

Effectiveness and Monitoring of Side Effects of Hypertension Drugs in the Elderly in Kalijaga Village

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Abstract

Hypertension is the disease with the highest prevalence in Indonesia. Prevalence of hypertension in the elderly aged 55-75 years and above, which is 62.63% of the overall percentage of people with hypertension. However, many elderly people are not aware and responsive to the treatment of hypertension. The use of anti-hypertensive drugs is often not taken with good procedures. The purpose of this study was to determine the effectiveness and side effects of anti-hypertensive drugs consumed by the elderly in Kalijaga. Sampling using purposive sampling technique with a sample of 30 respondents with blood pressure criteria $\geq 140/90$ mm Hg. Data analysis used *wilcoxon* and *chi-square* tests. The results showed a significant effectiveness after the administration of anti-hypertensive drugs as shown by 26 people reaching the target blood pressure therapy. Many of the side effects felt were derived from the use of anti-hypertensive drugs.

Keywords: Effectiveness, side effects, hypertension medication, elderly.

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INTRODUCTION

Hypertension or better known as high blood pressure disease is a non-communicable disease that is commonly found and is included in global health problems. (Andhyka *et al.*, 2019). It is said to be hypertension when a person has a blood pressure of 150/90 mmHg or more at the age of over 60 years and 140/90 mmHg at the age of under 60 years (Muhadi, 2016).

According to WHO (2023), an estimated 1.28 billion of the world's population aged 30-79 years have hypertension. An estimated 46% of adults with hypertension do not realise they have the condition. Fewer than 42% of adults are well managed and among 1 in 5 adults in the world (21%) have uncontrolled hypertension. Hypertension is the disease with the highest cause of death in the world, so one of the world's global targets is to reduce the prevalence of hypertension by 33% between 2010 and 2030 (World Health Organisation, 2023).

Elderly (elderly) is a category of people aged 45 years and above (Akbar *et al.*, 2021). With age, there are

changes in the structure of cells, tissues and decreased organ function (Akbar *et al.*, 2021). This results in a high percentage of chronic diseases suffered by the elderly such as hypertension. Research shows that hypertension in the elderly results because blood vessels naturally 'harden' with age, losing their elasticity (Writes, 2017). This may be one explanation why the elderly are more at risk of developing high blood pressure.

In Indonesia, research on the prevalence of hypertension was conducted by the Research and Development Agency of the Indonesian Ministry of Health, namely the Basic Health Research (Rikesdas) in 2018. The results showed that the prevalence of hypertension in the elderly aged 55-75 years and above was 62.63% of the total percentage of people with hypertension. (Ministry of Health of the Republic of Indonesia, 2018). In the preliminary study results, data from the Non-Communicable Disease Division (PTM), elderly people with hypertension at Kalijaga Health Centre in May 2023 were 199 people, in June there were 108 people and in July there were 116 people.

According to a survey by the Indonesian Medical Gerontology Association (2022), involving 816

respondents spread across 34 provinces in Indonesia, it revealed that healthy elderly people take 1 item of medicine per day and elderly people with chronic diseases take 2.7 items of medicine per day. One of the drugs consumed is antihypertensive drugs. Therefore, the use of antihypertensive drugs used requires the selection of effective and safe drugs when used in a continuous and prolonged period of time. Assessment of the effectiveness of a drug is based on the target achieved, such as a decrease in blood pressure after consumption of antihypertensive drugs (Indriani *et al.*, 2022).

Pharmacological therapy management in hypertensive patients usually requires a combination of antihypertensive drugs to obtain the targeted blood pressure (Setyoningsih & Zaini, 2022). These antihypertensive drugs include *Angiotensin Converting Enzym Inhibitors* (ACEI), *Angiotensin Receptor Blockers* (ARB), *Calcium Channel Blockers* (CCB) *beta-blockers*, and diuretics. However, antihypertensive drugs in addition to causing many beneficial effects, can also cause unwanted side effects if not monitored. this makes it necessary to monitor patients in the use of these drugs by conducting Monitoring of Drug Side Effects (MESO) activities.

