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Factors Associated with Depression in Elderly Patients with Hypertension

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Abstract

Background: Depression in elderly individuals with hypertension is a common but often underdiagnosed mental health issue that affects quality of life and treatment adherence. This study aimed to identify factors associated with depression in elderly patients with hypertension.
Design : A descriptive correlational study with a cross-sectional design was conducted.
Methods : This study involved 68 community-dwelling elderly patients with hypertension in a village of North Sulawesi selected through total sampling. Data were collected using structured questionnaires covering sociodemographic and clinical characteristics and the Geriatric Depression Scale-15 (GDS-15). Data were analyzed using the Mann-Whitney U test, Kruskal-Wallis H test, and Spearman's rank correlation.
Results : The mean depression score was 9.43 (SD = 1.79), with nearly half of participants experiencing moderate depression (48.5%). Only the duration of hypertension was significantly correlated with depression score (r = 0.275, p = 0.023).
Conclusions : These findings highlight the need for routine depression screening among elderly hypertensive patients, particularly those with a longer history of illness. Clinical implications include adopting integrated care models that combine hypertension management with psychosocial support in primary care settings.

Keywords: Depression, Elderly, Hypertension

INTRODUCTION

Globally, populations are aging at an unprecedented rate, with the number of adults over 60 years old expected to double by 2050 to around 2.1 billion (1,2). Depression is one of the most common mental health conditions in later life, affecting approximately 5-7% of people over age 60 worldwide (3). This condition poses a serious threat to older adults' well-being, as it significantly diminishes quality of life and contributes to disability and mortality (4–6). In fact, late-life depression has been identified as a leading cause of disability-adjusted life years and a significant risk factor for all-cause mortality in the elderly (4). These issues underscore the importance of understanding depression and its determinants among older adults.

Hypertension is likewise highly prevalent in older populations. More than half of individuals over 60 years of age have elevated blood pressure (7,8). The coexistence of hypertension and depression in the elderly has become a critical public health concern (9). There is evidence of a bidirectional relationship between these conditions, whereby chronic hypertension can adversely impact mental well-being, and conversely, depression may contribute to blood pressure dysregulation through stress-related neuroendocrine mechanisms (9,10). For example, the psychosocial stress of dealing with a chronic hypertensive illness (and potential side effects of antihypertensive drugs) can precipitate depression, while depression can activate the hypothalamic-pituitary-adrenal axis and other pathways that elevate blood pressure (10). Clinically, the combination of hypertension and depression in an elderly patient is associated with worse outcomes than either condition alone. Studies have shown that hypertensive patients with coexisting depression have poorer treatment adherence, lower quality of life, and higher mortality risk compared to non-depressed hypertensives (9,11). Thus, understanding and addressing depression in the context of hypertension is vital for improving prognosis in this vulnerable group.

Emerging epidemiological evidence suggests that depression is relatively frequent among older adults with hypertension. A recent meta-analysis reported that roughly 29% of community-dwelling elderly patients with hypertension suffer from clinically significant depression (12). In various studies, the prevalence of depression in hypertensive populations has ranged from about one-quarter to over one-half of patients, depending on the population and assessment method. For instance, longitudinal surveys in Western countries have noted depression rates around 26-30% in older adults with hypertension, while some clinical studies in Asia have found prevalence as high as 50% (13,14). In Indonesia and the broader Southeast Asian region, the dual burden of hypertension and depression is an increasing concern (15). National data indicate that approximately 8-12% of Indonesian older adults experience depression and about 63-70% of those over 60 have hypertension (9,16). This overlap implies that a substantial number of community-dwelling Indonesian elders may be living with both conditions, putting them at risk for the compounded negative effects on health and daily functioning.

Identifying the factors associated with depression in elderly patients with hypertension is crucial for prevention and intervention efforts. Prior studies have highlighted several socio-demographic correlates of depression in this population. Female sex is consistently associated with higher depression risk among older adults with hypertension. Women with hypertension are significantly more likely to exhibit depression than their male counterparts. Additionally, lower educational attainment has been linked to late-life depression, with hypertensive individuals who have fewer years of schooling showing higher odds of depression than those with higher education levels. Social and marital factors also play a role. Being unmarried (single, widowed, or divorced) and living alone are associated with an elevated likelihood of depression in older adults with hypertension. These findings align with the broader understanding that limited social support and socioeconomic disadvantages can exacerbate mental health problems in older adults. Conversely, strong family and community support networks may be protective against depression in those managing chronic illnesses like hypertension (12).

