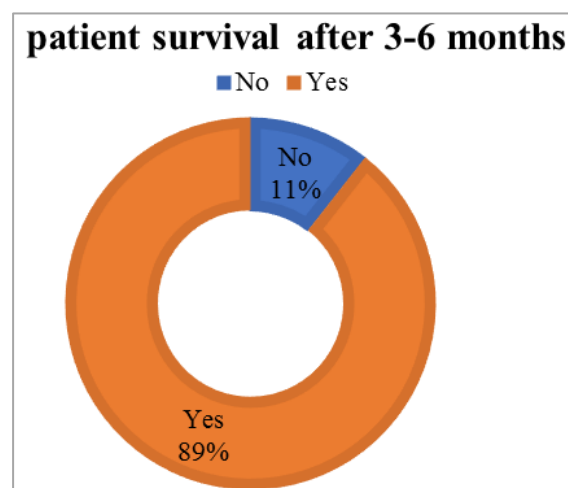


Figure 5. Overall survival after 3-6 months (Overall, 89% of the patients survived after 3-6months treatment follow up.).

There was a significant association between age of the patients and response to treatment ( $X^2 = 7.025$ ,  $p = 0.030$ ). Also, overweight/obesity was significantly associated with response to treatment ( $X^2 = 3.888$ ,  $p = 0.049$ ) and after adjustment for age of respondents, it was discovered that overweight/obese respondents were 1.5times (1/0.677) less likely to respond to

treatment (OR= 0.677, CI= 0.469- 0.979). It was also observed that response to treatment was significantly associated with reduction in heart failure ( $X^2= 16.303$ ,  $p< 0.001$ ). Patients who responded to treatment were 5.5times (1/0.183) less likely to have heart failure compared to those that did not respond to treatment (OR= 0.183, CI= 0.073- 0.456). Response to treatment was significantly associated with reduction in further complications ( $X^2= 34.423$ ,  $p< 0.001$ ). Patients who responded to treatment were 5.6times (1/0.178) less likely to develop complications like ischemic heart disease, myocardial infarction, Cerebrovascular disease, atrial fibrillation, peripheral artery disease and chronic renal disease compared to those that did not respond to treatment (OR= 0.178, CI= 0.095- 0.335). There was no significant association between response to treatment and survival among patients.

#### *Outcome measure*

The primary outcome measure was optimal BP control. Patient-reported outcome measures assessed varied perspectives on their health status thus providing opportunities to improve the quality of care.

## 4. Discussions

Interest in studying sociodemographic characteristics of populations and how these characteristics relate to the social determinants of health remains an important aspect of research. Understanding these interactions is important in implementing inclusive health policies. Women represented a larger proportion of participants. Participants over the age of 60 represented the highest number of participants (52.1%), while only 76 (10.4%) were between 15-45 years of age. There was a significant association between age of the patients and respond to treatment ( $X^2= 7.025$ ,  $p=0.030$ ). This is explained by the fact that, hypertension is more prevalent with advanced age.

Overall, psychosocial characteristics showed no significant relationship with response to treatment and treatment outcomes however, most (89%) of the respondents with severe hypertension, were likely to have a severe psychological distress, it was moderate and mild among 5% each while only 1% were likely to be well using the Kessler Psychological Distress Scale. This is similar to a previous study done, as an in-depth understanding of the underlying nature of the existing relationships amongst psychosocial factors such as job strain, job satisfaction, work stress, anxiety, and severe hypertension remains still unclear and difficult to fully understand and draw conclusions because of the several complicated and confounding factors [9].

