



Association Between Diabetes Mellitus and Hypertension Severity at a Primary Health Care Center in Indonesia (A Cross-Sectional Study)

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Abstract. Background: Hypertension remains a major public health problem, particularly in primary health care settings. The coexistence of diabetes mellitus may contribute to increased hypertension severity; however, evidence from primary care data in Indonesia remains limited. Objective: This study aimed to examine the association between diabetes mellitus and hypertension severity among patients attending a primary health care center in Indonesia. Methods: A cross-sectional study was conducted using secondary data obtained from medical records at a primary health care center in 2025. A total of 84 patients with hypertension were included using total sampling. Hypertension severity was classified into stage 1 and stage 2. Bivariate analysis was performed using the Chi-square test or Fisher's exact test as appropriate, with statistical significance set at $p < 0.05$. Data were analyzed using SPSS version 26. Results: Of the 84 participants, 33.3% had diabetes mellitus. Stage 2 hypertension was more prevalent than stage 1 hypertension. Diabetes mellitus was significantly associated with hypertension severity ($p = 0.029$), with a higher proportion of patients with diabetes mellitus presenting with stage 2 hypertension. Conclusion: Diabetes mellitus was significantly associated with greater hypertension severity in a primary health care setting. These findings highlight the importance of integrated management.

Keywords: Blood Pressure; Diabetes Mellitus; Hypertension severity; Indonesia; Primary Health Care.

1. INTRODUCTION

Hypertension and diabetes mellitus are among the most prevalent non-communicable diseases worldwide and remain leading contributors to cardiovascular morbidity and mortality (Aminian *et al.*, 2019; Mills *et al.*, 2020; World Health Organization, 2023; Zhang *et al.*, 2026). Hypertension is a major risk factor for stroke, coronary heart disease, heart failure, and chronic kidney disease, while diabetes mellitus is strongly associated with long-term microvascular and macrovascular complications, including nephropathy, retinopathy, and atherosclerotic cardiovascular disease (ElSayed *et al.*, 2022; Mills *et al.*, 2020; Task *et al.*, 2018). The coexistence of hypertension and diabetes mellitus is common and has been shown to substantially increase the risk of cardiovascular events and premature mortality compared with either condition alone (Geldsetzer *et al.*, 2019; World Health Organization, 2023). As the global burden of non-communicable diseases continues to rise, particularly in low- and middle-income countries, understanding the interaction between diabetes mellitus and hypertension has become increasingly important, especially in resource-limited health care settings (Aminian *et al.*, 2019; NCD Risk Factor Collaboration, 2021).

In Indonesia, the prevalence of hypertension and diabetes mellitus has increased steadily over recent years, posing a significant challenge to the national health care system (Ministry of Health Indonesia., 2018). According to national health surveys, hypertension and diabetes

mellitus are among the most frequently diagnosed chronic conditions and contribute substantially to disability and health care utilization (Maharani *et al.*, 2025). Primary health care centers (*Puskesmas*) serve as the frontline for the prevention, early detection, and long-term management of chronic diseases, including hypertension and diabetes mellitus (Mahwati *et al.*, 2022). However, patients attending primary health care facilities often present with multiple comorbidities, which complicates disease management and increases the risk of poor clinical outcomes (Geldsetzer *et al.*, 2019; Mahwati *et al.*, 2022). Strengthening chronic disease management at the primary care level is therefore essential to prevent disease progression and reduce cardiovascular complications (NCD Risk Factor Collaboration, 2021).

Although numerous studies have documented the association between diabetes mellitus and hypertension, most research has focused on the presence or prevalence of hypertension rather than its severity (Hung, 2024; Wang *et al.*, 2021). Hypertension severity is clinically important because higher stages of hypertension are associated with an increased risk of target organ damage, cardiovascular events, and mortality (Carey *et al.*, 2018; Hannah-Shmouni *et al.*, 2019). Diabetes mellitus may worsen hypertension severity through mechanisms such as endothelial dysfunction, arterial stiffness, chronic inflammation, and activation of neurohormonal pathways (American Diabetes Association, 2024). However, evidence examining factors associated with hypertension severity, particularly the role of diabetes mellitus, remains limited in Indonesian primary health care settings (Endra *et al.*, 2022; Maharani *et al.*, 2025). In addition, routine medical record data at the primary care level are underutilized, despite their potential value for informing clinical decision-making and local health policy (Mahwati *et al.*, 2022).

Therefore, this study aimed to examine the association between diabetes mellitus and hypertension severity among patients attending a primary health care center in Indonesia using a cross-sectional design. By exploring this relationship in a primary care setting, this study seeks to provide evidence to support integrated management strategies for hypertension and diabetes mellitus and to contribute to improved chronic disease care at the primary health care level.

