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Original Article

Cost minimization of cardiovascular disease (CVD) drugs in primary healthcare centers in Bandung, Indonesia

Rano K. Sinuraya[1,2]*, Angelika Rianti[1], Auliya A. Suwantika[1,2]

[1] Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Padjadjaran, Indonesia. [2]Center of Excellence in Higher Education for Pharmaceutical Care Innovation, Universitas Padjadjaran, Indonesia.

Correspondence: Rano K. Sinuraya, Jalan Raya Bandung Sumedang KM 21, Jatinangor, 45363, Sumedang, West Java, Indonesia; Email: r.k.sinuraya@unpad.ac.id

ABSTRACT

The implementation of the National Healthcare Insurance (NHI) Program has increased the role of Primary Healthcare Center in Indonesia. This program is focused on health promotion, prevention of the disease, curative care, and rehabilitative services at an affordable cost through the insurance system. In this program, cardiovascular disease (CVD) is one of the main focuses, because its high prevalence and the mortality rates for this disease was also high. This study aimed to assess the NHI program on cost minimization of drugs on cardiovascular diseases in all primary healthcare centers (PHCs) in Bandung. This was a cross-sectional study using retrospective data in all PHCs in Bandung. In this study, two settings were compared: (i) before the implementation of NHI (2013); and (ii) after the implementation of NHI (2014), by performing cost-minimization analysis. The use of Defined Daily Dose (DDD) and Drug Utilization (DU) were also taken into account with two thresholds of 75% and 90%. The implementation of NHI has decreased the number of CVD drug consumption (36.8%). Before the implementation of NHI, the cost related to CVD drug utilization (%) would be 72.84% and 90.76% in the segment of DU75% and DU90%, respectively. After the implementation of NHI, the cost would increase by up to 87.58% and 94.82% for both segments, respectively. In particular, the cost/DDD after the implementation of NHI also would increase by up to 80.37%% and 59.9%% for DU75% and DU90%, respectively. In conclusion, after the implementation of NHI, the cost related to CVD in all PHCs in Bandung is higher than before the implementation. It was estimated that the differences in drugs availability and prescribing pattern before and after the NHI program has influenced the CVD drugs utility in PHCs.

Keywords: Cost minimization, CVD, DDD, drug utilization, primary health care

Introduction

Cardiovascular disease (CVD) has become a major problem worldwide.[1, 2] CVD is an uncommunicable disease [3] and also a common problem for every country, but it has a high prevalence in low-middle income countries. Hypertension and atherosclerosis are the most prevalent symptoms and risk factors of cardiovascular diseases.[4] Many programs have been carried out by healthcare facilities to reduce the mortality rate and morbidity of CVDs.[1, 5]

National Health Insurance (NHI) in Indonesia has been conducted in 2014 through the Healthcare and Social Security Agency (*Ind: Badan Penyelenggara jaminan Sosial Kesehatan/BPJS Kesehatan*). This program is concerned to improve patients' quality of life through promotive, preventive, curative, and rehabilitative programs at a reasonable cost through healthcare insurance.[6, 7]

The most common CVDs in Indonesia are coronary heart disease, heart failure, hypertension, and stroke. Bandung is the capital city of West Java Province and has around 2.5 million citizens. In 2016, CVD became the top three disease with the highest prevalence (7.75%) in Bandung and 20% of the population in Bandung died because of CVD.[8, 9]

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Along with the implementation of NHI in Indonesia, some policies have been implemented to support this program *e.g.* updating national formulary, strengthen the role of primary healthcare, and performing referral systems in healthcare facilities. All of them directly would affect the cost of healthcare such as medicines, laboratory checks, and other direct and indirect medical costs. This study aimed to analyze the drug cost for CVD before and after the implementation of NHI through cost-minimization analysis in all Primary Health Cares (PHCs) in Bandung, Indonesia.

Materials and Methods

An observational study has been conducted using retrospective data of 73 primary healthcares (PHCs) in Bandung. The data were extracted from Medicines Use and Spending Report of CVD year 2013-2014 from the Health Department of Bandung. They are the data in 2013 represented before the implementation of NHI and data 2014 represented after the implementation of NHI. Furthermore, they were processed based on the ATC/DDD system. ATC codes and Defined Daily Dose (DDD) values can be found in the WHO official website (https://www.whocc.no/atc_ddd_index/). Data on CVD drugs were collected and calculated with the unit of DDD/1000 patient/day according to the ATC/DDD guideline. The utility of each CVD drug was transformed into gram unit and then calculated to find the total amount of CVD drugs in DDD units. One DDD means average maintenance dose per day for a drug used to maintain its main indication in adults.