A number of clinical characteristics related to hypertension itself may predispose elderly patients to depression. Uncontrolled or more severe hypertension has been associated with a higher risk of depression. Patients with persistently elevated blood pressure or end-organ effects of hypertension might experience greater psychological stress and frustration, which can contribute to depression. The duration of hypertensive disease is another important factor, a longer course of illness (many years living with hypertension) can increase the cumulative psychosocial burden, and one meta-analysis noted that a prolonged disease duration was linked to about three-fold higher odds of depression in older adults with hypertension. Comorbid chronic conditions frequently accompanying hypertension (such as heart disease, stroke, or diabetes) can further compound the risk of depression (12). The presence of multiple health problems often leads to functional impairment and chronic pain, which are well-known contributors to depressive states in the elderly. Nutritional and metabolic status may also influence mental health in this context. Extreme body mass index (BMI) values have been

implicated in depression risk. For example, studies have observed a U-shaped relationship between BMI and depression, wherein both underweight and obese older individuals show higher rates of depression compared to those with normal weight (17). Being underweight (BMI below 18.5 kg/m^2) might reflect frailty or poor nutritional status that parallels worse overall health and mood, while obesity-related inflammation and self-perception issues can likewise increase depression risk (17). These clinical factors underscore that patients with more severe or longstanding hypertension and health complications are particularly vulnerable to developing depression.

Treatment-related factors, especially medication use and adherence, are another critical piece of the puzzle. Depression can adversely affect adherence to antihypertensive medication regimens. Depressed patients are more likely to be non-compliant with their blood pressure medications than non-depressed patients. Cognitive symptoms like poor concentration, low motivation, and hopelessness in depression may lead to missed doses or complete discontinuation of treatment. Such non-adherence, in turn, can result in uncontrolled hypertension, creating a vicious cycle of worsening cardiovascular health and persistence of depression (11,18). Indeed, poor adherence has been identified as a major factor in hypertension control, and its links with depression suggest that addressing mental health is important for effective blood pressure management (19). On the other hand, the types of antihypertensive medications an elderly patient receives might also influence their mood. Certain classes of blood pressure-lowering drugs have historically been suspected to contribute to depression as a side effect. For instance, some β-blockers and central sympatholytic agents (like reserpine or methyldopa) have been reported to induce depression changes in susceptible individuals (10). In evaluating depression among older adults with hypertension, one should consider both the possibility that depression might be a barrier to proper hypertension treatment and that certain treatments could potentially exacerbate depression.

Despite growing research on the intersection of hypertension and mental health, there are still notable gaps in understanding the specific factors associated with depression in older adults with hypertension, especially in low- and middle-income countries (LMICs). Many studies on this topic have been conducted in high-income Western countries or in East Asian populations (20), and relatively fewer have focused on Southeast Asia or community settings in developing nations. Local cultural and healthcare context can significantly influence both the experience of depression and hypertension outcomes. In Asian societies such as Indonesia, stigma surrounding mental illness and limited health literacy may lead to underdiagnosis or reluctance to seek help for depression. Older individuals may downplay emotional symptoms or attribute them to aging, while healthcare providers in primary care may prioritize physical chronic disease management over mental health. These factors suggest that findings from Western populations cannot be automatically generalized to the Indonesian context. Consequently, there is a clear need for studies that examine the sociocultural and clinical determinants of depression among older adults with hypertension in community settings. Such research can provide evidence to guide tailored interventions. For example, community-based screening programs or educational initiatives to address the combined burden of hypertension and depression (9). By illuminating risk factors specific to the local context, health authorities can better plan integrated care strategies to improve outcomes for older adults living with these co-morbid conditions.

In light of the above considerations, the present study aimed to investigate the factors associated with depression in community-dwelling elderly patients with hypertension. We focus on a comprehensive set of independent variables encompassing sociodemographic characteristics and clinical characteristics. By elucidating which of these factors are significantly linked to depression in older adults with hypertension, this study seeks to inform more effective screening and management approaches for depression in the growing population of elderly individuals with hypertension.

