



Cost-Effectiveness Analysis of Amlodipine–Candesartan and Amlodipine–Furosemide in Hypertensive Inpatients at RSUD Dr. Loekmono Hadi Kudus, 2023

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ARTICLE INFO

Submitted : 01-01-2025

Revised : 17-03-2026

Accepted : 31-03-2026

Published : 30-06-2026

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ABSTRACT

Background: Hypertension is a major public health problem and a leading risk factor for cardiovascular morbidity and mortality. In hospitalized patients, combination antihypertensive therapy is frequently used to achieve optimal blood pressure control, which may lead to increased healthcare costs. Therefore, evaluating the cost-effectiveness of commonly used antihypertensive combinations is essential to support rational drug selection in hospital settings.

Objectives: This study aims to analyze the cost-effectiveness of amlodipine–candesartan and amlodipine–furosemide combination therapies for inpatient hypertension treatment at RSUD dr. Loekmono Hadi Kudus in 2023.

Methods: This non-experimental, descriptive study employed a retrospective design using medical record and cost data from 88 hypertensive inpatients. Patient characteristics, length of hospital stay, therapeutic effectiveness, and direct medical costs were analyzed. Therapeutic effectiveness was defined as the proportion of patients achieving target blood pressure based on JNC VIII guidelines. Cost-effectiveness was assessed using the Average Cost-Effectiveness Ratio (ACER) and Incremental Cost-Effectiveness Ratio (ICER).

Results: The amlodipine–candesartan combination demonstrated a lower ACER (Rp48,229 per 1% effectiveness) than amlodipine–furosemide (Rp90,275). The ICER value (–Rp597,651) indicated that amlodipine–candesartan was both more effective and less costly. Higher costs in the amlodipine–furosemide group were associated with injectable drug use and a greater proportion of prolonged hospital stays.

Conclusion: Amlodipine–candesartan was more cost-effective than amlodipine–furosemide for managing hypertensive inpatients. These findings support the preferential use of amlodipine–candesartan when clinically appropriate to optimize both clinical outcomes and healthcare resource utilization.

Keywords: ACER; Antihypertensive Combination; Cost Effectiveness; Hypertension; Hypertensive Patients; ICER

INTRODUCTION

Hypertension remains a major global health problem and a leading modifiable risk factor for cardiovascular morbidity and mortality.¹ The World Health Organization estimates that approximately 1.4 billion adults aged 30–79 years had hypertension in 2024, with a substantial proportion living in low- and middle-income countries.² In Indonesia, national survey-based data also demonstrate a high burden; the 2018 Basic Health Research (*Riskesmas*) reported hypertension prevalence of 34.1%.³ High blood pressure can be attributed to various factors such as age, smoking, high salt intake, and lack of physical activity.⁴ Effective antihypertensive therapy aims to reduce morbidity and mortality by maintaining blood pressure levels below 140/90 mmHg for

patients under 60 years and below 150/90 mmHg for patients above 60 years.⁵ Current guidelines generally recommend first-line drug classes including angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin II receptor blockers (ARBs), calcium channel blockers (CCBs), and thiazide/thiazide-like diuretics, with beta blockers (BBs) reserved for specific indications.⁶ Among these, CCBs are widely prescribed, often combined with ARBs rather than diuretics.⁷

Despite the efficacy of these therapies, hypertension management often requires prolonged treatment, significantly impacting medical costs.⁸ To address this economic burden, pharmacoeconomic analyses like cost effectiveness analysis are employed to evaluate the economic impact of various therapeutic options.⁹ Such analyses are crucial in recommending the most effective and cost-efficient hypertension treatments.¹⁰

Previous pharmacoeconomic studies have evaluated the cost-effectiveness of antihypertensive regimens, particularly combinations involving CCBs and renin-angiotensin system inhibitors, using different perspectives, settings, and effectiveness endpoints.⁸ International model-based evaluations have suggested that hypertension treatment can be cost-effective depending on baseline cardiovascular risk, time horizon, and local unit costs.⁸ In Indonesia, many published analyses are concentrated in outpatient settings and/or fixed-dose combinations and frequently use intermediate outcomes rather than inpatient outcomes.¹¹ Studies have also evaluated candesartan monotherapy versus candesartan-amlodipine combinations using direct medical cost approaches in Indonesian clinical settings.¹² Other Indonesian studies have examined cost-effectiveness patterns of amlodipine and candesartan use in routine care.¹³

However, evidence remains limited for real-world inpatient hypertension management, where cost structures can differ substantially from outpatient care and are strongly influenced by length of stay, treatment intensity, route of administration, and comorbidity complexity.⁶ In addition, prior studies rarely address the specific inpatient comparator regimens evaluated in this study within the same hospital setting.¹⁴ Therefore, this study aims to analyze the cost-effectiveness of the antihypertensive combinations amlodipine-candesartan and amlodipine-furosemide among hospitalized patients, using real-world hospital cost data and achievement of blood pressure targets as the effectiveness endpoint.

