



## The role of clinical reminder system to drug prescribing on patients of the National Health Insurance with ischemic stroke

Faramita Hiola<sup>1\*</sup>, Iwan Dwiprahasto<sup>2</sup>, Rizaldy Pinzon<sup>3</sup>

<sup>1</sup>Faculty of Sports and Health, Universitas Negeri Gorontalo, Gorontalo, Indonesia <sup>2</sup>Department of Pharmacology and Therapy, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, <sup>3</sup>Department of Neurology, Bethesda Hospital, Yogyakarta, Indonesia

### ABSTRACT

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Since 2014 Indonesia has entered the era of universal health coverage (UHC) and public health financing system managed by the Social Security Organizing Agency Law/SSOAL (*Badan Penyelenggara Jaminan Sosial/BPJS*). In this system, a national formulary was used as the basis for prescribing drugs by clinicians. One effort for quality and cost control in UHC was to develop a clinical reminder system (CRS) to help prescriber set treatment options in accordance with the national formulary. The aim of this study was to measure the role of CRS to the compatibility of drug prescribing in patients with ischemic stroke in Bethesda Hospital Yogyakarta, Indonesia. This study was carried out using quasi-experimental with pre-test and post-test design. The subjects of this study were outpatient ischemic stroke and the National Health Insurance (NHI) participant, age >18 years and had complete medication data. Prescribing data were compared between stroke patients treated at the hospital before and after implementation of CRS. The study was performed in 200 National Health Insurance (NHI) scheme outpatients with ischemic stroke. The groups consisted of 100 patients without CRS and 100 patients with CRS. The basic characteristics of both groups were similar. The results showed that after implementation of CRS, a significant improvement in the compliance of the neurologist prescribing medicine used to be available only in national formulary (RR: 1.02; 95% CI=1.00-1.04;  $p=0.015$ ). Among others the most significant improvement was the prescription of antidiabetic using HMG-CoA medicine available in formulary. In conclusion, CRS can improve the compliance of prescribing with national formulary in stroke ischemic patients.

### ABSTRAK

Sejak tahun 2014, Indonesia telah memasuki era jaminan kesehatan universal (JKU) dan sistem pembiayaan kesehatan masyarakat dikelola oleh Badan Penyelenggara Jaminan Sosial (BPJS). Dalam sistem ini, digunakan formularium nasional sebagai dasar persepsan obat oleh para klinisi. Salah satu upaya untuk kendali mutu dan kendali biaya dalam JKU adalah dengan mengembangkan sistem pengingat klinis (SPK) untuk membantu *prescriber* menetapkan pilihan terapi sesuai dengan yang terdapat dalam formularium nasional. Tujuan dari penelitian ini adalah untuk mengukur peran SPK terhadap kesesuaian persepsan obat pada pasien stroke iskemik di rumah sakit Bethesda, Yogyakarta. Penelitian ini adalah penelitian quasi eksperimental dengan desain *pre-test and post-test*. Subjek penelitian adalah pasien stroke iskemik rawat jalan peserta jaminan kesehatan nasional (JKN), usia >18 tahun dan memiliki data pengobatan yang lengkap. Data persepsan dibandingkan antara pasien stroke yang berobat pada saat sebelum dan setelah penerapan SPK. Penelitian dilakukan pada 200 pasien stroke iskemik peserta JKN rawat jalan di rumah sakit, 100 pasien pada saat sebelum penerapan SPK dan 100 pasien setelah penerapan SPK. Karakteristik kedua kelompok penelitian sebanding. Hasil penelitian menunjukkan bahwa setelah penerapan SPK, terdapat peningkatan kepatuhan dokter dalam meresepkan obat sesuai formularium nasional (RR: 1.02; 95% CI=1.00-1.04;  $p=0.015$ ). Perbaikan yang signifikan terdapat pada persepsan antidiabetes jenis HMG-CoA. Simpulan, SPK dapat meningkatkan kesesuaian persepsan obat dengan formularium nasional pada pasien stroke iskemik di rumah sakit.