Drug Utilization Analysis

Drug utilization was determined according to the value of DDD and then converted into DDD/1000 inhabitants/day. In this study, the cost of DU was classified into two thresholds, 75% and 90%. The percentage of drug use was ordered from the highest to the lowest, then divided into 75% and 90% segment. DU90% is a common indicator that is used to determine the utilities of drugs.[10] DU75% is recommended to analyze the utilities of drugs which is limited to specific diseases or kinds of drugs. Because this study was limited only on CVD drugs, so we used both DU75% and DU90% to compare the utilities in this setting.

Cost of Drug Utilization

The drugs used in both segments of 75% and 90% were taken into account. The cost of the drug was derived according to government perspective which has been set out in Minister of Health of Indonesia Decree in 2012 and 2013. Cost minimization analysis was performed by comparing the total cost of a drug used on segment 75% and 90% in 2013 and 2014. The currency units that are in Indonesian Rupiah were converted to USD using the Purchasing Power Parity exchange rates.

The number of patients and patterns of diseases was gained from the total number of patients attending, and the disease reports published by the Health Department of Bandung. Data on CVD drug use were analyzed using descriptive statistics.

Results and Discussion

Bandung is a city located in West Java, Indonesia. Its population growth rate was 0.54% during 2013-2014. Based on the data, patients who visit all PHCs in Bandung has increased by 2.84% in 2014. Even though the number of visits increased in 2014, the number of CVD drugs consumption (DDD) and the ratio of CVD drug use per visit decreased by 36.8% and 38.8%, respectively in 2014 (Table 1).

In 2013 and 2014, DDD/1000 inhabitants/day in all PHCs in Bandung were 54.9889 and 34.7150. It indicated that respectively 5.49889% and 3.4715% of patients who visited PHC in Bandung have consumed 1 DDD of CVD drugs every day in 2013 and 2014. It can be assumed that correspondingly in 2013 and 2014, approximately 136,591 and 85,774 inhabitants consumed 1 DDD of CVD drugs every day. Sixteen CVD drugs were used in 2013 and 2014 in all PHCs in Bandung. All of these drugs commonly were prescribed by general practitioners but in several PHCs, drug prescribing was conducted by the nurse or midwife.

In this study, we found that captopril 25 mg has the highest utilities in 2013. A previous study showed that ACE Inhibitor (ACEI), such as captopril, is of the first-line therapy for hypertension and commonly used for primary hypertension treatment.[11, 12] There were differences between DU75% and DU90% in 2013 and 2014. In 2013, captopril 25 mg, hydrochlorothiazide 25 mg, amlodipine 5 mg, and captopril 12.5 mg were in the DU75% segment. Then, for DU90% was the list of DU75% including reserpine 0.25 mg and nifedipine 10 mg. On the other hand, in 2014, the drugs that included in DU75% were amlodipine 5 mg, reserpine 0.25 mg, captopril 25 mg, captopril 12.5 mg. In addition to that, for DU90% were amlodipine 5 mg, reserpine 0.25 mg, captopril 25 mg, captopril 12.5 mg, and digoxin 0.25 mg (Table 2). There was a slight difference in the trend of CVD drug use in 2013 and 2014. Hydrochlorothiazide and nifedipine were excluded from DU90% in 2014. The total consumption of CVD drugs (in DDD) is presented in Figure 1 and the pattern of CVD drug use (in DDD/1000 habitants/day) in Table 2.

In 2014, consumption of 1 DDD of CVD drugs declined by 36,83% compared to 2013. As we can see, there are differences in DU75% and DU90% in 2013 and 2014. In 2014, NHI was started to be implemented and some policies have been implemented to support this program. One of them is updating the guideline therapy and drug list for CVD.