METHODS

Study Design

This was a descriptive correlational study with a cross-sectional approach.

Population and Sample

A total of 68 elderly patients with hypertension were recruited through total sampling from a

village in North Minahasa Regency, North Sulawesi Province, Indonesia, in March to April 2024. Participants were eligible for inclusion if they were aged 60 years or older, had a confirmed diagnosis of hypertension by a physician, possessed adequate hearing ability, were capable of providing reliable responses, and consented to participate by signing an informed consent form. Exclusion criteria comprised elderly individuals with hypertension who had been diagnosed with dementia, including Alzheimer's disease, or those who were completely bedridden.

Research Instrument

Data collection was carried out using structured questionnaires. Sociodemographic and clinical characteristics including age, gender, education, body mass index (BMI), systolic and diastolic blood pressures, classification of BP, medication compliance, duration of disease, and types of antihypertensive treatment received.

The Geriatric Depression Scale-15 (GDS-15) was employed to assess depression in elderly participants with hypertension (21). This concise instrument consists of 15 dichotomous (yes/no) items, making it suitable for older adults, including those with chronic illnesses such as hypertension. Scoring is based on the sum of depressive responses, yielding a total score ranging from 0 to 15. Interpretation of the scores is as follows: 0-4 indicates no depression, 5-8 suggests mild depression, 9-11 indicates moderate depression, and 12-15 reflects severe depression. This tool has been widely validated and is known for its non-somatic focus, minimizing symptom overlap with physical illness. In Indonesia, the GDS-15 has been culturally adapted and validated among older populations, demonstrating a reliability coefficient of 0.80 (22).

Data Collection and Analysis

Data were collected through structured interviews and validated questionnaires administered in a private setting to ensure participant comfort and data accuracy. Participants were assured that their involvement was entirely voluntary, and they had the right to decline or withdraw from the study at any point without any consequences to their medical care or relationship with the healthcare institution.

Data analysis was conducted using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including means, standard deviations, frequencies, and percentages, were utilized to present participants' sociodemographic characteristics, clinical variables, and depression scores. The Mann-Whitney U test and Kruskal-Wallis H test were applied to assess differences in depression scores across categorical variables, as both the dependent variable and several independent variables violated the assumption of normality. Given the modest sample size (n = 68), nonparametric methods were considered more appropriate due to their robustness to non-normal data distributions and their applicability to ordinal or skewed variables. Spearman's rank correlation was employed to evaluate the associations between depression and all independent variables. A p-value of less than 0.05 was considered statistically significant.

Ethical consideration

Ethical approval for this study was obtained from the Research Ethics Committee of the Faculty of Nursing from a university located in West Java (Approval No. 293/KEPK-FIK/EC/III/24). Prior to data collection, participants received a clear explanation regarding the study's purpose, procedures, confidentiality, and their rights as research subjects. Informed consent was obtained from all elderly patients with hypertension who met the inclusion criteria and agreed to participate voluntarily.

RESULTS

Description of Participants' Characteristics

Table 1 summarizes the sociodemographic and clinical characteristics of participants (n = 68). The mean age was 70.06 years (SD = 8.02), and the majority were female (57.4%). Most participants had completed elementary school (39.7%). The mean body mass index (BMI) was 23.47 kg/m^2 (SD = 4.26), with the largest proportion classified as having normal weight (47.1%). The mean systolic and diastolic blood pressures were 147.65 mmHg (SD = 12.35) and 88.21 mmHg (SD = 5.38), respectively. The majority of participants were classified as having stage 1 hypertension (76.5%) and reported rarely adhering to medication (53.7%). The mean duration of hypertension was 6.81 years (SD = 4.36), with most participants having lived with the condition for less than five years (61.8%). In terms of pharmacological treatment, calcium channel blockers (CCBs) were the most commonly used medication (95.6%).

