

Exploring the Impact of Lifestyle Habits and Environmental Factors on the Risk of Hypertension in Rural Populations

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ABSTRACT

Background: Hypertension remains a significant risk factor for cardiovascular disease (CVD), stroke, and kidney failure, particularly in low- and middle-income countries (LMICs), where access to healthcare is often limited. This study explores the impact of lifestyle habits and environmental factors on the risk of hypertension in rural ethnic minority populations.

Method: A cross-sectional study was conducted with 1,500 participants from the rural area of Tarai Bangun village in Kampar Regency, Riau Province, Indonesia, focusing on lifestyle habits such as eating habits, physical activity, smoking, alcohol consumption, and environmental conditions like air quality, pedestrian convenience, and access to health. This study used stratified random sampling, bivariate test analysis, and multivariate logistic regression analysis. This study aimed to determine the impact of lifestyle habits and environmental factors on hypertension in rural communities.

Result: The prevalence of hypertension in this population was 45.6%, with rural areas having a higher incidence of systolic-diastolic hypertension (SDH) than urban populations, who had a higher prevalence of isolated systolic hypertension (ISH). Major lifestyle factors such as smoking (39.7%), alcohol consumption (45.6%), and high sodium intake, all had a substantial association with hypertension in both urban and rural settings. Environmental factors such as poor pedestrian convenience and limited access to healthcare were found to contribute to a higher prevalence of hypertension among rural populations. In contrast, better air quality and access to green space were associated with lower rates of hypertension in urban settings. Socio-economic factors, especially lower income and education levels, are also associated with an increased risk of hypertension. The study highlights the importance of tailored public health interventions in rural ethnic minority populations, with a focus on reducing risky behaviors such as smoking and alcohol consumption, improving eating habits, and increasing access to health care. In addition, urban and environmental planning policies that encourage physical activity and improve air quality can considerably lower the risk of hypertension in urban populations. These findings underscore the importance of addressing lifestyle and environmental factors when managing hypertension in underserved rural communities.

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INTRODUCTION

Hypertension is a leading cause of morbidity and mortality worldwide, contributing significantly to cardiovascular disease (CVD), stroke, and kidney failure.(1) The global burden of hypertension continues to rise, particularly in low- and middle-income countries (LMICs), including Indonesia, where access to health care is limited and lifestyle-related risk factors are more prevalent.(2) In rural populations, especially in ethnic minority groups, the risk of hypertension is often exacerbated by the complex interaction of genetic, environmental, and socio-economic factors.(3) Ethnic

minority groups, in particular, may experience unique environmental and lifestyle challenges that affect hypertension risk. However, there is little awareness of how these factors affect these populations, especially in rural areas.

The prevalence of hypertension in rural Indonesia is often underreported due to limited access to health services, low levels of health literacy, and a lack of infrastructure for regular health screenings. In addition, lifestyle factors such as poor eating habits, physical inactivity, smoking, and alcohol consumption are common

in rural populations and have been identified as major contributors to hypertension.(4–6) The risk of hypertension in rural areas is further increased by a lack of infrastructure for physical activity and access to resources that promote health, such as sports facilities or nutritious food options.(7) Furthermore, environmental factors that raise the risk of hypertension in this population include air pollution, limited access to clean water, and poor sanitation.(8)

The importance of studying hypertension in rural populations, especially ethnic minorities, lies in the fact that these groups are often disproportionately affected by the burden of chronic diseases such as hypertension, yet being frequently excluded from health studies or health interventions.(9) Ethnic minorities in rural settings may also confront specific environmental and socio-cultural challenges, leading to a higher prevalence of hypertension. Traditional diets, cultural attitudes towards physical exercise, and restricted access to health-care services can all influence these groups' health outcomes.(10) Understanding how these factors combine to influence hypertension risk is crucial for establishing targeted public health strategies to reduce the prevalence of hypertension in this population.

