Association between Educational Level and Hypertension Severity among Adults: A Cross-Sectional Study

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ARTICLE INFORMATION

ABSTRACT

Hypertension is a major public health problem and a leading contributor to cardiovascular morbidity and premature mortality. Beyond biological determinants, hypertension outcomes are shaped by social determinants of health, including educational attainment, which influences health literacy, self-care behaviors, access to health services, and adherence to antihypertensive therapy. This study aimed to examine the association between educational level and hypertension grade among adults with hypertension. An analytical observational cross-sectional design was conducted at Samata Public Health Center (Puskesmas Samata), Gowa Regency, Indonesia. The population comprised 530 registered hypertension patients recorded in December 2024. Blood pressure measurements were obtained during routine clinical visits in February 2025. Sample size estimation using Slovin's formula with a 10% margin of error yielded a minimum of 84 participants; to improve representativeness and anticipate incomplete data, the sample size was increased by approximately 20%, resulting in 100 respondents included in the analysis. Educational level was classified as elementary school, junior high school, senior high school, and higher education. Hypertension grade was categorized into Grade 1, Grade 2, and Grade 3 based on standard clinical classification. Descriptive statistics were presented as frequencies and percentages, and the association between educational level and hypertension grade was assessed using the Gamma test because both variables were ordinal. Most respondents had senior high school education (39%) and were classified as having Grade 1 hypertension (57%). The Gamma test showed a statistically significant inverse association between educational level and hypertension grade ($\gamma = -0.518$; p 0.000), indicating that higher educational attainment tended to be associated with lower hypertension grade. These findings underscore the importance of targeted, literacy-sensitive hypertension education and management strategies for individuals with lower educational backgrounds to prevent disease progression and reduce health disparities.

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1. Introduction

Hypertension remains a major public health challenge worldwide and is a leading risk factor for cardiovascular disease, stroke, and premature mortality. Recent global reports

indicate that the prevalence of hypertension continues to increase, particularly in low- and middle-income countries, where awareness, treatment, and control rates remain suboptimal(1). In Indonesia, hypertension is one of the most common non-communicable diseases encountered in primary health care settings and contributes substantially to morbidity and health system burden(2), (3).

Beyond biological factors, hypertension is strongly influenced by social determinants of health, including socioeconomic status, health literacy, and educational attainment. Education plays a crucial role in shaping health-related knowledge, attitudes, and behaviors, which subsequently affect disease prevention, treatment adherence, and clinical outcomes(4) , (5). Individuals with lower levels of education often experience limited access to health information and preventive services, which may increase their vulnerability to uncontrolled or severe hypertension.

Several studies have demonstrated an association between educational level and hypertension prevalence. Research conducted in both national and international settings has shown that lower educational attainment is associated with a higher risk of hypertension and poorer blood pressure control(6),(7), (8). Studies focusing on hypertensive patients further indicate that education level is closely related to patients' knowledge of hypertension, self-care practices, and adherence to treatment regimens(9), (10),(11). These factors are essential for effective blood pressure management and the prevention of disease progression.

Despite growing evidence linking education with hypertension outcomes, most previous studies have primarily focused on hypertension prevalence, knowledge, or treatment adherence rather than the severity of hypertension itself. The degree of hypertension, commonly classified into Grade 1, Grade 2, and Grade 3, reflects disease progression and is clinically important for determining management strategies and predicting complications(3). Limited studies have directly examined how educational level relates to the degree of hypertension severity, particularly using a cross-sectional analytical approach in community or primary care populations.

Moreover, existing findings suggest a potential gradient effect, where individuals with higher educational attainment tend to present with less severe hypertension, while those with lower education are more likely to experience advanced disease stages(12),(13). However, empirical evidence addressing this relationship remains insufficient and inconsistent, especially in the Indonesian context. This gap highlights the need for further investigation to clarify whether educational level is significantly associated with hypertension severity.

Understanding the relationship between educational attainment and the degree of hypertension is essential for developing targeted prevention and health education strategies. Identifying vulnerable groups based on educational background may help health professionals design more effective interventions aimed at improving disease awareness, early detection, and blood pressure control.

Therefore, this study aims to analyze the relationship between educational level and the degree of hypertension. The findings of this study are expected to provide evidence-based insights into the role of education as a social determinant of hypertension severity and to support the development of more equitable and effective hypertension management programs.

