

# Utilization and cost minimization study of antihypertensive drugs in primary healthcare center

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## ABSTRACT

**Objective:** Hypertension is the biggest cause of death in Indonesia, including in the district of Pandeglang, for the category of non-communicable diseases. Since the implementation of National Health Insurance (NHI) in 2014, prevention strategies are expected to be able to improve the control of the patient's systolic blood pressure in the district of Pandeglang through interventions that are more focused on blood pressure changes and treatment cost. However, it is necessary to conduct a cost-minimization analysis of antihypertension drug use since drug cost is responsible with approximately 40% of the total healthcare costs in Indonesia. In the context of management on the use of antihypertension drugs at primary healthcare centers, this study was aimed to analyze the cost minimization of hypertension treatment in the district of Pandeglang in a period of 2014-2016 by taking into account the drug utilization and its cost consequences. **Material and method:** Data related to drug utilization was collected retrospectively from the Department of Health. The economic evaluation was conducted by applying Drug Utilization 90% (DU90%) and Cost Minimization Analysis (CMA) methods. **Result:** The results showed that captopril 25mg was obviously included in both 75% and 90% segments each year. Other drugs with the highest frequency included amlodipine 5mg and 10mg, captopril 12.5mg, furosemide 40mg, HCT, reserpine 0.25mg, and amlodipine besylate 5mg. Cost per Defined Daily Dose (DDD) was estimated to be Rp 58 (18%), Rp 195 (80%), and Rp 68 (25%) per DDD in 2014, 2015, and 2016, respectively, when a threshold of 90% in the drug utilization was applied. When a threshold of 75% was applied, cost/DDD would be Rp 62 (18%), Rp 208 (79%), and Rp 68 (23%) per DDD in 2014, 2015, and 2016, respectively. **Conclusion:** It can be concluded that the first year of NHI implementation yielded the lowest cost/DDD.

**Keywords:** DU90%, economic evaluation, DDD, cost/DDD

## Introduction

Hypertension is a cardiovascular disease that is commonly known as the "silent killer". It also has been highlighted as a risk factor for various diseases (e.g., coronary artery, heart failure, stroke, and kidney failure) when the blood pressure increases significantly as the consequence of people's lifestyle. In the

context of management therapy, the use of antihypertension drugs plays an important role in successful treatment. Several previous studies confirmed that patients who discontinue antihypertension drugs have a five times greater likelihood of having a stroke<sup>[1]</sup>.

In Indonesia, hypertension has been acknowledged as the biggest cause of death in the category of non-communicable diseases, according to the reports from Basic Health Research that was conducted every five years by the Ministry of Health. In the province of Banten, the prevalence of hypertension was reported to significantly increase from 8.0% in 2007 to 8.6% in 2013<sup>[2]</sup>. This situation occurred in all districts in this province including in the district of Pandeglang.

Since the implementation of National Health Insurance (NHI) in 2014, prevention strategies are expected to be able to improve

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the control of the patient's systolic blood pressure in Indonesia, specifically in the district of Pandeglang through interventions that are more focused on changes of blood pressure and treatment cost<sup>[3]</sup>. However, it is necessary to conduct a cost-minimization analysis of antihypertension drug use since drug cost covers approximately 40% of the total cost of healthcare in Indonesia. This study was aimed to analyze the cost minimization of hypertension treatment in the district of Pandeglang since the implementation of NHI in 2014 until 2016 in the context of management on the use of the antihypertension drug at primary healthcare centers, taking into account the drug utilization and its cost consequences<sup>[4]</sup>.

## Subjects and Methods

A longitudinal time series of data collection was applied in this study by considering more than one stage of data collection at different times. The study was conducted by analyzing the use of antihypertensive drugs in all primary healthcare centers (PHCs) in the district of Pandeglang and taking into account initial-final amount of usage, price, Defined Daily Dose (DDD) value, cost related to Drug Utilization (DU), and cost per DDD in two selected thresholds (90% and 75%) in a period of 2014-2016. To calculate DDD, it was based on the Anatomical Therapeutic Chemical (ATC) Classification, according to the guideline set by the WHO Collaborating Center for Drug Statistics Methodology in 2011<sup>[5-9]</sup>. As DDD represents the average maintenance dose per day, value DDD of each type of antihypertensive use was obtained by dividing the total usage of the drug (in grams or milligrams) with the value of DDD set by WHO. The use of antihypertensive per day in terms of DDD/1,000 inhabitants was calculated, thereafter. To present data in the percentage of antihypertensive use, the percentage of cumulative DDD was taken into account by considering applied thresholds. In the context of cost per DDD, cost-minimization analysis (CMA) was conducted by comparing the total cost of antihypertensive use in 2014, 2015, and 2016 to investigate the lowest cost in these years. More detailed description of the calculation can be seen in Table 1.