### Keywords:

clinical reminder system;  
stroke;  
prescription;  
universal health coverage;  
national formulary

## **INTRODUCTION**

Indonesia has entered the era of universal health coverage (UHC) since 2014. The public health financing system is managed by the Social Security Organizing Agency Law/SSOAL (Badan Penyelenggara Jaminan Sosial/BPJS) with a publicly subsidized or premium system.<sup>1</sup> Recently, there are more than 178 million inhabitants of about 256 million have become UHC members managed by BPJS.<sup>1</sup> In this system, the Minister of Health of Republic of Indonesia establishes a national formulary as a basis for prescribing medicines by clinicians. The national formulary is a list of selected drugs are needed and must be available at health service facilities in the context of implementing the National Health Insurance (NHI).<sup>2</sup>

Since the introduction of UHC, one of the diseases classified as high cost is stroke. Stroke is the 5<sup>th</sup> leading cause of death and the first leading cause of disability. There are two main types of strokes. The commoner type is an ischemic stroke, caused by interruption of blood flow to a certain area of the brain, and hemorrhagic stroke caused by leak or interruption of a blood flow in brain.<sup>3,4</sup> The incidence of stroke in Indonesia is high. Therefore, various efforts to optimize stroke management in Indonesia are required.<sup>1</sup> In an effort to quality and cost control in the execution of NHI schema, the Ministry of Health of Republic of Indonesia set up a drug price list and as outlined in a national formulary.<sup>5</sup> According to the applicable provisions, every health service should use the National Formulary to establish the type of drug for NHI patients.<sup>5</sup>

Stroke is one of the diseases that the number of events is increasing from time to time (8.3%), then in 2013 the incidence of stroke increased by 12.1%.<sup>6</sup> In NHI, stroke is included in high-cost disease from the diagnosis, therapy,

up to rehabilitation of physiotherapy to improve patient's quality of life. An attempt that can be done to control the quality and the cost of disease implementation is using clinical reminder system (CRS). This system is a computer-based reminder system that is used to inform the doctor about the drug, indication of use, restrictions and maximum prescription of each type of drug.

Clinical reminder system is an information system for improving health services to patients in hospitals and helps in clinical evaluation, decision making, assisting doctors in diagnosing and reducing prescribing errors. It is adapted from treatment guidelines both locally and nationally by providing complete access to information on patient treatment data to obtain quality treatment.<sup>7</sup> This reminder system is integrated in a computerized provider order entry (CPOE), therefore every doctor determines the types and items of the drug accompanied by a reminder that explains what drugs can be given to NHI patients. This clinical reminder is expected to help control hospital costs and select therapy according to the National Formulary.<sup>8</sup>

This study aimed to evaluate the usefulness of the CRS in improving physician compliance to prescribe drugs contained in the National Formulary.

## **MATERIALS AND METHODS**

### **Protocol of the study**

It was a quasi-experimental study with pre-test and post-test design. The inclusion criteria of this study were all ischemic stroke patients with diagnostic criteria based on CT scans and in accordance with ischemic stroke characteristics of the American Heart Association.<sup>9</sup> Subjects were outpatients NHI participants who underwent treatment during the period January

2014 to December 2015, subjects aged > 18 years and had complete treatment data. They were excluded from the study if not SSOAL patients, died, and had incomplete medical record data. Prescribing data were compared between ischemic stroke patients treated before and after CRS application. The protocol of the study has been approved by the Medical and Health Research Ethics Committee, Universitas Gadjah Mada, Yogyakarta.

The CRS was developed by the team at Bethesda Hospital, based on the list of drugs in the National Formulary. One of the outcomes of this study was an increase in physician compliance to use the National Formulary, and reduce the use of drugs outside the National Formulary which is the burden of hospitals.

**Statistical analysis**

The sample size used in this study was calculated using the power and sample size software. Data of ischemic stroke patients that have been collected were analyzed using data

processing software. For comparisons of dichotomous outcomes, the relative risk (RR) with their 95% confidence interval (95% CI) was calculated. The exact p value was calculated using Yates-corrected chi-square test. The outcome with continuous data was first checked for normality of distribution. For normally distributed data, comparison of means was performed using an independent t-test; otherwise, the non parametric Mann-Whitney U test was used. Patients factors such as age, sex, onset, and comorbidity was assessed to determine the amount of influence on the study outcome.

**RESULT**

Based on data from the electronic stroke register, there are 6 neurologists who treat outpatient ischemic stroke patients. The subjects were divided into two groups i.e. before implementation of the CRS in 2014 and after implementation of the CRS in 2015. The sample size used can be seen in FIGURE 1 that each group consists of 100 subjects.

