

The Evaluation of The use of Antihypertensive Drugs with ATC&DDD Method in Cardiac Poly Geriatric Patient at Ajibarang Hospitas Inpatient Instalation

Eko Hidayaturrohman Khumaeni¹, Ratna Mildawati^{2*}, Fendy Prasetyawan³
STIKES Ibnu Sina Ajibarang¹, STIKES Ganesha Husada Kediri², Universitas
Kadiri³

Corresponding Author: Ratna Mildawati ratnamildawati@gmail.com

ARTICLE INFO

Keywords: antihypertensive drugs, ATC/DDD, DU90%.

Received : 2 December

Revised : 16 December

Accepted: 29 December

Khumaeni, Mildawati, Prasetyawan : This is an open-access article distributed under the terms of the [Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

Hypertension is one of the leading causes of mortality and morbidity in Indonesia. This research aims to determine the quantity of antihypertensive drugs used with Anatomical Therapeutic Chemical & Defined Daily Dose methods and determine antihypertensive drugs which include in Drug Utilization 90% segment. This research used secondary data which were taken from the patient's Medical Record. This research was quantitative descriptive research, the data were collected retrospectively. Data of antihypertensive drugs utilization and inpatient visit obtained from Medical Record Installation. Entire data then were processed to determine the quantity of antihypertensive drugs utilization in DDD/100 unit of inpatient day and Drug Utilization profile (DU90%). The results showed that the antihypertensive drugs utilization in hypertensive patients in RSUD Ajibarang were furosemid 28,07%, candesartan 17,42%, amlodipin 17,15%, spironolactone 11,52%, captopril 8,81%, valsaran 6,36%, irbesartan 3,60%, bisoprolol 3,38%, ramipril 3,31%, propranolol 0,34%. And from the DU90% table, drugs which include in the DU90% segment were furosemid, candesaran, amlodipin, spironolactone and captopril

INTRODUCTION

Hypertension stands as a formidable health issue globally, given its status as a primary risk factor for cardiovascular diseases like heart attack, heart failure, stroke, and kidney disease, according to data from the World Health Organization (WHO) on Country-Level Causes of Death in 2018. Typically, an individual is classified as hypertensive if their blood pressure exceeds 140/90 mmHg. Multiple risk factors contribute to the onset of hypertension, including genetic predisposition, obesity, excessive sodium intake, dyslipidemia, insufficient physical activity, and a deficiency in vitamin D (Japanan, 2017).

More than 1.3 billion individuals worldwide are affected by hypertension, constituting 31% of the global adult population. This prevalence has surged by 5.1%, surpassing the global rate observed between 2000 and 2010 (Bloch, 2016). Notably, within the same timeframe, developing countries exhibited a higher incidence of hypertension compared to developed nations, with nearly 75% of hypertensive individuals residing in developing regions (Mills et al., 2016). Concurrently, data from the 2018 Riskesdas survey indicates that Indonesia ranks 8th among 10 types of chronic non-communicable diseases in terms of hypertension incidence. The prevalence of hypertension events in Indonesia, based on blood pressure measurements in individuals aged ≥ 18 years, has risen from 25.8% in 2013 to 34.1% (Riskesdas, 2018).

The prevalence rate of the population in Central Java Province with hypertension is 37.57%. The prevalence of hypertension in women (40.17%) is greater than in men (34.83%). The prevalence in urban areas is slightly greater (38.11%) compared to rural areas (37.01%) (Riskesdas, 2018). Information from the Central Java Provincial Health Service, recapitulation of new problems of non-communicable diseases in Central Java in 2016 the total reported was 943,927 cases. The highest proportion of non-communicable diseases is still occupied by hypertension, namely 60%. There were 24,446 cases of hypertension in the calculation of non-communicable disease problems in Banyumas Regency/City Health Centers and Hospitals in 2017 (Widianto et al., 2019).

As age increases, chronic diseases also increase, so that older people require more treatment to manage the various diseases they experience. Hypertension is a disease whose prevalence increases with increasing age. The risk of developing hypertension in the population ≥ 55 years old who previously had normal blood pressure is 90% (Sihombing et al., 2016). Evaluation of drug use needs to be carried out to evaluate drugs regarding the expected efficacy and safety according to the patient's condition.

