



RATIONALITY OF ANTIHYPERTENSIVE THERAPY AND BLOOD PRESSURE CONTROL IN COMORBID INPATIENTS

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ABSTRACT

Hypertension management in patients with comorbidities requires drug selection and dosing that are consistent with clinical conditions, organ function, and evidence-based recommendations. Inappropriate therapy may compromise blood pressure control and increase treatment-related risk. To evaluate the rationality of antihypertensive therapy and its association with blood pressure control among hospitalised patients with hypertension and comorbidities. An analytical retrospective cohort study used medical records from January to August 2025 at a public hospital in Central Java, Indonesia. Total sampling identified 76 eligible patients. Rational therapy required concordant assessments of right patient, right drug, and right dose. Blood pressure control was defined as a final measurement below 140/90 mmHg. Descriptive statistics, the Wilcoxon signed-rank test, and Fisher's exact test were used. The mean age was 59.37 ± 13.01 years and 51.3% were male. Overall therapy was rational in 68 patients (89.5%); right-patient and right-dose criteria were each fulfilled in 98.7%, while right-drug criteria were fulfilled in 89.5%. Mean blood pressure declined from 187.39/100.24 mmHg to 133.07/81.89 mmHg ($p < 0.001$). Forty-seven patients (61.8%) achieved control. Control occurred in 63.2% of the rational group and 50.0% of the non-rational group; the association was not statistically significant (OR 1.72; 95% CI 0.40–7.49; $p = 0.472$). Most antihypertensive regimens met the documented rationality criteria and blood pressure improved substantially during hospitalisation. Although control was more frequent with rational therapy, the association was inconclusive because the non-rational group was small and inpatient outcomes were influenced by multiple clinical factors.

Keywords: antihypertensive; blood pressure control; comorbidity; rational prescribing; retrospective cohort

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INTRODUCTION

Hypertension remains the leading modifiable contributor to cardiovascular and renal morbidity worldwide. Global analyses indicate that the number of adults aged 30–79 years with hypertension doubled between 1990 and 2019, while treatment and control remain inadequate in many low- and middle-income countries (NCD Risk Factor Collaboration [NCD-RisC], 2021). Effective blood pressure reduction substantially decreases the risk of major cardiovascular events, stroke, heart failure, and death (Carey et al., 2021; Ettehad et al., 2016). The World Health Organization (WHO, 2021) therefore emphasises timely pharmacological treatment, simplified evidence-based regimens, and systematic follow-up.

Treatment becomes more complex when hypertension coexists with diabetes mellitus, chronic kidney disease, cerebrovascular disease, coronary disease, heart failure, electrolyte disturbances, or other acute conditions. Comorbidity changes the expected benefit-risk profile of antihypertensive classes, the need for renal and electrolyte monitoring, and the appropriateness of specific combinations (American Diabetes Association Professional Practice Committee, 2024; KDIGO Blood Pressure Work Group, 2021; Mancia et al., 2023). Rational prescribing consequently requires more than selecting an antihypertensive agent; it requires the right drug for the patient's indication and comorbidities, at an appropriate dose and frequency, with attention to contraindications, duplication, interactions, and monitoring.

International guidelines recommend angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, calcium-channel blockers, and thiazide or thiazide-like diuretics as principal first-line classes, with combinations used for many patients who are markedly above target (Unger et al., 2020; WHO, 2021; Williams et al., 2018). Nevertheless, prescribing patterns vary considerably between settings. A global review found limited direct assessment of guideline concordance and continuing opportunities to improve antihypertensive prescribing (Abdelkader et al., 2023). Longitudinal drug-utilisation evidence further shows that the relative use of antihypertensive classes changes over time and is shaped by national guidelines and medicine availability (Kalinić et al., 2022).

The inpatient setting presents additional challenges. Elevated blood pressure may reflect chronic uncontrolled hypertension, pain, anxiety, fluid shifts, medication withdrawal, or acute organ injury. Recent guidance cautions against reflexive treatment intensification in patients without acute target-organ damage because inpatient treatment may not improve longer-term control and may increase adverse events (Bress et al., 2024; Rastogi et al., 2021). A structured evaluation of rationality and short-term blood pressure outcomes is therefore useful for identifying modifiable prescribing problems while recognising the complexity of hospital care.