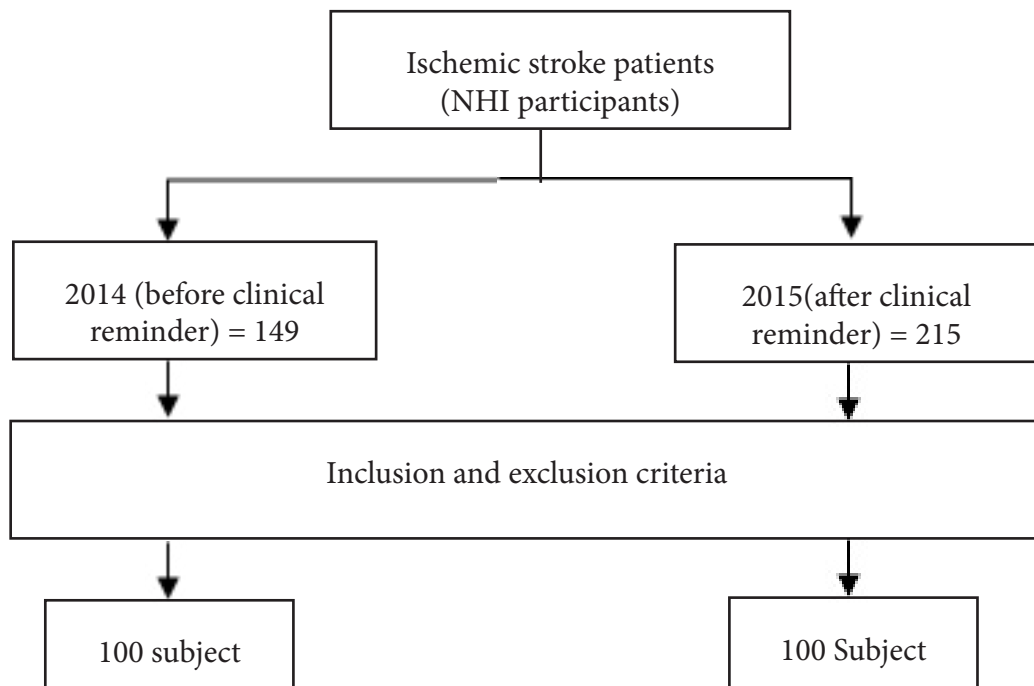


FIGURE 1. The flowchart of the study data selection process

The subjects of this study were 100 in each observation group showing that between the two groups was comparable in terms of age, gender, onset of attack, number of comorbidities and visits. The characteristics of the subject are presented in TABLE 1.

TABLE 1 shows that men (60.5%) and age (63.0%) have a high risk of having

ischemic stroke. Based on the basic characteristics of patients including age, gender, onset, number of comorbidities, and frequency of visits between groups before and after the application of the CRS was the same. It can be seen that the widely prescribed antiplatelet type is acetylsalicylic acid, clopidogrel and cilostazol (TABLE 2).

TABLE 1. Study subject characteristics

Characteristics	Total n = 200	Before CRS [n =100 (%)]	After CRS [n = 100 (%)]	p
<b>Gender</b>				
▪ Male	121 (60.5)	58 (58)	63 (63)	0.470
▪ Female	79 (39.5)	42 (42)	37 (37)	
<b>Age (y.o.)</b>				
▪ ≤ 60 years	74 (37)	33 (33)	41 (41)	0.241
▪ > 60 years	126 (63)	67 (67)	59 (59)	
<b>Onset (h)</b>				
▪ ≥ 3	164 (82)	84 (84)	80 (80)	0.462
▪ < 3	36 (18)	16 (16)	20 (20)	
<b>Comorbidity</b>				
▪ 1	99 (49.5)	49 (49)	50 (50)	0.888
▪ > 1	101 (50.5)	51 (51)	50 (50)	
<b>Visitation frequency (times)</b>				
▪ ≥ 3	77 (38.5)	39 (39)	38 (38)	0.884
▪ < 3	123 (61.5)	61 (61)	62 (62)	