LITERATURE REVIEW

Evaluation of drug use is divided into 2, namely qualitative and quantitative. Qualitative drug use evaluation is a method for assessing the appropriateness of drug use (rationality of prescribing/using drugs) based on predetermined drug use criteria. The aim is to identify and, if possible, improve medication use. Meanwhile, quantitative drug use evaluation is a study to measure the amount and pattern of drug use, including determining local, regional and national drug use, following drug use trends, making comparisons between regional and international institutions, identifying excessive or non-use

of drugs, estimating drug use according to demographics, estimating the prevalence of morbidity based on the use of special drugs. (Indonesian Ministry of Health, 2017). Quantitative drug evaluation recommended by WHO is to use the ATC&DDD method, from this method the quantity of antihypertensive drugs used can be determined (Du et al., 2019).

The ATC&DDD (Anatomical Therapeutic Chemical & Defined Daily Dose) method is to change the physical amount of medication (capsules, bottles and inhalers) into standard units of measurement. The DDD calculation together with the ATC drug classification will form a system which, if used appropriately and correctly, can be a powerful method or tool for analyzing patterns of drug use and quantity of the drug as well as the therapeutic results obtained. Meanwhile, to see the pattern of drug use, it can be seen using the DU 90% (Drug Utilization 90%) method. The 90% DU method is a method commonly used to describe drug use patterns, where in this method use is sorted from greatest use to smallest use (Du et al., 2019).

METHODOLOGY

This research was conducted in the Medical Records Installation Room at Ajibarang Banyumas Regional Hospital. This study used univariate analysis and the ATC&DDD method which was carried out retrospectively with a cross sectional design collecting secondary data, namely in the form of patient medical records to determine the quantity of antihypertensive drug use in DDD/100 patient-days units.

The population in this study were all geriatric cardiac polyclinic patients diagnosed with hypertension who were hospitalized at Ajibarang Regional Hospital. The sample for this study was the entire population that met the inclusion and exclusion criteria, taken using a purposive sampling technique.

In this study, researchers collected data retrospectively by taking data from geriatric patients with hypertension who will be used as research samples in the medical records section of Ajibarang Regional Hospital. Data were taken from geriatric patients diagnosed with hypertension who were included in the inclusion. Secondary data recorded in the patient's medical record included: name, age, gender, length of stay, blood pressure values, and profile of antihypertensive drug use.

RESEARCH RESULT

Patient Characteristics

Patient demographics in this study included age, gender, type of comorbidity and blood pressure. Evaluation of the use of antihypertensive drugs using the ATC&DDD method in patients is described descriptively in the form of percentages.

From 237 patients, 100 patients were selected who met the inclusion criteria in this study. Patients who met the inclusion criteria were hypertensive patients with comorbid cardiovascular disease who were hospitalized and received antihypertensive medication and had complete medical records.

Table 1. Percentage of Geriatric Patient Characteristics at Ajibarang Regional Hospital

No	Characteristics	N	Percentage
1	Gender:		
	1. Men	48	48%
	2. Women	52	52%
2	Age:		
	1. 60-69	52	52%
	2. 70-79	38	38%
	3. 80-89	9	9%
	4. >90	1	1%
3	Diagnosis of Hypertension with cardiovascular disease:		
	1. CHF	73	73%
	2. STEMI	13	13%
	3. AP	8	8%
	4. ACS	6	6%
4	Blood Pressure:		
	1. Normal		
	• Systolic BP <120 mmHg	0	0%
	• Diastolic BP <80 mmHg	0	0%
	2. Pre-Hypertension		
	• Systolic BP 120-139 mmHg	0	0%
	• Diastolic BP 80-89 mmHg	18	18%
	3. Hypertension Stadium 1		
	• Systolic BP 140-159 mmHg	44	44%
	• Diastolic BP 90-99 mmHg	37	37%
	4. Hypertension stadium 2		
	• Systolic BP ≥160 mmHg	57	57%
	• Diastolic BP ≥100 mmHg	44	44%

Table 1 Patient characteristics consist of age, gender, comorbidities, and blood pressure. Age of most research subjects many range from 60-69 years old, which is dominated by patients women as much as 52% with CHF comorbidities as much as 73%, STEMI is 13% and other comorbidities are below 10%. Based on high blood pressure, there were 57% of subjects study with high systolic blood

pressure (≥ 160 mmHg) and 44% research subjects with high diastolic blood pressure (≥ 100 mmHg).