Identification, prevention, and resolution of drug-related problems are an integral part of pharmaceutical service activities (Musdalipah *et al.*, 2017). A pharmacist is tasked with ensuring the effectiveness and safety of drugs consumed by patients, so it is necessary to guarantee and understand patients, especially the elderly and chronic groups (Ahmad, 2019).

1. Respondent Characteristics

Table 1: Characteristics Data of Respondents

Variables	Frequency	Percentage (%)
Gender		
Male	8	26,7
Women	22	73,3
Age (years)		
60-65	16	53,3
66-70	8	26,7
71-75	3	10,0
76-80	2	6,7
81-85	1	3,3
Body Weight (kg)		
41-50	6	20,0
51-60	7	23,3
61-70	7	23,3
71-80	7	23,3
81-90	3	10,0
Body Weight (kg)		
41-50	6	20,0
51-60	7	23,3
61-70	7	23,3

METHODOLOGY

This study uses an observational method, meaning that this research is conducted on *causal-effect* events or phenomena that have occurred and the cause is not due to treatment / intervention from researchers. Data collection is carried out prospectively, which is research by *looking forward*, meaning that information processing is carried out looking at the cause or exposure then followed prospectively until a specified period of time and the effects or impacts that occur are seen (Adiputra *et al.*, 2021).

RESULTS AND DISCUSSION

A. Classification of Elderly Data with Hypertension

Ethical clearance or research ethics review is issued to ensure that the research will be carried out according to the code of ethics and according to guidelines. Submission of ethical clearance in this study was carried out at YPIB Majalengka University, Faculty of Pharmacy. After the ethical code standards have been reviewed, an ethical clearance letter was issued with number 202/KEPK/EC/VI/2024.

Data collection was conducted from February to June 2024. research data collection includes blood pressure, drugs consumed, age and demographic data (work history and education level) through interviews. respondents were obtained at posyandu / posbindu who were conducting free health checks. In addition, patients seeking treatment at Kalijaga Health Centre who fit the criteria and agreed to be the object of the study were included as respondents. The following data characteristics were obtained after conducting the research.

Variables	Frequency	Percentage (%)
71-80	7	23,3
81-90	3	10,0
Education Level		
SD	7	23,3
SMP	8	26,7
HIGH SCHOOL	7	23,3
Diploma/Bachelor's degree	5	16,7
Not in School	3	10,0
Work History		
trader/entrepreneur	7	23,3
Not working / housewife	8	26,7
ASN/CIVIL SERVANT	5	16,7
Private	1	3,3
DLL	9	30,0

The characteristics of elderly people with hypertension in Kalijaga Village based on the gender category are dominated by 22 women (73.3%) and 8 men (26.7%). This is in line with research by Maringga and Sari (2020), which shows that elderly women are prone to hypertension due to menopausal factors which result in hormonal changes. One of the hormones that affects the increase in blood pressure is the hormone estrogen. A decrease in the hormone estrogen causes the structure of the heart to change due to its function as a cardioprotective. In addition, the estrogen hormone functions as a vasodilator of blood vessels, which when its levels decrease, the blood flow becomes narrowed and there is an increase in blood pressure. In addition, according to Maas and Franke (2009), the estrogen hormone in menopause decreases which affects the regulation of the renin-angiotensin system so that blood pressure stability is disturbed.

The percentage of research results in table 1 shows that elderly people with hypertension in Kalijaga Village are dominated by the age group 60-65 years with a percentage of 53.3% and the second age group 66-70 years with a percentage of (26.7%). The elderly age group is more susceptible to hypertension due to the physiological decline of the body including a decrease in the elasticity of blood vessels which causes the heart to work harder in pumping blood.

Also proven by the research of Nurhayati *et al.*, (2023), with non-probability sampling in the form of incidental sampling at PKU Muhammadiyah Bantul Hospital, it was found that the incidence of elderly people with hypertension was 19 elderly people (38%) out of 50 respondents of all ages. This shows that the incidence of hypertension is highly correlated with a

person's age. In Nuraeni's research (2019) it is also explained, aging causes problems with intestinal disorders such as increased vasoconstriction so that blood pressure increases.

