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Evaluation of the Rationality of Hypertension Treatment in Indonesia Based on JNC 7 and JNC 8 Treatment Standards: A Review

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Abstract: Hypertension is a multifactorial chronic disease and a leading cause of global morbidity and mortality, with a high prevalence in Indonesia. Irrational pharmacotherapy can reduce therapeutic effectiveness, increase the risk of adverse drug reactions, and exacerbate the economic burden on the healthcare system. This study aims to evaluate the rationality of hypertension treatment in Indonesia based on the Joint National Committee 7 (JNC 7) and 8 (JNC 8) therapy standards. A literature review was conducted on research articles accessed via Google Scholar, published between 2015 and 2025. Of the 675 identified articles, 10 met the inclusion criteria, which required that the articles contain percentage data on the rationality of hypertension treatment and use JNC 7 or JNC 8 as a reference. The results indicate that the appropriate indication aspect achieved the highest level of adherence, with 8 out of 10 studies (80%) reporting 100% compliance. The aspect of appropriate dosage was also high, exceeding 97% in 9 studies (90%). However, the appropriate drug selection rate showed wide variation, ranging from 48.65% to 100%. This inconsistency was primarily attributed to the prevalent use of monotherapy in stage 2 hypertension patients, for whom combination therapy is recommended. Calcium Channel Blockers (CCBs), particularly amlodipine, were the most frequently prescribed antihypertensive class, dominating the prescribing patterns in 8 out of the 10 studies (80%). In conclusion, hypertension treatment in Indonesia demonstrates a high degree of rationality concerning indication, drug selection, and dosage appropriateness, aligning with JNC standards to achieve optimal blood pressure control.

Keywords: Appropriate Dosage; Appropriate Drug Selection; Hypertension; Rationality.

Introduction

Hypertension is a chronic condition characterized by elevated systemic arterial blood pressure above normal limits (>140/90 mmHg), which increases the risk of cardiovascular and cerebrovascular diseases. This multifactorial chronic disease arises from the interaction of genetic and environmental factors, with the main mechanisms being activation of the renin-angiotensin system, which increases vasoconstriction and sodium retention, stimulation of the sympathetic nervous system, endothelial dysfunction that reduces vasodilation capacity, and vascular wall remodelling. This condition can cause serious complications such as stroke, heart failure, and target organ damage due to oxidative stress and chronic inflammation [1], [2]. The health burden caused by hypertension is increasingly evident when viewed from the high prevalence both globally and in Indonesia.

Globally, more than 1.28 billion adults (aged 30-79 years) live with hypertension, and only about 21% achieve adequate blood pressure control despite most receiving treatment [3]. This condition is also reflected in Indonesia, where the results of the 2023 Indonesian Health Survey (SKI) show that the prevalence of hypertension based on blood pressure measurements reaches 30.8% in people aged ≥18 years [4]. Given the large gap between the high number of patients and the low therapy success rate, rational treatment efforts are needed to improve therapy effectiveness.

Rational treatment is when patients receive medication that is appropriate for their clinical needs, in the right dosage for the individual, for the optimal duration, and at the lowest possible cost to the patient [5], [6]. In practical terms, according to the Eighth Joint National Committee (JNC 8), rational therapy for adult patients with essential hypertension without comorbidities can begin with one of the first-line drug classes, namely thiazide-type diuretics, calcium channel blockers (CCBs), angiotensin-converting enzyme inhibitors (ACEIs), or angiotensin receptor blockers (ARBs).

Evaluating the rationality of treatment requires clear, well-established standards. This study used two main guidelines: the Seventh Report of the Joint National Committee (JNC 7) in 2003 and the Eighth Joint National Committee (JNC 8) in 2014, which differ in their first-line therapy recommendations. JNC 7 recommends thiazide diuretics as initial therapy for most patients, with beta-blockers as an option. Meanwhile, JNC 8 provides more flexibility, recognizing four classes of drugs, removing beta-blockers from the first line, and setting looser blood pressure targets in the elderly population. These fundamental differences make the two guidelines complementary evaluation tools for analyzing the appropriateness of treatment patterns in Indonesia.