TABLE 2. Type of single-antiplatelet prescribed in patients with ischemic stroke

Variable	Before CRS	After CRS
	[n = 257 (%)]	[n = 273 (%)]
Acetylsalicylic acid	193 (75.1)	200 (73.3)
Clopidogrel	53 (20.6)	65 (23.8)
Cilostazol	11 (4.3)	8 (2.9)

There were various types of antihypertensive prescribed for stroke patients, most of which are the calcium channel blocker groups which is amlodipine (TABLE 3). From the two study groups, it can be seen that in 2014 the prescribed amlodipine was 93 drugs

(52.5%) compared to others, while in 2015 it was 85 (56.3%). In addition, there were also groups of angiotensin II antagonists' namely irbesartan, valsartan and candesartan were widely prescribed for patients with ischemic stroke.

TABLE 3. Types of single-antihypertensive prescribed in patients with ischemic stroke

Variable	Before CRS	After CRS
	[n = 177 (%)]	[n = 151 (%)]
Amlodipine	93 (52.5)	85 (56.3)
Irbesartan	13 (7.3)	18 (11.9)
Valsartan	12 (6.8)	12 (7.9)
Candesartan	10 (5.6)	10 (6.6)
Spiroinolacton	11 (6.2)	6 (4.0)
Telmisartan	14 (7.9)	2 (1.3)
Ramipril	2 (1.1)	8 (5.3)
Bisoprolol	6 (3.4)	2 (1.3)
Losartan	7 (4.0)	0 (0.0)
Furosemide	2 (1.1)	5 (3.3)
Lisinopril	4 (2.3)	0 (0.0)
Captopril	1 (0.6)	1 (0.7)
Nifedipine	1 (0.6)	1 (0.7)
Telmisartan + amlodipine	1 (0.6)	0 (0.0)
Clonidine	0 (0.0)	1 (0.7)

TABLE 4 shows the most prescribed statin group which was 90 simvastatin (67.2%) of the prescribed drugs in 2015.

Atorvastatin was the most prescribed in 2014 of 57 (38%), followed by fenofibrate and gemfibrozil.

TABLE 4. Type of single-antidyslipidemic prescribed in patients with ischemic stroke

Variable	Before CRS	After CRS
	[n = 150 (%)]	[n = 134 (%)]
Simvastatin	82 (54.7)	90 (67.2)
Atorvastatin	57 (38)	37 (27.6)
Fenofibrate	9 (6)	7 (5.2)
Gemfibrozil	2 (1.3)	0 (0)

This study found that the amount of national formulary drugs prescribed in 2015 was higher than in 2014 before the implementation of the CRS (76.3% vs. 61.3%). In 2014 (before CRS) the amount of generic drugs prescribed was 31.6%, while in 2015 (after CRS) there was an

increase of 43.9% (TABLE 5).

The results in TABLE 6 illustrate the compliance of neurologist prescription at Bethesda Hospital. It appears that the application of CRS has been well utilized, and proved significant in CRS used by doctors with DS-A, DS-B and DS-D codes.

**TABLE 5. Prescription of drugs in ischemic stroke patients**

Variable	Before CRS [n = 1254 (%)]	After CRS [n = 1083 (%)]
National formulary		
▪ Yes	769 (61.3)	826 (76.3)
▪ No	485 (38.7)	257 (23.7)
Generic		
▪ Yes	396 (31.6)	475 (43.9)
▪ No	858 (68.4)	608 (56.1)

**TABLE 6. The compatibility of physicians prescription with a list of drugs in national formulary**

Variable	Before CRS [n (%)]	After CRS [n (%)]	p
DS-A			
▪ National formulary	297 (65.4)	185 (80.8)	<0.001
▪ No	157 (34.6)	44 (19.2)	
DS-B			
▪ National formulary	90 (54.5)	114 (73.1)	0.001
▪ No	75 (45.5)	42 (26.9)	
DS-C			
▪ National formulary	84 (54.5)	117 (65.4)	0.056
▪ No	70 (45.5)	62 (34.6)	
DS-D			
▪ National formulary	231 (58.9)	264 (80.2)	<0.001
▪ No	161 (41.1)	65 (19.8)	
DS-E			
▪ National formulary	44 (67.7)	111 (75.5)	0.244
▪ No	21 (32.3)	36 (24.5)	
DS-F			
▪ National formulary	23 (95.8)	35 (81.4)	0.142
▪ No	1 (4.2)	8 (18.6)	

Assessment of prescribing compatibility was only carried on drugs included in the national formulary, based on drug strength, restriction, and maximum prescribing. Drugs prescribed outside from national formulary were categorized as inappropriate. The results in TABLE 7 show that the application

of CRS significantly improves the prescribing compatibility with the national formulary of 1.02 than without CRS. The prescribing of antiplatelet and antihypertensive was also increased but these results were not significant. The prescribing antidyslipidemic is proven to increase the compatibility (p<0.001).