The percentage of research results for the characteristics of respondents based on body weight obtained quite evenly distributed results with the age group 41-50 years as many as 60 people (20%), the age group 51-60 years as many as 7 people (23.33%), age 61-70 as many as 7 people (23.33%), age 71-80 years as many as 23.33% and age 81-90 years as many as 3 people (10%).

The percentage of research results for the characteristics of respondents based on work history is dominated by the non-working group and housewives as many as 8 people (26.7%), then followed by traders or entrepreneurs as many as 7 people (23.3%), ASN or civil servants as many as 5 people (16.7%), private as many as 1 person (3.3%) and jobs that are not grouped as many as 9 people (30%).

The percentage of research results for the characteristics of respondents based on educational history in table 1 shows that hypertension sufferers are dominated by elderly people with the latest junior high school education, namely as many as 8 people (26.67%), then the second highest rank is the elderly with the latest elementary and high school education with 7 respondents (23.3%) and 7 people (23.3%) of high school, respondents with diploma / degree level education as many as 5 people (16.67%) and the last respondent who did not go to school as many as 3 people (10%). Low education allows a lack of information and behaviour towards a disease.

2. Analysis of Antihypertensive Drug Use

Table 2: Hypertension Drugs Used

Name of Medicine	Drug Group	Total	Percentage (%)
Amlodipine	CCB	5	16,67
Bisoprolol	BB	1	3,33
Candesartan	ARB	2	6,67
Captopril	ACEI	2	6,67
Nifedipine	CCB	1	3,33
Ramipril	ACEI	1	3,33
Amlodipine + Bisoprolol	CCB + BB	1	3,33
Amlodipine + Candesartan	CCB + ARB	7	23,33
Amlodipine + Captopril	CCB + ACEI	5	13,33
Amlodipine + Furosemide	CCB + Diuretic	1	3,33
Bisoprolol + Rampril	BB + ACEI	1	3,33
Candesartan + Bisprolol	ARB + BB	1	3,33
Captopril + Furosemide	ACEI + Diuretic	1	3,33
Irbesartan + Spironolotone	ARB + Diuretic	1	3,33
Total		30	100,00

The pattern of use of antihypertensive drugs consumed by the elderly in Kalijaga Village based on its classification there are 5 types, namely Calcium Canal Blocker (CCB), beta-blocker (β -blocker), Angiotensin Receptor Blocker (ARB), Angiotensin inhibitor (ACEi) and diuretic. The single antihypertensive that is widely used is the CCB class antihypertensive, namely amlodipine (16.67%). Amlodipine is an antihypertensive with the mechanism of inhibiting the entry of calcium ions into the heart membrane and smooth muscle which causes blood vessels to become vasoconstricted (Setyoningsih & Zaini, 2022). In addition, amlodipine was chosen because it has a long half-life with peak plasma time occurring around 6-9 hours after drug administration so that its use is sufficient once a day. (Abernethy, 1992). The use of a single antihypertensive drug such as amlodipine compared to candesartan (6.67%) and captopril (6.67%) was chosen as the first line because it has high bioavailability (60-80%) and can last for 24 hours which is beneficial in patient compliance. Even if a dose is missed, blood pressure can be maintained which is a common non-compliance. After discontinuation of amlodipine, blood pressure gradually returns to the original pressure after about 1 week of discontinuation (Ji Guang Wang *et al.*, 2023).

The administration of combined antihypertensive drug therapy is carried out when single therapy is not sufficient to reduce blood pressure to reach the target so that it is expected to achieve synergistic effects and efficacy (Setyoningsih & Zaini, 2022). The

most widely used combination therapy in this study was between CCB with ARB (amlodipine and candesartan) as many as 7 people (23.33%). The combination of these two drugs showed a better effect in reducing cardiovascular events in patients with hypertension. Amlodipine complements the less potent inhibitory effect of candesartan on vascular smooth muscle. In addition, amlodipine also has anti-arterisklerosis effects by inhibiting smooth muscle cell proliferation and platelet aggregation (Ryo Koyanagi *et al.*, 2013).