Irrational drug use can have serious consequences, such as increased healthcare costs, treatment failure, harmful side effects, and a decline in service quality. In Indonesia, similar conditions are also common, such as the use of drugs

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without clear indications, incorrect dosages or durations, and inappropriate drug selection. However, there have not been many evaluations that directly compare these actual practices with the JNC 7 and JNC 8 standard frameworks. The results of the study found that the antihypertensive drugs administered were not in accordance with the patients' blood pressure conditions; some stage 2 hypertensive patients only received monotherapy, even though they should have been given a combination of drugs, and some patients received lower doses of drugs than recommended [7].

Although evaluations based on JNC 7 and JNC 8 have been widely conducted, there is a gap in the literature regarding the relevance of these standards amid increasingly stringent global therapy targets. The latest international guidelines, such as ACC/AHA 2017 and ISH 2020, now emphasize lower thresholds (130/80 mmHg) compared to conventional JNC standards in order to reduce cardiovascular risk more progressively [8], [9]. In Indonesia, inconsistencies in the selection of drug regimens and dosages remain a major obstacle, which is often not comprehensively mapped in the context of the transition from old guidelines to the latest clinical updates [10], [11]. The novelty of this study lies in its comparative approach using two standard frameworks simultaneously to identify the extent to which clinical practices are able to adapt to dynamic developments in treatment protocols to achieve optimal treatment success [12], [13].

Considering the development of these therapeutic standards, the irrationality of hypertension treatment underscores the urgency of evaluating the rationality of antihypertensive therapy. Therefore, this article aims to review research publications on the rationality of hypertension treatment in Indonesia and to evaluate their compliance with the JNC 7 (2003) and JNC 8 (2014) treatment standards, focusing on three main aspects: correct indication, correct medication, and correct dosage.

Research Methods

Mainly, this review article was written using the literature review method. Primary literature searches were conducted in Google Scholar, covering articles published between 2015 and 2025. Studies were identified using a combination of keywords, namely "hypertension," "rationality," "appropriate dosage," and "appropriate medication," which yielded 675 articles in the initial stage. The selection process then continued by filtering 100 articles from the total identified, based on an assessment of the suitability of their titles and abstracts. At the screening stage, the selection process used strict inclusion criteria to ensure the quality of the studies reviewed. These criteria required articles to include a percentage evaluation of the rationality of hypertension treatment, use JNC 7 or JNC 8 standards as a reference for assessment, and be published in a journal accredited at SINTA 4 or higher. Of the 100 articles screened, 67 did not meet the requirements and were excluded from the study. Furthermore, the remaining 33 articles underwent a comprehensive feasibility assessment based on the full text. As a result of this selection process, 10 research articles were finally selected and declared eligible for further analysis in this literature review.

Table 1. Inclusion and Exclusion Criteria in PICO Literature Review

PICO	Inclusion	Exclusion
Population	Articles involving hypertensive patients in Indonesia	Articles not involving hypertensive patients in Indonesia
Intervention	Articles discussing the use of antihypertensive drugs based on the aspects of rationality, appropriate indication, appropriate medication, and appropriate dosage	Articles that do not discuss the use of antihypertensive drugs based on the aspects of rationality, appropriate indication, appropriate medication, and appropriate dosage
Comparison	Articles comparing the treatment of hypertensive patients with the JNC 7 and JNC 8 treatment standards	Articles comparing hypertension treatment in patients with treatment standards other than JNC 7 and JNC 8
Outcome	Articles that measure the level of rationality of hypertension treatment in patients	Articles that do not measure the rationality of hypertension treatment in patients

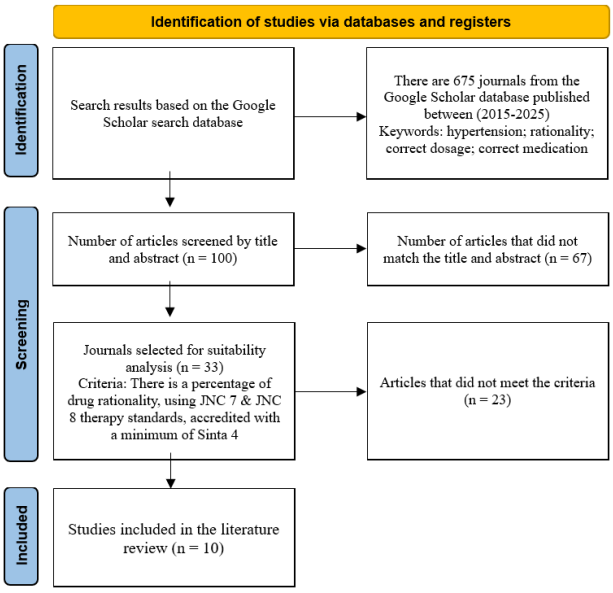

Figure 1. PRISMA flow chart.