Table 1. The Sociodemographic and Clinical Characteristics of Participants (n=68)

Variables	n (%)	Mean (SD)
Age (years)		70.06 (8.02)
Gender		
Female	39 (57.4)	
Male	29 (42.6)	
Education		
Elementary school	27 (39.7)	
Junior high school	20 (29.4)	
Senior high school	21 (30.9)	
BMI (kg/m^2)		23.47 (4.26)
Underweight	12 (17.6)	
Normal	32 (47.1)	
Overweight	20 (29.4)	
Obesity	4 (5.9)	
Systolic BP (mmHg)		147.65 (12.35)
Diastolic BP (mmHg)		88.21 (5.38)
Classification of BP		
Normal	4 (5.9)	
Stage 1	52 (76.5)	
Stage 2	12 (17.6)	
Medication compliance		
Rarely	15 (22.1)	
Sometimes	22 (32.4)	
Always	31 (45.6)	
Duration of disease (years)		6.81 (4.36)
<5 year	42 (61.8)	
≥5 year	26 (38.2)	
ACEIs		
Yes	2 (2.9)	
No	66 (97.1)	
CCBs		
Yes	65 (95.6)	
No	3 (4.4)	
ARBs		
Yes	5 (7.4)	
No	63 (92.6)	

Note: ACEIs = Angiotensin-Converting Enzyme Inhibitors; ARBs = Angiotensin Receptor Blockers; BMI = Body Mass Index; BP = Blood Pressure; CCBs = Calcium Channel Blockers; kg = Kilogram; m = Meter; mmHg = Millimeter Hidrargirum; SD = Standard Deviation.

The Description of Depression among Participants

Table 2 presents the distribution of responses to the GDS-15 and the overall scores among participants. The mean total depression score was 9.43 (SD = 1.79). The most frequently endorsed depressive items were GDS15 “think that most people are better” (M = 0.94, SD = 0.23), GDS4 “get bored” (M = 0.87, SD = 0.34), and GDS6 “afraid that something bad is going to happen” (M = 0.84, SD = 0.37) In contrast, positive affect items such as GDS11 "think it is wonderful to be alive" (M = 0.21, SD = 0.40) and GDS7 "feel happy most of the time" (M = 0.35, SD = 0.48) had lower mean scores. Nearly half of the participants (48.5%) experienced moderate depression and 36.8% experienced mild depression.

Table 2. The Description of Depression among Participants (n=68)

Items	n (%)	Mean (SD)
GDS1 - Satisfied with life		0.44 (0.50)
GDS2 - Dropped many of activities and interests		0.74 (0.44)
GDS3 - Feel empty		0.74 (0.44)
GDS4 - Get bored		0.87 (0.34)
GDS5 - In good spirits most of the time		0.40 (0.49)
GDS6 - Afraid that something bad is going to happen		0.84 (0.37)
GDS7 - Feel happy most of the time		0.35 (0.48)
GDS8 - Often feel helpless		0.75 (0.75)
GDS9 - Prefer to stay at home		0.66 (0.47)
GDS10 - Feel you have more problems with memory		0.68 (0.47)
GDS11 - Think it is wonderful to be alive		0.21 (0.40)
GDS12 - Feel pretty worthless		0.59 (0.49)
GDS13 - Feel full of energy		0.50 (0.50)
GDS14 - Feel that situation is hopeless		0.74 (0.44)
GDS15 - Think that most people are better		0.94 (0.23)
Depression Score		9.43 (1.79)
Normal (0-4)	0 (0.0)	
Mild (5-8)	25 (36.8)	
Moderate (9-11)	33 (48.5)	
Severe (12-15)	10 (14.7)	

Note: GDS = Geriatric Depression Scale; SD = Standard Deviation.

Differences in Depression Scores Across Various Categorical Variables among Participants

Table 3 displays the differences in depression scores across various categorical variables among participants. Female participants had a slightly higher mean depression score of 9.54 (SD = 1.83) compared to males with a mean of 9.28 (SD = 1.77), although this difference was not statistically significant (Z = -0.635, p = 0.525). Those with primary school education had the highest mean score of 9.67 (SD = 1.13), followed by junior high school (M = 9.50, SD = 1.44), and senior high school (M = 9.05, SD = 1.13), with no significant difference observed (H(2) = 1.489, p = 0.475). Regarding BMI, participants in the normal category had the highest mean score of 9.91 (SD = 1.75), while those classified as obese had the lowest mean score of 8.25 (SD = 1.89), with no significant association (H(3) = 5.365, p = 0.147). Depression mean scores were highest among those with Stage 2 hypertension at 10.00 (SD = 2.13), but the difference across hypertension stages was not statistically significant (H(2) = 1.576, p = 0.455). Similarly, no significant differences in depression scores were found based on medication compliance (H(2) = 0.029, p = 0.986), ACE inhibitor use (Z = -1.012, p = 0.311), calcium channel blocker use (Z = 0.590, p = 0.555), or angiotensin receptor blocker use (Z = 1.310, p = 0.190).