Psychological factors may act through many different complex mechanisms. One premise is that stress and adverse experiences predispose to behavioral risk factors, such as smoking, substance use, poor diet, and sedentary lifestyle. Those who have poor psychosocial health may also have limited access to care. From this study, overweight/obesity was significantly associated with respond to treatment ( $X^2=$

3.888,  $p=0.049$ ). This study has demonstrated that while psychosocial factors play a huge role as potential risk factors in the onset and progression of hypertension, its effect on the final treatment outcome in patients remains unclear as it involves a complex interplay of various risk factors. This finding is also consistent with an earlier study that identified various psychosocial indicators as potential risk factors for the onset and progression of hypertension. [18] In this study, 6% of respondents reported that they were experiencing domestic violence, about 45% had a friend/family that died in the past 12 months. Also, 3 in 10 respondents felt depressed about life situation, 6% of respondents/family members were diagnosed of depression, of which 11% were admitted while medication was prescribed to 42%. This also relates to another study which that noted that following adjustment for demographic, socioeconomic, clinical, and psychological factors, the risk of CVD events were no longer significant, suggesting that these factors are mediators of this relationship. [19]

According to an earlier study done [8] comorbidities concordant with hypertension have been conceptualized as those having a similar pathophysiologic profile, while the discordant comorbidities have no direct relationship or similarity with hypertension in the overall pathophysiologic profile. Such categorization of co-morbidities could facilitate an examination of the relationship between the type of comorbidities and hypertension control). In another study done [3], it was noted that blood pressure levels at which patients were diagnosed with hypertension varied substantially according to the presence of comorbidities and were lowest in patients with multi-morbidity suggesting that early selection bias of hypertension diagnosis at different BP levels was a key determinant of long-term differences in BP by comorbidity status and that the lack of a more rapid decline in SBP in those with multi-morbidity provided some reassurance for BP treatment in these high-risk individuals. In this study, respondents reported several comorbidities and multimorbidity's. Overall prevalence of multimorbidity was 55%. Diabetes was the most reported comorbidity 18% followed by Osteo/Rheumatoid Arthritis (16%). We noted that 65 % of those who reported comorbidities had multimorbidity's (more than two chronic conditions) Overall, there was no direct association of multi-morbidity and patient related outcomes in hypertension, however, overweight/obesity was significantly associated with response to treatment ( $X^2= 3.888$ ,  $p=0.049$ ) and after adjustment for age of respondents, it was discovered that overweight/obese respondents were 1.5times (1/0.677) less likely to respond to treatment.

There was no significant association between response to treatment and survival among patients. Overall, 7 in 10 respondents responded to treatment. It was also observed that for perceived response to treatment there was significant reduction in BP below 190/120 mmHg ( $X^2= 16.401$ ,  $p< 0.001$ ). Patients who responded to treatment were 2.5times (1/0.403) less likely to have BP reading above 190/120 mmHg compared to those that did not perceive response to treatment.

From the study, it was observed that response to treatment was significantly associated with reduction in heart failure ( $X^2=16.303$ ,  $p<0.001$ ). Patients who responded to treatment were 5.5times (1/0.183) less likely to have heart failure compared to those that did not respond to treatment (OR= 0.183, CI= 0.073- 0.456). Also, response to treatment was significantly associated with reduction in further complications ( $X^2=34.423$ ,  $p<0.001$ ) as patients who responded to treatment were 5.6times (1/0.178) less likely to develop complications like ischemic heart disease, myocardial infarction, Cerebrovascular disease, atrial fibrillation, peripheral artery disease and chronic renal disease compared to those that did not respond to treatment (OR= 0.178, CI= 0.095- 0.335). The finding of this study is similar to the findings of Sakar et al [1] where he examined the role of multimorbidity in blood pressure control. The role of multimorbidity in the management of cardiovascular risk factors is complex but is a vital component of primary care and needs to be reflected in clinical guidance, training, and improvement initiatives.

## 5. Conclusion

Hypertension has remained the most common cardiovascular disease in Nigeria contributing to a large non-communicable disease burden. It is important that policy makers closely assess how the interplay of these factors influence the management and treatment outcomes in people living with this condition to promote drafting new policies for its management. Successfully implementing any health policies in the management of severe hypertension must involve full engagement and active participation of the relevant stakeholders as well as monitoring and evaluation to ascertain its efficacy. This intervention should be focused on health promotion and reducing the disease burden and mortality.