Amlodipine 5 mg has the highest utilities in 2014. Both captopril and amlodipine were first-line therapy for hypertension.[12] Captopril is an ACE Inhibitors and amlodipine is a calcium channel blocker. Both of these drugs have been widely used for hypertension treatment and showed significant effectiveness in lowering blood pressure.[13] However, in 2014, general practitioners preferred to prescribe amlodipine because most of the patients complained about cough after they took it. Azimivaghar[14] found that cough is a common side effect of captopril and the incidence of cough after treatment with

captopril decreased by increasing of patients' age and this reduction in both male and female patients was statistically significant.

The availability of CVD drugs in PHC generally depends on the epidemiology status of previous year and procurement system in PHC.[15] In Indonesia, the drugs procurement system for PHC is conducted centrally. Every 6 or 12 months, each PHC has to make its need list for drugs and medical devices and all of that needs will be provided by the Ministry of Health. After the NHI implementation procurement system has been combined with e-catalog. But sometimes the price of drugs and/or the quantity of drugs does not meet the requirement or they are not available because the drugs are not produced in that period of time. This condition caused the doctor to give prescription only based on the available drugs in PHC and this action absolutely will affect the segment of DU75% and DU90%.[15, 16]

The utilities of digoxin increased in 2014 because in that year diuretic drugs e.g. spironolactone, furosemide, and hydrochlorothiazide were available. Therefore, the utilities of diuretics decreased because of the percentage of diuretic use will be divided into those drugs. Along with the decreasing of diuretic use, the utilities of digoxin have increased in 2014.

The difference between DU75% and DU90% segments is based on the most widely used drug. In DU75%, all of the drugs belong to first-line therapy for hypertension because Bandung is one of the city in Indonesia which has a high prevalence of hypertension.[17] Formerly, drugs that belong to DU90% and DU10% were for hypertension and heart disease treatment.

Cost analysis can be used to evaluate the effectiveness of a program.[18] Cost analysis was conducted to compare the percentage of both the cost of DU75% and the cost of DU90% in 2013 and 2014. In this study, we evaluate the NHI program on CVD drug utilities using several parameters, *i.e.* cost of DU 75%, cost of DU 90%, cost/DDD for drugs, including DU75%, DU 90%, DU 25%, and DU 10% segments.[10, 19] It was found that the average cost of DU (75% and 90%) in 2014 is higher than in 2013. In 2014, the average cost for DU75% and 90% have increased around 20.33% and 4.47%, respectively (Figure 2).

The average cost of DU was higher in 2014, it was initiated by the cost that required to provide the drugs for DU75% and DU90% segment. In 2014, amlodipine was included in DU70% and DU90% and this drug has the highest price per unit among other CVD drugs. The same findings were stated by Johnson [20] and Valluri [21], the drug cost and procurement method influenced the drug utilities in community healthcare.

The other parameter is cost/DDD, this parameter shows the cost to provide 1 DDD of medication for CVD. Cost/DDD was also performed to calculate drugs outside of DU75% and DU90%, it is also called by cost/DDD of DU25% and cost/DDD of DU10%. The comparison of cost/DDD in drug utilization 10%, 25%, 75%, and 90% is presented in Figure 3. Cost/DDD of DU10% in 2013 is greater than the cost/DDD of DU90%. It was similar to the cost/DDD of DU25% which greater than cost/DDD of DU75%. It can be inferred that it took a great expense to provide medicine which less-used in 2013 or before the implementation of NHI.

Otherwise, in 2014 there were different values of cost/DDD in both DU75% and DU90% segments. Cost/DDD of DU90% was more superior than the cost/DDD of DU10%. The same thing also happened on cost/DDD of DU75%. Its value was greater than the cost/DDD of DU25%. It was concluded that higher expense was used to provide the most widely used CVD drugs in 2014. This condition could happen because, in 2014, amlodipine was more expensive than other CVD drugs and amlodipine came into DU75% and DU90% segment. Cost/DDD increased in DU75%, DU90%, and DU10% segment respectively by 44.53%, 37.46%, and 8%. However, the cost/DDD of DU25% decrease by 17%.

The total expense in the utilization of CVD drugs is presented in Table 3. The total cost for CVD drugs in 2013 was lower than in 2014. The total cost of CVD drugs in 2014 was higher by 347 USD than in 2013. The main factor of this condition was because the price of the most prescribed CVD drugs in 2014 was high. There was no significant difference between the total cost of CVD drugs in 2013 and 2014 (p=0,497).