2. METHODS

This study employed an observational analytic design with a cross-sectional approach and was conducted at Tiley Primary Health Care Center, Pulau Morotai Regency, North Maluku Province, Indonesia, using secondary data obtained from medical records collected in 2025. The study population consisted of patients diagnosed with hypertension who were

registered at the primary health care center during the study period. All eligible records that met the inclusion criteria were included in the analysis using a total sampling technique. A total of 84 patient records were analyzed. Secondary data were extracted from standardized medical records maintained by the primary health care center. The variables included sociodemographic characteristics (gender, age group, educational level, marital status, and employment status), comorbid conditions (diabetes mellitus), lifestyle factors (smoking habits and physical activity), and clinical characteristics (stage of hypertension). Hypertension severity was classified into stage 1 and stage 2 based on clinical assessment recorded in the medical records. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were used to summarize participant characteristics and were presented as frequencies and percentages. Bivariate analysis was conducted to examine the association between independent variables and hypertension severity. The Chi-square test was applied when the expected cell counts were five or more, while Fisher's exact test was used when the expected cell counts were less than five. A p-value of less than 0.05 was considered statistically significant.

This study used secondary data obtained from medical records at Tiley Primary Health Care Center. Permission to access and use the data was formally granted by the management of the primary health care center prior to data collection. All data were anonymized before analysis, and no personal identifiers were included to ensure patient confidentiality. The study was conducted in accordance with ethical principles for research involving human data.

3. RESULT

Table 1 summarizes the sociodemographic, comorbid, lifestyle, and clinical characteristics of the participants. A total of 84 individuals were included in the analysis. The study population was predominantly female (69.0%), with more than half aged over 60 years (58.3%). Most participants had completed elementary education (83.3%) and were married (95.2%), while 78.6% were employed.

Diabetes mellitus was reported by 33.3% of participants. With respect to lifestyle factors, 65.5% were non-smokers and 63.1% reported adequate physical activity. Clinically, stage 2 hypertension was more prevalent (65.5%) than stage 1 hypertension (34.5%).

Table 1. Sociodemographic and Clinical Characteristics of Participants.

Variable	Frequency (n)	Percent (%)
Demographic Characteristic		
Gender		
Male	26	31,0%
Female	58	69,0%
Age Group (years)		
Adults (18-59)	35	41,7%
Older Adults (>60)	49	58,3%
Educational Level		
Elementary	70	83,3%
Junior High School	14	16,7%
Marital Status		
Married	80	95,2%
Divorced	4	4,8%
Employment		
Employed	66	78,6%
Unemployed	18	21,4%
Comorbid		
Diabetes Mellitus		
Yes	28	33,3%
No	56	66,7%
Lifestyle		
Smoking Habits		
Yes	29	34,5%
No	55	65,5%
Physical Activity		
Adequate	53	63,1%
Inadequate	31	36,9%
Clinical		
Stage of Hypertension		
Stage 1	29	34,5%
Stage 2	55	65,5%

Table 2 presents the results of the bivariate analysis examining factors associated with hypertension severity. Sociodemographic characteristics, including gender, age group, educational level, marital status, and employment status, were not significantly associated with the stage of hypertension ($p > 0.05$).

In contrast, diabetes mellitus was significantly associated with hypertension severity ($p = 0.029$), with a higher proportion of participants with diabetes mellitus classified as having stage 2 hypertension. No significant associations were observed between hypertension severity and lifestyle factors, including smoking habits and physical activity ($p > 0.05$).

Table 2. Bivariate Analysis of Factors Associated with Hypertension Severity.

Variable	Stage of Hypertension				p-Value
	Stage 1		Stage 2		
	n	%	n	%	
Demographic Characteristic					
Gender					0.140
Male	6	7,1%	20	23,8%	
Female	23	27,4	35	41,7	
Age Group (years)					0.670
Adults (18-59)	13	15,5%	22	26,2%	
Older Adults (>60)	16	19,0%	33	39,3%	
Educational Level					0.081
Elementary	27	32,1%	43	51,2%	
Junior High School	2	2,4%	12	14,3%	
Marital Status					1.000 ^a
Married	28	33,3%	52	61,9%	
Divorced	1	1,2%	3	3,6%	
Employment					0.497
Employed	24	28,6%	42	50,0%	
Unemployed	5	6,0%	13	15,5%	
Comorbid					
Diabetes Mellitus					0.029*
Yes	5	6,0%	23	27,4%	
No	24	28,6%	32	38,1%	
Lifestyle					
Smoking Habits					0.995
Yes	10	11,9%	19	22,6%	
No	19	22,6%	36	42,9%	
Physical Activity					0.418
Adequate	20	23,8%	33	39,3%	
Inadequate	9	10,7%	22	26,2%	

Note: Chi-square test was applied when expected cell counts ≥ 5 , and Fisher's exact test was used when expected cell counts < 5 .