The second combination therapy was CCB with ACEi (13.33%). This combination is used when captopril therapy for up to 4 weeks does not show effective results in reducing blood pressure. The combination of amlodipine and captopril can reduce hypertension with minimal side effects (Presticasari *et al.*, 2023).

B. Effectiveness of Antihypertensive Drugs on Reducing Pressure in the Elderly

The target blood pressure reduction for the elderly over 60 years after being given antihypertensive drug therapy according to JNC VIII is $>150/90$ mm/Hg without other comorbidities such as coronary heart disease and diabetes mellitus. The results obtained from SPSS testing by transforming data, the distribution of the effectiveness of antihypertensive drugs on reducing blood pressure to reach the target according to JNC VIII are shown in table 3.

Table 3: Effectiveness Test Results using SPSS

Variables	Effective Frequency	Percentage	Frequency Ineffective	Percentage
Day 1 Effectiveness	14	46,70%	16	53,30%
Day 2 Effectiveness	19	63,30%	11	36,70%
Day 3 Effectiveness	26	86,70%	4	13,30%

The effectiveness of antihypertensive drugs on the first day to the third day after drug administration showed significant results. On the first day, the decrease in blood pressure that reached the target was successful in 14 people (46.70%) and the rest had not decreased

blood pressure that reached the target. Then blood pressure testing on the second day was successful in 19 people (63.30%) and on the third day as many as 26 people (86.70%) reached the therapeutic target of blood pressure below >150/90 mm/Hg.

Table 4: Wilcoxon Test for Blood Pressure Decrease

Blood Pressure (mmHg)	Average Blood Pressure Decrease	p-value	Conclusion
Systolic	24,37	0,000	Significant
Diastolic	11,43	0,015	Significant

Then non-parametric statistical testing was carried out, namely the Wilcoxon test to see if there was a decrease in blood pressure before being given antihypertensive drugs and after being given therapy on the last day. Data interpretation obtained $p < 0.05$ the results of the wilcoxon test which means there is a difference in blood pressure after being given antihypertensive drugs. According to the study, a

decrease that indicates the effectiveness of antihypertensive drugs is a decrease in the average systolic of more than 7-13 mmHg and diastolic of more than 4-8 mmHg.

C. Side Effects that Occur After Administration of Antihypertensive Drugs

Table 5: Side Effects Perceived Based on Drug Use

Name of Medicine	Side Effects
Amlodipine	Sleeplessness, leg pain, leg swelling, constipation, dizziness, body aches, headache, shortness of breath
Amlodipine + Bisoprolol	Difficulty breathing, body aches, dry mouth
Amlodipine + Candesartan	Dizziness, weakness, body aches, palpitations, headache, tremors, diarrhoea, nausea, itchy skin, chills
Amlodipine + Captopril	Squinting eyes, joint pain, dry throat, hyperhidrosis, cramps, weakness, nausea, itchy body
Amlodipine + Furosemide	Headache, body aches
Bisoprolol	Leg pain, nausea, stomach upset
Bisoprolol + Ramipril	Headache, stomach upset, tremor
Candesartan	Body aches, tingling, tremors
Candesartan + Bisoprolol	Headache, body aches, no appetite
Captopril	Cough, blurred vision, dizziness
Captopril + Furosemide	<i>Overactive bladder</i>
Irbesartan + Spironolotone	Weakness, thirst, dry throat
Nifedipine	Dizziness, body aches
Ramipril	Nausea

Table 5 shows the results of side effects caused by antihypertensive drugs used by the elderly. In the process of extracting side effects, researchers conducted an interview process which was carried out for 3 days after the administration of antihypertensive drugs. Identification of side effects almost 100% of elderly people with hypertension experience the incidence of side effects from mild to moderate. In fact, all drugs with vasodilator effects cause effects due to dilation such as lowering blood pressure (hypotension) which causes dizziness, headache, eye foginess. Then there is also heart palpitations, *hot flushes*, hives and digestive problems (Tan & Rahardja, 2015).