Table 3. Factors Associated with Depression among Participants (n=68)

Variables	Mean (SD)	p
Gender		0.525
Female	9.54 (1.83)	
Male	9.28 (1.77)	
Education		0.475
Elementary school	9.67 (1.13)	
Junior high school	9.50 (1.44)	
Senior high school	9.05 (1.13)	
BMI (kg/m^2)		0.147
Underweight	8.83 (1.95)	
Normal	9.91 (1.75)	
Overweight	9.25 (1.65)	
Obese	8.25 (1.89)	
Classification of BP		0.455
Normal	8.75 (1.26)	
Stage 1	9.35 (1.75)	
Stage 2	10.00 (2.13)	
Medication compliance		0.986
Rarely	9.40 (1.96)	
Sometimes	9.50 (1.97)	
Always	9.39 (1.65)	
ACEIs		0.311
Yes	10.50 (0.71)	
No	9.39 (1.81)	
CCBs		0.555
Yes	9.40 (1.80)	
No	10.00 (2.00)	
ARBs		0.190
Yes	8.40 (1.14)	
No	9.51 (1.82)	

*Note: *p < 0.05; **p < 0.01; ***p < 0.001; ACE = Angiotensin Converting Enzyme Inhibitors; ARB = Angiotensin Receptor Blockers; BMI = Body Mass Index; BP = Blood Pressure; CCBs = Calcium Channel Blockers; SD = Standard Deviation.*

Table 4. Correlation Matrix of Continuous Variables among Participants (n=68)

Variables	1	2	3	4	5	6
1. Age	1					
2. BMI	0.082	1				
3. SBP	0.203	-0.108	1			
4. DBP	0.215	0.140	**0.357****	1		
5. Duration	**0.401***	0.052	**0.318****	0.087	1	
6. GDS-15	-0.072	-0.036	0.211	0.140	**0.275***	1

*Note: *p < 0.05; **p < 0.01; ***p < 0.001; BMI = Body Mass Index; DBP = Diastolic Blood Pressure; GDS-15 = Geriatric Depression Scale-15; SBP = Systolic Blood Pressure.*

Correlation of Continuous Variables among Participants

Table 4 portrays the correlation matrix among continuous variables in the study. A significant positive correlation was found between age and duration of hypertension (r = 0.401, p = 0.001), indicating that older participants tended to have had hypertension for a longer period. Systolic blood pressure was positively correlated with both diastolic blood pressure (r = 0.357, p = 0.003) and duration of disease (r = 0.318, p =

0.008). Depression scores were significantly and positively correlated with the duration of disease ($r = 0.275$, $p = 0.023$). No significant correlations were observed between depression and age, BMI, systolic, or diastolic blood pressure ($p > 0.05$).

DISCUSSION

This study found a notably high prevalence of depression among elderly patients with hypertension. The mean depression score in our sample was approximately 9.4 (out of 15), indicating overall moderate depression. This prevalence is substantially higher than that observed in the general Indonesian older adult population (national surveys report roughly 8-12% depression prevalence in older adults) and reflects the elevated psychiatric vulnerability of those with chronic illnesses. It is also consistent with patterns reported in other settings. Epidemiological studies internationally have noted that between roughly one-quarter and over one-half of older adults with hypertension experience clinically significant depression (13,14,23). For example, a recent meta-analysis estimated that about 29% of community-dwelling elders with hypertension have depression (12). The consistently high figures underscore that late-life depression is a common comorbidity in hypertension both regionally and globally. Our finding that a majority of patients had at least mild depression places our community sample at the upper end of this spectrum, highlighting an urgent public health concern.