Evidence linking the rationality of antihypertensive therapy directly with blood pressure control among Indonesian inpatients with multiple comorbidities remains limited. This study evaluated the proportion of therapy meeting right-patient, right-drug, and right-dose criteria, described antihypertensive use and blood pressure outcomes, and examined whether rational therapy was associated with achieving a final blood pressure below 140/90 mmHg.

METHOD

Study design and setting. This analytical observational study used a retrospective cohort approach based on inpatient medical records at a public hospital in Central Java, Indonesia. Records dated January to August 2025 were reviewed.

Population and sample. The study included 76 patients diagnosed with hypertension and at least one chronic or clinically relevant comorbidity who received antihypertensive therapy. Total sampling was applied to all eligible medical records during the study period. Records were included when patient characteristics, comorbidities, antihypertensive medicines, doses, and serial blood pressure measurements were available. Records with insufficient information for therapy or outcome evaluation were excluded.

Variables and operational definitions. The primary exposure was rationality of antihypertensive therapy. A structured study checklist assessed right patient, right drug, and right dose using the clinical condition, comorbidity, documented laboratory information, protocol-based guideline criteria, and standard drug-dose references. Overall therapy was classified as rational only when all three documented components were fulfilled. Because a separate right-indication variable was not available in the dataset, the overall category represents the three assessable dimensions rather than every possible component of rational medicine use.

Outcome assessment. Initial blood pressure was the first documented measurement in the inpatient episode, and final blood pressure was the last documented measurement in the serial monitoring record. Controlled blood pressure was operationally defined as systolic pressure <140 mmHg and diastolic pressure <90 mmHg, consistent with the study protocol and commonly used international thresholds (Unger et al., 2020; WHO, 2021). Adverse drug reactions and cardiovascular complications were not analysed because these outcomes were not available as structured variables.

Statistical analysis. Continuous variables were summarised using mean, standard deviation, and range as appropriate; categorical variables were presented as frequencies and percentages. Changes in systolic and diastolic blood pressure were analysed using the Wilcoxon signed-rank test. The association between therapy rationality and blood pressure control was examined using Fisher's exact test because of small expected cell counts. Odds ratios (ORs) and 95% confidence intervals (CIs) were reported, with statistical significance set at $p < 0.05$. **Ethical considerations.** Patient identifiers were replaced with study codes and the dataset was analysed in aggregate Universitas Muhammadiyah Purwokerto KEPK/UMP/24/XII/2025

RESULT

A total of 76 patients were included. Their mean age was 59.37 ± 13.01 years (range 19–86 years), and 43 patients (56.6%) were aged 60 years or older. Men accounted for 51.3% of the sample. Mean blood pressure declined from 187.39/100.24 mmHg at the initial measurement to 133.07/81.89 mmHg at the final measurement. The median direction of change was a reduction for both systolic and diastolic pressure, and the paired reductions were statistically significant (both $p < 0.001$). Forty-seven patients (61.8%) met the operational control target at the final measurement.

Table 1.

Patient characteristics and blood pressure outcomes (n=76)

Characteristic	f (%) / Mean $\pm$ SD	Range / category
Age, years	59.37 ± 13.01	19–86
Adult	10 (13.2)	19–44 years
Pre-elderly	23 (30.3)	45–59 years
Elderly	43 (56.6)	≥ 60 years
Male	39 (51.3)	
Female	37 (48.7)	
Initial blood pressure, mmHg	187.39 / 100.24	SBP / DBP
Final blood pressure, mmHg	133.07 / 81.89	SBP / DBP
Controlled final blood pressure	47 (61.8)	$< 140/90$ mmHg
Uncontrolled final blood pressure	29 (38.2)	≥ 140 and/or ≥ 90 mmHg

Overall therapy was categorised as rational in 68 patients (89.5%). Right-patient and right-dose criteria were each fulfilled in 75 patients (98.7%), while the right-drug criterion was fulfilled in 68 patients (89.5%). Thus, drug selection was the most frequent source of non-rational classification. Recorded concerns included drug selection that was insufficiently aligned with the documented comorbidity, beta-blocker use without a clearly documented compelling indication in selected cases, duplication within the dihydropyridine calcium-channel blocker class, and diuretic use requiring caution in the presence of electrolyte disturbance. One record was classified as an inappropriate dose.