The most common side effects are dizziness and headache. This is common because one of the most commonly used therapies is amlodipine. Amlodipine has an effect on lowering blood pressure which causes a

decrease in blood flow in some blood vessels, causing dizziness, fatigue and headaches (Indriani *et al.*, 2022b).

In addition, in the use of drugs with calcium blockers, due to the blocking of calcium entry into heart muscle cells and smooth muscles, it causes dilation or vasodilation of the artiole. One of the side effects of this dilation of blood vessels is heart palpitations, leg edema and gastrointestinal complaints (Tan & Rahardja, 2015).

Common side effects of beta-blockers include shortness of breath, body aches and dry mouth. The use of non-selective beta-blockers causes breathing difficulties. This is because it works by blocking beta-2 as a smooth muscle relaxant in breathing. In addition, beta-blockers also cause hyperglycaemia and tachycardia. In some studies, beta-blockers have also caused sleep disruption (Khashayar Farzam & Arif Jan, 2023).

In the use of *Angiotensin Converting enzyme Inhibitors* (ACEi), some patients experience cough. This is because ACEi inhibition of the conversion of angiotensin I to angiotensin II results in the breakdown of bradykinin, increasing the amount of its active metabolite. Bradykinin causes bronchoconstriction and triggers cough. (Indriani *et al.*, 2022c). The side effects that may occur with the use of ACEi drugs are gastric-

intestinal complaints, skin hypersensitivity reactions, and joint pain.

Side effects that often occur with the use of *Angiotensin II Receptor Blockers* (ARBs) are hypotension that causes dizziness, hyperkalaemia and increased creatinine levels in the kidneys (Jayanti *et al.*, 2023).

D. Sociodemographic Associations with Antihypertensive Drug Effectiveness

Table 6: SPSS Sociodemographic Testing using Chi-square

Category	Characteristics	p Value	Description
Drug Effectiveness	Age	0,535	Unrelated
	Gender	0,935	Unrelated
	Education Level	0,123	Unrelated
	Work History	0,933	Unrelated
	Body Weight	0,26	Unrelated

The results of the relationship between the effectiveness of antihypertensive drugs with demographics can be seen in table 6 In the age category, the relationship value shows the results of the chi square statistical test with a p value = 0.035 ($p > 0.05$) which means there is no relationship between age and the effectiveness of antihypertensive drugs. This is because the respondents taken have the same age category, namely the elderly with hypertension.

The next statistical test results are the relationship between gender and the effectiveness of antihypertensive drugs. The chi-square statistical test results were obtained with a p value = 0.935 ($p > 0.05$), which means that there is no significant relationship between gender and drug effectiveness.

In testing the relationship between education level and drug effectiveness, the p value=0.123 ($p > 0.05$) means that there is no relationship between education level and drug effectiveness. In MMMM () research, this is due to a lack of awareness and knowledge about the risk factors that cause hypertension and a poor lifestyle even though there are also respondents with a high level of education.

The results of testing the relationship between work history and drug effectiveness show the results of p value = 0.933 ($p > 0.05$) which means that there is no relationship between work history and the effectiveness of antihypertensive drugs. Work is one of the things that triggers hypertension because for some people it takes up time so that there is less time to exercise in youth and busyness and work pressure creates a sense of stress that causes blood pressure to rise (Lestari and Nugroho, 2019).

The last statistical test is the relationship between body weight and the effectiveness of antihypertensive drugs. The results obtained are p value

= 0.260 ($p > 0.05$) which indicates there is no relationship between body weight and the effectiveness of antihypertensive drugs.

CONCLUSION AND SUGGESTION

A. CONCLUSION

Based on the results of the study "Effectiveness and Monitoring of Side Effects of Hypertension Drugs in the Elderly in Kalijaga Village" it can be concluded as follows:

1. The effectiveness of antihypertensive drugs obtained good results with the acquisition of elderly blood pressure reaching the target $>150/90$ mmHg as many as 26 people (86.7%) after using antihypertensive drugs for 3 days.
2. The majority of the side effects were from the side effects of antihypertensive drugs.
3. Demographics do not affect the effectiveness of antihypertensive drugs in the elderly in Kalijaga Village.