METHODS

Study design

This study was a non-experimental observational study with a cross-sectional design, conducted through a retrospective review of inpatient medical records and hospital billing data. The analysis compared costs and effectiveness between two antihypertensive combination regimens during the same hospitalization episode in 2023.

Population and samples

The study population comprised 726 inpatient records of patients diagnosed with hypertension at RSUD dr. Loekmono Hadi Kudus during January–December 2023. The sample size was determined using the Slovin formula, and eligible records were selected using purposive sampling based on predefined criteria. The final sample included 88 patients, consisting of 57 patients in the amlodipine-candesartan group and 31 patients in the amlodipine-furosemide group (Figure 1).

The inclusion criteria for this study were (1) inpatients diagnosed with hypertension in 2023; (2) received amlodipine-candesartan or amlodipine-furosemide as the primary antihypertensive combination during hospitalization; (3) had complete and legible medical record data including blood pressure measurements; and (4) had complete direct medical cost data from the hospital billing system.

Conversely, the exclusion criteria consist of patients who (1) received antihypertensive regimens other than the two study combinations as the primary regimen, including triple therapy (≥ 3 antihypertensive agents) or regimen switching during the hospitalization episode; (2) were referred/transferred to another facility (outcome not observed until discharge in this hospital); (3) were discharged against medical advice; or (4) died during hospitalization.

Study instruments

Data were extracted from inpatient medical records and hospital billing data, including medical record number, demographics (age, sex), diagnosis and comorbidities, antihypertensive therapy, admission and discharge dates, discharge status, blood pressure measurements, and direct medical cost components (medicines, laboratory, radiology, treatments/procedures, and administrative charges).

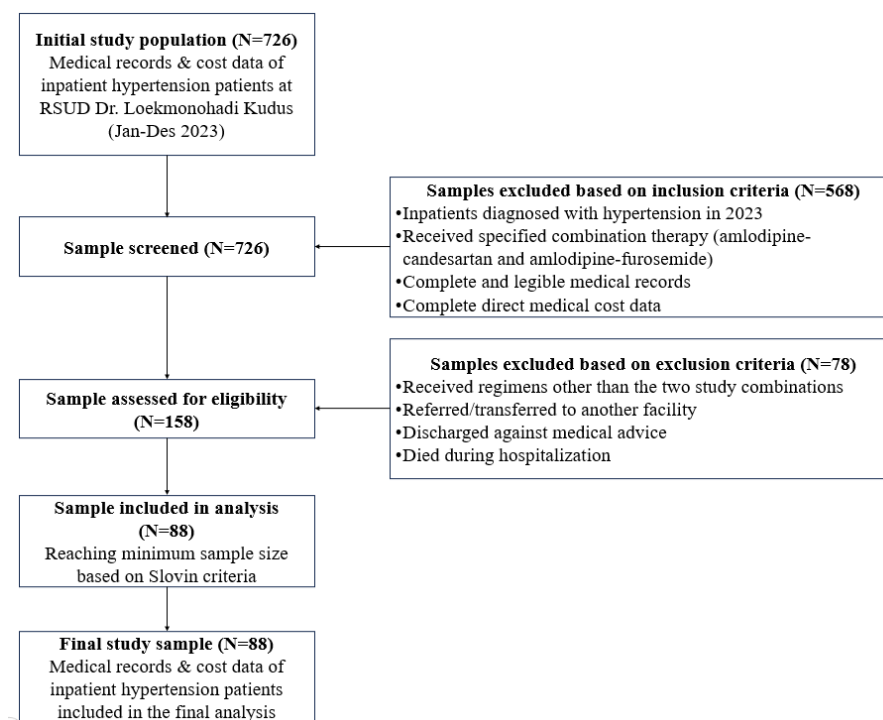


Figure I. Flowchart of Sample Selection and Criteria Application.