2. Methods

This analytical observational study employed a cross-sectional design to examine the association between educational level and hypertension grade among adults with hypertension. The study was conducted at Samata Public Health Center (Puskesmas Samata), Gowa Regency, Indonesia. The sampling frame consisted of 530 registered hypertension

patients documented in December 2024. Data collection, including blood pressure measurement, was carried out during February 2025 when patients attended the health center for routine examination and follow-up.

The target population comprised adult patients (≥18 years) diagnosed with hypertension who were registered at Puskesmas Samata. Sample size was estimated using Slovin's formula with a 10% margin of error, producing a minimum required sample of 84 respondents from the population of 530. To improve representativeness and to account for potential incomplete information, the sample size was increased by approximately 10–20%, resulting in a final sample of 100 respondents included in the analysis. Participants were recruited during their routine visits at the health center throughout the data collection period in February 2025 using consecutive sampling until the target sample size was achieved.

Records were included if respondents: (1) had a documented diagnosis of hypertension; (2) had complete information on educational attainment; and (3) had a blood pressure measurement recorded during the data collection period (February 2025). Records with missing key variables were excluded.

Educational level was defined as the highest completed formal education and categorized into elementary school, junior high school, senior high school, and higher education. Hypertension grade was determined using the most recent blood pressure measurement obtained during the respondent's visit to the health center for examination/control while the researcher was present at the study site in February 2025. Hypertension was classified into Grade 1, Grade 2, and Grade 3 based on standard clinical classification: Grade 1 (SBP 140–159 mmHg and/or DBP 90–99 mmHg), Grade 2 (SBP 160–179 mmHg and/or DBP 100–109 mmHg), and Grade 3 (SBP ≥180 mmHg and/or DBP ≥110 mmHg).

Data were obtained from medical records and a structured data extraction/observation sheet. Descriptive analysis was performed to summarize educational level and hypertension grade using frequencies and percentages. The association between educational level and hypertension grade was assessed using the Gamma test because both variables are ordinal categorical. Statistical significance was set at $p < 0.05$. All respondent information was anonymized and used solely for research purposes.

3. Results

3.1 Education Level

A total of 100 respondents were included in the analysis. Based on educational attainment, the majority of respondents had completed senior high school (39%), followed by elementary school education (29%) and junior high school education (21%). Respondents with higher education accounted for the smallest proportion of the sample (11%). This distribution indicates that most hypertensive patients in the study population had a low to moderate level of formal education.

Table 1. Distribution of education Level

Education Level	n	%
Elementary	29	29%
Junior High	21	21%
Senior High	39	39%
Higher Education	11	11%
Total	**100**	**100%**

3.2 Hypertension Severity

Hypertension grade was classified using standard clinical cut-offs: Grade 1 (SBP 140–159 mmHg and/or DBP 90–99 mmHg), Grade 2 (SBP 160–179 mmHg and/or DBP 100–109 mmHg), and Grade 3 (SBP ≥180 mmHg and/or DBP ≥110 mmHg). Among the 100 respondents, 57% were categorized as Grade 1 hypertension, 19% as Grade 2, and 24% as Grade 3. These results indicate that Grade 1 hypertension was most common; however, nearly one-quarter of respondents presented with Grade 3 hypertension, reflecting a substantial burden of severe blood pressure elevation in this primary care population.

Table 2. Distribution of Hypertension Severity

Hypertension Severity	n	%
Grade 1	57	57%
Grade 2	19	19%
Grade 3	24	24%
Total	**100**	**100%**

3.3 Correlation Between Education Level and Hypertension Severity

The bivariate analysis demonstrated a statistically significant association between educational level and the degree of hypertension. The Gamma test revealed a negative correlation between the two variables (γ = −0.518; p < 0.001), indicating that higher educational attainment was associated with lower hypertension severity. This finding suggests a moderate inverse relationship, where respondents with lower levels of education tended to present with more severe grades of hypertension.