B. Advice

1. Future researchers are advised to explore factors that influence the effectiveness and side effects of antihypertensive drugs.
2. For future researchers, there is a laboratory test to see if the side effects caused by antihypertensive drugs

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REFERENCES

- Abernethy. (1992). Pharmacokinetics and pharmacodynamics of amlodipine. *Pubmed, I(Cardiology)*, 16.
- Adiputra, I. M. S., Trisnadewi, N. W., Oktaviani, N. P. W., Munthe, S. A., Hulu, V. T., Budiastutik, I.,

- Faridi, A., Ramdany, R., Fitriani, R. J., Tania, P. O. A., Rahmiati, B. F., Lusiana, S. A., Susilawaty, A., Sianturi, E., & Suryana. (2021). *Health Research Methodology* (R. Watrionthos & J. Simarmata, Ed.). Yayasan Kita Tulis.
- Ahmad, A. (2019). Home Pharmacy Care: Solution for Successful Therapy at Home. *Pharmaceutics.com (Online)*, 3(5), 70. <https://doi.org/10.24198/farmasetika.v3i5.21634>
 - Akbar, F., Alrani, G. M. S., & Darmiati. (2021). Empowerment of the Elderly with Gymnastics in Rumpa Village, Mapilli District, Polewali Mandar Regency. *Indonesian Journal of Community Dedication*, Vol.3, No.1, 19-21. <http://thesis.umy.ac.id/>.
 - Aliviyanti, R. U. Y. (2014, December 11). *Patient Adherence: A Critical Factor in Therapeutic Success*.
 - Andhyka, I., Sidrotullah, M., & Elvvi, D. (2019). Effectiveness Profile of Captopril and Amlodipine Hypertension Drugs in Outpatient Hypertension Patients in the Selaparang Health Centre Working Area in June 2017. In *JIKF* (Vol. 7, Number 1).
 - Benowitz, N. L. (2002). Basic and Clinical Pharmacology. In *Basic and Clinical Pharmacology: Vol. Vol.1* (pp. 187-213).
 - BPOM. (2022). *Implementation of Pharmacovigilance*.
 - Ekasari, R., Pradana, M. S., Adriansyah, G., Prasnowo, M. A., Rodli, A. F., & Hidayat, K. (2017). Analysis of Puskesmas Service Quality with the Servqual Method. *Darussalam Journal*, IX(1), 86-93.
 - Fajri, I., Nurhamsyah, D., Alifatal Mudrikah, K., Aisyah, S., Rizka Azjunia, A., Nursing PSDKU Unpad Pangandaran, M., Nursing, F., Padjadjaran, U., & Department of Emergency and Critical Care Nursing, D. (2022). Non-Pharmacological Therapy in Reducing Pain Levels in Stage 2-4 Breast Cancer Patients: Literature Review. In *Indonesian Nursing Scientific Journal*, 5(2). <http://jurnal.umt.ac.id/index.php/jik/index>
 - Filia, M., Agustina, E., & Rahmat, B. (2019). Legal Aspects of Informed Consent in the Application of Cardiac Surgery Techniques. *Journal of Legal Essence*, 1(1), 96-108. <https://journal.upnvj.ac.id/index.php/esensihukum/index96>
 - Fuad, M. I., & Handayani, S. (2022). Non pharmacological therapy in hypertension. *Journal for Healthy Society (JUKMAS)*, 6(1), 41-51. <http://ejournal.urindo.ac.id/index.php/jukmas>