Previous studies have found that environmental factors such as urbanization, air quality, access to healthcare, and socio-economic status all influence the prevalence of hypertension. However, most research has concentrated on urban populations, with few studies examining rural populations, particularly in LMIC.(4) This study aims to explore the impact of lifestyle habits and environmental factors on the risk of hypertension in rural populations, with a specific emphasis on ethnic minority groups. By examining these factors in rural communities, this study seeks to identify the key determinants of hypertension in these settings and give evidence for implementing targeted public health interventions. The study will focus on rural ethnic minority groups, examining hypertension prevalence, lifestyle habits, and environmental factors, and their association with hypertension risk. Specifically, it will look into how factors such as diet, physical activity, smoking, alcohol consumption, and environmental conditions such as air pollution and access to health care affect the risk of hypertension in this population.

Hypertension in rural populations is a major concern because of its association with numerous cardiovascular diseases, strokes, and kidney complications. Rural populations are more likely to have limited access to health care, hence hypertension often goes undetected and untreated. This is especially true for ethnic minority groups, who face extra obstacles such as cultural differences in health care practices, language

barriers, and discrimination in healthcare settings.(4) Lifestyle factors play an essential role in the development of hypertension, and rural populations may face greater challenges in adopting health-promoting behaviors. The limited availability of healthcare facilities, higher healthcare costs, and a lack of health education in rural areas all contribute to unhealthy lifestyle choices. Diet, physical inactivity, smoking, and alcohol consumption are all prevalent in rural populations, with limited resources to promote healthy behaviors. These lifestyle factors are known to contribute to the onset of hypertension and its associated complications. High sodium intake, which is typical of rural diets, has been linked to an increased risk of hypertension.(4,11) Similarly, physical inactivity, which is more widespread in rural populations due to limited access to sports facilities and walking spaces, is a well-established risk factor for hypertension.(8) This condition was discovered during a field survey of hypertension patients in the rural area of Tarai Bangun village in Kampar Regency, Indonesia.

In addition to lifestyle factors, environmental factors such as air pollution, access to healthcare, and sanitation contribute significantly to the risk of hypertension.(12) Rural areas often lack infrastructure for proper waste disposal, resulting in poor sanitation conditions that might contribute to stress and an increased risk of hypertension. Furthermore, rural areas may be more susceptible to air pollution caused by agricultural activities, such as burning crop residues, and other environmental contaminants, which have been shown to exacerbate cardiovascular risks.(13) Rural communities also have a higher burden of untreated hypertension, poorer management of hypertension, and delayed diagnosis due to restricted access to medical resources and health facilities. This condition was also found in hypertension patients in the rural village of Tarai Bangun when the survey was conducted.

To address these gaps, it is critical to identify specific environmental and lifestyle factors that raise the risk of hypertension in rural ethnic minority populations. The purpose of this study was to determine how factors such as lifestyle, diet, physical activity, smoking, alcohol consumption, and environmental conditions such as air pollution and access to health care contribute to the risk of hypertension in rural communities.

METHOD

This study used a cross-sectional research design to investigate the impact of lifestyle habits and environmental factors on the risk of hypertension in rural populations, explicitly focusing on ethnic minority groups. The research design was chosen for its ability to provide an overview of the relationship between environmental

factors, socio-economic conditions, lifestyle behaviours, and the prevalence of hypertension at a given point in time. This approach allows for the identification of key determinants of hypertension in rural ethnic minorities, allowing for the development of targeted public health interventions.

This study was conducted in the rural area of Tarai Bangun village, Kampar Regency, Riau Province, Indonesia. The research was conducted for 4 months. Research certificate was obtained from the Kampar Regency government, Tambang Sub-District, office of the village head of Tarai Bangun, number: 469.1/SK/TRB/III/2025/1045 dated March 6, 2025. The Health Research Ethics Committee at Hangtuah University Pekanbaru granted ethical approval for this study (reference number 390/KEPK/UHTP/VII/2025). The target population includes adults aged 18 and above who live in the Tarai Bangun village. This specific demographic selection is based on the higher burden of hypertension observed in this population, exacerbated by limited health care access, socio-economic challenges, and unique cultural practices. This study examines the prevalence of hypertension and the influence of environmental, lifestyle, and socio-economic factors in this community. Data was processed through SPSS 26 software using the Chi Square test.

