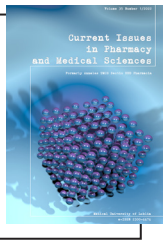
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Effectiveness of pharmacist counseling on medication adherence and blood pressure in patients with hypertension at a private clinic in Bali, Indonesia

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ABSTRACT

Hypertension can be influenced by several factors, including age, genetics, lifestyle, and sex. Poor medication adherence and uncontrolled blood pressure are associated with increased morbidity and mortality; therefore, pharmacist counseling may play an important role in improving treatment outcomes. This study aimed to evaluate the effectiveness of pharmacist counseling on medication adherence and blood pressure in patients with hypertension at a private clinic in Bali, Indonesia. A quasi-experimental study with a nonequivalent pretest-posttest control group design was conducted. A total of 71 respondents participated in the study, including 28 in the control group and 43 in the intervention group, using a total sampling method. Medical record data were collected retrospectively over a 6-month period (June-November 2025) and prospectively for 5 months after the intervention (January-May 2026) to assess medication adherence using the Medication Possession Ratio (MPR) and to evaluate blood pressure. The chi-square test was used to analyze medication adherence, while the Mann-Whitney, Wilcoxon, and ANCOVA tests were used to analyze blood pressure. A significant difference in medication adherence was observed after pharmacist counseling (p = 0.006). No significant differences were observed in systolic or diastolic blood pressure after pharmacist counseling, with p = 0.318 and p = 0.623, respectively. In conclusion, pharmacist counseling was effective in improving medication adherence but did not have a statistically significant effect on blood pressure.

INTRODUCTION

Hypertension is characterized by elevated blood pressure, defined as >140/90 mmHg [1]. It can be influenced by several factors, including age, genetics, lifestyle, and sex [2]. Because hypertension has multiple contributing factors, its prevalence may vary according to demographic characteristics such as age and sex, as well as across populations. According to data from the American Heart Association (AHA) published in 2025, the prevalence of hypertension by sex in 2017-2020 was 49.5% in males and 43.9% in females [3]. In Indonesia, the prevalence of hypertension is 34.1% of the total population, with the highest prevalence reported in Kalimantan Province at 44.1% and the lowest in Papua Province at 22.2%. Bali Province also has a relatively high prevalence of approximately 30% [1].

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Counseling is a communication process between patients and pharmacists that involves providing information and education to improve therapeutic outcomes and promote positive behavioral changes [4]. The aims of pharmacist counseling include educating patients about their health conditions and prescribed therapies, increasing awareness of treatment, supporting the selection and monitoring of effective and efficient therapies, increasing patient knowledge, and improving medication adherence [5,6]. However, pharmacist counseling is not yet optimally implemented in Indonesia because of the high number of patients, limited consultation time, and insufficient counseling training. These barriers should be addressed to improve treatment success and help patients achieve therapeutic goals [5,7].

Medication adherence can be influenced by several factors, including socioeconomic status, treatment regimen, and interactions with healthcare professionals [4]. According

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to the 2023 Indonesian Health Survey, the prevalence of adherence to hypertension treatment was 46.70% [8]. Among patients who were nonadherent to hypertension treatment, the reported reasons included feeling healthy (72.3%), experiencing adverse effects from antihypertensive medications (5.0%), using traditional medicine (3.7%), feeling bored or lazy or forgetting to take antihypertensive medications (13.9%), unavailability of antihypertensive medications at healthcare facilities (1.4%), taking medication only during pregnancy (0.1%), and other reasons (3.6%) [8]. Medication adherence plays an important role in reducing morbidity and mortality among patients with hypertension.

Based on these considerations, research is needed to evaluate the effectiveness of pharmacist counseling on medication adherence and blood pressure in patients with hypertension. This study aimed to analyze the effectiveness of pharmacist counseling on medication adherence and blood pressure in patients with hypertension attending a private clinic in Bali, Indonesia. It is expected that the findings of this study may support broader implementation of pharmacist counseling to improve pharmaceutical care, particularly clinical pharmacy services for patients with hypertension.

MATERIALS AND METHODS

Materials

The materials used in this study included informed consent forms and electronic medical records, which were used to assess medication adherence over the 6 months before and 5 months after pharmacist counseling using the Medication Possession Ratio (MPR), as well as blood pressure. Data collected from the medical records included anonymized patient identification, sex, age, height, weight, diagnosis, blood pressure, and antihypertensive therapy.