 - Indriani, L., Rokhmah, N. N., & Shania, N. (2022a). Assessment of Antihypertensive Effectiveness and Drug Side Effects at Fatmawati General Hospital. *Journal of Pharmaceutical & Clinical Science*, 9(sup), 146. <https://doi.org/10.25077/jsfk.9.sup.146-151.2022>
 - Indriani, L., Rokhmah, N. N., & Shania, N. (2022b). Assessment of Antihypertensive Effectiveness and Drug Side Effects at Fatmawati General Hospital. *Journal of Pharmaceutical & Clinical Science*, 9(sup), 146. <https://doi.org/10.25077/jsfk.9.sup.146-151.2022>
 - Indriani, L., Rokhmah, N. N., & Shania, N. (2022c). Assessment of Antihypertensive Effectiveness and Drug Side Effects at Fatmawati General Hospital. *Journal of Pharmaceutical & Clinical Science*, 9(sup), 146. <https://doi.org/10.25077/jsfk.9.sup.146-151.2022>
 - Iqbal, A. M., & Jamal, S. F. (2023). Essential Hypertension. In *National Library of Medicine*. Treasure Island (FL): StatPearls Publishing.
 - Jayanti, M., Mpila, D. A., & Hariyanto, Y. A. (2023). Potential Side Effects of Antihypertensive Drugs at Puskesmas Manado City. *Optimising the Role of Pharmacists in the Therapy and Prevention of Degenerative Diseases in Productive Age*, 1-6.
 - Wang, J. G., Palmer, B. F., Vogel Anderson, K., & Sever, P. (2023). Amlodipine in the current management of hypertension. *The Journal of Clinical Hypertension*, 25(9), 801-807.
 - Kartika, M., Mirsiyanto, E., & Subakir. (2021). Risk Factors Associated with Hypertension in the Working Area of Puskesmas Rawang, Sungai Penuh City in 2020. *Jambi Community Health Journal (JKMJ)*, 5(1), 1-9.
 - Indonesian Ministry of Health. (2021). *National Guidelines for Medical Services; Management of Adult Hypertension*.
 - Ministry of Health of the Republic of Indonesia. (2018). *Main Results of Basic Health Research (RISKESDAS) 2018*.
 - Khashayar Farzam, & Arif Jan. (2023). Beta Blockers. *National Library of Medicine*.
 - Kristanti, P. (2015). Effectiveness and Side Effects of Antihypertensive Drug Use in Hypertensive Patients at Kalirungkut Health Centre Surabaya. *Scientific Journal of the University of Surabaya*, Vol.4, No.2, 1-13.
 - Lenaini, I. (2021). Purposive and Snowball Sampling Techniques. *Journal of Studies, Research and History*, 6(1), 33-39. <https://doi.org/10.31764/historis.vXiY.4075>
 - Muhadi. (2016). JNC 8: Evidence-based Guideline for the Management of Adult Hypertensive Patients. *CDK-236*, 43(1), 54-59.
 - Musdalipah, Saehu, M. S., & Asmiati. (2017). Analysis of Pharmaceutical Services at Puskesmas Tosiba, Kolaka Regency. *Warta Farmasi*, 6(2), 23-31.
 - Naranjo, C. A., Busto, U., Sellers, E. M., Sandor, P., Ruiz, I., Roberts, E. A., Janecek, E., Domecq, C., & Greenblatt, D. J. (1981). A Method for Estimating the Probability of Adverse Drug Reaction. *Clinical Pharmacology and Therapeutics*, 30(2), 239-245.