The diagram illustrates the transition from the initial study population (N = 726) to the final study sample (N = 88), from which the final sample was derived using purposive sampling and the Slovin formula at RSUD Dr. Loekmono Hadi Kudus (January–December 2023).

Data collection

Data were collected retrospectively from the medical records and finance/billing departments of RSUD dr. Loekmono Hadi Kudus. The study used inpatient hospitalization data from January to December 2023, and data extraction was performed during February–April 2024 using purposive sampling from records that met the eligibility criteria.

Data Analysis

Data analysis for this study was conducted through a systematic approach involving the collection of necessary data from medical records.

Patient Characteristics Analysis: The collected data was analyzed to describe patient characteristics, including gender, age, comorbidities, and length of hospital stay, which were presented in percentage tables.

Therapeutic Effectiveness Analysis: Therapeutic effectiveness was assessed using a clinical outcome, namely the proportion of patients achieving target blood pressure based on the JNC VIII guideline¹. Patients aged <60 years were categorized as achieving the therapeutic target if the final recorded inpatient blood pressure was <140/90 mmHg, whereas patients aged ≥60 years were categorized as controlled if the final blood pressure was <150/90 mmHg.¹ Because baseline (pre-treatment) blood pressure values and serial measurements were not consistently available in the extracted dataset, mean systolic/diastolic BP reduction could not be analyzed. Therapeutic effectiveness was calculated using the following formula:

$$\text{Treatment efficacy} = \frac{\text{Recovered patient count}}{\text{Total patient count}} \times 100\%$$

Cost-Effectiveness Analysis: Direct medical costs were calculated to assess cost-effectiveness using the average cost effectiveness ratio (ACER) and incremental cost effectiveness ratio (ICER)⁹. The ACER represents the average direct medical cost associated with each treatment divided by the percentage effectiveness of that therapy.

$$\text{ACER} = \frac{\text{Total cost (Rp)}}{\text{Therapeutic Effectiveness (\%)}}$$

The ICER is calculated to determine the additional cost incurred for each additional unit of outcome achieved.

$$ICER = \frac{\text{Medicine A cost (Rp)} - \text{Medicine B cost (Rp)}}{\text{Medicine A effectiveness(\%)} - \text{Medicine B effectiveness (\%)}}$$

This comprehensive analysis framework aims to provide insights into both the clinical outcomes and economic implications of the treatment regimens employed in managing hypertension.

RESULTS AND DISCUSSION

Patient Characteristics

Gender Distribution

The study analyzed 88 hypertensive patients treated at RSUD dr. Loekmono Hadi Kudus in 2023. According to

Table I, females exhibited a higher prevalence of hypertension, constituting 74% of the amlodipine-candesartan group and 55% of the amlodipine-furosemide group. This trend is consistent with previous research linking post-menopausal hormonal changes, particularly the decline in estrogen levels, to increased vascular stiffness and reduced endothelial protection, both of which elevate the risk of hypertension.^{15,16} The role of menopause in reducing the protective effects of estrogen highlights its significance in the observed gender disparity.

Table I. Hypertension Patients Characteristics (N=88)

Characteristics	Amlodipine-Candesartan N (%)	Amlodipine-Furosemide N (%)
Total	57 (65)	31 (35)
Gender		
Male	15 (26)	14 (45)
Female	42 (74)	17 (55)
Age [y.o.]		
26–45	15 (26)	5 (11)
46–64	29 (51)	21 (67)
≥ 65	13 (23)	5 (22)
Length of stay [days]		
1-3	12 (21)	0 (0)
4-7	34 (60)	18 (58)
≥ 7	11 (19)	13 (42)
Therapeutic effectivity		
Achieved therapeutic target	47 (83)	10 (17)
Not achieved therapeutic target	24 (77)	7 (23)

Age Distribution

The data presented in

Table I demonstrate a higher prevalence of hypertension among patients aged 46–64 years, with this age group accounting for 51% and 67% of cases in the amlodipine-candesartan and amlodipine-furosemide groups, respectively. This pattern aligns with the physiological changes associated with aging, including arterial thickening, reduced vascular elasticity, and hormonal fluctuations, which collectively contribute to increased blood pressure.¹⁷ Notably, the progressive loss of arterial compliance and accumulation of collagen in the vascular walls are key factors in the heightened risk of hypertension observed in this age demographic.