Interestingly, we did not find a significant relationship between patients' current blood pressure levels and their depression scores. Depression severity was similar in participants with controlled blood pressure versus those with higher readings, and there were no significant differences across hypertension stages. This absence of association is in line with several studies that have reported inconsistent or null findings on the BP-depression link in the elderly (9,24). In one large Iranian cohort, higher depression scores were associated with slightly lower systolic BP after adjusting for confounders, suggesting depression and its treatment might facilitate blood pressure control (20). Taken together, the literature indicates that the connection between BP and depression is complex and may be bidirectional or confounded by factors like antihypertensive therapy and autonomic function (24,25). In our community sample with generally well-managed hypertension, it appears that blood pressure per se was not a primary driver of depression. Similarly, we found no significant association between BMI and depression in this study. While extreme BMI values have been linked to late-life depression, an analysis reported a non-linear or weak relationship in older populations. The same study findings suggest that the typical U-shaped BMI-depression curve evident in younger adults becomes attenuated in older age groups. Higher BMI in the elderly might not confer the same psychological risk it does in midlife, some data from Asian seniors even indicate that being overweight is associated with lower depression rates, possibly because it correlates with better nutritional status and reserve (17). In our sample, the lack of any clear linear trend between BMI and depression may reflect these countervailing effects. Overall, our results concur with the view that mild to moderate weight differences are not decisive for depression in late life, especially when controlling for health status, whereas very low or very high BMI might matter more in specific contexts.

We also examined core sociodemographic factors (age, gender, and education level) in relation to depression, and none showed a statistically significant association in our sample. Women had slightly higher mean depression scores than men, and older seniors (those ≥70) did not differ significantly from younger seniors, but these trends did not reach significance. This finding is somewhat unexpected given the weight of evidence from larger studies. In general, late-life depression tends to be more common in females and in individuals of lower socioeconomic or educational status (26–32). A recent meta-analysis of depressed hypertensive patients found, for that female sex carried an odds ratio about 2.2 for depression compared to male sex, and having less education was associated with significantly higher depression odds (12). Likewise, multiple studies have reported that very old age (over 75) is linked to increased depression risk, possibly due to greater loneliness, disability, or neurological changes (26–32). The absence of sociodemographic disparities in our results may be due to the characteristics of our study sample and design. Our sample size was modest, limiting statistical power to detect small-to-moderate differences. The community we surveyed may also be relatively homogeneous, most participants had similar rural backgrounds and family support

systems, which could buffer the typical gender or education effects seen elsewhere.

Another noteworthy result is that depression in our study was not significantly associated with antihypertensive medication compliance or with the type of hypertension treatment. We stratified participants by their self-reported adherence to blood pressure medications and found no significant differences in depression scores between these groups. We also examined whether patients on certain classes of antihypertensive drugs such as ACEIs, CCBs, or ARBs had differing depression levels, but again found no notable pattern. These findings run somewhat contrary to expectations from prior research, yet they can be interpreted in light of recent evidence. On one hand, depression is often implicated in poorer treatment adherence among chronic disease patients. Depressed hypertensive individuals may lack motivation for self-care and are known to be less compliant with medication regimens in some studies (13,14,23). For instance, an analysis of US hypertensive adults showed depression was associated with a slight but significant increase in the odds of non-adherence to antihypertensive medication (11). In our study, however, adherence was high overall (reported always taking their medications), which may have limited our ability to detect differences. It is possible that community health support in our study setting such as family supervision of medication, helped depressed patients maintain their treatment routines, thereby narrowing the compliance gap. On the other hand, the lack of any discernible impact of specific antihypertensive drug classes on depression aligns with the bulk of contemporary evidence.