Table 2.

Rationality components, regimen intensity, and commonly used antihypertensives

Indicator	f	%
Right patient	75	98.7
Right drug	68	89.5
Right dose	75	98.7
Overall rational therapy	68	89.5
Monotherapy	39	51.3
Two-drug regimen	26	34.2
Three-drug regimen	7	9.2
Four- or five-drug regimen	4	5.3
Candesartan	42	55.3
Amlodipine	36	47.4
Ramipril	17	22.4
Furosemide	12	15.8
Spirolactone	8	10.5
Bisoprolol	8	10.5

Monotherapy was used in 39 patients (51.3%), while 26 (34.2%) received two agents, 7 (9.2%) received three, 3 (3.9%) received four, and 1 (1.3%) received five antihypertensive agents. Candesartan and amlodipine were the most frequently recorded medicines. Because patients could receive more than one agent, drug-specific percentages exceed 100% when summed.

Among patients receiving rational therapy, 43 of 68 (63.2%) achieved blood pressure control. Four of eight patients (50.0%) in the non-rational group achieved control. Fisher's exact test produced an OR of 1.72 (95% CI 0.40–7.49; $p=0.472$). The point estimate favoured rational therapy, but the wide confidence interval and non-significant p value indicated substantial statistical uncertainty.

Table 3.

Association between therapy rationality and final blood pressure control

Therapy rationality	Controlled, n (%)	Uncontrolled, n (%)	Total
Rational	43 (63.2)	25 (36.8)	68
Non-rational	4 (50.0)	4 (50.0)	8
Total	47	29	76

Fisher's exact test: OR 1.72; 95% CI 0.40–7.49; $p=0.472$.

DISCUSSION

The principal finding was that 89.5% of antihypertensive regimens met all three documented rationality criteria, while 61.8% of patients achieved a final blood pressure below 140/90 mmHg. Systolic and diastolic pressure declined substantially during hospitalisation. The proportion of control was numerically higher with rational therapy than with non-rational therapy, but the association was not statistically significant.

The observed rationality rate suggests generally high concordance with the study checklist, although it should not be interpreted as a complete assessment of rational medicine use. Right-indication, duration, drug interactions, adherence, and monitoring adequacy were not represented as independent variables. Drug selection was the weakest component, consistent with systematic evidence that prescribing concordance is assessed inconsistently and that important gaps remain despite widely available guidelines (Abdelkader et al., 2023). In a Saudi study using ISH recommendations, prescription adherence was 83.5%, broadly comparable with the present 89.5%, although that study found a significant association between guideline adherence and control (Rashikh et al., 2023). Differences in setting, sample size, patient risk, and the definition of adherence probably explain the contrasting statistical results.

Candesartan and amlodipine were the most frequently used agents, followed by ramipril. This pattern reflects extensive use of renin–angiotensin system blockers and dihydropyridine calcium-channel blockers, which are central classes in current guidelines (Mancia et al., 2023; Unger et al., 2020; WHO, 2021). An 11-year drug-utilisation study found ACE inhibitors and calcium-channel blockers to be the leading classes, with a substantial increase in angiotensin receptor blocker use, illustrating how prescribing patterns are influenced by guideline implementation and medicine availability (Kalinić et al., 2022). Another global review found ACE inhibitors or ARBs to be the most frequent monotherapy, with ACE inhibitor/ARB plus calcium-channel blocker among common dual combinations (Abdelkader et al., 2023).

