Medicines Cost Analysis for Inpatient Ischemic Stroke in Indonesia

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Abstract. Stroke is a major health problem causing 75.2% of mortality and 81.0% of disability in developing countries. It accounts for the primary causes of Indonesian deaths (15.4%). This research aims to analyze the variation of medicines costs for inpatient ischemic stroke based on the hospital, patients, and prescribing characteristics. Retrospective data were collected from January-September 2019 by reviewing medical records of living patients on discharge. The number of complete data for analysis is 443 entries from 23 hospitals in 5 regionals of Indonesia which are transferred to the SPSS program for further analysis. The result shows that all hospital characteristics, either type/class, ownership, and alliance with BPJSK, significantly influence medicines cost ($p = 0.000$). Patients in hospitals not allied with BPJSK are charged more than fourfold higher than the other group (mean IDR 4,892,570 vs. IDR 1,194,757). Patients' biological characteristics (sex and age) have no significant influence, unlike the length of stay, the number of diagnoses, and financial source. On average, the national health insurance (NHI) group pays less than a quarter (IDR 1,009,196) compared with the non-NHI group (IDR 4,261,870). Prescribing characteristics show a significant role except for injection percentage. The higher the percentage of generic and essential medicines prescribed, the lower the cost of the medicines is, while the increasing number of items also elevates medicines cost. Medicines cost for generic prescribing less than 50% is 4–5 times higher (mean = IDR 4,029,106) than the other groups. Encouraging the use of generic and essential medicines can reduce medical costs.

Keywords: ischemic stroke · medicines cost · inpatient · prescribing pattern

1 Introduction

Based on its etiology, stroke can be divided into hemorrhagic, non-hemorrhagic, or ischemic. The differences lie in their pathology, risk factors, treatment, and prognosis. Ischemic stroke is a myocardial infarct resulting from the depletion of blood flowing to the brain, which causes damage or even decreased neurons in the affected area [1]. The prevalence of ischemic stroke is higher than hemorrhagic stroke [2, 3]. Stroke

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is becoming a major health problem accounting for 75.2% of mortality and 81.0% of disabilities as reported by developing countries [4]. The prevalence of stroke in Indonesia reaches 8.3 out of 1000 population and rises as age increases [2, 3]. Stroke is the highest cause of death in Indonesia. The prevalence of stroke increased from 7 per mile in 2013 to 10.9 per mile in 2018 [5]. Finkelstein estimated that in the year 2020, the population in Indonesia aged 40 years and up would grow 34.4%, from 73.4 million to 98.7 million, which means that stroke prevalence will increase by about 20% and will contribute around 56.6% to the escalation of economic burden from $0.29 million to $0.45 million [6].

Ischemic stroke may lead to complications such as stress ulcers, urinary tract infections, pneumonia, and decubitus [7]. Age and sex are the unmodified variables, while hypertension, diabetes, and atrial fibrillation are modifiable and appropriately documented and other variables such as migraine and drug abuse are alterable but rarely well documented [8]. The purpose of acute stroke treatment is to reduce neurological symptoms, decrease mortality and morbidity, prevent secondary complications of the mobility organs, and avoid stroke relapse [9]. Wrong medicine choices might cause an extended stay, which is vulnerable to other complications and results in a high cost of care. In addition to safety and efficacy, prescribing medicines must also meet the pharmacoeconomic aspect [10].

Provided with other infectious or comorbid diseases, stroke patients tend to receive polypharmacy frequently [11]. Previous research showed that medicines and medical devices cost 35–48%, the highest proportion of stroke treatment, followed by hospitalizing and service costs (9–15% and 7–17%, respectively) [12]. Research to explore the variations and the causal factors of medicine cost for ischemic stroke in Indonesia will attribute to previous knowledge. The examined factors are the hospital characteristics (type/class, ownership, and partnership with the Social Security Administrator for Health or BPJSK), patients characteristics (sex, age, length of stay, number of diagnoses, and financial sources), and prescribing pattern (number of medicines items, generic prescribing, injection and essential medicines prescribing). All three factors will be compared with the nominal cost of medicines.

2 Materials and Methods

Ethical approval was obtained from the National Institute of Health Research and Development Institutional Review Board number LB.02.01/2/KE.251/2019. This study was a part of research entitled "Medicines Utilization Study in Hospitals and Clinics," which was thematic research of the Indonesian National Health Facility Survey conducted in 2019. Since only administrative data from the medical record and pharmacy were gathered, there was no influence on the outcome of the patients. Thus, we did not use an informed consent form.