Results and Discussion

Evaluation of treatment rationality is a critical component in ensuring the quality of pharmaceutical services and clinical outcomes for hypertensive patients. Based on a synthesis of 10 research articles that met the inclusion criteria, this study examined patterns and levels of compliance with antihypertensive prescribing practices across various regions of Indonesia according to the Joint

National Committee 7 (JNC 7) and 8 (JNC 8) standards. The diversity of research settings, ranging from primary health facilities to hospitals, provides a comprehensive picture of the achievement of hypertension management at the national level in meeting the criteria of rationality, namely correct indication, correct medication, and correct dosage.

The rationality of antihypertensive therapy in 80 geriatric inpatients in Central Java showed very high quality, as evidenced by the perfect accuracy of drug indication and dosage, which reached 100% [14]. The prescribing pattern in this study was dominated by Calcium Channel Blocker (CCB) drugs such as Amlodipine (27.5%) in monotherapy and RamiprilAmlodipine (ACEI-CCB) combination therapy (17.5%). However, the criteria for Appropriate Drug Selection still had an irrationality gap of 7.5% due to the administration of monotherapy in stage 2 hypertension patients, who, according to JNC 8, should have already started combination therapy.

In the report, 136 patient visits in Pontianak, West Kalimantan, the Appropriate Dosage criteria were recorded at 100% for patients with or without comorbidities [15]. Although Appropriate Indication in patients with comorbidities also reached 100%, the study highlighted significant problems in the Appropriate Patient (42.72%) and Appropriate Drug (80.58%) criteria in the comorbidity group. Patient inaccuracy was largely triggered by the prescription of drugs other than Diuretics and ACEI/ARB in patients with a history of Ischemic Stroke, even though JNC 7 explicitly recommends this class for the prevention of recurrent stroke. The most commonly used drug was Amlodipine.

Near-perfect compliance was found in Pekalongan, Central Java, with 41 outpatient samples evaluated based on JNC 8 [16]. The results showed that the criteria for Indication, Patient, and Dosage were 100%. Although the Appropriate Drug criterion reached 98%, the 2% irrationality was due to the administration of monotherapy in patients with stage 2 hypertension, where JNC 8 recommends combination therapy for optimal blood pressure control. The most common monotherapy regimen was Amlodipine (32%), while combination therapy was dominated by CCB-ARB (Amlodipine-Candesartan) (22%).

The rationality of antihypertensive treatment at the Central Cimahi Community Health Center, achieved ideal consistency [17]. This observational study of 56 medical records showed 100% compliance with the four criteria (Appropriate Indication, Appropriate Drug, Appropriate Patient, and Appropriate Dose) using the JNC 7 standard. The most commonly prescribed drug was Amlodipine monotherapy (92%). Despite the dominance of monotherapy, the researchers concluded that the overall treatment met the rationality criteria set by the applicable standards in that health service.

Although Correct Indication (100%) and Correct Patient (100%) were excellent, in Pontianak, it showed that the Correct Drug criterion remained a challenge, with a percentage of only 70.65% [18]. The 29.35% medication inaccuracy was largely due to the administration of single therapy to patients with stage 2 hypertension, even though JNC 7 recommends combination therapy for this group. Interestingly, the most commonly used drug at the health center was Captopril (ACEI) (47.46%), surpassing Amlodipine (34.75%).

An assessment of rationality in Primary Health Care Facilities in Sleman District showed high compliance with JNC 8, with Indication Accuracy reaching 100% and Dosage Accuracy reaching 96.15% [19]. However, the criteria for Appropriate Drug Selection reached 93.59%, with inaccuracy (6.41%) caused by therapy that was not fully in accordance with the JNC 8 algorithm. Monotherapy (51.3%) was the most common, with Amlodipine (CCB) as the top single choice (29.5%). The most commonly used drug combination was Amlodipine with Candesartan (CCB + ARB) (21.8%).