Distribution of Patterns of Use of Antihypertensive Drug Therapy

Table 2. Distribution of Antihypertensive Drug Use Patterns based on Type of Antihypertensive Therapy at Ajibarang Regional Hospital

No	Class	N	Percentage
1	Monoterapi		
	ACEI	12	41,38%
	Diuretik	8	27,58%
	CCB	6	20,69%
	ARB	2	6,90%
	<i>Beta Blocker</i>	1	3,45%
	Total		29%
2	Terapi Kombinasi		
	A. Kombinasi 2 Antihipertensi		
	1. Diuretik + ACEI	12	16,90%
	2. Diuretik + Diuretik	8	11,27%
	3. ARB + Diuretik	8	11,27%
	4. ACEI + CCB	3	4,22%
	5. CCB + ARB	2	2,82%
	6. <i>Beta Blocker</i> + ACEI	2	2,82%
	7. Diuretik + <i>Beta Blocker</i>	1	1,41%
	B. Kombinasi 3 Antihipertensi		
	1. Diuretik + ARB + Diuretik	11	15,49%
	2. Diuretik + Diuretik + ACEI	9	12,67%
	3. ARB + CCB + <i>Beta Blocker</i>	1	1,%
	4. <i>Beta Blocker</i> + ACEI+ Diuretik	1	1,41%
	5. Diuretik + ARB + CCB	1	1,41%
	6. Diuretik + <i>Beta Blocker</i> + Diuretik	1	1,41%
	7. ARB + Diuretik + <i>Beta Blocker</i>	1	1,41%
	c. Kombinasi 4 Antihipertensi		
	1. Diuretik + ACEI + <i>Beta Blocker</i> + Diuretik	3	4,22%
	2. Diuretik + ACEI + ARB + Diuretik	2	2,28%
	3. Diuretik + ARB + Diuretik + <i>Beta Blocker</i>	2	2,28%
	4. Diuretik + ARB + <i>Beta Blocker</i> + <i>Beta Blocker</i>	1	1,41%
	5. CCB + ACEI + Diuretik + Diuretik	1	1,41%
	D. Kobinasi 5 Antihipertensi	1	1,41%
	1. CCB + ARB + Diuretik + <i>Beta Blocker</i> +Diuretik	1	1,41%
	Total		71%

Based on table 2, it can be seen that the use of antihypertensives is grouped based on the type of therapy received by the patient. Of all hypertensive patients, 29% of patients received antihypertensive monotherapy and 71% of patients received antihypertensive combination therapy. The antihypertensive drug most

commonly prescribed as monotherapy is ACEI 41.38%. Meanwhile, the drugs most commonly prescribed as combination therapy are grouped according to their class and arranged based on the number of combination therapies. In combination therapy with 2 antihypertensive drugs, the combination of Diuretic + ACEI is the most frequently prescribed at 16.90%. Furthermore, for combination therapy with 3 antihypertensive drugs, the combination of Diuretic+ARB+Diuretic was the most frequently prescribed at 15.49%. For combination therapy with 4 antihypertensive drugs, the combination of Diuretic + ACEI + Beta Blocker + Diuretic is the most frequently prescribed at 4.22%. For combination therapy with 5 antihypertensive drugs, it was only found in one patient, namely the C1CB+ARB+Diuretic+BetaBlocker+Diuretic group, which was 1.45%.

Number of Patient Hospitalization Days in January-June

Table 3. Number of days treated for geriatric poly-cardiac patients at Ajibarang Regional Hospital in January-June

Month	N	LOS	Range (Day)
January	27	68	2,52
February	29	72	2,48
March	19	44	2,31
April	9	24	2,67
May	6	22	3,67
June	10	27	2,70
Total	100	257	16,35
Range	16,67	42,83	2,72

Quantity of Antihypertensive Drug Use at Ajibarang Regional Hospital in January-June

Table 4. Distribution of Antihypertensive Use and Calculation of DDD/100 Patient-days at Ajibarang Regional Hospital in January-June