Comorbidities

Chronic kidney disease (CKD) emerged as the predominant comorbidity, affecting 22% of the total study population as indicated in

Table II. The study identified a complex spectrum of comorbidities, with CKD combined with congestive heart failure present in 13% of cases. This finding highlights the intricate relationship between hypertension and renal function, where uncontrolled blood pressure can accelerate kidney damage, while declining renal function may exacerbate hypertension.^{18,19} Notably, hypertension management becomes particularly challenging in end-stage renal disease patients undergoing hemodialysis.²⁰

Table II. Hypertension comorbidity characteristics

No	Comorbidity	Count	%
0	None	8	9%
1	Cephalgia	8	9%
2	Congestive Heart Failure	7	8%
3	Congestive Heart Failure + Diabetes Mellitus	6	7%
4	Chronic Kidney Disease	19	22%
5	Chronic Kidney Disease + Congestive Heart Failure	11	13%
6	Chronic Kidney Disease + Diabetes Mellitus	1	1%
7	Chronic Kidney Disease + Acute Gastroenteritis	1	1%
8	Dyspepsia	1	1%
9	Diabetes Mellitus	4	5%
10	Diabetes Mellitus + Coronary Heart Disease	1	1%
11	Epistaxis	5	6%
12	GERD (Gastroesophageal Reflux Disease)	2	2%
13	Hypertensive Heart Disease	7	8%
14	COPD (Chronic Obstructive Pulmonary Disease)	1	1%
15	Stroke	1	1%
16	Vertigo	5	6%
	Total	88	100%

Length of Hospital Stay

The duration of hospital stays varied according to treatment and disease severity. According to

Table I, most patients receiving amlodipine-candesartan (60%) and amlodipine-furosemide (58%) were hospitalized for 4–7 days. However, extended stays (≥ 7 days) were more frequent in the amlodipine-furosemide group (42%) compared to the amlodipine-candesartan group (19%). Prolonged hospitalization was often associated with severe hypertension and multiple comorbidities, which required more intensive management.²¹ Hospitalized patients with a diagnosis of hypertension accompanied by other complications often require longer stays exceeding 7 days.²² This increased duration of hospitalization directly contributed to higher patient costs. Moreover, the effectiveness of antihypertensive medications in reducing blood pressure and improving the patient's condition also significantly influences the length of hospital stay.²³

Therapeutic Effectiveness

Therapeutic effectiveness in this study was defined as the proportion of patients achieving the target blood pressure according to the JNC VIII guidelines,¹ based on systolic and diastolic blood pressure measurements recorded after antihypertensive therapy, as mentioned in the Methods section. Based on this definition, the combination therapy of amlodipine and candesartan demonstrated higher therapeutic effectiveness, with 83% of patients achieving the therapeutic target, compared to 77% in the amlodipine and furosemide combination group, as presented in Table I. This finding highlights the benefits of utilizing a CCB like amlodipine alongside an ARB such as candesartan. The CCB-ARB combination is well-supported by evidence,⁷ which emphasizes its superior capacity to control blood pressure and improve vascular outcomes.

This combination is also widely recommended when monotherapy is insufficient because it provides complementary mechanisms: vasodilation from CCBs and reduced angiotensin II–mediated vasoconstriction and volume effects from ARBs, improving the likelihood of reaching BP targets.^{24,25} This pharmacologic complementarity supports why amlodipine–candesartan may achieve target control in a larger proportion of inpatients. As a CCB, amlodipine inhibits L-type calcium channels in vascular smooth muscle, producing vasodilation and decreased peripheral vascular resistance.²⁶ Meanwhile, candesartan, an ARB, inhibits the renin-angiotensin-aldosterone system (RAAS, thereby reducing angiotensin-II-mediated vasoconstriction and aldosterone-driven volume expansion.²⁷ Because these agents act on distinct but complementary pathways their combination produces additive blood-pressure lowering and may improve vascular outcomes compared with monotherapy.²⁸ Major hypertension guidelines also support combinations that include a RAS blocker (ACEi/ARB) plus a CCB as a preferred strategy in many patients, further supporting the clinical rationale for CCB–ARB combinations.²⁹

Conversely, the amlodipine-furosemide combination, while effective in clinical situations characterized by volume overload or edema, exhibited comparatively lower therapeutic outcomes in achieving target blood pressure levels in non-edematous hypertensive inpatients.^{30,31} Loop diuretics such as furosemide are primarily indicated for rapid diuresis and management of volume overload and are generally less effective than thiazide-type diuretics for long-term blood-pressure control in patients without fluid retention; therefore, they are not recommended as first-line antihypertensive agents in uncomplicated hypertension except in specific circumstances (for example, advanced chronic kidney disease or concomitant heart failure).^{31–33} These factors underscore the importance of selecting antihypertensive therapies that not only lower blood pressure effectively but also minimize adverse effects. These limitations may explain the reduced effectiveness of this combination in achieving optimal blood pressure control.