- Nasution, S. (2017). Research Variables. *Raudhatul Athfal Teacher Education Study Programme*, 05(2), 1-9.
- Ningsih, wahyu, Kamaludin, M., & Alfian, R. (2021). The Relationship between Learning Media and Increased Student Learning Motivation in PAI Subjects at SMP Iptek Sengkol South Tangerang. *Journal of Religious Education*, 6(1), 77-92.
- Nopiani, & Sasmito, C. (2019). Public Health Services at Puskesmas Simpang Tiga, Banyuke Hulu District, Landak Regency. *Journal of Management Science and Accounting*, 7(1), 1-7.
- Pemerintah, J. I., Khatulistiwa, S., Jeddawi, O. M., Rahman, A., Nawawi, M., Bakri, R., Billy, D., & Sagrim, G. (2018). *A Study of the Possibility of Changing The Status of Teluk Kapuas Village to Urban Village In Kubu Raya District*.
- Presticasari, H., Rahmawati, F., & Nugroho, A. E. (2023). Comparison of Clinical Response of Captopril and Amlodipine-Candesartan Combination in Urgent Hypertension Patients. *Pharmaceutics Magazine*, 19(3), 307-313. <https://doi.org/10.22146/farmaseutik.v19i3.67258>
- Prof. Dr Sugiyono. (2013). *Quantitative Research Methods* (19th ed.). Alfabeta.
- Putra, R. J. S., Achmad, A., & Rachma, H. (2017). Incidence of Potential Side Effects of Anti-diabetic Drug Therapy for Diabetes Mellitus Patients Based on the Naranjo Algorithm. *Pharmaceutical Journal of Indonesia*, 2(2), 45-50. <http://pji.ub.ac.id>
- Rohkuswara, T. D., & Syarif, S. (2017). The Relationship between Obesity and the Incidence of 1st Degree Hypertension at the Integrated Development Post for Non-Communicable Diseases (POSBINDU PTM) of the Bandung Port Health Office in 2016. *Indonesian Health Epidemiology*, 1(2), 13-18.
- Koyanagi, R., Hagiwara, N., Yamaguchi, J. I., Kawada-Watanabe, E., Haruta, S., Takagi, A., ... & HIJ-CREATE Investigators. (2013). Efficacy of the combination of amlodipine and candesartan in hypertensive patients with coronary artery disease: a subanalysis of the HIJ-CREATE study. *Journal of Cardiology*, 62(4), 217-223.
- Sanah, N. (2017). Implementation of Puskesmas Functions in Improving the Quality of Health Services in Long Kali District, Paser Regency. *eJournal of Government Science*, 5(1), 305-314. ejournal.ip.fisip-unmul.ac.id
- Setiabudhi, I. K. R., Noak, P. A., Kartika, I. G. A. P., Dewi, A. A. A. A., Yudharta, I. P. D., & Winaya, I. K. (2017). *The Existence of Kelurahan in the Perspective of Village Law*.
- Setyoningsih, H., & Zaini, F. (2022). The Relationship of Drug Interaction to the Effectiveness of Antihypertensive Drugs in RSUD dr. R. Seotrasno Rembang. *Cendekia Journal of Pharmacy STIKES Cendekia Utama Kudus*, 6(1), 77-88.
- Soelaeman, M. R. (2017). Hypertension in chronic kidney disease. In S. Setiati, I. Alwi, A. W. Sudoyo, M. Simadibrata, B. Setiyohadi, & A. F. Syam (Ed.), *Internal Medicine* (VI, pp. 2296-2301). InternaPublishing.
- Tan, H. T., & Rahardja, K. (2015). *Essential medicines: efficacy, uses, and side effects* (7th ed.). PT Elex Media Komputindo.
- Utami, R. E. M., Untari, E. K., & Robiyanti. (2018). *Monitoring of Adverse Antibiotic Side Effects in Pediatric Patients at Puskesmas of North Pontianak Subdistrict in November-December 2018 Period*. 1-8.
- Wicaksono, A. A., & Baroroh, F. (2023). The Effectiveness of Amlodipine and Nifedipine on Hypertension Outpatients at Public Health Centre. *Ahmad Dalan University National Seminar on Pharmacy*, 13-18.
- Wijayanti, U., Setyoko., & Setiawan, M. R. (2015). *Differences in Risk Factors for Hypertension in Working and Non-Working Women* [Thesis (Bachelor/Applied Degree (S1/D4))]. University of Muhammadiyah Semarang.
- World Health Organisation. (2023, March 16). *Hypertension*.
- Yogiantoro, M. (2017). Clinical Approach to Hypertension. In S. Setiati, I. Alwi, A. W. Sudoyo, M. Simadibrata, B. Setiyohadi, & A. F. Syam (Ed.), *Internal Medicine* (VI, pp. 2261-2286). InternaPublishing.
- Yudhana, A., Umar, R., & Alameka, F. (2016). Monographic Data Management System in Sidodadi Village. *ILKOM Scientific Journal*, 8(3), 167-173.