The price of amlodipine is 0.12 USD/tablet and it is the highest price among other CVD drugs which included in DU75% and DU90%. On the other hand, spironolactone was included in the CVD drug list in 2014. Spironolactone also has a higher price compared with amlodipine. Even though spironolactone utility only 0.0783 DDD/1000 inhabitants/day, it also took a high cost to provide these drugs (about 1,054 USD).

It can be seen that although the total cost of CVD was higher in 2014, it was not statistically different between 2013 and 2014. There are some identifiable factors to explain this condition. The procurement system, availability of drugs, and the drug price gave enormous effect to drug utilization, cost of drug utilization, and cost/DDD of CVD drugs in all PHCs in Bandung.

Table 1. Population, patient visits, and CVD drugs consumption in all PHCs in Bandung during 2013-2014

Information	2013	2014
Population (inhabitants)	2,483,977	2,470,802
Patient' visit (patients)	1,827,199	1,879,178
CVD drugs consumption (DDD)	1,546,028.67	976.630,92
Ratio of CVD drugs use per visit (total DDD/total patient visit)	0.85	0.52
CVD drugs consumption (DDD/1000 inhabitants/day)	54.9889	34.7150

Table 2. Pattern of CVD drug use during 2013-2014 in all PHCs in Bandung (DDD/1000 inhabitants/day)

CVD Drugs	2013	2014
Captopril 25 mg	15.6204[a)b)]	7.0862[a)b)]
Hydrochlorothiazide 25 mg	15.5453[a)b)]	0.3428
Amlodipine 5 mg	6.8682[a)b)]	9.5783[a)b)]
Captopril 12,5 mg	6.4509[a)b)]	5.1161[a)b)]
Reserpine 0,25 mg	2.9331[b)]	8.5376[a)b)]
Nifedipine 10 mg	2.6402[b)]	0.2979
Furosemide 40 mg	2.5122	0.9459
Atenolol 50 mg	1.3308	1.0289
Digoxin 0,25 mg	0.7400	1.4429[b)]
Diltiazem 30 mg	0.1162	0.1051
Methyldopa 250 mg	0.1155	0.0246
Isosorbide dinitrat 5 mg	0.0384	0.0740
Furosemide inj 10 mg/mL	0.0371	0.0070
Propanolol HCl 40 mg	0.0356	0.0495
Propanolol HCl 10 mg	0.0050	0.0000
Spironolactone 25 mg	0.0000	0.0783
Total	54.9889	34.7150

[a)] DU75% segment
[b)] DU90% segment

Table 3. Total cost of CVD drugs use in 2013 and 2014 in all PHCs in Bandung

CVD Drugs	**2013 (USD)**	**2014 (USD)**
Captopril 25 mg	14,835	7,275
Hydrochlorothiazide 25 mg	1,999	43
Captopril 12,5 mg	8,067	6,151
Amlodipine 5 mg	21,563	30,952
Reserpine 0,25 mg	1,885	5,541
Nifedipine 10 mg	3,272	397
Furosemide 40 mg	1,097	311
Atenolol 50 mg	1,747	3,433
Digoxin 0,25 mg	171	458
Methyldopa 250 mg	596	469
Diltiazem 30 mg	119	350
Isosorbide dinitrat 5 mg	159	132
Propanolol HCl 40 mg	60	114
Furosemide inj 10 mg/mL	826	92
Propanolol HCl 10 mg	28	0
Spironolactone 25 mg	0	1,054
Total	56,424	56,771