Table 1. Calculation

$$\text{DDD (one year)} = \frac{\text{Total use of antihypertension drugs in one year (gr)}}{\text{gr is equivalent to 1 DDD}}$$

$$\text{DDD/1,000 inhabitants/day} = \frac{\text{DDD one year} \times 1,000}{\text{Total inhabitants} \times 365}$$

Table 2. Defined Daily Dose

| Name of Drug        | 2014 |                           |          | 2015  |                           |          | 2016 |                           |          |
|---------------------|------|---------------------------|----------|-------|---------------------------|----------|------|---------------------------|----------|
|                     | DDD  | DDD/1,000 inhabitants/day | % of use | DDD   | DDD/1,000 inhabitants/day | % of use | DDD  | DDD/1,000 inhabitants/day | % of use |
| Nifedipine<br>30 mg | 0    | 0                         | 0        | 1,500 | 0.003                     | 0.22     | 0    | 0                         | 0        |

$$\% \text{ Drug Use} = \frac{\text{DDD/1,000 inhabitants/day}}{\text{Total DDD/1,000 inhabitants/day in all drugs}} \times 100\%$$

$$\text{Cost of DU90\%} = \frac{\text{Total price of drugs included in the DU90\%}}{\text{Total price of drugs in all segments}}$$

$$\text{Cost/DDD (90\%)} = \frac{\text{Total price of drugs included in 90\% segment}}{\text{Total DDD of drugs included in 90\% segment}}$$

$$\text{Cost/DDD (10\%)} = \frac{\text{Total price of drugs included in 10\% segment}}{\text{Total DDD of drugs included in 10\% segment}}$$

$$\text{Cost Minimization Analysis (CMA)} = \text{Cost per DDD}$$

## Method

### Materials

The research material was data of antihypertensive use in 2014, 2015, and 2016, and the DDD value of any type of antihypertensive.

### Instrument

Excel Calculation System, computer, pencil, ballpoint, ruler, book reference, calculator, and paper.

### Procedure

Analyzing the use of antihypertensive drugs in all primary healthcare centers (PHCs) in the district of Pandeglang and taking into account initial-final amount of usage, price, Defined Daily Dose (DDD) value, cost related to Drug Utilization (DU), and cost per DDD in two selected thresholds (90% and 75%) in a period of 2014-2016.

### Statistical Analysis

The study results were statistically analyzed using the Excel program and diagrams to decide the value of Defined Daily Dose (DDD), cost related to Drug Utilization (DU), and cost per DDD in two selected thresholds (90% and 75%) in a period of 2014-2016.

## Results

Utilization of all antihypertensive drugs used in 36 PHCs in the district of Pandeglang was analyzed by considering 90% and 75% thresholds, which are in accordance with the National Essential Medication List in the Health Center issued by the Ministry of Health of the Republic of Indonesia<sup>[3]</sup>.