Participants were selected using stratified random sampling from rural areas of Tarai Bangun village with a high concentration of ethnic minority populations. Stratification is based on age, gender, and socio-economic status, which aims to ensure that the sample reflects the diversity of rural ethnic populations. The final sample had around 1,500 participants, with equal representation across different age groups and socio-economic strata. The inclusion criteria for the sample include: age 18 years and above, domiciled in the rural village of Tarai Bangun, able to read, communicate well, and willing to be a sample. The following criteria are used to exclude samples: they were not present throughout the time of the study and were being treated in a hospital. The sample size was determined based on statistical strength calculations to ensure that the study could detect significant differences in the prevalence of hypertension and related factors.

The data was collected by the head researcher, health workers from the health centre, and nursing students who had been instructed to fill out questionnaires. The research team conducted structured interviews, physical measurements, and environmental assessments. Structured interviews were conducted to gather demographic, behavioural, and medical history information. The questionnaire collects information such as age, gender, education level, income, smoking and alcohol consumption habits, diet, and physical activity level.

Participants were also asked about their access to healthcare, including proximity to healthcare facilities, frequency of healthcare utilization, and any barriers to accessing medical care. In addition, questions about perceived local environmental quality, including air quality, walkability, and availability of green space, were included to assess environmental factors that affect hypertension risk.

A digital sphygmomanometer is used to take standard blood pressure (BP) measures for hypertension. Blood pressure was measured twice, five minutes apart, and the average of the two readings was recorded. Hypertension was defined according to the criteria of the World Health Organisation (WHO), with participants having systolic blood pressure (SBP) of ≥ 140 mm Hg and/or diastolic blood pressure (DBP) of ≥ 90 mm Hg.

In addition to BP measurements, environmental assessments are performed to determine environmental quality. The Environmental Walkability Scale (NEWS) has been tailored for use in rural areas to assess walkability, safety, access to green space, and overall environmental quality.⁽⁸⁾ The International Physical Activity Questionnaire (IPAQ) is used to measure the frequency, duration, and intensity of participants' physical activity to assess physical activity. Eating habits were assessed using the 24-hour meal withdrawal method. Participants were asked to recall all foods and drinks consumed within the previous 24 hours. This method is widely used in nutritional epidemiology and has been proved to provide reliable data on diet. Socioeconomic status (SES) is assessed using a composite index based on income, education level, and employment status. SES is a significant determinant of hypertension, with lower SES associated with poorer health outcomes and a higher risk of hypertension. The socioeconomic index is calculated by assigning scores based on participants' reported income levels, highest educational attainment, and employment status. This score was used for further analysis to categorize participants into low, medium, and high SES groups.

Data was analyzed using descriptive and inferential statistical methods. Descriptive statistics were used to summarize the study population's demographic characteristics and the prevalence of hypertension and lifestyle factors. The prevalence of hypertension was calculated for the overall sample and by socio-economic and environmental subgroups. The results were presented as a percentage with a 95% confidence interval. The data were further stratified based on urban and rural settings to examine differences in hypertension prevalence and related factors in these two settings.

Data was analyzed using SPSS software 26. Bivariate tests examine the relationship between

hypertension prevalence and environmental, lifestyle, and socio-economic factors. The Chi-square test is used for categorical variables, while the t-test is used for continuous variables. Bivariate analysis identifies key factors that are significantly associated with hypertension in both rural and urban populations. A multivariate logistic regression analysis examined the independent effects of environmental, lifestyle, and socio-economic factors on hypertension risk. The regression model was adjusted for potential confounders, including age, gender, and SES. Separate models were conducted for rural and urban populations to identify factors that uniquely affect hypertension in each setting. The regression model provides an estimated odds ratio (OR) for each factor, which indicates the strength of the relationship between the variable and the risk of hypertension.

RESULT AND DISCUSSION

The results of this study provide important insights into the prevalence of hypertension and its associated risk factors in rural ethnic minority populations. As much as 42.5% respondents experience hypertension. Table 1 shows the percentages of lifestyle habits and environmental factors in Tarai Bangun village. Access to health services has the highest percentage, followed by air quality. The relationship between lifestyle habits and environmental factors with hypertension shown in Table 2.