Table 3. Correlation Between Education Level and Hypertension Severity

Education Level	Hypertension Severity						Total		y-value	p-value
	Grade 1		Grade 2		Grade 3					
	n	%	n	%	n	%	n	%		
Elementary	11	11	4	4	14	14	**29**	**29**		
Junior High	9	9	6	6	6	6	**21**	**21**		
Senior High	28	28	8	8	3	3	**39**	**39**	**-0.518**	**0.000**
Higher Education	9	9	1	1	1	1	**11**	**11**		
Total	**57**	**57**	**19**	**19**	**24**	**24**	**100**	**100**		

4. Discussion

This study demonstrated a statistically significant inverse association between educational attainment and hypertension grade (γ = −0.518; p < 0.001), indicating that respondents with higher education tended to present with lower hypertension grades, whereas those with lower educational attainment were more likely to have higher grades. This finding supports the social determinants of health perspective, which positions education as a fundamental determinant shaping health trajectories and disparities through structural and behavioral pathways.(1,14)

A plausible explanation is that higher educational attainment improves health literacy and problem-solving capacity, thereby facilitating more effective hypertension self-management.(4,5) Individuals with higher education may be more able to understand clinical advice, interpret the importance of long-term risk reduction, and engage consistently in medication adherence and lifestyle modification (e.g., salt restriction, physical activity, weight control), resulting in better blood pressure control and lower hypertension grade.(4,9)Conversely, limited education may constrain access to accurate health information, reduce comprehension of treatment regimens,

and weaken sustained self-care behaviors, which can lead to persistent uncontrolled blood pressure and progression to higher hypertension grades.(4,9,12)This mechanism is consistent with evidence showing that lower education is associated with higher hypertension risk and poorer blood pressure control.(6,8)

In the context of primary care at Puskesmas Samata, where patients often seek care during symptomatic episodes or routine control visits, the educational gradient may be amplified by differences in service utilization, follow-up consistency, and the ability to translate counseling into daily practice.(3,4)The present study graded hypertension using the most recent blood pressure measurement obtained during routine visits in February 2025, which may reflect real-world control status at the point of care. Therefore, educational attainment can be considered a practical marker to identify patients who may require intensified counseling and structured follow-up.

These findings reinforce prior studies reporting that educational level is closely related to hypertension-related knowledge, attitudes, and practices,(9) as well as treatment adherence among hypertensive patients.(12) Moreover, evidence indicates that lower knowledge is associated with higher hypertension grades among older adults,(10) suggesting that educational attainment may indirectly influence hypertension severity through knowledge acquisition and self-care performance. Collectively, this supports the interpretation that education is not only associated with hypertension occurrence but also with its clinical severity.

From an implementation standpoint, primary care services should incorporate literacy-sensitive hypertension education and management strategies for patients with lower educational backgrounds. Such approaches may include simplified and culturally appropriate educational materials, visual aids, teach-back methods to confirm comprehension, and structured follow-up mechanisms to reinforce adherence and lifestyle changes. Strengthening these interventions may help prevent progression to higher hypertension grades and reduce inequities in cardiovascular risk.

This study has limitations. The cross-sectional design precludes causal inference. Hypertension grade was determined based on a single most recent blood pressure measurement recorded during routine visits, which may be affected by short-term variability and measurement conditions. Additionally, potential confounders such as age, sex, duration of hypertension, obesity, smoking, dietary intake, comorbidities, and medication adherence were not adjusted, which may partially explain the observed association. Future longitudinal studies with multivariable modeling are recommended to clarify causal pathways and estimate the independent contribution of educational attainment to hypertension progression.

5. Conclusion

This study concludes that there is a significant inverse relationship between educational level and the degree of hypertension, where lower educational attainment is associated with more severe hypertension. These findings underscore the role of education as an important social determinant influencing disease severity, likely through its impact on health knowledge, self-care behaviors, and treatment adherence. Targeted health education and hypertension management interventions tailored to individuals with lower educational backgrounds are therefore essential to prevent disease progression and reduce health disparities, while future studies using longitudinal designs are needed to further clarify causal mechanisms underlying this relationship.

Ethics Approval and Consent to Participate
This study received ethical clearance categorized as Ethical Exemption from the Health Research Ethics Committee of Universitas Islam Negeri Alauddin Makassar with reference number No. C.100/KEPK/FKIK/I/2025. Data collection was conducted at Puskesmas Samata, Gowa Regency, using two sources: (1) secondary data from medical records and (2) primary data collected through questionnaires administered directly to patients during their visits in February 2025. Prior to data collection, official permission was obtained from the Head of Puskesmas Samata.
All respondents participated voluntarily. Verbal informed consent was obtained before questionnaire administration. To ensure confidentiality and privacy, no personal identifiers were recorded. Respondent data were coded using initials only, and all information was handled anonymously and confidentially for research purposes.

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