|                           |                |              |            |                |             |            |                |              |            |
|---------------------------|----------------|--------------|------------|----------------|-------------|------------|----------------|--------------|------------|
| Amlodipine 10 mg          | 600            | 0.0014       | 0.19       | 189,540        | 0.43        | 27.5       | 432,200        | 0.99         | 47.11      |
| Amlodipine 5 mg           | 0              | 0            | 0          | 205,080        | 0.47        | 29.8       | 0              | 0            | 0          |
| Amlodipine besylate 5 mg  | 12,530         | 0.03         | 4          | 85,090         | 0.196       | 12.34      | 209,640        | 0.48         | 22.9       |
| Bisoprolol 2.5 mg         | 0              | 0            | 0          | 0              | 0           | 0          | 0              | 0            | 0          |
| Bisoprolol 5 mg           | 0              | 0            | 0          | 2,655          | 0.006       | 0.39       | 3,195          | 0.007        | 0.35       |
| Captopril 12.5 mg         | 12,275         | 0.03         | 4          | 48,150         | 0.11        | 7          | 69,050         | 0.16         | 7.53       |
| Captopril 25 mg           | 116,720        | 0.27         | 37.2       | 102,200        | 0.23        | 14.9       | 164,700        | 0.38         | 18         |
| Diltiazem 30 mg           | 0              | 0            | 0          | 800            | 0.0019      | 0.12       | 825            | 0.002        | 0.09       |
| Furosemide 40 mg          | 43,200         | 0.1          | 13.8       | 50,500         | 0.12        | 7.32       | 32,500         | 0.07         | 3.54       |
| Furosemide injection      | 0              | 0            | 0          | 162            | 0.0004      | 0.024      | 675            | 0.002        | 0.08       |
| Hydrochlorothiazide 25 mg | 19,000         | 0.044        | 6.06       | 0              | 0           | 0          | 0              | 0            | 0          |
| Lisinopril 10 mg          | 0              | 0            | 0          | 0              | 0           | 0          | 0              | 0            | 0          |
| Lisinopril 5 mg           | 0              | 0            | 0          | 0              | 0           | 0          | 0              | 0            | 0          |
| Nifedipine 10 mg          | 3,600          | 0.0083       | 1.148      | 400            | 0.0009      | 0.06       | 3,733          | 0.009        | 0.41       |
| Propranolol 10 mg         | 238            | 0.00055      | 0.076      | 575            | 0.0013      | 0.08       | 0              | 0            | 0          |
| Propranolol 40 mg         | 0              | 0            | 0          | 975            | 0.002       | 0.14       | 0              | 0            | 0          |
| Reserpine 0.1 mg          | 0              | 0            | 0          | 0              | 0           | 0          | 0              | 0            | 0          |
| Reserpine 0.25 mg         | 105,500        | 0.243        | 33.63      | 0              | 0           | 0          | 0              | 0            | 0          |
| Spirolactone 25 mg        | 0              | 0            | 0          | 1,867          | 0.00428     | 0.27       | 933,333        | 0.0022       | 0.102      |
| <b>Total</b>              | <b>313,663</b> | <b>0.723</b> | <b>100</b> | <b>689,494</b> | <b>1.59</b> | <b>100</b> | <b>917,452</b> | <b>2.094</b> | <b>100</b> |

From Table 2, it can be seen that the highest DDD value was presented in 2016 (917,452 DDD) and the smallest DDD value was presented in 2014 (313,663 DDD). The results also showed that captopril 25 mg, amlodipine 5 mg, and amlodipine 10 mg were considered as the drugs with the highest DDD in 2014, 2015, and 2016, respectively.

In particular, the highest value of DDD/1,000 population/day in 2014 was calculated to be 0.269 of captopril 25 mg, meaning that 0.0269% of the population in the district of Pandeglang consumed 1 DDD from captopril 25 mg daily. In 2015, the highest value of DDD/1,000 population/day was calculated to be 0.470 of amlodipine 5 mg, meaning 0.047% of the population

in the district of Pandeglang consumed 1 DDD from amlodipine 5 mg daily. In 2016, the highest value of DDD/1,000 population/day was calculated to be 0.986 of amlodipine 10 mg, meaning 0.0986% of the population in the district of Pandeglang consumed 1 DDD from amlodipine 10 mg daily. The calculated value of DDD/1,000 population/day was then determined by the percentage of usage and then sorted from highest to lowest. Applying 90% and 75% thresholds as cut points in term of drug use, it can be seen that captopril 25 mg is always used every year and amlodipine 10 mg is the most widely used drug with the highest DDD value in DU 90% and 75% segments (see Figure 1).