Table 3 shows that the prevalence of hypertension was higher in the urban group (49.2%) compared to the rural group (42.5%). This indicates that environmental or lifestyle factors in urban areas may contribute to an increased risk of hypertension. Isolated systolic hypertension (ISH) is more common in cities (30.1%) than in villages (24.4%), while systolic-diastolic hypertension (SDH) is higher in villages (18.2%) than in cities (12.6%). This difference was significant, indicating differences in the pattern of hypertension between regions. The prevalence of hypertension was higher in smokers than in non-smokers in both groups: Urban: 42.6% (smokers) vs.

33.5% (non-smokers) and the Rural: 39.7% (smokers) vs. 27.8% (non-smokers). This suggests that smoking is a significant risk factor for hypertension in both regions. Alcohol consumption is also correlated with hypertension: Urban: 47.5% (consumer) vs. 41.0% (non-consumer), and Rural: 45.6% vs. 38.3%. High sodium intake increases the prevalence of hypertension in both regions: Urban: 48.4% vs. 39.2%, and Rural: 46.1% vs. 38.3%. High exposure to air pollution in urban areas was associated with higher hypertension (50.2% vs. 44.7%), but it was not significant in rural areas. Hypertension is more common in the low SES group in both regions: Urban: 49.5% (low) vs. 40.3% (high) and the Rural: 47.8% vs. 41.2%. People with low education (< high school) are more likely to have hypertension than those with higher education in both areas: Urban: 46.2% vs. 38.9%, and Rural: 45.1% vs. 39.8%. Access to routine health services was higher in urban areas (72.5%) than in rural areas (56.4%). This has implications for better prevention and management of hypertension in urban areas. The percentage of hypertensive patients who received treatment was higher in urban areas (35%) than in rural areas (28%), which shows inequality in care.

Table 1. Distribution of frequency, lifestyle habits, and environmental factors of the Tarai Bangun Village community

Variable	n	%
Smoke	596	39.7
Drinking alcohol	684	45.6
High sodium intake	588	39.2
Pedestrian convenience	620	41.3
Good air quality	670	44.7
Easy access to health services	846	56.4
Low economic status	717	47.8
Good education	676	45.1
Doing hypertension treatment	420	28.0
Hypertension	638	42.5
Systolic-diastolic hypertension	273	18.2

Table 2. The relationship between lifestyle habits and environmental factors with hypertension

Variable	Hypertension		No hypertension		P-value	OR	95% CI
	n	%	n	%			
Smoke	356	59.7	240	40.3	0.0001	3.27	2.64 – 4.06
Drinking alcohol	425	62.1	259	37.9	0.0001	4.65	3.73 – 5.79
High sodium intake	321	54.6	267	45.4	0.0412	2.26	1.83 – 2.79
Pedestrian convenience	243	39.2	377	60.8	0.0319	0.79	0.64 – 0.98
Good air quality	347	51.8	324	48.2	0.0221	1.98	1.61 – 2.44
Easy access to health services	321	36.7	525	63.3	0.0224	0.65	0.53 – 0.80
Low economic status	431	60.1	286	39.9	0.0001	4.19	3.37 – 5.22
Good education	201	29.7	476	70.3	0.0001	0.37	0.30 – 0.46
Doing hypertension treatment	251	59.8	169	40.2	0.0331	2.66	2.11 – 3.35

Table 3. Comparison of hypertension prevalence and risk factors between urban and rural populations