Methods

This study used a quasi-experimental design with a nonequivalent pretest-posttest control group. The study was conducted at two primary care clinics in Bali, Indonesia, with Clinic X serving as the control group and Clinic Y as the intervention group. The study period extended from June 2025 to May 2026 and included a 6-month retrospective period for baseline data collection (June-November 2025), a 1-month preparation period (December 2025), and a 5-month prospective period (January-May 2026).

The preparation period in December 2025 was used to prepare counseling materials and await ethical approval. No participant contact, recruitment, or retrospective or prospective data collection was conducted during this period, ensuring compliance with the ethical approval timeline, which began in January 2026.

Because the total populations at both clinics were limited, comprising 50 patients at Clinic X and 75 patients at Clinic Y, total sampling was used, and no formal sample size calculation was performed. A total of 40 patients at Clinic X and 60 patients at Clinic Y met the inclusion and exclusion criteria and agreed to participate in the study. However, several participants were lost to follow-up or withdrew from the study, resulting in final sample sizes of 28 participants at Clinic X and 43 participants at Clinic Y. The participant recruitment flow is shown in Figure 1.

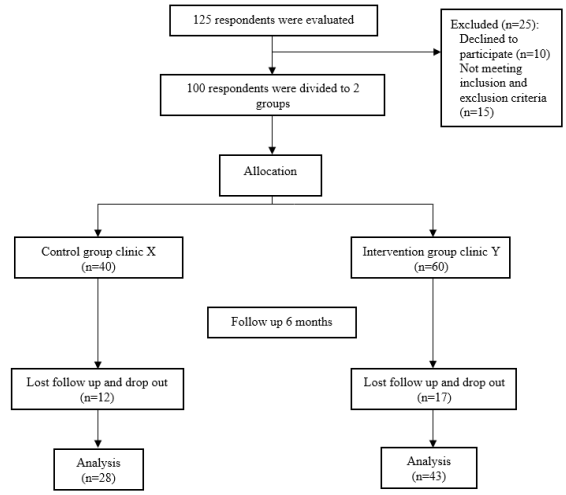


Figure 1. Participant recruitment flow

The inclusion criteria for this study were as follows: participants aged 30-60 years who had received antihypertensive medication at least three times during the 6-month baseline period (June-November 2025), were willing to participate in the study, had a diagnosis of hypertension, and had complete medical records. The exclusion criteria included the use of antihypertensive medications for noncardiovascular indications and pregnancy or breastfeeding. During the study, loss to follow-up and dropout occurred in both clinics: 12 participants in Clinic X and 17 participants in Clinic Y. In Clinic X, the main reason was participant fatigue associated with the prolonged treatment duration, which led some participants to discontinue medication use. In Clinic Y, long waiting times at the pharmacy, which served both chronic and non-chronic patients, together with limited pharmacy staffing, caused some participants to leave before receiving counseling or medication and not return for follow-up.

Effectiveness was assessed by comparing MPR values before and after pharmacist counseling. Blood pressure values were obtained from the final month of the pre-intervention and post-intervention periods and were analyzed using 95% confidence intervals (CIs).

$$\text{MPR} = \frac{\text{All day supply}}{\text{Elapsed days}^{*}} \times 100\%$$

*inclusive of the last prescription

Medication adherence was calculated using the Medication Possession Ratio (MPR), specifically the Variable MPR (VMPR), over the 6-month baseline period (June-November 2025) and the 5-month follow-up period (January-May 2026). The VMPR was calculated by dividing the total days' supply by the number of elapsed days.

To minimize bias, prescriptions extending beyond the end of the observation period (May 31, 2026) were truncated at the study cutoff date so that medication supply extending into the subsequent period was excluded from the VMPR calculation. An MPR threshold of ≥80% was used to define adherent participants, whereas an MPR <80% was classified as nonadherence [9].

When a prescription was refilled before the expected refill date, the remaining medication from the previous prescription was assumed to be retained for subsequent use. Any

resulting increase in total days' supply due to early refills was capped at 100% to avoid overestimating adherence.

No medication switches, either within the same therapeutic class or between different therapeutic classes, were observed among study participants. If a switch within the same therapeutic class had occurred, it would have been treated as continuation of therapy, and the days' supply would have been accumulated continuously. In contrast, a switch between therapeutic classes would have resulted in the previous therapy being classified as discontinued, with any remaining days' supply excluded from the calculation.