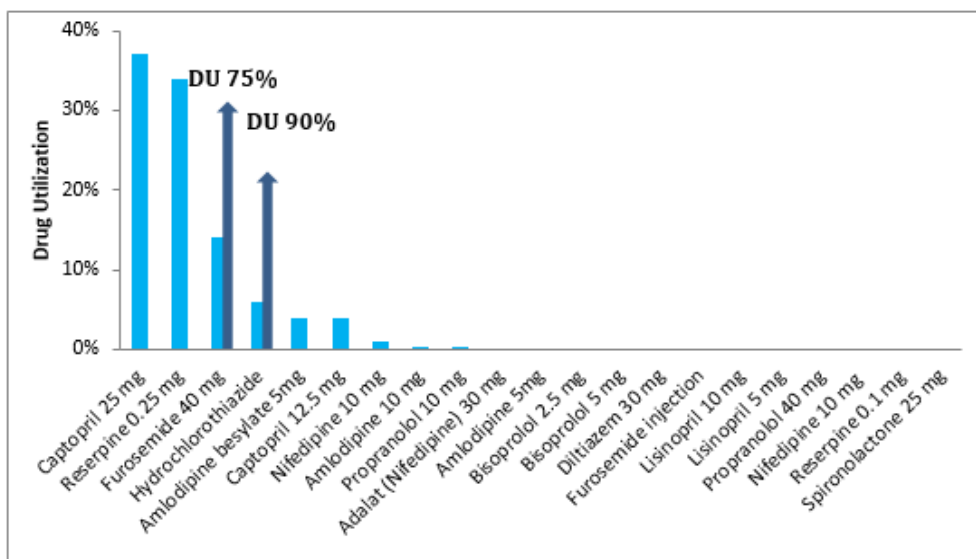


Figure 1a. Profile of Drug Utilization in 2014

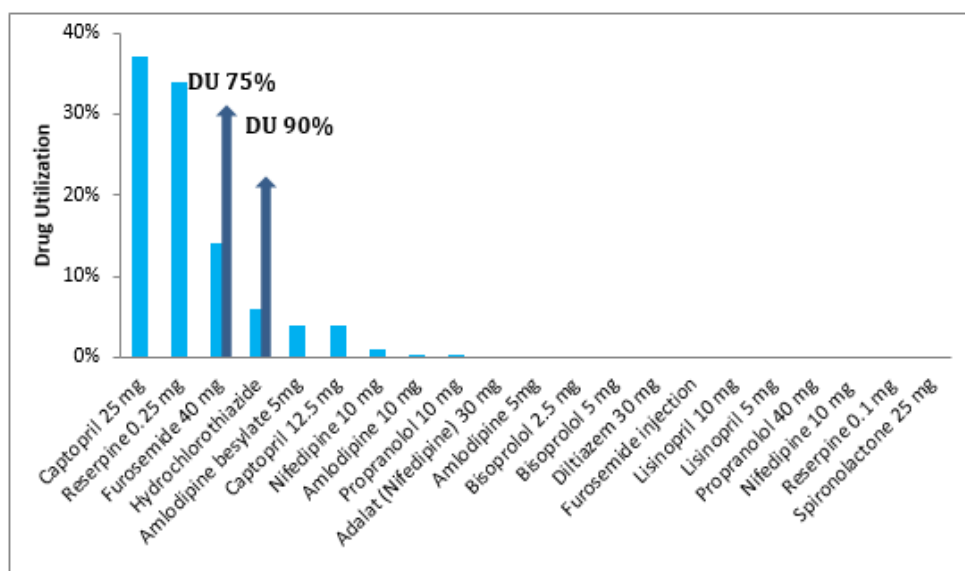


Figure 1b. Profile of Drug Utilization in 2015

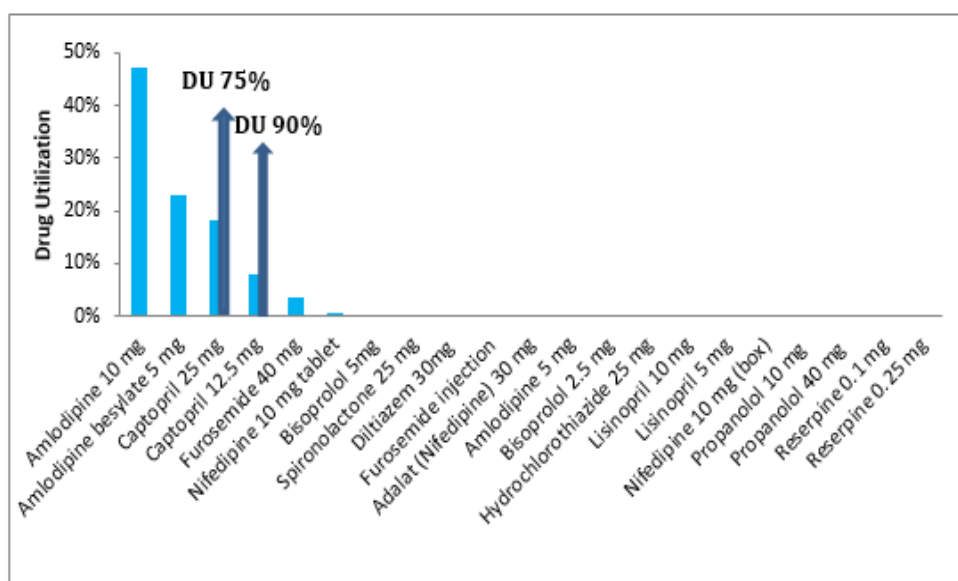


Figure 1c. Profile of Drug Utilization in 2016

**Table 3. Cost of Antihypertensive Drugs in All PHCs in 2014-2016**

|                              | 2014  | 2015  | 2016  |
|------------------------------|-------|-------|-------|
| <b>DU 90%</b>                |       |       |       |
| Cost of DU 90% (%)           | 17.9  | 80.1  | 24.8  |
| Cost/DDD in 90% segment (Rp) | 57.6  | 195.4 | 67.9  |
| Cost/DDD in 10% segment (Rp) | 2,578 | 536,7 | 4,308 |
| <b>DU 75%</b>                |       |       |       |
| Cost of DU 90% (%)           | 17.8  | 78.6  | 22.9  |
| Cost/DDD in 90% segment (Rp) | 61.7  | 208.2 | 68.2  |
| Cost/DDD in 10% segment (Rp) | 1,563 | 307,4 | 1,666 |