Unlike other studies, Banjarmasin presented the lowest rationality results, with Indication Accuracy, Drug Accuracy, and Dose Accuracy all below 50% [7]. Inappropriate indications (51.35%) and dosages (54.05%) were due to the administration of antihypertensive drugs to patients with normal blood pressure or prehypertension and the lack of drug combinations in stage 2 hypertension. The prescribing pattern was dominated by Amlodipine (CCB) monotherapy (56.76%). This low percentage indicates an urgent need to improve prescribing practices in accordance with JNC 7 at these facilities.

Although located in a different region, Bandar Lampung reported a perfect pattern of Correct Dosage and Correct Indication, reaching 100% in 82 samples of inpatients measured based on JNC 8 [20]. The main challenge was the Correct Drug criterion, which only reached 74.4%. This irrationality in the Right Drug (25.6%) was mainly due to the administration of single therapy to patients with stage 2 hypertension. Amlodipine (CCB) was the most commonly used drug (45%).

An evaluation of rationality in 96 elderly patients in Pulo Gadung, East Jakarta, showed good Indication Accuracy (100%) and Dose Accuracy (97.9%), referring to based on JNC 7 [21]. However, the Drug Accuracy percentage only reached 57.3%. The low Medication Appropriateness (42.7% inappropriate) was due to the administration of monotherapy in patients with stage 2 hypertension, even though JNC 7 indicates combination therapy for this severity. The most dominant drug used was Amlodipine (CCB) (67.7%).

Finally, the rationality of treatment in 70 BPJS patients in Tanggamus, Lampung, was almost perfect, with Patient Appropriateness, Indication Appropriateness, and Drug Appropriateness reaching 100% [22]. The Appropriate Dosage criterion was slightly lower (97.1%), with the 2.9% inaccuracy attributed to the frequency of Captopril administration not aligning with the standard daily dose (administered once daily). Contrary to the general trend, the most commonly used medication was Captopril (ACEI) (51%), and the majority of patients received monotherapy (91%).

An analysis of 10 studies identified a consistent pattern in antihypertensive prescribing in Indonesia. The Calcium Channel Blocker (CCB) class, particularly Amlodipine, dominated prescribing practices in most studies. Its prevalence is striking, ranging from 27.5% [14] to 92% [17]. This dominance is in line with the JNC 8 recommendations, which place CCBs as one of the first-line choices for the general non-black population, including the Asian population, which responds well to this class [23]. Amlodipine is a first-line choice because it has demonstrated a strong reduction in cardiovascular endpoints, particularly

stroke, and has the longest half-life (30-50 hours) in its class, allowing for once-daily dosing [24].

Table 2. Literature Review Results

Author	Title	Most Frequently Used Medication (%)	Appropriate Indication (%)	Appropriate Medication (%)	Appropriate Dosage (%)
[14]	Analisis Rasionalitas Penggunaan Obat Antihipertensi Pada Pasien Geriatri di Rumah Sakit X Periode Tahun 2023	Amlodipine (27.5)	100	92.5	100
[15]	Gambaran Rasionalitas Penggunaan Obat Antihipertensi pada Pasien Hipertensi di Instalasi Rawat Jalan RSUD Sultan Syarif Mohamad Alkadrie Pontianak Tahun 2020	Amlodipine (47.47)	93.94	72.73	100
[16]	Analisis Rasionalitas Penggunaan Obat pada Pasien Hipertensi Rawat Jalan di RSUD Bendan	Amlodipine (32)	100	98	100
[17]	Evaluation of The Rationality of Hypertension Medication Use in Puskesmas Central Cimahi	Amlodipine (92)	100	100	100
[18]	Evaluasi Rasionalitas Penggunaan Obat Antihipertensi di Puskesmas Siantan Hilir Kota Pontianak Tahun 2015	Captropil (47.46)	100	70.65	98.91
[19]	Profil dan Rasionalitas Penggunaan Obat Antihipertensi Pada Pasien Hipertensi di Fasilitas Kesehatan Tingkat Pertama Periode Mei - Juli 2021	Amlodipine (29.5)	100	93.59	100
[7]	Evaluasi Rasionalitas Pengobatan Hipertensi di Puskesmas Pelambuan Banjar Masin Tahun 2017	Amlodipine (56.76)	48,65	48.65	45,95
[20]	Rasionalitas Penggunaan Obat Antihipertensi pada Pasien Hipertensi Rawat Inap di RS Daerah dr. A. Dadi Tjokrodipo Bandar Lampung	Amlodipine (45)	100	74.4	100
[21]	Pola penggunaan obat antihipertensi pada lansia di Puskesmas Kecamatan Pulo Gadung periode Juli-Desember 2020	Amlodipine (67.7)	100	57.3	97.9
[22]	Rasionalitas Penggunaan Obat Hipertensi pada Pasien BPJS di Puskesmas Rantau Tijang Tanggamus	Captropil (51)	100	100	97.1