Historically, certain medications (like some β-blockers and central agents such as methyldopa or reserpine) were suspected to induce depressive side effects. However, recent large-scale trials and reviews have challenged the strength of this effect for modern antihypertensive drugs (10). A 2021 systematic review and network meta-analysis found no consistent increase in depression risk for most major antihypertensive classes, in pooled analyses, use of ACE inhibitors, angiotensin receptor blockers, β-blockers, and diuretics was not associated with higher depression incidence, and only calcium-channel blockers showed a very slight risk increase (33). Moreover, a meta-analysis focusing on β-blockers concluded that these drugs are not significantly related to new-onset depression, with any apparent association likely due to misinterpretation of side effects or confounding by the cardiovascular condition (34). Our finding of no difference in depression scores across treatment types is in line with this current consensus. It suggests that, within a reasonably managed hypertensive population, the choice of antihypertensive therapy itself is unlikely to be a major determinant of mood. This is reassuring for clinicians because it implies that effective blood pressure control can be pursued without undue concern about negative mood effects in most patients. Overall, the interplay between depression and hypertension treatment seems to be more about adherence and holistic care than about specific drug effects. Ensuring that depressed patients are identified and supported may improve their medication adherence and outcomes (13,14,23), whereas switching or avoiding particular antihypertensive drugs is usually not necessary solely to prevent depression, except in cases of clear individual side effects.

A key finding of our study is the significant association between the duration of hypertension and depression severity. Elderly patients who had been living with hypertension for a longer time tended to exhibit higher depression scores. This trend suggests that the cumulative burden of a chronic condition over many years can adversely affect mental well-being. Our result aligns with prior research indicating that prolonged disease duration is a risk factor for depression in hypertensive populations. A meta-analysis reported that older hypertensive individuals with a longer course of illness had more than three times the odds of experiencing depression compared to those with shorter disease duration (12). Similarly, a study in China noted that co-occurring depression was strongly linked to having a long history of hypertension (32). There are several plausible mechanisms for this relationship. These findings reinforce that those in the later stages of hypertensive illness are an at-risk group, they may benefit from targeted mental health screening and support as part of their routine care.

Limitation

This study has several limitations that must be acknowledged. First, the cross-sectional design precludes any inference of causality or temporal direction in the observed associations. We

measured hypertension duration and depression at the same point in time, so we cannot definitively determine whether longer hypertension led to depression or if subclinical depression perhaps affected patients' illness perception. Second, the sample was relatively small and drawn from a single rural community in North Sulawesi, Indonesia. This limits the generalizability of our findings. The homogeneous sample may explain why some expected associations (e.g. with gender or education) were not observed. A larger, more diverse sample might yield different results. Third, all data were collected via self-report questionnaires and interviews, which introduces the possibility of response bias. For instance, medication adherence was self-rated and may be overestimated due to social desirability bias, and depression might be underreported due to stigma. The use of the GDS-15, while suitable for older adults, is a screening tool rather than a clinical diagnostic interview. Thus, we identified depression but did not confirm clinical depression diagnoses. Finally, given the focus on a community-dwelling population, our results may not apply to institutionalized or hospital-based older adults with hypertension, who could have different profiles and risk factors.

CONCLUSION

This study revealed a high prevalence of depression among community-dwelling elderly patients with hypertension, with nearly half participants experiencing moderate levels. Among the sociodemographic and clinical variables examined, only the duration of hypertension was significantly associated with depression, indicating that longer illness trajectories may increase psychological vulnerability in this population. Other factors, including age, gender, education, BMI, blood pressure levels, medication adherence, and antihypertensive treatment types, were not significantly related to depression scores. These findings highlight the complex interplay between chronic illness and mental health in later life.

Given the elevated burden of depression observed, mental health screening should be routinely incorporated into the management of older adults with hypertension, particularly those with a long-standing history of the disease. Community health services, especially in low- and middle-income settings like Indonesia, should adopt integrated care models that address both physical and psychological health. Future research should employ longitudinal designs and larger, more diverse samples to better understand causality and generalizability. Additionally, interventions that combine hypertension management with psychosocial support and education, targeted toward both patients and caregivers are warranted to improve overall health outcomes and quality of life in this vulnerable population.

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Author Contributions
FL: Conceptualization, methodology, data collection, data analysis, original draft writing, and manuscript revision.
RML: Methodology support, data curation, statistical analysis support, interpretation of findings, and manuscript review/editing.
BHW: Supervision, critical review of the manuscript, interpretation and clinical contextualization of results, and final approval of the manuscript.

Conflict of interest
All author declare no conflict of interest

Data Availability Statement
The datasets generated and/or analyzed during the current study are not publicly available due to ethical restrictions and participant confidentiality but are available from the corresponding author on reasonable request and with approval from the relevant ethics committee.

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