Drug Classes	Antihypertensive Drug	Value Preparation	Mark Standard DDD from WHO (mg)	Strength Preparation (mg)	Amount Use (mg)	DDD/100 Patient-days
ACE Inhibitor	Captopril	Oral	50	6,25	268,7	
				12,5	525	12,11
Calcium Chanel Bloker	Ramipril	Oral	2,5	25	800	
				10	30	4,56
Diuretik	Amlodipin	Oral	5	10	310	23,56
				40	1040	
				20	3020	38,57
	Furosemid	Parenteral	40	20	3020	38,57
				75	3125	15,83
	Spirolakton	Oral		25	3125	

<i>Angitensi n Reseptor Bloker</i>	Candesartan	Oral	8	8	248	23,94
	Valsartan	Oral	80	16	176	8,74
	Irbesartan	Oral	150	150	350	4,94
□ blocker	Bisoprolol	Oral	10	2,5	122,5	4,65
	Propranolol	Oral	160	40	200	0,47

Table 5. DU Profile 90% Use of Antihypertensive Drugs at Ajibarang Regional Hospital in January-June

Kode ATC	Antihipertensi	DDD/100 Patient-days	Use (%)	Segmen DU
C03CA01	Furosemid	38,57	28,07%	90%
C09CA06	Candesartan	23,94	17,42%	
C08CA01	Amlodipin	23,56	17,15%	
C03DA01	Spironolakton	15,83	11,52%	
C09AA01	Captopril	12,11	8,81%	
C09CA03	Valsartan	8,74	6,36%	10%
C09CA04	Irbesartan	4,94	3,60%	
C07AB07	Bisoprolol	4,65	3,38%	
C09AA05	Ramipril	4,56	3,31%	
C07AA05	Propranolol	0,47	0,34%	
Jumlah		137,37	100	

Compatibility of Use of Antihypertensive Drugs with Hospital Formulary\

Table 6. Compliance with the use of antihypertensive drugs with the hospital formulary at Ajibarang Regional Hospital in January-June

Drug class	Generic Name	Preparation	Compatibility with Hospital Formulary
ACEI	Captopril	Tablet	√
	Ramipril	Tablet	√
□-blocker	Propranolol Bisoprolol	Tablet	√
	Fumarat	Tablet	√

CCB	Amlodipin besilat	Tablet	√
ARB	Candesartan	Tablet	√
	Valsartan	Tablet	√
	Irbesartan	Tablet	√
Diuretik	Furosemid	Tablet, injeksi	√
	Spironolakton	Tablet	√

DISCUSSION

Patient Characteristics

1) Patient Characteristics Based on Age

Based on research results, the most common patients with cardiovascular disease at Ajibarang Regional Hospital were aged 60-69 years, namely 52%. This is almost the same as the 2018 Riskesdas data, where there was an increase in hypertensive patients aged 65-74, namely 63.2%.

Hypertension increases with age. Increasing age causes physiological changes in the body, such as thickening of the arterial walls due to the buildup of collagen in the muscle layer, so that blood vessels narrow and become stiff starting at the age of 45 years. Apart from that, there is also an increase in peripheral resistance and sympathetic activity as well as a lack of baroreceptor sensitivity (regulating blood pressure and the role of the kidneys, blood flow and glomerular filtration rate). (Widjaya et al., 2019).

2) Patient Characteristics Based on Gender

Based on the results of this study, the number of female patients is greater than male patients. This is in accordance with 2018 Riskesdas data which states that female hypertension patients are higher, namely 36.9%, while for men it is 31.3%. Men have around 2.3 times more risk of experiencing an increase in systolic blood pressure compared to women, because men are thought to have a lifestyle that tends to increase blood pressure. However, after entering menopause, the prevalence of hypertension in women increases. Even after the age of 65 years, hypertension in women is higher than in men, due to hormonal factors (Riskesdas, 2018).

Women who have experienced menopause have low estrogen levels. Even though estrogen functions to increase levels High Density Lipoprotein (HDL) which plays a very important role in maintaining healthy blood vessels. So in menopausal women, decreasing estrogen levels will also be followed by a decrease in HDL levels if it is not followed by a good lifestyle (Sari & Susanti, 2016).

3) Patient Characteristics Based on Concomitant Diseases

Comorbidities are complaints suffered by patients apart from hypertension and other complications. The comorbidities experienced by patients in this study consisted of cardiovascular system disorders such as Congestive Heart Failure (CHF), ST-segment elevation myocardial infarction (STEMI), angina pectoris (AP), and acute coronary syndrome (ACS).