However, there are interesting variations worth noting. Two studies, namely [18] and [22], Captopril (ACEI) was reported as the most widely used drug, surpassing Amlodipine. This indicates that national trends, local preferences, drug availability, and policy factors in the health facility formulary can greatly influence prescribing patterns. The use of Captopril, which is a short-acting ACEI, is less ideal than long-acting ACEIs for long-term therapy because it requires repeated dosing throughout the day for optimal 24-hour blood pressure control [25].

The accuracy rate of drug selection (Appropriate Medication) showed considerable variation among the ten studies, ranging from a low of 48.65% [7] to a high of 100% [17], [22]. Analysis of the inaccuracies revealed that monotherapy is still common among patients with stage 2 hypertension, even though the JNC 8 guidelines recommend initiating combination therapy to achieve blood pressure targets more quickly, reflecting the phenomenon of therapeutic inertia, which is the failure of healthcare providers to initiate or intensify therapy in a timely manner, even though treatment targets have not been achieved [26].

Inaccuracy in the context of comorbidity was found in a study by [15]. In patients with a history of ischemic stroke, drugs outside the diuretic or ACEI/ARB classes were prescribed. Meanwhile, JNC 7 specifically recommends both classes for secondary stroke prevention based on strong clinical trial evidence. This non-adherence may be due to a lack of knowledge about specific recommendations for comorbidities or limited drug options in healthcare facilities.

One of the factors influencing this discrepancy is the limited availability of drugs funded by the health insurance system (BPJS) through the National Formulary (FORNAS),

and the e-Catalogue significantly limits doctors' prescribing options, where the mismatch between the FORNAS drug list and the latest Clinical Practice Guidelines (PPK) contributes to barriers in service quality and clinical decision-making [27].

One of the main factors underlying this discrepancy is the limited availability of drugs funded by the health insurance system (BPJS) through the National Formulary (FORNAS), where stock availability in pharmacies often does not reach 100%, thereby hindering patient access to optimal therapy [28]. The discrepancy between the list of drugs in FORNAS and the latest Clinical Practice Guidelines (PPK) creates obstacles in clinical decision-making, given that doctors often have to choose between compliance with cost regulations or clinical efficacy according to the latest guidelines [29]. In addition to systemic factors, therapeutic inertia is also triggered by doctors' perceptions that blood pressure measurements in clinics are not representative, leading them to delay therapy intensification [30]. This phenomenon is even more complex in patients with stage 2 hypertension, where doctors are often hesitant to add new types of drugs due to concerns about polypharmacy and increased risk of side effects [31]. Administrative barriers and financial constraints in the INA-CBGs payment system also force health facilities to restrict the types of drugs available, resulting in doctors' non-compliance with JNC therapy standards [32].

On the other hand, prescribing patterns in community pharmacies also show variations influenced by the drug distribution policy of the Referral Back Program (PRB), which is not yet fully synchronized with clinical needs in the field [33]. The complexity of evolving guidelines is often not commensurate with the clinical workload, resulting in low adoption of the latest recommendations in daily practice [34]. Ultimately, this inaccuracy in drug and dose selection has a direct impact on the failure to achieve blood pressure targets and a decline in the overall quality of patient clinical outcomes [35].

A synthesis of 10 studies revealed that the appropriate indication aspect achieved a very high level of compliance. Eight studies reported 100% accuracy of indication. This indicates that healthcare workers in various healthcare facilities, from hospitals to community health centers, have generally implemented accurate diagnostic procedures before initiating pharmacological therapy, in accordance with the basic principles of rational medication (World Health Organization, 1994). This consistency is a positive indicator in the implementation of hypertension management in Indonesia.

However, findings from [7] show a contrasting condition with an indication accuracy rate of only 48.65%. This inaccuracy is mainly due to the phenomenon of over-treatment, namely the administration of antihypertensive drugs to patients with blood pressure in the prehypertension category or even normal according to JNC 7 standards. An increase in potentially inappropriate drug prescriptions is independently associated with an increased risk of adverse drug events, which in turn has a significant impact on health costs [36].