Cost-Effectiveness Analysis

Analysis of direct medical costs as presented in

Table III and Table IV revealed that the amlodipine-candesartan combination therapy was more cost-effective than the amlodipine-furosemide combination. The ACER for amlodipine-candesartan was IDR 48,229 per 1% therapeutic effectiveness, compared to IDR 90,275 for amlodipine-furosemide. The ICER further supported these findings, with amlodipine-candesartan demonstrating a negative ICER value of -IDR 597,651, indicating that it was both more effective and less costly than amlodipine-furosemide.

Table III. Total Cost of Inpatient Hypertensive Patients

Cost Category	Amlodipine-Candesartan Group		Amlodipine-Furosemide Group	
Medicine	Rp	169,900	Rp	1,653,750
Treatment	Rp	180,354,650	Rp	172,667,000
Laboratory	Rp	35,076,000	Rp	33,637,000
Radiology	Rp	11,086,250	Rp	8,705,100
Total	Rp	226,686,800	Rp	216,662,850
Average	Rp	3,976,961	Rp	6,989,124

Several factors may have contributed to this cost difference. The higher cost of amlodipine–furosemide therapy was primarily driven by the use of furosemide in injectable form, which is more expensive compared to the oral formulations of candesartan. Additionally, patients receiving amlodipine–furosemide therapy were more likely to experience extended hospital stays (≥ 7 days), accounting for 42% of patients, compared with 19% in the amlodipine–candesartan group, further increasing direct medical costs, such as hospitalization and laboratory services.

The superior cost-effectiveness of amlodipine–candesartan may also be related to its complementary mechanism of action, which supports blood pressure control and may reduce the need for additional inpatient management.²⁶ In contrast, while furosemide is effective in managing fluid overload, its shorter duration of action and potential to cause electrolyte imbalances may contribute to less stable blood pressure control in some patients and may increase monitoring needs and overall costs.³³

Table IV. ACER and ICER Cost Effectivity

No	Anti-HT Combination	Total Medical Cost per Patient (C) [Rp]	Therapeutic Effectiveness (E)	ACER (C/E) [Rp]	ICER ($\Delta C/\Delta E$) [Rp]
1	Amlodipine-Candesartan	3,976,961	82.46%	48,229	
2	Amlodipine-Furosemide	6,989,124	77.42%	90,275	-597,651

This analysis aligns with prior studies indicating that the combination of a CCB and an ARB is more cost-effective for managing hypertension than regimens including loop diuretics.^{14,34} The ARB component in amlodipine-candesartan not only ensures sustained antihypertensive effects but also mitigates side effects commonly associated with CCB monotherapy, such as peripheral edema, reducing the likelihood of treatment discontinuation or the need for additional medications.³⁵

While treatment characteristics likely contributed to higher medication costs, differences in baseline clinical complexity may also have played a role. Because this study did not stratify patients by disease severity or comorbidity burden, these explanations remain plausible but not proven. Patients receiving amlodipine-furosemide therapy may represent a subgroup with more complex clinical profiles, such as greater fluid retention, higher disease severity, or accompanying comorbidities, which could necessitate longer inpatient management and closer monitoring.¹⁴ These factors, rather than the pharmacological effect of Furosemide alone, may partly explain the higher proportion of prolonged hospitalization and increased direct medical costs observed in this group.¹⁴

Our cost-effectiveness results should be interpreted in light of Indonesian pharmacoeconomic literature showing that incremental cost-effectiveness can vary substantially depending on perspective (payer vs hospital), cost components included, and the outcome definition (e.g., target achievement vs mmHg reduction). Prior studies in Indonesia have evaluated ARB-CCB combinations and reported differing ICER/ACER conclusions depending on setting and comparator regimens.^{12,14,36} For example, published Indonesian analyses comparing candesartan-based regimens report that relative 'most cost-effective' options can change when effectiveness is defined differently and when direct medical cost structure differs across facilities.^{12,14} This supports the need to interpret our findings as context-specific to our hospital cost structure and outcome definition (BP target achievement at discharge).