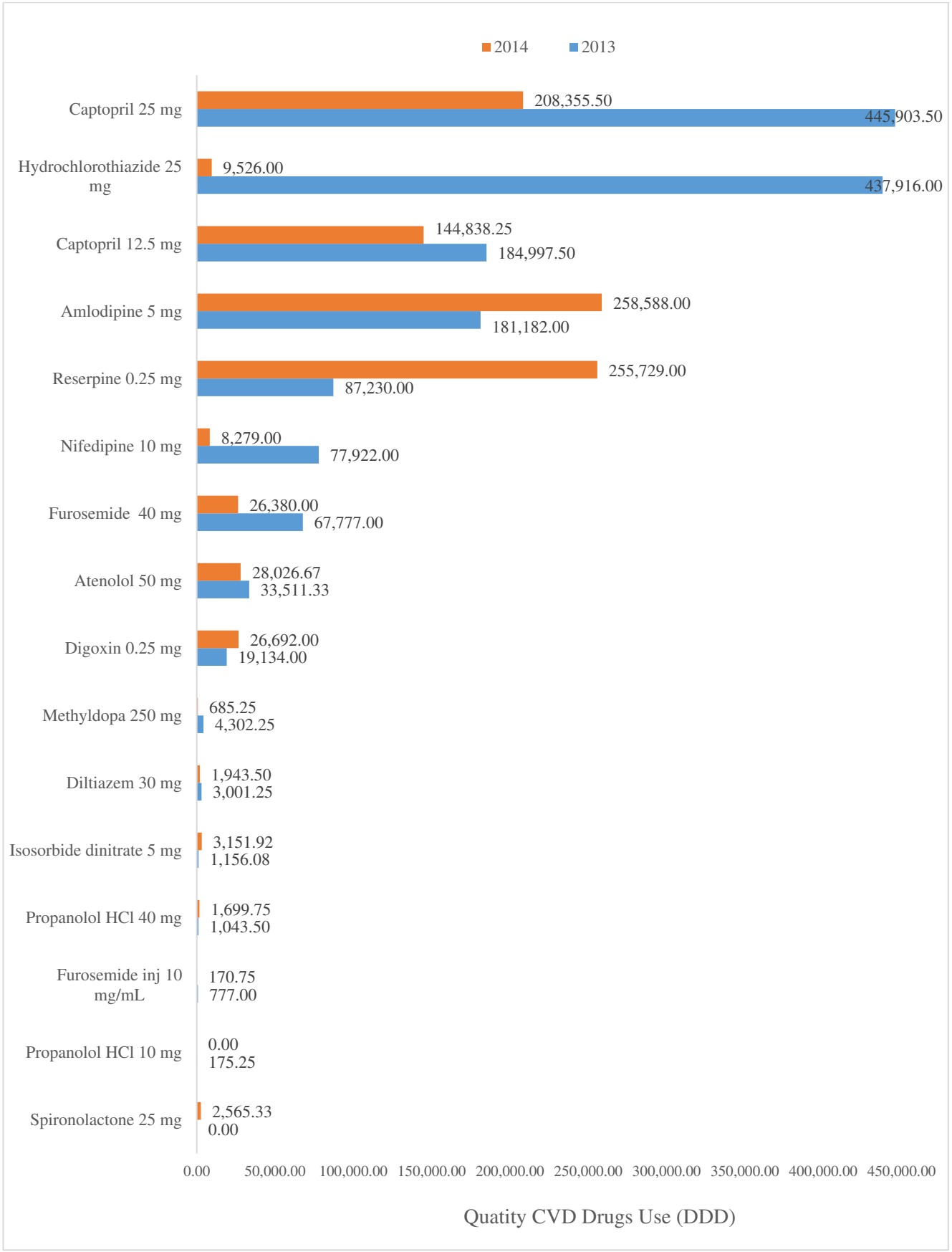

Figure 1. Total consumption of CVD drugs in all PHCs in Bandung during 2013-2014 (defined daily doses)