Other specific factors that can influence the inaccuracy of antihypertensive drug indications are the administration of drugs to patients whose blood pressure does not yet meet the criteria for hypertension according to current guidelines [37]. The use of monotherapy in cases of stage 2 hypertension, which should receive combination therapy, has also been reported as a source of irrationality [38], [39], [40], [41]. The phenomenon of over-treatment, namely the administration of antihypertensive drugs in the prehypertension or normal blood pressure categories, also contributes to inappropriate indications [42]. There is a lack of consideration of strong medical reasons in every prescription decision, as the best pharmacotherapy alternative for patients [43]. Other factors include the inappropriate selection of drug classes for specific comorbid conditions in patients, such as the administration of β-blockers to diabetic patients, which may cause masked hypoglycemia [44].

In general, the aspect of correct dosage is the criterion with the highest level of compliance. Eight out of ten studies reported a correct dosage rate above 96%, with six reaching 100%. This high figure indicates that healthcare professionals generally understand and apply the recommended initial and maintenance doses for first-line antihypertensive drugs.

The study by [7], which reported the lowest dosage accuracy rate (45.95%), most likely reflects a real problem of underdosing, where the administered dose is insufficient to control blood pressure. Underdosing will render the therapy ineffective and increase the risk of long-term complications. On the other hand, [18] reported dosage inaccuracy due to overdosing (administration of 20 mg/day of Amlodipine), where the administration of high doses of dihydropyridine calcium channel blockers (CCBs) can cause dose-dependent side effects of ankle edema, with a sharp increase in incidence to more than 75% at a daily dose of 20 mg, due to greater arteriolar vasodilation than venular vasodilation, thereby increasing capillary hydrostatic pressure [45]. The findings of [22] The inappropriate frequency of Captopril administration (once daily) also underscores the importance of understanding the pharmacokinetics of the drug, not just the dosage.

Factors contributing to antihypertensive drug dosing inaccuracy include geriatric characteristics, which can lead to pharmacokinetic and pharmacodynamic changes that require more careful dose adjustment to prevent side effects and treatment failure [46]. Dosing inaccuracy is also influenced by a lack of dose adjustment based on the severity of hypertension, particularly in patients with advanced-stage hypertension who do not receive adequate dose titration according to guidelines [47], as well as non-compliance with treatment guidelines covering daily dosage ranges and frequency of administration [48]. Another crucial factor is the failure to consider the patient's renal function, especially when using ACE inhibitors, where a decrease in glomerular filtration rate (GFR) requires a lower initial dose and gradual adjustment to prevent drug accumulation and adverse reactions [49]. Another cause is the mismatch between the frequency of administration and therapeutic guidelines, for example, administering captopril once a day, which does not meet standard recommendations [50]. The use of doses exceeding the maximum daily limit, especially for amlodipine, has also been reported as a common cause of dosing inaccuracy in clinical practice [51]. Furthermore, the use of doses that are too low to produce the desired response and drug concentrations in the patient's plasma that are below the desired therapeutic range [52].

Conclusion

Overall, the prescription profile is dominated by the Calcium Channel Blocker (CCB) class, such as Amlodipine, with a prevalence of 27.5% to 92%. Based on a synthesis of 10 studies, the rationality of hypertension treatment in Indonesia shows the highest achievement in the correct indication, with 8 out of 10 studies (80%) reporting 100% compliance. The aspect of correct dosage is also very good, with 9 studies (90%) above 97%. The main challenge lies in the appropriate medication, which shows the greatest variation, ranging from 48.65% to 100%, with 5 studies (50%) below 75%. Irrationality was caused by the administration of monotherapy for stage 2 hypertension, which contradicts the combination recommendations of JNC 7 and JNC 8. Although the basis for diagnosis and dosage administration was sound, the intensification of therapy and the selection of drugs based on comorbidities still need improvement to fully meet rationality standards.

Author's Contribution

Pratama Immanuel Parlinggoman Sagala: Collecting and analyzing research data, and completing the entire article manuscript; Atika: Reviewing the article manuscript; Jef Gishard Kristo Kalalo: Providing advice, input, and revising the article manuscript.

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