TABLE 7. Compatibility of drugs prescription with the National Formulary

Variable	National formulary restriction		Total	RR (95% CI)	p
	Compatible [n (%)]	Not compatible [n (%)]			
CRS					
▪ After	809 (97.9)	17 (2.1)	826	1.02 (1.00-1.04)	0.015
▪ Before	737 (95.8)	32 (4.2)	769		
Antiplatelets					
▪ After	267 (97.8)	6 (2.2)	273	1.01 (0.98-1.03)	0.512
▪ Before	249 (96.9)	8 (3.1)	257		
Antihypertensive					
▪ After	144 (95.4)	7 (4.6)	151	1.02 (0.97-1.08)	0.307
▪ Before	164 (92.7)	13 (7.3)	177		
Antidyslipidemic					
▪ After	119 (88.8)	15 (11.2)	134	1.43 (1.24-1.64)	<0.001
▪ Before	93 (62)	57 (38)	150		

## DISCUSSION

The CRS started as a prototype system and evolved into an integrated and daily used software in outpatient care services. It can be used simultaneously and also available to multiple clinics and physician practices through a web-based system.<sup>10</sup> This study aimed to evaluate the effectiveness of CRS application to physician prescribing in outpatient ischemic stroke patients. The results suggest that CRS can improve the compliance of drugs prescribing with national formulary for NHI patients compared without CRS. This reminder would appear in the form of a reminder spot that is automatically displayed on the computer of each physician when prescribing drugs. Therefore it can help in reminding the list of drugs and restrictions according to the formulary.

The results in this study were similar to the result obtained by Youssef *et al.*<sup>11</sup> The use of clinical reminders has been proven to reduce 30% patient treatment costs and medication errors in hospitals.<sup>11</sup> Other study by Foster *et al.*<sup>12</sup> in their 6-month study showed that adherence to prescribing was significantly higher in the group receiving CRS than without

CRS. Prescribing compatibility to formulary rules can improve medication safety and assist hospitals in managing drugs as quality and cost control. Clinical reminder systems can increase the percentage of generic drugs prescription, generic drugs have the same benefits and efficacy compared to branded drugs.<sup>13</sup> The application of clinical reminder systems can assist in controlling the medication cost in hospitals.

Analysis result of the use antidyslipidemic drugs showed that the CRS could improve prescribing compatibility with the national formulary than without the CRS, because the prescribing of antidyslipidemic should be based on the results of patient's laboratory, and attached when taking drugs at the pharmacy.

There was no significant difference in antiplatelet and antihypertensive prescribing. These results were different from those conducted by Sequist *et al.*<sup>14</sup> on the use of aspirin in diabetic patients and coronary arteries, suggesting that CRS can improve the appropriateness of aspirin than without CRS. Other research conducted by Filippi *et al.*<sup>15</sup> suggests that the compatibility of antiplatelet prescribing was increased

in the intervention group than in the control group but these results were not significant. Incompatibility in this study occurred in the prescription of acetylsalicylic acid 100 mg. In formulary restriction, the maximum prescription is 30 tablets for 30 days, but in this case 40 tablets were given.

Incompatibility of antihypertensive prescribing occurs in telmisartan 80 mg and valsartan 80 mg. This drug is only used in hypertension patients who are intolerant to ACE inhibitors with prescribing maximum 30 tablets for 30 days, but in this study 60 tablets were given. In addition, another class of angiotensin II antagonists used was losartan 50 mg. However this drug is not attached to the list in the national formulary, so it is categorized as inappropriate. In prescribing amlodipine 5 mg there is also incompatibility because it exceeds the maximum prescriptions.

## CONCLUSION

Application of CRS can improve the compatibility of prescribing drugs based on the restriction of the national formulary.

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