In the BPJS/JKN era, hospitals face strong incentives to use pharmacoeconomic evidence to optimize therapy choices under constrained budgets and standardized payment structures.³⁷ A hospital-perspective cost-effectiveness approach using direct medical costs can therefore support formulary and clinical pathway decisions, particularly for high-prevalence chronic diseases such as hypertension where small per-patient cost differences scale to substantial system-level impact.

Study Limitations

This study has several limitations. First, the sample size was relatively small ($n = 88$) and derived from a single hospital, which may limit generalizability. Second, the retrospective observational design relied solely on medical record and billing data; incomplete or non-standardized documentation may have led to unmeasured clinical differences between groups and precluded causal inference regarding regimen selection and economic outcomes. Third, room/ward class (e.g., class III to VVIP), an important determinant of inpatient costs, was not available in the extracted dataset; therefore, cost comparisons could not be stratified or adjusted by room class. Fourth, therapeutic effectiveness was assessed using achievement of guideline-based discharge blood pressure targets rather than mean reductions in systolic/diastolic blood pressure because baseline and serial blood pressure measurements were not consistently retrievable across all records. These limitations may reduce comparability with studies using longitudinal blood pressure outcomes and may contribute to residual cost variability.

CONCLUSION

This study found that the combination of Amlodipine-Candesartan was more cost-effective than amlodipine-furosemide for hypertensive inpatients at RSUD Dr. Loekmono Hadi Kudus in 2023. The Average Cost-Effectiveness Ratio (ACER) was IDR 48,229 per 1% therapeutic effectiveness for Amlodipine-Candesartan versus IDR 90,275 for Amlodipine-Furosemide; the negative ICER (-IDR 597,651) indicates that Amlodipine-

Candesartan was both less costly and more effective in our sample. These differences were driven in part by higher medication costs associated with injectable furosemide and a greater proportion of prolonged hospital stays (≥ 7 days) in the amlodipine–furosemide group (42% vs 19%), which increased direct medical expenditures. Nevertheless, these findings should be interpreted in the context of study limitations, including the relatively small sample size ($n = 88$) and the retrospective design relying solely on medical record and hospital billing data, which may involve incomplete clinical documentation and limits causal inference. Future studies with larger samples and prospective or multicenter designs are recommended to confirm these findings and improve generalizability.

ACKNOWLEDGEMENT

None. There is no funding to declare.

STATEMENT OF ETHICS

This study was conducted in accordance with the ethical standards of Universitas Muhammadiyah Purwokerto and received approval from the Health Research Ethic Committee (Approval Number: KEPK/UMP/51/III/2024; Date: 07/03/2024). Informed consent was obtained from all individual participants included in the study. All data were anonymized to ensure confidentiality, and participants were assured that their involvement was voluntary with the right to withdraw at any time without consequence. No conflicts of interest were declared by the authors.