## 6. Limitations of the Study

The research is limited to tertiary health institutions in Enugu state. Involving additional health facilities in the various states in southeastern Nigeria would have been more beneficial to provide a more inclusive and better diversified result. This would also provide a broader perspective for generalization of its findings.

## 7. Recommendations

Based on the findings from this study, we recommend that this study be extended to other parts of the country and regions especially in sub-Saharan Africa where this disease burden remains a huge challenge for an in-depth understanding of the influence of these factors in treatment response and outcomes.

Further research should consider categorization of co-morbidities to facilitate an examination of the relationship between the type of comorbidities and hypertension control

which is not investigated in this study.

Psychosocial pathways are significant in mediating the effects of social determinants (social, environmental, economic, political, and cultural factors) on health. Despite this significance, these pathways are often not explicitly recognised as an important part of the framework of causes from social determinants to health outcomes. These pathways need improved clarification and stronger recognition in policy and practice to reduce health inequalities. Further research should be done for a deeper understanding on its influence.

## Abbreviations

BMI: Body Mass Index  
BP: Blood Pressure  
CAD: Coronary Artery Disease  
CHD: Congenital Heart Disease  
CHF: Congestive Heart Failure  
CVD: Cardiovascular Disease  
SBP: Systolic Blood Pressure  
DBP: Diastolic Blood Pressure  
ECG: Electrocardiogram  
HTN: Hypertension  
IHD: ischemic Heart Disease  
KPDS: Kessler Psychological Distress Scale  
MM: Multimorbidity  
SPSS: Statistical Package for Social Sciences  
WHO: World Health Organization

## Acknowledgments

Special thanks to the Nigerian Health Research and Ethics Committee of the Federal Ministry of Health and the Health Research and Ethics Committee of the University of Nigeria Teaching Hospital Enugu and the Enugu State University Teaching hospital for their approval and support in the data collections and to all others who contributed to the success of this research.

## Conflicts of Interest

The authors declare no conflicts of interest.

## References

- [1] C. Sarkar, H. Dodhia, J. Crompton, P. Schofield, P. White, C. Millett, M. Ashworth. (2015). Hypertension- A cross sectional study of the role of multimorbidity in blood pressure control. *BMC Fam Pract*. <https://doi.org/10.1186/s12875-015-0313-y>
- [2] Okubadejo, N. U., Ozoh, O. B., Ojo, O. O. *et al.* (2019). Prevalence of hypertension and blood pressure profile amongst urban-dwelling adults in Nigeria: a comparative analysis based on recent guideline recommendations. *Clin Hypertens* 25, <https://doi.org/10.1186/s40885-019-0112-1>