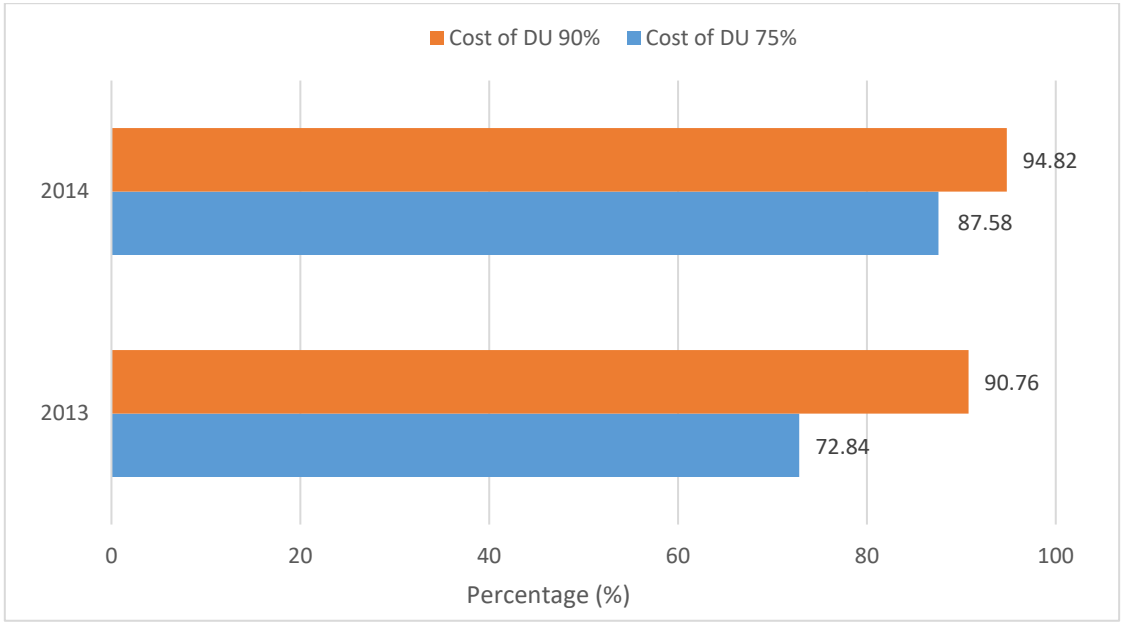

Figure 2. Average cost of DU 75% and DU 90% all PHCs in Bandung from 2013 to 2014

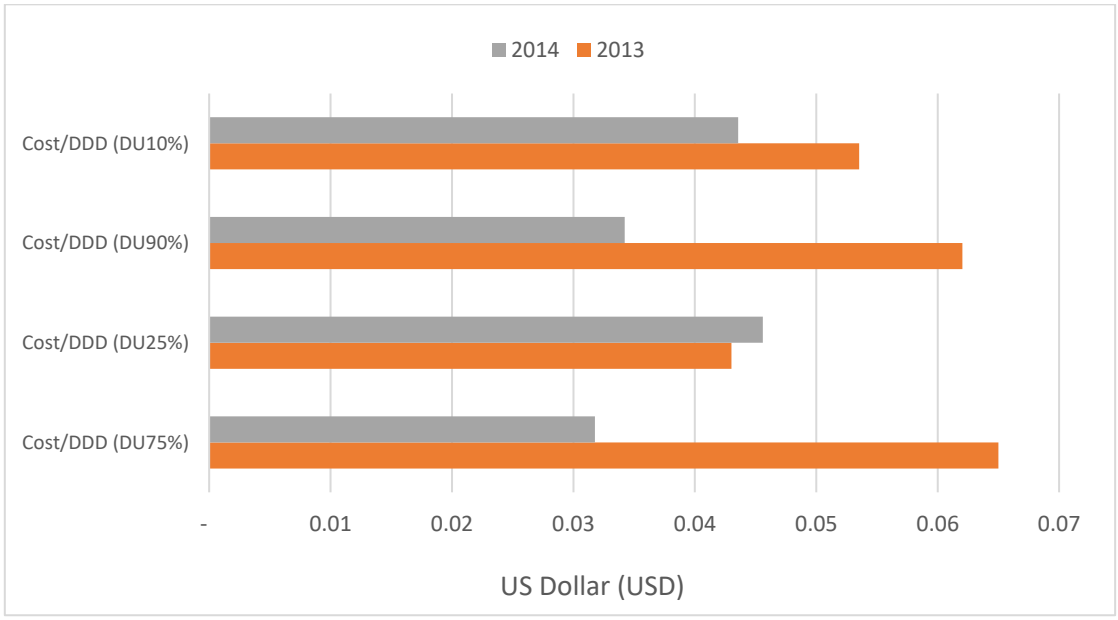

Figure 3. Average cost/DDD for DU 10%, 90%, 25% and 75% segments in all PHCs in Bandung during 2013-2014

Conclusion

Cost related to CVD in all PHCs in Bandung is higher after the implementation of NHI. It was estimated that the differences in drugs availability and prescribing pattern before and after the NHI program has influenced the CVD drugs utility in all PHCs in Bandung.

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Conflict of Interest

None.

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