4. DISCUSSIONS

This study examined the association between diabetes mellitus and hypertension severity among patients attending a primary health care center in Indonesia. The findings indicate that diabetes mellitus was significantly associated with greater hypertension severity, with patients who had diabetes mellitus more likely to present with stage 2 hypertension. In contrast, sociodemographic characteristics and lifestyle factors were not significantly associated with hypertension severity. These results highlight the important role of metabolic comorbidity in the progression of hypertension at the primary care level.

The significant association between diabetes mellitus and hypertension severity observed in this study is consistent with previous evidence demonstrating a strong interrelationship between these two non-communicable diseases (Hezam *et al.*, 2024; Mills *et al.*, 2020; Petrie *et al.*, 2018). Diabetes mellitus contributes to endothelial dysfunction, increased arterial stiffness, chronic inflammation, and activation of the renin-angiotensin-

aldosterone system, all of which can exacerbate blood pressure elevation and accelerate the progression to more severe hypertension (Alicic *et al.*, 2017; Task *et al.*, 2018; Wang *et al.*, 2021). Several studies conducted in Indonesia and other low- and middle-income countries have similarly reported that individuals with diabetes mellitus are more likely to experience uncontrolled or severe hypertension compared to those without diabetes mellitus (Febriyanti *et al.*, 2025; Oktaviyani *et al.*, 2022).

The coexistence of diabetes mellitus and hypertension represents a major public health concern, particularly in primary care settings where long-term disease management is essential. A large population-based study in Indonesia demonstrated a strong bidirectional relationship between diabetes mellitus and hypertension, suggesting that each condition may act as both a cause and a consequence of the other (NCD Risk Factor Collaboration (NCD-RisC), 2021). Similar findings have been reported in multinational analyses, indicating that diabetes mellitus increases the risk of developing hypertension and worsens blood pressure control, while hypertension contributes to the progression of diabetes-related complications (Geldsetzer *et al.*, 2019; Zhou *et al.*, 2016). The findings of the present study extend this evidence by showing that diabetes mellitus is not only associated with the presence of hypertension but also with its severity in a real-world primary health care setting.

In contrast, sociodemographic factors such as age, gender, educational level, marital status, and employment status were not significantly associated with hypertension severity in this study. Although older age and female sex were more prevalent among participants with stage 2 hypertension, these differences did not reach statistical significance. This finding may be explained by the relatively homogeneous characteristics of the study population, which was dominated by older adults with low educational attainment. Similar results have been reported in facility-based studies, where clinical and metabolic factors were stronger determinants of hypertension severity than sociodemographic characteristics (Calhoun *et al.*, 2019; Mahwati *et al.*, 2022).

Lifestyle factors, including smoking habits and physical activity, were also not significantly associated with hypertension severity in this study. While smoking and physical inactivity are well-established risk factors for the development of hypertension, their association with hypertension severity is less consistent across studies (Wang *et al.*, 2021; Wihatno *et al.*, 2025). The lack of association observed in this study may be related to the use of secondary medical record data, which may not capture detailed information on intensity, duration, or cumulative exposure to these behaviors. Additionally, patients attending primary health care centers may have already received lifestyle counseling as part

of routine chronic disease management, potentially reducing behavioral variability among participants (Endra *et al.*, 2022; World Health Organization, 2021).

Overall, the findings of this study underscore the importance of diabetes mellitus as a key determinant of hypertension severity in primary care settings. Integrated management of diabetes mellitus and hypertension is therefore essential to prevent disease progression, reduce cardiovascular risk, and improve long-term outcomes among patients with chronic non-communicable diseases.

5. CONCLUSIONS

This study demonstrates a significant association between diabetes mellitus and hypertension severity among patients attending a primary health care center in Indonesia. Patients with diabetes mellitus were more likely to present with stage 2 hypertension compared to those without diabetes mellitus, highlighting the important role of metabolic comorbidity in the progression of hypertension. In contrast, sociodemographic characteristics and lifestyle factors were not significantly associated with hypertension severity in this study population.

The findings underscore the substantial burden posed by the coexistence of diabetes mellitus and hypertension in primary care settings, where early detection and long-term management are critical. The results suggest that diabetes mellitus may contribute to worsening blood pressure control and increased hypertension severity, emphasizing the need for comprehensive and integrated care strategies. Strengthening routine screening for diabetes mellitus among patients with hypertension, as well as optimizing blood pressure monitoring and management in patients with diabetes, may help prevent disease progression and reduce the risk of cardiovascular complications.

Overall, this study provides valuable evidence from a primary health care setting that supports the integration of diabetes and hypertension management at the frontline of health services. Future studies with larger sample sizes, multicenter designs, and longitudinal follow-up are recommended to further clarify causal relationships and to explore the impact of glycemic control and treatment adherence on hypertension severity.

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