From the results data obtained, the most common comorbidity suffered was CHF at 73%. The risk for patients who have a history of hypertension is greater than patients who do not have a history of hypertension. Because hypertension is the number one risk factor associated with reduced left ventricular systolic function, hypertension sufferers who have uncontrolled blood pressure will continue to increase and the heart's work will become increasingly difficult, which ultimately causes heart enlargement and increases the risk of heart failure (Bangsawan, 2013).

Classification of Hypertensive Patients Based on High Blood Pressure.

Hypertension can be classified based on high blood pressure and based on etiology. Based on high blood pressure, a person is said to be hypertensive if his systolic blood pressure is high >140 mmHg and diastolic blood pressure >90 mmHg. Blood pressure classification is divided into 4 categories, namely normal category, pre-hypertension, stage 1 hypertension and stage 2 hypertension. In general, pharmacological therapy for hypertension is started if the patient with stage 1 hypertension does not experience a decrease in blood pressure after >6 months of undergoing treatment. healthy living and in patients with hypertension stage ≥ 2 (PERKI, 2015).

Based on the research results, hypertensive patients with comorbid cardiovascular disease at Ajibarang Regional Hospital most often experience stage 2 hypertension, namely systolic blood pressure ≥ 160 and diastolic blood pressure ≥ 100 mmHg. Stage 2 blood pressure is more at risk as a trigger for heart failure, because it is associated with reduced left ventricular systolic function so that the heart's work increases, which ultimately triggers heart failure (Padoli, Sari Luthfiyah, 2017).

Distribution of Patterns of Use of Antihypertensive Drug Therapy

The objective of investigating drug utilization patterns is to identify the specific drugs employed by hypertensive individuals at Ajibarang Regional Hospital. In accordance with JNC VIII guidelines, the initial approach to stage 1 hypertension involves administering monotherapy, commencing with a starting dose and progressively increasing it to the maximum if the blood pressure target remains unattained. In cases where the target is not met, an alternative medication with a distinct mechanism of action may be substituted, starting with a low dose and titrating upwards. If the desired outcome is still not achieved, a combination of 2 to 3 medications may be considered. For stage 2 hypertension with high or very high risk factors, initial therapy entails a combination of two low-dose drugs. Should the target blood pressure persistently elude attainment with two drugs, a regimen consisting of three anti-hypertensive medications may be prescribed.

Based on the research results, it shows that more patients received antihypertensive therapy with more than one drug, namely combination antihypertensive therapy as much as 71%. The most common antihypertensive used as monotherapy by the subjects of this study was ACEI. Meanwhile, combination therapy is the most common used is combination therapy with 2 antihypertensive drugs, namely the Diuretic + ACEI group.

This is in accordance with the management of heart failure that the first line drugs used are diuretic drugs. Diuretic drugs are useful for treating fluid retention that occurs in patients with heart failure. However, the use of diuretics cannot reduce mortality, so diuretics are usually given in combination with ACEI drugs. ACEI works by blocking the function of the RAA system, where the ACEI class of drugs suppresses the vasoconstrictive effect of angiotensin II in the blood vessels thereby reducing total peripheral resistance in blood pressure, causing natriuresis and diuresis which helps the effect of lowering blood pressure and helps to reverse systemic pulmonary edema and cardiac remodeling which plays a role in the symptoms and progression of chronic heart failure (Wulandari et al., 2015).

Profile of Antihypertensive Drug Use

1) Evaluation of the Quantity of Antihypertensive Use in the DDD Unit.

From the data that has been obtained, it is then calculated quantity of antihypertensive use by following the calculation rules established by the WHO Collaborating Center 2011. Antihypertensives are grouped according to the ATC code and class, then the dosage form is adjusted to the DDD unit of each antihypertensive. The definitive DDD unit uses milligrams, so the antihypertensive dose unit must be converted into milligrams first (Sataloff et al., 2020).

The DDD value is derived through the computation of the overall utilization of antihypertensive medications, divided by the established definitive DDD value as determined by the WHO Collaborating Center for each specific type of antihypertensive. The term "definitive DDD" refers to a singular strength allocated per patient. The process involves obtaining the DDD usage by dividing the total consumption of a particular antihypertensive in milligrams by the definitive DDD mg/patient. Subsequently, the DDD/100 patient-days is ascertained by dividing the total DDD usage by the overall number of inpatient care days over a six-month period, which has been previously adjusted to a per-100-patient-days basis.