For participants receiving multiple medications for the same condition, the overall MPR was calculated as the mean of the MPR values for each medication [10].

The intervention consisted of pharmacist counseling. Face-to-face counseling sessions lasted 5-10 minutes and were conducted once monthly for 5 months. A total of three pharmacists provided the counseling. Before implementation of the intervention, the pharmacists completed a 1-day training session conducted by the physician in charge of Clinic Y. The counseling module was developed by the physician in charge of Clinic Y and adapted to the clinic's standards.

The counseling materials covered hypertension, medication, dosage, administration, interactions with other medications or food, adverse effects, storage, the importance of medication adherence, lifestyle modification, and follow-up. The counseling session began with an opening statement and questions regarding the patient's condition, followed by an explanation of the purpose of the session. Education about hypertension was then provided. Blood pressure was monitored, patient understanding was assessed, and follow-up appointments were scheduled. Pharmacists were provided with a counseling checklist to ensure consistent delivery of the intervention. The completed checklists were submitted to the researcher at the end of each month. In Clinic X, only routine drug information services were provided without structured pharmacist counseling.

Data were analyzed using SPSS. Descriptive statistics were used to summarize participant characteristics, and normality was assessed using the Kolmogorov-Smirnov test. Because the blood pressure data were not normally distributed, within-group and between-group comparisons were performed using the Wilcoxon signed-rank test and Mann-Whitney U test, respectively. Medication adherence was analyzed using the chi-square test.

ANCOVA was used to account for baseline blood pressure imbalance, and an ANCOVA model based on change scores (Δ = post-intervention − pre-intervention) was used for between-group comparisons. In this model, the change score was entered as the dependent variable, group assignment (control *vs*. intervention) as the fixed factor, and baseline blood pressure as the covariate. Adjusted estimated marginal mean (EMM) differences between groups were reported with 95% confidence intervals (CIs) and partial eta-squared (partial η^2) effect sizes.

Ethical approval was obtained from the Research Ethics Commission Unit, Faculty of Medicine, Udayana University, Bali, Indonesia (Approval No. 0090/UN14.2.2.VII.14/LT/2026; January 2026).

RESULTS

This study was conducted at two primary care clinics in Bali, Indonesia: Clinic X, which served as the control group, and Clinic Y, which served as the intervention group. A total of 71 participants were included in the final analysis, with 28 participants in the control group and 43 in the intervention group. Participant characteristics included sex, age, body mass index (BMI), systolic blood pressure, and diastolic blood pressure. Baseline characteristics were generally comparable between the control and intervention groups. No statistically significant differences were observed for categorical variables analyzed using the chi-square test, including sex ($p = 0.983$), age group ($p = 0.367$), diagnosis ($p = 0.446$), and BMI category ($p = 0.202$). Because blood pressure data were not normally distributed, between-group comparisons were performed using the Mann-Whitney U test. No statistically significant differences were observed in systolic ($p = 0.095$) or diastolic blood pressure ($p = 0.501$). Participant characteristics are presented in Table 1.

Table 1. Baseline characteristics of participants at Clinics X and Y in Bali, Indonesia

Characteristics	Groups		*p*-value
	Control (n=28) N (%)	Intervention (n=43) N (%)	
Gender			
Male	11 (39.3)	17 (39.5)	0.983*
Female	17 (60.7)	26 (60.5)	
Age (years)			
30-45 years old (young adult)	7 (25.0)	7 (16.3)	0.367*
46-60 years old (middle age)	21 (75.0)	36 (83.7)	
Diagnosis			
Essential (primary) hypertension	22 (78.6)	36 (83.7)	0.446*
Other secondary hypertension	1 (3.6)	0 (0.0)	
Secondary hypertension	5 (17.8)	7 (16.3)	
Body Mass Index			
Normal	8 (28.6)	11 (25.6)	0.202*
Obesity I	12 (42.8)	17 (39.6)	
Obesity II	4 (14.3)	1 (2.3)	
Overweight	3 (10.7)	12 (27.9)	
Underweight	1 (3.6)	2 (4.6)	
Systolic blood pressure (mmHg)			
Optimal (< 120)	2 (7.1)	3 (7.0)	0.095**
Normal (120-129)	22 (78.6)	21 (48.8)	
Normal-high (130-139)	2 (7.1)	18 (41.9)	
Hypertension 1st (140-159)	2 (7.1)	1 (2.3)	
Hypertension 2nd (160-179)	0 (0.0)	0 (0.0)	
Diastolic blood pressure (mmHg)			
Optimal (< 80)	20 (71.4)	33 (76.7)	0.501**
Normal (80-84)	7 (25.0)	9 (20.9)	
Normal-high (85-89)	0 (0.0)	0 (0.0)	
Hypertension 1st (90-99)	1 (3.6)	0 (0.0)	
Hypertension 2nd (100-109)	0 (0.0)	1 (2.3)	
Total	28 (100)	43 (100)	