Furthermore, Table 3 showed that the highest cost of DU 90% and 75% can be found in 2015, which was estimated to be 80.1% and 78.6% in the segment of 90% and 75%, respectively. In particular, the lowest cost of DU 90% and 75% can be found in 2014, which was estimated to be 17.8-17.9% in both segments. Applying a 90% threshold, cost/DDD in 90% segment was calculated to be constantly lower than cost/DDD in a 10% segment in 2014-2016. Applying a 75% threshold, cost/DDD in 75% segment was also calculated to be lower than in cost/DDD in 25% segment in the same period.

From the calculation, it can be seen that captopril 25 mg was obviously included in both 90% and 75% segments every year. Other drugs with the highest frequency were amlodipine 5 mg and 10 mg, captopril 12.5 mg, furosemide 40 mg, hydrochlorothiazide, reserpine 0.25 mg, and amlodipine besylate 5 mg. With respect to DDD, which is the average daily adult dose used for medical indication, its value has been acknowledged to analyze drug utilization in the selected period. The value of DDD is internationally standardized so that drug use can be compared with other countries. However, its extensive use also needs to monitor the side effects of the drug and the patient's compliance with it. Considering the total population of 1,188,405, the results confirmed that 320 residents consumed 1 DDD of captopril 25 mg daily in 2014; 562 residents consumed 1 DDD of amlodipine 5 mg daily in 2015, and 1,184 residents consumed 1 DDD of amlodipine 10 mg daily in 2016. The results confirmed that the highest DDD value of antihypertensive drugs was changing over three years. It can be highlighted that there was a difference in the highest antihypertensive drug items used each year. Despite the fact that amlodipine and captopril were considered to be the most common used antihypertensive drugs, amlodipine was reported to be more effective in lowering blood pressure in Indonesia, compared to captopril [10].

Comparing cost/DDD in the period of 2014-2016, the lowest cost of DU 90% and 75% can be found in 2014, which was estimated to be 17.8-17.9% in both thresholds. This result confirmed that the lowest cost related to DU can be found in 2014, which was the initial year of NHI implementation. It also can be highlighted that the cost of DU fluctuated over three years. In terms of cost minimization, the cost of DU in 2014 would obviously give the lowest cost. However, this current situation contradicts the ideal situation that the cost of DU should continuously decrease from year to year. This situation might be

due to the increasing number of residents in the district from year to year and the number of patients with hypertension [11-14]. Moreover, cost/DDD in the most majority segment (90% or 75%) was calculated to constantly lower than cost/DDD in the less majority segment (10% or 25%) in these three years. It can be concluded that antihypertensive drugs in the most majority segment would give less impact in terms of cost/DDD compared to antihypertensive drugs in the less majority segment. This situation might be caused by a relatively low price of antihypertensive drugs in the most majority segment, such as captopril 25 mg, amlodipine 5 mg, and 10 mg. Besides the price of drugs, the effectiveness of those antihypertensive drugs in all segments should be taken into account by expanding the study into the cost-effectiveness or cost-utility analysis. However, one limitation of this study was assuming the same effectiveness for all analyzed drugs.

Despite the fact that this study had several limitations, the results of this study can assist the stakeholder in Indonesia, specifically in the district of Pandeglang in deciding to gain optimal cost efficiency in treating hypertension in PHCs. In the recent few years, several critical factors such as the increasing number of residents and patients with hypertension from year to year should be taken into account by the central and local government in Indonesia to deal with a limited budget in the treatment of non-communicable diseases.

## Conclusion

The results showed that captopril 25mg was obviously included in both 75% and 90% segments every year. Other drugs with the highest frequency were amlodipine 5mg and 10mg, captopril 12.5mg, furosemide 40mg, HCT, reserpine 0.25mg, and amlodipine besylate 5mg. when a threshold of 90% in the drug utilization was applied, Cost per Defined Daily Dose (DDD) was estimated to be Rp 58 (18%), Rp 195 (80%), and Rp 68 (25%) per DDD in 2014, 2015, and 2016, respectively. When a threshold of 75% was applied, cost/DDD was Rp 62 (18%), Rp 208 (79%), and Rp 68 (23%) per DDD in 2014, 2015, and 2016, respectively. It can be concluded that the first year of NHI implementation yielded the lowest cost/DDD.

## Conflicts of interest

There are no conflicts of interest.

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