- [3] J. Tran, R. Norton, D. Canoy, J. R. A. Solares, N. Conrad, M. Nazarzadeh, F. Raimondi, G. Salimi-Khorshidi, A. Rodgers, K. Rahimi. (2021). Multi-morbidity and blood pressure trajectories in hypertensive patients: A multiple landmark cohort study. <https://doi.org/10.1371/journal.pmed.1003674>
- [4] Noh, J., Kim, H. C., Shin, A., Yeom, H., Jang, S. Y., Lee, J. H., Kim, C., & Suh, I. (2016). Prevalence of Comorbidity among People with Hypertension: The Korea National Health and Nutrition Examination Survey 2007-2013. *Korean circulation journal*, 46(5), 672–680. <https://doi.org/10.4070/kcj.2016.46.5.672>
- [5] C. D. Ford, M. Sims, J. C. Higginbotham, M. R. Crowther, S. B. Wyatt, S. K. Musani, T. J. Payne, E. R. Fox, J. M. Parton. (2016) Psychosocial Factors Are Associated with Blood Pressure Progression Among African Americans in the Jackson Heart Study. *American Journal of Hypertension*. <https://doi.org/10.1093/ajh/hpw013>
- [6] Caldwell JR, Theisen V, Kaunisto CA, Reddy PJ, Smythe PS, Smith DW. (1983) Psychosocial factors influence control of moderate and severe hypertension. *Soc Sci Med*. [https://doi.org/10.1016/0277-9536\(83\)90028-x](https://doi.org/10.1016/0277-9536(83)90028-x) PMID: 6879236.
- [7] Paulsen, M. S, Andersen M, Thomsen J. L, Schroll H, Larsen PV, Lykkegaard J, et al. (2013) Multimorbidity and Blood Pressure Control in 37, 651 Hypertensive Patients from Danish General Practice. *Journal of the American Heart Association*. <https://www.ahajournals.org/doi/10.1161/JAHA.112.004531>
- [8] Mini G K, Mohan M, Sarma P S, Thankappan K. R. (2021) Multimorbidity and Blood pressure control Results of a cross-sectional study among schoolteachers in Kerala India. *Indian J Public Health*. <https://www.ijph.in/article.asp?issn=557X;year=2021;volume=65;issue=2;epage=190;epage=193;aulast=Mini>
- [9] Maatouk, I., Herzog, W., Böhlen, F., Quinzler, R., Löwe, B., Saum, K. U., et al. (2016). Association of hypertension with depression, and generalized anxiety symptoms in a large population-based sample of older adults. *J. Hypertens*. 34, 1711–1720. <https://doi.org/10.1097/HJH.0000000000001006>
- [10] Svetkey, L. P, Pollak. K. I, Yancy, W. S. (2009) Hypertension improvement project: Randomized trial of quality improvement for physicians and lifestyle modification for patients. *Hypertension* 54: 1226–33. <https://doi.org/10.1161/HYPERTENSIONAHA.109.134874>
- [11] Bhattarai S, Bajracharya S, Shrestha A, et al (2023) Facilitators and barriers to hypertension management in urban Nepal: findings from a qualitative study *Open Heart*; 10: e002394. <https://doi.org/10.1136/openhrt-2023-002394>
- [12] Andrew Steptoe (2000) Psychosocial factors in the development of hypertension, *Annals of Medicine*, 32: 5, 371-375, <https://doi.org/10.3109/07853890008995940>
- [13] Pilic, L., Pedlar, C. R., and Mavrommatis, Y. (2016). Salt-sensitive hypertension: mechanisms and effects of dietary and other lifestyle factors. *Nutr. Rev* 74, 645–658. <https://doi.org/10.1093/nutrit/nuw028>
- [14] Graham, N., and Smith, D. J. (2016). Comorbidity of depression and anxiety disorders in patients with hypertension. *J. Hypertens*. 34, 397–398. <https://doi.org/10.1097/HJH.0000000000000850>
- [15] Mermerelis, A., Kyvelou, S. M., Vellinga, A., Papageorgiou, C., Stefanadis, C., and Douzenis, A. (2016). Association between anxiety and depression symptoms with resistant hypertension and central hemodynamics: a pilot study. *Hellenic J. Cardiol*. 57, 203–204. <https://doi.org/10.1016/j.hjc.2016.07.004>
- [16] Ventura, H. O., and Lavie, C. J. (2016). Impact of comorbidities in hypertension. *Curr. Opin. Cardiol*. 31, 374–375. <https://doi.org/10.1097/HCO.0000000000000302>
- [17] Cuffee Y, Ogedegbe C, Williams NJ, Ogedegbe G, Schoenthaler A. (2014). Psychosocial Risk Factors for Hypertension: An Update of the Literature. *Curr Hypertens Rep*. <https://doi.org/10.1007/s11906-014-0483-3>
- [18] Barr DA. (2020) Steppingstones from childhood adversity to cardiovascular disease and premature mortality. *J Am Heart Assoc*. <https://doi.org/10.1161/JAHA.120.016162>
- [19] Peterson P. N, (2020) JAHA Spotlight on Psychosocial factors and cardiovascular diseases. *Journal of American Heart Association*. <https://doi.org/10.1161/JAHA.120.017112>