This was cross-sectional quantitative research using retrospective data based on patients' entrance from January-September 2019. Before further analysis, all data entries were examined thoroughly for their completeness and data quality. The subjects of this research were ischemic stroke patients (ICD 10 code: I63). All of them had finished their hospitalization and were discharged alive. The category for the length of stay (LoS) was

Table 1. Hospital characteristics

No	Characteristics	Sub characteristics	Number	%
1	Class	B	10	43.48
		C	13	56.52
2	Ownership	Public	9	39.13
		Private	14	60.87
3	BPJSK alliance	Yes	17	73.91
		No	6	26.09
Total			23	100.00

up to 14 days. All sorts of, including laboratory assays, numbers, and medicines lists, were compiled based on the medical record. Medicines cost data were obtained from the hospital information system covering all medicines-related costs during hospitalization. All data from medical records and pharmacy were transferred on-site to an excel file on a computer.

The number of recorded data was 524 from 26 hospitals. However, some records were excluded, leaving 443 data from 23 hospitals that met the determined completeness. All data were checked and transferred to the SPSS program for further analysis. All characteristics and cost data were analyzed statistically. The relation of prescribing characteristics with hospital and patient characteristics was also analyzed. Independent variables were the hospital, patients, and prescribing characteristics, while the dependent variable was medicines cost which is defined as the component of the direct medical cost. Descriptive analysis was applied to describe each characteristic and sub-characteristic. Bivariate analysis tests the differences in medicine cost based on those characteristics.

Provinces were categorized based on the regionalization of INA-CBGs tariff and selected by simple random sampling to choose two provinces for each of the five regions. The selected provinces were Banten and West Java (region 1), Riau and Bali (region 2), Aceh and South Sulawesi (region 3), South and Central Borneo (region 4), and East Nusa Tenggara and Papua (region 5). However, all the medicines cost data of Papua were incomplete and thus not available for analysis. The hospital chosen for each province should be either class B or C and include a public hospital and two private hospitals (one allied with BPJSK while the other not) (Table 1).

3 Results

There are 443 entries or admission to the hospitals, either of the same or different patients. Each entry is treated as a unit of analysis.

According to their characteristic, most patients are male, aged 50–59 years old, with 4–6 days of being hospitalized. Most of them (70.43%) use BPJSK as the funding source. They share almost similar proportions of patients for each category on the number of medicines items and generic prescribing, the number of medicines items, and

Table 2. Medicines cost analysis based on the hospital, patients, and prescribing characteristics

No	Characteristics	Category	Number	Medicines cost		
				Mean (IDR)	SD	p-Value
Hospital characteristics						
1	Class/Type	B	236	979,492	1,074,164	0.000
		C	207	3,101,518	3,862,128	
2	Ownership	Public	207	1,019,540	1,109,710	0.000
		Private	236	2,805,633	3,710,221	
3	Alliance with BPJSK	Yes	350	1,194,757	1,479,620	0.000
		No	93	4,892,570	4,745,321	
Patients' characteristics and care						
1	Sex	Male	244	1,687,914	3,352,575	0.162
		Female	199	4,089,515	2,348,613	
2	Age	<50 years	79	2,301,748	3,326,224	0.429
		50–59 years	137	1,723,099	2,605,266	
		60–69 years	119	1,841,427	2,544,882	
		≥70 years	108	2,186,497	3,439,827	
3	Length of stay	<5 days	124	1,130,750	1,415,485	0.000
		5–6 days	153	1,560,221	2,147,513	
		7–8 days	91	1,945,565	2,827,968	
		≥9 days	75	4,229,347	4,760,884	
4	Number of diagnoses	<3 diagnoses	223	2,479,311	3,582,824	0.000
		≥3 diagnoses	220	1,455,854	1,998,503	
5	Financial source	BPJSK	312	1,009,196	1,186,409	0.000
		Non BPJSK	131	4,261,870	4,320,389	
Prescribing characteristics						
1	Number of medicines item	<8	108	874,418	1,176,123	0.000
		8–9	108	956,313	957,235	
		10–11	104	1,653,424	2,236,115	
		>11	123	4,093,489	4,317,030	
2	% of generic prescribing	0–59.9%	146	4,029,106	4,192,529	0.000
		60–79.9%	146	1,136,944	1,345,423	
		80–100%	151	787,622	807,425	
3	% of injection prescribing	0–49.9%	285	1,901,004	2,684,888	0.502
		50–100%	158	2,097,393	3,375,872	
4	% of Essential medicines prescribing	0–59.9%	113	3,300,968	3,744,181	0.000
		60–79.9%	173	1,589,982	2,199,907	
		80–100%	157	1,433,745	2,735,789	
			443	1,971,048	2,947,666	