* Chi-square test, ** Mann-Whitney U test

The common antihypertensive classes prescribed at Clinics X and Y included angiotensin-converting enzyme inhibitors (ACEIs), beta blockers (BBs), angiotensin receptor blockers (ARBs), and calcium channel blockers (CCBs). Based on the data on the antihypertensive regimens administered to the respondents, the most frequent therapies were CCB monotherapy and the two-drug combination of CCB + ARB, accounting for 28.2% and 23.9% of prescriptions, respectively. The remaining regimens included ACEI monotherapy (2.8%), ARB monotherapy (7.0%), BB monotherapy (1.4%), the two-drug combinations ACEI + BB (4.2%), BB + ARB (9.9%), CCB + ACEI (11.3%), and CCB + BB (5.6%), as well as the three-drug combinations CCB + ARB + BB (2.8%) and CCB + BB + ACEI (2.8%). The distribution of antihypertensive regimens is presented in Figure 2.

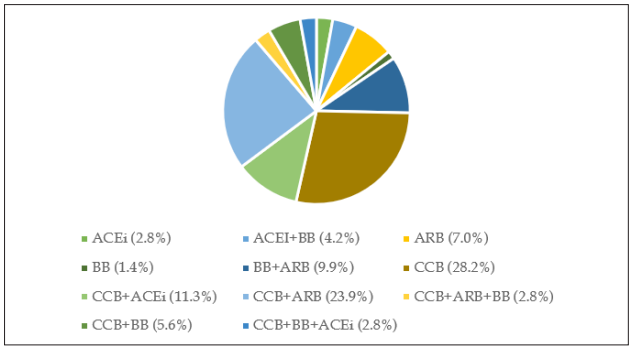


Figure 2. Distribution of antihypertensive classes

The effectiveness of pharmacist counseling on compliance was assessed using the Medication Possession Ratio (MPR), measured before and after the intervention. In the intervention group, counseling was provided to improve patients' understanding of medication use and to enhance adherence to therapy. Data on the effectiveness of pharmacist counseling on compliance are presented in Table 2.

Table 2. Effectiveness of pharmacist counseling on compliance

Compliance Level (MPR)		Control (N (%))	Intervention (N (%))	*p*-value	OR
Before	Compliance	12 (42.9)	12 (27.9)	0.193	0.516 (0.189-1.406)
	Non-compliance	16 (57.1)	31 (72.1)		
After	Compliance	16 (57.1)	37 (86.0)	0.006	4.625 (1.476-14.491)
	Non-compliance	12 (42.9)	6 (14.0)		

The effectiveness of pharmacist counseling on blood pressure was analyzed based on two measurement time points: the last month before the intervention and the last month after the intervention. Data on the effectiveness of pharmacist counseling on systolic and diastolic blood pressure are presented in Tables 3, 4, and 5.

Based on the systolic blood pressure data between groups, a *p*-value of 0.022 was obtained, indicating a statistically significant difference between the control and intervention groups before pharmacist counseling. After pharmacist counseling, the *p*-value for systolic blood pressure was 0.195, indicating no statistically significant difference between the groups. Within-group analyses showed a *p*-value of 0.780 in the control group and 0.791 in the intervention group,

Table 3. Effectiveness of pharmacist counseling on blood pressure

Blood Pressure		Control (mean±SD)	Intervention (mean±SD)	*p*-value*
Systolic	Before (Baseline)	123.18±6.77	125.76±6.50	0.022*
	After (5 months)	122.68±6.30	125.36±7.75	0.195*
p-value**		0.780**	0.791**	
Diastolic	Before (Baseline)	76.64±4.90	76.19±5.56	0.809*
	After (5 months)	77.89±5.16	78.43±6.30	0.802*
p-value**		0.235**	0.043**	