DDD/100 Patient-days was calculated to determine how many patients received antihypertensive DDD for hypertensive patients with cardiovascular comorbidities. From this research in January-June 2020, the total days of hospitalization (Length of Stay) for 100 patients was 257 days as shown in table 4.3. The total LOS used in this study was used in the DDD calculation as a divider by the WHO DDD standard value.

The quantity of antihypertensive use at Ajibarang Regional Hospital in units of DDD/100 patient-days is shown in table 4.4. The highest quantity of antihypertensive use in January-June was Furosemide. The DDD calculation for Furosemide reached 38.57 DDD/100 patient-days. This means that there were 38 patients from all research subjects who consumed 1 DDD of 40 mg of furosemide every day.

Furosemide is a loop diuretic. This loop diuretic drug is used to reduce edema in heart failure patients. The mechanism of action of the drug furosemide is by inhibiting NaCl reabsorption in the thick segment of the ascending loop of Henle. Furosemide works by inhibiting Na⁺ /K⁺ cotransport/Cl⁻ . Na⁺ is

actively transported out of the cell into the interstitium by a Na⁺ /K⁺ -ATPase-dependent pump in the basolateral membrane. This will cause diuresis and end with a decrease in blood pressure (Wulandari et al., 2015).

2) Profile of Antihypertensive Use Based on 90% DU Profile

Drug Utilization (DU) 90% is obtained by dividing the total DDD/100 patient-days of antihypertensives by the total DDD/100 patient-days of all antihypertensives used then multiplied by 100%. The percentage of antihypertensive use is then cumulative and sorted from highest percentage to lowest percentage. Drugs that are included in the 90% DU segment are drugs that are included in the accumulated 90% usage. The DU profile of 90% antihypertensive use based on type of antihypertensive at Ajibarang Regional Hospital in January-June can be seen in table.5.

From the data in table.5, it shows that 90% of the antihypertensive drugs included in the DU segment consist of diuretics (furosemide 28.07%, spironolactone 11.52%), ARB group (candesartan 17.42%), CCB group (amlodipine 17.15%). %) and ACEI group (captopril 8.81%). Meanwhile, those included in the 10% DU segment are valsartan (6.36%), irbesartan (3.60%), bisoprolol (3.38%), ramipril (3.31%), propranolol (0.34%).

CONCLUSIONS AND RECOMMENDATIONS

From the results of this research, several conclusions can be drawn:

1. Use of antihypertensive drugs in geriatric cardiac patients in the inpatient installation of Ajibarang Regional Hospital:
 - a. Of all hypertensive patients, 29% of patients received antihypertensive monotherapy and 71% of patients received antihypertensive combination therapy.
 - b. The antihypertensive drug most commonly prescribed as monotherapy is ACEI 41.38%.
 - c. The combination of 2 antihypertensives, Diuretic + ACEI, is the most frequently prescribed at 16.90%.
 - d. The combination of 3 antihypertensives, Diuretic + ARB + Diuretic, is the most frequently prescribed at 15.49%.
 - e. The combination of 4 antihypertensives, Diuretic + ACEI + Beta Blocker + Diuretic is the most commonly prescribed at 4.22%.
 - f. The combination of 5 antihypertensives was only found in one patient, namely the CCB + ARB + Diuretic + BetaBlocker + Diuretic group, which was 1.45%.
2. Quantity of antihypertensive drugs in geriatric poly-cardiac patients in the inpatient installation of Ajibarang Regional Hospital:
 - a. Diuretic group (furosemide 28.07%, spironolactone 11.52%), ARB group (candesartan 17.42%, irbesartan 3.60%, valsartan 6.36%), CCB group (amlodipine 17.15%), ACEI group (captopril 8.81%, ramipril 3.31%) and β -blockers (bisoprolol 3.38%, propranolol 0.34%).
 - b. Based on the number of uses, it was found that the highest use of antihypertensives was furosemide, namely 38.57 DDD/100 patient-days.

- c. Based on the 90% DU profile, the antihypertensive drugs included in the 90% DU segment are furosemide, candesartan, amlodipine, spironolactone and captopril, respectively.