REFERENCES

1. Page MR. The JNC 8 hypertension guidelines: an in-depth guide. *Am J Manag Care*. 2014;20(1 Spec No.):E8.
2. Organization WH. Hypertension. *World Health Organization*. Preprint posted online 2025.
3. Kesehatan BKP. Prevalence, Impact, and Efforts in Controlling Hypertension and Diabetes in Indonesia. *Badan Kebijakan Pembangunan Kesehatan*. Preprint posted online 2024.
4. Jannah LM. The Relationship of Lifestyle with Hypertension in Bumiayu Kabupaten Bojonegoro. *Jurnal Berkala Epidemiologi*. 2018;6(2):157-165. doi:10.20473/JBE.V6I22018.157-165
5. Muhadi M. JNC 8: Evidence-based Guideline Penanganan Pasien Hipertensi Dewasa. *Cermin Dunia Kedokteran*. 2016;43(1):54-59. doi:10.55175/cdk.v43i1.11
6. James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*. 2014;311(5):507-520. doi:10.1001/JAMA.2013.284427
7. Putri LSA, Satriyasa BK. Gambaran pola penggunaan obat antihipertensi pada pasien hipertensi di instalasi rawat inap RSUP Sanglah Denpasar tahun 2016. *Jurnal Medika Udayana*. 2019;8(6):1-8.
8. Sumiati L. Analisis Efektivitas Biaya Terapi Antihipertensi Pada Pasien Hipertensi Rawat Inap di RSU Pancaran Kasih Gmim Manado. *Pharmacon*. 2018;7(1).
9. Andayani TM. *Farmakoekonomi Prinsip Dan Metodologi*. UGM; 2013.
10. Moran AE, Odden MC, Thanataveerat A, et al. Cost-effectiveness of hypertension therapy according to 2014 guidelines. *N Engl J Med*. 2015;372(5):447-455. doi:10.1056/NEJMSA1406751
11. Rahayu A, Afdhal AF, Hasan D, Suwarna F, Meila O. Analisis Efektivitas Biaya Terapi Antihipertensi Kombinasi Tetap Di Satu Rumah Sakit Jakarta Selatan. *JURNAL MANAJEMEN DAN PELAYANAN FARMASI (Journal of Management and Pharmacy Practice)*. 2020;10(1):1. doi:10.22146/jmpf.43667
12. Baroroh F, Sari A, Masruroh N. Cost Effectiveness Analysis of Candesartan Therapy in Comparison to Candesartan-Amlodipine Therapy on Hypertensive Outpatients. *Open Access Maced J Med Sci*. 2019;7(22):3837-3840. doi:10.3889/oamjms.2019.515
13. Hasanah NU, Dewi NMAR, Saputra YD. Cost-effectiveness analysis of amlodipine and candesartan in the inpatient setting at Mataram University Hospital in Indonesia, 2021. *Pharmacy Education*. 2024;24(3):228-233. doi:10.46542/pe.2024.243.228233
14. Nur Rahmi Hidayati, Rinto Susilo, Tomi, Sulistiorini Indriaty, Dewi Kartika. Analisis Efektivitas Biaya Kombinasi Candesartan-Amlodipin dengan Candesartan-Furosemide Pasien Hipertensi Rawat Inap RS XXX. *Medical Sains : Jurnal Ilmiah Kefarmasian*. 2022;7(4):951-962. doi:10.37874/ms.v7i4.585