*Mann-Whitney Analysis, **Wilcoxon Analysis

Table 4. ANCOVA analysis for blood pressure

Blood Pressure		Control (mean±SD)	Intervention (mean±SD)	Adjusted (mean±SD)	F	*p*-value***
Systolic	Before (Baseline)	123.18 ±6.77	125.76 ±6.50	122.99 ±1.38	1.013	0.318
	After (5 months)	122.68 ±6.30	125.36 ±7.75	124.79 ±1.14		
Diastolic	Before (Baseline)	76.64 ±4.90	76.19 ±5.56	77.82 ±1.07	0.244	0.623
	After (5 months)	77.89 ±5.16	78.43 ±6.30	78.50 ±0.86		

***ANCOVA Analysis

Table 5. ANCOVA and adjusted mean (EMM) of blood pressure changes

Blood Pressure		Adjusted Mean	95% CI	F	*p*-value***	Partial η2
Systolic	Control	-1.526	-4.287 to 1.235			
	Intervention	0.273	-1.950 to 2.495			
	Group effect	-	-	1.013	0.318	0.015
	Baseline effect	-	-	35.547	0.000	0.343
Diastolic	Control	1.405	-0.732 to 3.543			
	Intervention	2.085	0.360 to 3.810			
	Group effect	-	-	0.244	0.623	0.004
	Baseline effect	-	-	29.978	0.000	0.306

***ANCOVA Analysis

indicating no significant change between the beginning and the end of the measurement period.

Because of the baseline imbalance, an ANCOVA was performed to increase the precision of the study results, with baseline blood pressure values included as a covariate [11]. The ANCOVA yielded a *p*-value of 0.318 (> 0.05) and an F-value of 1.013, confirming that pharmacist counseling had no significant effect on systolic blood pressure. The ANCOVA results for blood pressure changes indicate that the baseline covariate had a significant effect on systolic blood pressure changes ($F = 35.547$, $p = 0.000$, partial $\eta^2 = 0.343$), whereas the effect of the intervention group was not significant ($F = 1.013$, $p = 0.318$, partial $\eta^2 = 0.015$). The estimated marginal means (EMMs) indicated a decrease in systolic blood pressure of −1.526 mmHg (95% CI: −4.287 to 1.235) in the control group and an increase of 0.273 mmHg (95% CI: −1.950 to 2.495) in the intervention group. The distribution of systolic blood pressure is shown in Figure 3.

For diastolic blood pressure, the between-group analysis before pharmacist counseling yielded a *p*-value of 0.809, indicating no significant difference between the control and intervention groups at baseline. After pharmacist counseling, the p-value was 0.802, which also indicated no significant difference between the groups.

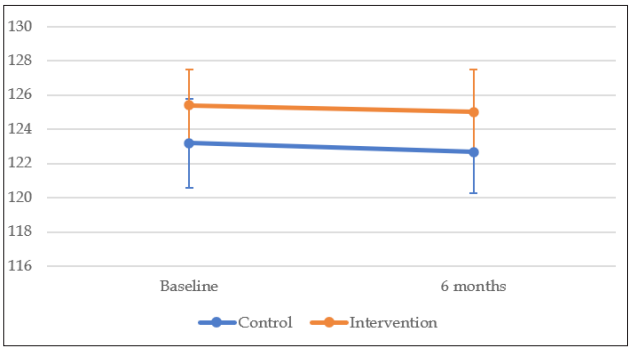


Figure 3. Systolic blood pressure diagram

Within-group analyses showed a p-value of 0.235 in the control group, indicating no significant difference, and a p-value of 0.043 in the intervention group, indicating a significant difference and suggesting an increase in diastolic blood pressure after 5 months. To confirm the study results, an ANCOVA was performed for diastolic blood pressure. The ANCOVA yielded a *p*-value of 0.623 (> 0.05) and an F-value of 0.244, confirming that pharmacist counseling had no significant effect on diastolic blood pressure.

The ANCOVA results for blood pressure changes showed that the baseline covariate had a significant effect on diastolic blood pressure changes ($F = 29.978$, $p = 0.000$, partial $\eta^2 = 0.306$), whereas the effect of the intervention group was not significant ($F = 0.244$, $p = 0.623$, partial $\eta^2 = 0.004$). The estimated marginal means (EMMs) indicated an increase in diastolic blood pressure of 1.405 mmHg (95% CI: −0.732 to 3.543) in the control group and an increase of 2.085 mmHg (95% CI: 0.360 to 3.810) in the intervention group. The distribution of diastolic blood pressure is shown in Figure 4.