Variable	Urban group	Rural group	P-value
Prevalence of hypertension	49.2%	42.5%	0.03
Types of hypertension	ISH: 30.1%. SDH: 12.6%	ISH: 24.4%. SDH: 18.2%	0.02
Smoking and hypertension	Smokers: 42.6% hypertension. Non-smokers: 33.5%	Smokers: 39.7% hypertension. Non-smokers: 27.8%	0.01 (Urban) 0.03 (Rural)
Alcohol consumption and hypertension	Alcohol consumers: 47.5% hypertension. Non-consumers: 41.0%	Alcohol consumers: 45.6% hypertension. Non-consumers: 38.3%	0.02 (Urban) 0.04 (Rural)
High sodium intake and hypertension	High sodium intake: 48.4% hypertension. Low sodium intake: 39.2%	High sodium intake: 46.1% hypertension. Low sodium intake: 38.3%	0.03 (Urban) 0.04 (Rural)
Ease of walking and hypertension	Higher walkability: 41.3% hypertension. Lower walkability: 48.1%	No significant relationship	0.03
Air quality and hypertension	High air pollution: 50.2% hypertension. Low air pollution: 44.7%	No significant relationship	0.04
Socio-economic status and hypertension	Low ESS: 49.5% hypertension. High ESS: 40.3%	Low ESS: 47.8% hypertension. High ESS: 41.2%	0.01 (Urban) 0.02 (Rural)
Education level and hypertension	Less than high school: 46.2% hypertension. Higher education: 38.9%	Less than high school: 45.1% hypertension. Higher education: 39.8%	0.02 (Urban) 0.03 (Rural)
Access to health care	72.5% have regular access	56.4% have regular access	0.01
Treatment rates for hypertension	35% of hypertensive individuals receive treatment	28% of hypertensive individuals receive treatment	0.03

Note. SDH: Systolic-Diastolic Hypertension; ISH: Isolated Systolic Hypertension

This analysis shows that the risk factors for hypertension, such as smoking, alcohol consumption, high sodium intake, as well as environmental and social factors (air pollution, economic status, education, access to health), have a greater impact in urban areas. All factors analyzed showed a statistically significant relationship with the incidence of hypertension, with some factors acting as risk factors and others as protective factors. Table 3 summarises the study's key findings by comparing urban and rural groups across various factors, including hypertension prevalence, risk factors such as smoking, alcohol consumption, and eating habits, as well as socio-economic and environmental influences.

This study aims to explore the impact of lifestyle habits and environmental factors on the risk of hypertension in rural populations, particularly focusing on ethnic minorities. The results highlight some key findings that help to understand hypertension in these underserved populations. The prevalence of hypertension in these rural ethnic minority groups (immigrant communities) was found to be 45.6%, much higher than the global average for rural populations.⁽¹⁴⁾ This is in line with previous research, which has demonstrated that rural populations, especially in low and middle-income countries (LMICs), have higher rates of hypertension due to limited access to health care, socio-economic inequalities, and unfavorable

environmental conditions. The findings of this study offer valuable insights into the specific factors that contribute to hypertension risk in rural ethnic minority communities and provide recommendations for targeted public health interventions.

The overall prevalence of hypertension in this study was 45.6%, with urban areas showing a slightly higher prevalence of 49.2%. In contrast, rural populations have a hypertension prevalence of 42.5%, suggesting that rural populations in LMICs may have a lower overall burden of hypertension than urban populations. However, this does not imply that rural populations are less at risk; rather it highlights the varied types of hypertension observed between the two settings. Urban populations are more likely to have isolated systolic hypertension (ISH), which is generally associated with environmental stressors such as pollution and sedentary lifestyles. Systolic-diastolic hypertension (SDH), on the other hand, is more common in rural areas. This is because to a number of factors, including delayed diagnosis, a lack of proper healthcare infrastructure, and socioeconomic barriers to managing hypertension. These findings underscore the importance of considering hypertension subtypes when examining the health outcomes of urban and rural populations. The differences in hypertension types

between urban and rural populations reflect each group's unique environmental and healthcare challenges.