REFERENCES

- Bangsawan, M. (2013). *Merah Bangsawan**, *Purbianto**. IX(2), 145–150.
- Depkes RI. (2010). No Kewajiban Menggunakan Obat Generik di Fasilitas Pelayanan Kesehatan Pemerintah. *Theoretical and Applied Genetics*, 7(2), 1– 7.
- Du, D. A. N., Nguru, L., Adolof, D., Winda, L. N., Rame, T., & Melia, M. (2019). *EVALUASI PENGGUNAAN OBAT ANTIHIPERTENSI PADA PASIEN RAWAT INAP DI RSUD S K LERIK KUPANG TAHUN 2018 DENGAN METODE ATC / DDD Mahasiswa Program Studi Sarjana Farmasi Universitas Citra Bangsa Dosen Program Studi Sarjana Farmasi Universitas Citra Bangsa Koresp.* 2(September), 55–61.
- ESH. (2013). 2013 ESH/ESC guidelines for the management of arterial hypertension: The Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *European Heart Journal*, 34(28), 2159–2219. <https://doi.org/10.1093/eurheartj/eh151>
- Hendarti, H. F. (2016). Evaluasi Ketepatan Obat dan Dosis Obat Antihipertensi pada Pasien Hipertensi Rawat Jalan di Puskesmas Ciputat Januari-Maret 2015. In *Universitas Islam Negeri Syarif Hidayatullah Jakarta*.
- Japanan, D. (2017). *Peningkatan Pengetahuan tentang Hipertensi Guna Perbaikan Tekanan Darah pada Anak Muda.* 3(1), 26–38.
- Kandarini, Y. (2015). *Pendahuluan.* 13–14.
- Kementrian kesehatan RI. (2017). Petunjuk Teknis Evaluasi Penggunaan Obat Di Fasilitas Kesehatan. *Kementerian Kesehatan Republik Indonesia*, 1–50.
- Riskesdas, K. (2018). Hasil Utama Riset Kesehata Dasar (RISKESDAS). *Journal of Physics A: Mathematical and Theoretical*, 44(8), 1–200. <https://doi.org/10.1088/1751-8113/44/8/085201>
- Sari, Y. K., & Susanti, E. T. (2016). Hubungan Jenis Kelamin dengan Kejadian Hipertensi pada Lansia di Puskesmas Nglegok Kabupaten Blitar. *Jurnal Ners Dan Kebidanan (Journal of Ners and Midwifery)*, 3(3), 262–265. <https://doi.org/10.26699/jnk.v3i3.art.p262-265>
- Sihombing, B., Aprilia, D., Purba, A., & Sinurat, F. (2016). Penatalaksanaan hipertensi pada usia lanjut. *Divisi Geriatri – Departemen Ilmu Penyakit Dalam. Universitas Sumatera Utara*, 1–35.
- WHO. (2018). *Methods and data sources for country-level causes of death.* March.

- Widianto, A. A., Romdhoni, M. F., Karita, D., & Purbowati, M. R. (2019). Hubungan Pola Makan Dan Gaya Hidup Dengan Angka Kejadian Hipertensi Pralansia Dan Lansia Di Wilayah Kerja Puskesmas I Kembaran. *MAGNA MEDICA: Berkala Ilmiah Kedokteran Dan Kesehatan*, 1(5), 58. <https://doi.org/10.26714/magnamed.1.5.2018.58-67>
- Widjaya, N., Anwar, F., Laura Sabrina, R., Rizki Puspawati, R., & Wijayanti, E. (2019). Hubungan Usia Dengan Kejadian Hipertensi di Kecamatan Kresek dan Tegal Angus, Kabupaten Tangerang. *YARSI Medical Journal*, 26(3), 131. <https://doi.org/10.33476/jky.v26i3.756>
- World Health Organization. (2015). <http://weekly.cnbnews.com/news/article.html?no=124000>
- Wulandari, T., Nurmainah, & Robiyanto. (2015). Gambaran Penggunaan Obat Pada Pasien Gagal Jantung Kongestif Rawat Inap Di Rumah Sakit Sultan Syarif Mohamad Alkadrie Pontianak. *Jurnal Farmasi Kalbar*, 3(1), 1-9.