Slightly more than half of the patients received monotherapy even though initial mean blood pressure was markedly elevated. Current recommendations favour initial combination therapy for many patients who are substantially above target, because complementary mechanisms may improve blood pressure response and facilitate treatment intensification (Mancia et al., 2023; WHO, 2021). Nevertheless, inpatient prescribing cannot be judged solely from the number of agents. Acute illness, volume status, kidney function, oral intake, haemodynamic stability, previous therapy, and the possibility of transient pressure elevation influence whether immediate combination intensification is appropriate

The large reduction between initial and final measurements demonstrates short-term clinical improvement, but causality cannot be assigned to antihypertensive rationality alone. In hospital, blood pressure can fall as pain, anxiety, infection, respiratory distress, dehydration, or other acute disturbances improve. Standardised measurement is also essential because technique, cuff size, position, rest period, and repeated readings affect classification (Cheung et al., 2023; Muntner et al., 2019). The final measurement therefore represents an inpatient outcome rather than stable long-term control.

The absence of a statistically significant association should be interpreted cautiously. Only eight patients were classified as receiving non-rational therapy, producing low statistical power and a wide confidence interval. The directional difference—63.2% control with rational therapy compared with 50.0% with non-rational therapy—remains clinically plausible, but the data are compatible with both benefit and no benefit. Longer follow-up, a larger non-rational comparison group, and multivariable adjustment for baseline pressure, comorbidity, kidney function, number of medicines, and acute disease severity would provide a more precise estimate.

The inpatient context also requires caution against equating lower pressure with better care in every patient. The American Heart Association notes that evidence for treating asymptomatic elevated inpatient blood pressure is limited and recommends repeated accurate measurement and assessment of reversible factors and target-organ damage (Bress et al., 2024). In a large cohort of adults admitted for noncardiac conditions, acute treatment without clear end-organ damage was associated with more acute kidney injury and myocardial injury and did not improve subsequent control (Rastogi et al., 2021). These findings support individualised review rather than automatic escalation based on an isolated measurement.

Comorbidities should remain central to rationality assessment. For chronic kidney disease, renin–angiotensin system blockade may offer specific benefit in albuminuric disease, but serum creatinine and potassium require monitoring after initiation or titration (KDIGO Blood Pressure Work Group, 2021). In diabetes, treatment decisions should integrate cardiovascular and kidney risk, orthostatic symptoms, treatment burden, and tolerability (American Diabetes Association Professional Practice Committee, 2024; de Boer et al., 2022). Beta-blockers are particularly appropriate for selected indications such as ischaemic heart disease, heart failure with reduced ejection fraction, or certain arrhythmias, but are not universal first-line agents for uncomplicated hypertension (Unger et al., 2020).

The findings have practical implications for clinical pharmacy. A concise inpatient audit tool should document indication, comorbidity-specific preference, renal function, electrolytes, duplication, interaction risk, dose, frequency, route, and monitoring. Pharmacist-led medication review can prioritise the right-drug component, which accounted for most non-rational classifications in this study. Discharge planning should reconcile medicines, specify the intended regimen, and arrange outpatient blood pressure and laboratory follow-up, particularly after renin–angiotensin system blockers or diuretics are initiated or intensified.

This study has several limitations. It was retrospective and dependent on the completeness of medical records. Rationality was restricted to three documented dimensions, and the number of non-rational cases was small. Blood pressure control was based on the last inpatient measurement rather than ambulatory or post-discharge follow-up. Measurement technique, adherence, acute disease severity, and several potential confounders could not be fully evaluated. Adverse drug reactions and cardiovascular complications were not available as structured outcomes. Consequently, the results describe association and short-term patterns rather than causal effects.

CONCLUSION

Most antihypertensive regimens in patients with comorbidities met the documented right-patient, right-drug, and right-dose criteria. Blood pressure declined significantly during hospitalisation and 61.8% of patients achieved a final value below 140/90 mmHg. Control was more frequent among patients receiving rational therapy, but the association was not statistically significant. Drug selection was the principal area requiring improvement. Larger prospective studies with standardised blood pressure measurement, complete assessment of rational medicine use, adverse-event monitoring, and post-discharge follow-up are needed.

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