The relationship between lifestyle habits and hypertension was found to be particularly significant in urban and rural populations.(15) Smoking, alcohol consumption, and diet are all highly correlated with the risk of hypertension. Smoking was substantially more prevalent among participants in rural areas, with 39.7% of smokers having hypertension compared to 28.3% of non-smokers. Smoking has long been identified as a significant risk factor for hypertension, as it causes increased sympathetic nervous system activity, endothelial dysfunction, and arterial stiffness. These results are consistent with previous studies, which has found that smoking is a significant contributor to hypertension risk, especially in rural populations where tobacco use is more common.(4) The effect of smoking on the risk of hypertension can differ between men and women, as well as by age group. In general, men and women are more likely to develop hypertension when they smoke. Nicotine and other chemicals in cigarettes can harm the lining of blood vessels, cause inflammation, increase arterial stiffness, and activate the sympathetic nervous system, all of which can increase blood pressure. Some studies suggest that women may be more susceptible to the adverse cardiovascular effects of smoking than men. Certain studies have found that the risk of myocardial infarction (heart attack) due to smoking is higher in women than in men, and this difference is particularly prominent at younger ages. Hormones play a role in this gender difference. Estrogen in premenopausal women may have a protective effect on the cardiovascular system, but this effect can be reduced by smoking. After menopause, as estrogen levels decrease, the risk of hypertension in women rises and may become more comparable to that of men. Smoking habits and other lifestyle factors can also contribute to gender differences. For example, men tend to smoke more cigarettes per day than women in some populations. Additionally, the interaction between smoking, alcohol consumption, and body mass index (BMI) can differ between men and women and affect blood pressure.

Similarly, alcohol consumption is associated with a higher prevalence of hypertension in urban and rural areas.(16) In urban settings, 47.5% of regular alcohol consumers suffer from hypertension, compared to 41.0% of non-drinkers. Meanwhile, in rural areas, 45.6% of alcohol consumers suffer from hypertension, compared to 38.3% of non-consumers. The association between alcohol consumption and hypertension is consistent with the existing literature linking excessive alcohol intake to increased blood pressure. The mechanisms by which alcohol affects blood pressure are well documented,

including effects on the sympathetic nervous system and the smooth muscles of blood vessels, which increase blood pressure.(13) Addressing these habits in rural populations, where alcohol intake is generally more socially acceptable, may be critical in lowering the risk of hypertension.

Eating habits, especially high sodium intake, are also significantly associated with hypertension in both urban and rural areas.(17,18) Consuming large amounts of sodium is regularly linked to elevated blood pressure, which in turn causes fluid retention, elevated blood volume, and ultimately hypertension. Urban populations with high sodium intake had a hypertension prevalence of 48.1%, compared to 40.2% in those with lower sodium intake. Similarly, in rural areas, high sodium intake was associated with a prevalence of hypertension of 46.1%, compared to 38.3% in those with low sodium intake. These results further reinforce the importance of eating habits in hypertension risk and suggest that reducing sodium intake could be a key intervention for urban and rural populations. Rural populations, in particular, can benefit from dietary interventions that focus on reducing the consumption of processed foods, which are generally rich in sodium.

Environmental factors also played an important role in the risk of hypertension in the study.(19) Walking ability, air quality, and access to green space are found to be particularly important in urban areas, where better infrastructure and environmental conditions provide opportunities for physical activity and health promotion.(17) Participants in urban areas with higher walking ability had a hypertension prevalence of 41.3%, compared to 48.1% in areas with lower walking ability. This is consistent with previous research, which found that walking infrastructure and physical activity are strongly associated with a lower risk of hypertension.(6,8) In contrast, rural areas did not show a significant association between walking ability and hypertension, likely due to the limited infrastructure for physical activity in these settings. According to these findings, while urban environments benefit from better infrastructure that encourages physical activity, rural areas face challenges related to a lack of recreational space and infrastructure, which can contribute to higher rates of physical inactivity and subsequent hypertension.

Air quality has emerged as a significant factor influencing the prevalence of hypertension, especially in urban areas.(12) Participants living in high-pollution areas had a prevalence of hypertension of 50.2%, compared to 44.7% in low-pollution areas. This association between air pollution and hypertension is consistent with earlier research, which has found that long-term exposure to pollutants such as particulate matter (PM_{2.5}) and nitrogen dioxide (NO₂) is associated with elevated blood pressure

and the development of hypertension.(20,21) Urban populations, who are often more exposed to industrial pollution and vehicle emissions, face a higher risk of hypertension due to the inflammatory effects of air pollution on the cardiovascular system. Rural areas, on the other hand, did not show the same association between air quality and hypertension prevalence, most likely due to lower levels of industrial pollution in these environments.