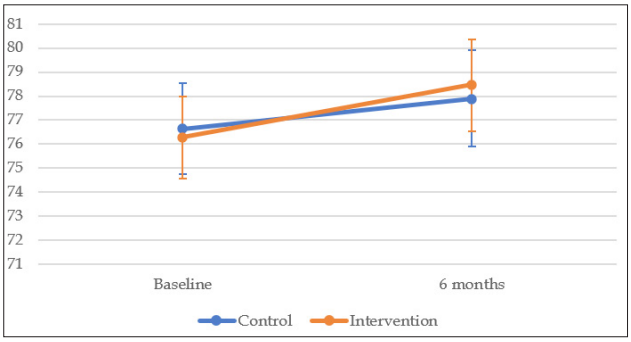


Figure 4. Diastolic blood pressure diagram

DISCUSSION

Participant characteristics showed that, in both groups, the proportion of female participants was higher than that of male participants (60.7% and 60.5% *vs*. 39.3% and 39.5%, respectively). These findings are consistent with a previous study conducted at a primary healthcare center in Bandung in 2021, in which the proportions of male and female participants were 25.75% and 74.25%, respectively [12]. This may be related to the menopausal transition in women, during which declining estrogen levels may contribute to increased activity of the renin-angiotensin-aldosterone system (RAAS), thereby promoting an increase in blood pressure [12-15].

Age data showed that hypertension was most prevalent among participants aged 46-60 years (75.0% and 83.7% in the control and intervention groups, respectively). This may be explained by age-related physiological changes, particularly in individuals aged ≥40 years, including reduced arterial elasticity, declining kidney function, increased peripheral vascular resistance, and greater salt sensitivity [16-19].

Diagnostic data showed that the most common type of hypertension was essential (primary) hypertension, accounting for 78.6% of cases in the control group and 83.7% in the intervention group. Regarding body mass index (BMI), obesity class I was the most common category, accounting for 42.8% of participants in the control group and 39.6% in the intervention group. A high BMI may contribute to increased RAAS activity, which can promote elevated blood pressure. The association between BMI and the risk of hypertension may be particularly relevant in women aged 40-65 years because of postmenopausal hormonal changes [20,21].

Based on systolic blood pressure data, the normal category had the highest proportion in both groups, accounting for 78.6% of participants in the control group and 48.8% in the intervention group. For diastolic blood pressure, the optimal category had the highest proportion, accounting for 71.4% and 76.7% of participants in the control and intervention groups, respectively.

The frequent use of calcium channel blocker (CCB) monotherapy in this study may be explained by its effectiveness in reducing the risk of angina, myocardial infarction, and stroke, as well as its favorable safety profile in hypertensive patients with comorbid conditions [22,23]. The two-drug combination of a CCB and an angiotensin receptor blocker (ARB) was also commonly prescribed because it may provide a greater reduction in blood pressure than monotherapy. These findings are consistent with previous studies reporting that CCB monotherapy and the combination of CCBs with ARBs are commonly prescribed in patients with hypertension [22,24].

The sympatholytic effects of ARBs may help reduce elevated heart rate and may also decrease the incidence of peripheral edema associated with CCB therapy [25,26]. ARBs also provide renoprotective and cardioprotective effects, particularly in patients with comorbid diabetes mellitus and chronic kidney disease (CKD). Therefore, their combination with CCBs may provide additional protection for vital organs [27].

Regarding the effectiveness of counseling on medication adherence, *p*-values of 0.193 before the intervention and 0.006 after the intervention were obtained. Before pharmacist counseling, there was no statistically significant difference between the groups (OR = 0.516, 95% CI: 0.189-1.406), as the 95% CI included the null value of 1.0. After pharmacist counseling, the intervention group had 4.625 times higher odds of adherence than the control group (OR = 4.625, 95% CI: 1.476-14.491), with the 95% CI entirely above the null value of 1.0.