15. Yulistina F, Deliana SM, Rustiana ER. Korelasi Asupan Makanan, Stres, dan Aktivitas Fisik dengan Hipertensi pada Usia Menopause. *Unnes Journal of Public Health*. 2017;6(1):35. doi:10.15294/ujph.v6i1.13695
16. Lestari A, Hediya R, Yunitasari E. Hipertensi pada wanita menopause; Sebuah tinjauan literatur. *Wellness And Healthy Magazine*. 2020;2:309-313. doi:10.30604/well.022.82000121
17. Astuti E, Suwardianto H, Yuliantin N. 5 Th Octave Music Therapy Menurunkan Tekanan Darah Terhadap Penderita Hipertensi. *Ejournal Stikes Baptis*. 2016;1.
18. Ku E, Lee BJ, Wei J, Weir MR. Hypertension in CKD: Core Curriculum 2019. *American Journal of Kidney Diseases*. 2019;74(1):120-131. doi:10.1053/j.ajkd.2018.12.044
19. Stevens PE, Ahmed SB, Carrero JJ, et al. KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney Int*. 2024;105(4S):S117-S314. doi:10.1016/J.KINT.2023.10.018
20. Agarwal R, Flynn J, Pogue V, Rahman M, Reisin E, Weir MR. Assessment and management of hypertension in patients on dialysis. *J Am Soc Nephrol*. 2014;25(8):1630-1646. doi:10.1681/ASN.2013060601
21. Mehata S, Shrestha N, Mehta R, et al. Prevalence, awareness, treatment and control of hypertension in Nepal: data from nationally representative population-based cross-sectional study. *J Hypertens*. 2018;36(8):1680-1688. doi:10.1097/HJH.0000000000001745
22. Bambang YM, Oetari R, Satibi S. Analisis Biaya Pengobatan Hipertensi Pada Pasien Rawat Inap di RSUD Sorong. 2-TRIK: *TUNAS-TUNAS Riset KESEHATAN*. 2017;7(2):72-76. Accessed December 27, 2024. <https://2trik.jurnalelektronik.com/index.php/2trik/article/view/7203>
23. Sukmadriyani Y. *Analisis Efektivitas Biaya Pengobatan Hipertensi Dengan Diltiazem Dan Amlodipin Pada Pasien Rawat Inap Di RSUD Kabupaten Sukoarjo Tahun 2016*. Universitas Setia Budi Surakarta; 2017.
24. Kementerian Kesehatan Republik Indonesia. Keputusan Menteri Kesehatan Republik Indonesia Nomor HK.01.07/MENKES/4634/2021 tentang Pedoman Nasional Pelayanan Kedokteran Tata Laksana Hipertensi Dewasa. *Kementerian Kesehatan Republik Indonesia*. Preprint posted online May 2021. https://kemkes.go.id/app_asset/file_content_download/1700108499655598d3c61e16.60954826.pdf
25. Perhimpunan Dokter Spesialis Kardiovaskular Indonesia (PERKI). Pedoman Tatalaksana Hipertensi pada Penyakit Kardiovaskular: Edisi Pertama. Preprint posted online 2015. <https://www.inaheart.org/wp-content/uploads/2025/10/Pedoman-Tatalaksana-Hipertensi-Pada-Penyakit-Kardiovaskular.pdf>
26. Bulsara KG, Patel P, Cassagnol M. *Amlodipine*. StatPearls; 2025.
27. Gopal S, Patel P, Makaryus AN. *Candesartan*. StatPearls; 2025.
28. Bakris GL. Combined therapy with a calcium channel blocker and an angiotensin II type 1 receptor blocker. *J Clin Hypertens (Greenwich)*. 2008;10(1 Suppl 1):27-32. doi:10.1111/j.1524-6175.2007.08029.x
29. Kollias A, Foukarakis E, Karakousis K, HYPEDIA Study Group, Stergiou GS. Implementation of the 2018 ESC/ESH Guidelines for the management of hypertension in primary care: the HYPEDIA study. *J Hum Hypertens*. 2023;37(6):449-454. doi:10.1038/s41371-022-00713-w
30. Arumugham VB, Shahin MH. *Therapeutic Uses of Diuretic Agents*. StatPearls; 2025.
31. Mancia G, Kreutz R, Brunström M, et al. 2023 ESH Guidelines for the management of arterial hypertension The Task Force for the management of arterial hypertension of the European Society of Hypertension. *J Hypertens*. 2023;41(12):1874-2071. doi:10.1097/HJH.0000000000003480
32. Sica DA, Carter B, Cushman W, Hamm L. Thiazide and loop diuretics. *J Clin Hypertens (Greenwich)*. 2011;13(9):639-643. doi:10.1111/j.1751-7176.2011.00512.x
33. Khan TM, Patel R, Siddiqui AH. *Furosemide*. StatPearls; 2025.
34. Fitria N, Zazna Syaputri Y, Mardatillah M, Akram M, Nasif H. Amlodipine-Candesartan Combination: A Cost-Effective Strategy for Successful Therapy of Hypertension. *Jurnal Sains Farmasi & Klinis*. 2024;11(1):32-38. doi:10.25077/jsfk.11.1.32-38.2024
35. Amal S, Karlina L, Astuti D, Hidayah H. Analisis Efektivitas Biaya (Cost Effectiveness Analysis) Penggunaan Kombinasi Dua Obat Antihipertensi pada Pasien Hipertensi Rawat Jalan di RSUD Karawang. *Pharma Xplore Jurnal Ilmiah Farmasi*. 2021;6(2):13-26. doi:10.36805/farmasi.v6i2.1938
36. Baroroh F, Sari A. Cost Effectiveness Analysis Therapy Combination of Candesartan-Amlodipine and Candesartan-Diltiazem on Hypertensive Outpatients. *PHARMACY: Jurnal Farmasi Indonesia (Pharmaceutical Journal of Indonesia)*. 2018;14(2):188. doi:10.30595/pharmacy.v14i2.1952
37. Kementerian Kesehatan Republik Indonesia Badan Kebijakan Pembangunan Kesehatan. *Pedoman Umum Penilaian Teknologi Kesehatan Di Indonesia*. (Suryawati S, others, eds.). Lembaga Penerbit BKPK; 2022.

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<https://repository.badankebijakan.kemkes.go.id/id/eprint/5670/1/PEDOMAN%20UMUM%20PENILAIAN%20TEKNOLOGI%20KESEHATAN%20DI%20INDONESIA.pdf>