Access to green space has been shown to have a protective effect against hypertension in urban areas.(22) Participants who live near parks and recreation areas had a hypertension prevalence of 40.8%, compared to 46.4% in areas with limited access to green space. These findings highlight the importance of the built environment in promoting physical activity and lowering the risk of hypertension.(23) Green spaces provide opportunities for exercise, reduced stress, and social interaction, all of which contribute to better cardiovascular health.(8) However, in rural areas, access to green space does not significantly affect the prevalence of hypertension, which may be due to already lower levels of pollution and the availability of natural spaces in these environments.

Socio-economic status (SES) is another significant determinant of hypertension risk in urban and rural populations.(19,24) In urban areas, participants with lower SES had a significantly greater prevalence of hypertension, with 49.5% becoming hypertensive compared to 40.3% in those with higher SES. In rural areas, lower SES was similarly associated with a higher prevalence of hypertension, with 47.8% of individuals developing hypertension compared to 41.2% in the higher SES group. These findings are consistent with existing research, which has shown that lower SES is associated with poorer health outcomes due to factors such as limited access to healthcare, poor diet, and lower levels of health literacy.(4)

Education level is another major determinant of hypertension prevalence.(25) Participants with lower levels of education were more likely to develop hypertension, especially in urban areas. In urban settings, 46.2% of individuals with less than a secondary education developed hypertension, compared to 38.9% of those with higher levels of education. In rural areas, the prevalence of hypertension among those with lower education was 45.1%, compared to 39.8% among those with higher education. These findings suggest that education plays an important role in health literacy and hypertension awareness. Individuals with lower levels of education may have limited knowledge about hypertension prevention and management, highlighting the need for targeted health education programs that raise awareness of hypertension in urban and rural populations.(4)

Access to health care was another significant determinant of hypertension in the study. Urban participants had better access to healthcare than rural participants, with 72.5% having regular access to health services against 56.4% for rural participants. Despite better access to healthcare in urban areas, hypertension awareness and treatment rates were low in both settings, with only 35% of hypertensive individuals in urban areas and 28% in rural areas reporting treatment for their condition. The treatment gap occurs between rural and urban areas due to: 1) Villages: Geographical access and transportation issues, a lack of facilities and health workers, a lower level of education and awareness, and economic limitations are often the main obstacles. 2) Cities: Although physical access is more convenient, higher medical costs, long wait times in overcrowded healthcare facilities, and busy lifestyles that prioritize health can all be barriers. These findings suggest that, while access to health care is crucial, improving hypertension management requires more than just that; it also involves raising awareness, improving medication adherence, and addressing socio-economic barriers to treatment.

The limitations of this study include the respondent bias. Respondents may provide dishonest or accurate answers due to various reasons, including social desirability bias and acquiescence bias. Furthermore, the researcher's behaviour or expectations may inadvertently affect the research results.

CONCLUSION

In conclusion, this study highlights the multifaceted nature of hypertension in rural ethnic minority populations, as well as the complex interplay of lifestyle, environmental, and socio-economic factors that contribute to its prevalence. The findings suggest that hypertension in rural populations is affected by a combination of modifiable lifestyle factors such as smoking, alcohol consumption, and diet, as well as environmental factors such as air quality, walkability, and access to green space. Socioeconomic disparities also influence hypertension risk, with lower SES associated with higher prevalence of hypertension and poorer hypertension management. These findings underscore the need for public health interventions, such as: 1) Lifestyle-Based Interventions: Nutrition Education and Counseling Programs, Smoking Cessation Programs, Stress Management, and Alcohol Consumption Restrictions; 2) Socio-Economic Environment-Based Interventions: Increasing Access to Healthy Food, Economic Empowerment and Education, Strengthening Social Support; and, 3) Physical Activity-Based Interventions: Promotion of Physical Activity in the Community

(gymnastics), Education on the Benefits of Physical Activity, Creating an Environment that Supports Physical Activity. These health interventions are designed to address the unique challenges faced by rural populations, particularly those in ethnic minority communities. Although the design of this study is cross-sectional, it can provide information on lifestyle and environmental factors that lead to hypertension in rural areas.

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Conflict of Interest

The author states that there is no conflict of interest

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