In this study, pharmacist counseling was provided to outpatients with hypertension. The findings are consistent with several previous studies reporting that pharmacist counseling

can improve medication adherence in patients with hypertension [28-30]. A study conducted in Nepal focused on counseling services, provision of leaflets, and telephone follow-up [28]; a study in Vietnam used educational booklets and videos [29]; and a study in China focused on pharmacist-led medication reviews and recommendations regarding antihypertensive therapy to physicians [30]. Although the counseling methods differed among these studies, they consistently demonstrated improvements in medication adherence following pharmacist intervention.

Through counseling, pharmacists can help patients better understand hypertension, their medications and dosages, potential interactions, medication storage, and the management of possible adverse effects, thereby supporting more consistent adherence to therapy. Hypertension is a chronic condition that requires long-term management and regular monitoring to achieve optimal therapeutic outcomes [31-33].

In this study, a baseline imbalance in systolic blood pressure was observed, possibly because allocation concealment was not feasible. The study was conducted at two different clinics, with Clinic X serving as the control group and Clinic Y as the intervention group. Because group assignment was determined by clinic, the researchers knew in advance which participants would belong to the control or intervention group, which may have contributed to baseline imbalance. Differences in the quality of communication between participants and healthcare teams, as well as differences in organizational systems between the two clinics, may also have influenced the findings.

Furthermore, the relatively small sample size, resulting partly from the high loss to follow-up and unequal numbers of participants between groups, may have contributed to the baseline imbalance [34]. Factors contributing to loss to follow-up included fatigue, long waiting times at the pharmacy, and limited pharmacy staffing. Participants may become fatigued by spending extended periods attending routine visits and collecting antihypertensive medications, which may contribute to intentional nonadherence or treatment discontinuation [35].

For systolic blood pressure, no significant effect of pharmacist counseling was observed, possibly because blood pressure was already relatively well controlled before the intervention. For diastolic blood pressure, although the within-group Wilcoxon test showed a statistically significant increase in the intervention group ($p = 0.043$), the baseline-adjusted between-group ANCOVA confirmed no statistically significant difference between the intervention and control groups ($F = 0.244$, $p = 0.623$). These findings are consistent with previous research reporting no statistically significant effect of pharmacist intervention on systolic blood pressure ($p = 0.175$) or diastolic blood pressure ($p = 0.599$) [36].

Several factors that were not controlled in this study, including diet, physical activity, family support, lifestyle, sleep quality, and stress, may have influenced systolic and diastolic blood pressure despite the counseling intervention [35,37].

Nevertheless, pharmacist counseling may still be beneficial for maintaining blood pressure control, supporting therapeutic targets, and preventing complications [38,39]. Counseling may also help prevent patients from independently discontinuing therapy when they perceive their blood pressure to be controlled [40,41]. Because hypertension is often asymptomatic, patients whose blood pressure is controlled may mistakenly believe that continued treatment is unnecessary [38,42,43]. Through pharmacist counseling, patients can receive education that reinforces the importance of maintaining regular and consistent therapy to achieve and sustain blood pressure control.

CONCLUSION

Pharmacist counseling was significantly effective in improving medication adherence but had no statistically significant effect on systolic or diastolic blood pressure in patients with hypertension. Ideally, pharmacist counseling should be implemented more widely in pharmaceutical care services in Indonesia to support treatment success and help patients achieve therapeutic goals.

STUDY LIMITATIONS

This study has several limitations. First, the relatively small sample size of 71 participants and the absence of a formal sample size calculation, due to the limited population available at the two clinics, may have limited the statistical power of the study. Second, there was an imbalance in baseline systolic blood pressure between the groups, which may have influenced the study findings despite adjustment in the statistical analysis. Third, although a statistically significant within-group change in diastolic blood pressure was observed in the intervention group, this change represented an increase rather than a decrease in blood pressure and therefore did not reflect achievement of the intended clinical treatment goals.

Fourth, the study did not control for several potential confounding variables, which may have introduced bias into the results. Fifth, the intervention and control groups were recruited from two different clinics, and differences between the clinics may have influenced the findings; therefore, the results should be interpreted with caution. Sixth, the MPR method has inherent limitations because adherence estimates may be influenced by early refills, changes in medication regimens, and combination therapy. Therefore, MPR-based adherence results should also be interpreted cautiously.

Given these limitations, further studies with larger sample sizes, randomized controlled designs, better control of confounding variables, more comprehensive statistical analyses, and additional or complementary methods for assessing medication adherence are needed to confirm the findings of this study.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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