the number of medicines items and prescriptions. Meanwhile, for injection medicines prescribing, the group of less than 50% of injections contributes to 64.33% of patients. Lastly, almost 40% of patients received 60–79% essential medicines. Table 2 shows

that all hospital characteristics, type/class, ownership, and alliance with BPJSK significantly influence medicines cost. Patients in the hospitals that were not allied with BPJSK showed medicines cost more than fourfold higher than the other group. Patients' biological characteristics (sex and age) do not significantly influence them, yet other medical characteristics show a contrasting situation. The financial source of funding related to the national health insurance (NHI) program reveals a significant difference in medical costs, which is more than four times higher for the non-NHI group than the NHI group. Nevertheless, only injection prescribing percentage has no significant effect on medicines cost, while other prescribing patterns indicate the opposite condition. The higher the percentage of generic and essential medicines prescribed, the lower the cost, while the increasing number of items also elevates medicines costs.

4 Discussion

The costs related to inpatient care are divided into direct medical costs and non-medical costs. Pharmaceutical cost, especially medicines cost, is considered a direct medical cost. Previous studies conclude that medicines and consumable medical devices acquire the highest cost component [2, 4, 12, 13, 14]. This situation implies the staff's role as the main factor in patients' therapy during inpatient care and treatment. It also suggests that the medicines cost component is cost-driven by inpatient ischemic stroke patients. Research in China showed the proportion of medicines cost for ischemic stroke as the primary contributor accounting for 42.9% of the total cost [15]. The higher the medicines costs mean, the higher the total hospital costs will be.

Hospital characteristics (type, ownership, and alliance with BPJSK), length of stay, and funding source significantly influence the number of prescribed medicines, as shown by this research which is relevant to another study [15]. Patients hospitalized in class B hospitals are larger, which might be due to the condition demanding treatment in hospitals with adequate facilities. In 2016, the average cost of generic medicines in class A hospitals was 4.5 times higher than in class B and 8.9 times higher than in class C hospitals. Non-generic medicines expenditures were much higher for class A and B hospitals but not for class C types [16].

The number of male patients is more domineering than females. Sex and age of patients have no significant relation with medicines costs ($p > 0.05$) which is also concluded by other similar research [2, 10, 13, 14, 17]. Other results stated that sex significantly influences medicine costs. Males experience a higher prevalence of stroke as the incidence of hypertension is higher than the opposite group of the same age [18]. Hypertension has been the predominant risk factor for stroke in both groups [19]. In contrast, some research denoted that female patient have a higher prevalence [20]. However, Sitorus claimed that sex has no relevant influence on stroke occurrences in younger ages, less than 40 years, but Goldstein stated the other way [8, 21]. Historically, males have higher risk factors than females, yet female life expectancy is longer; thus, more death occurs in females [11]. These female risk factors amplify in the menopause transition period signed with the reduction of estrogen up to 60%. It leads to the decrease of LDL (Low-Density Lipoprotein) catabolism and HDL (High-Density Lipoprotein) uptake and will finally cause atherosclerosis [22].

Most patients were more than 50 years old (50–59 years), with an average age of 60.66 years. Previous research by Zulfa indicated an average age of 61.3, in which those aged 60 years up contributed to 52.72% of the total subject [13]. Goldstein mentions that the risk of stroke will be twofold greater after reaching 55 years, while two-thirds of those older than 65 face the risk of hypertension [8]. It follows the presumption that hypertension increases as age increases. Those who survive until 80 years old have a 90% probability of the risk [23]. Destanul research found that the dominant group of stroke patients was males aged 46–55 [17]. Other research in Malaysia and Singapore concluded that age influences the total cost [24].

The average length of stay based on table 3 is 6.13 days. Most patients were hospitalized for more than five days. Former research stated that the average length of stay was 6.5 days, in which 61.98% of them were hospitalized for less than seven days [13]. Other research revealed different results stating that most patients were hospitalized for 7–10 days [20]. The length of stay is influenced by several factors, including stroke severity, comorbidity, complication, and operation measures and the appropriateness of therapy [24, 25]. The proportion of the group based on the number of diagnoses is quite similar. However, the difference in the number of diagnoses is closely linked to comorbidity. Younger male patients have a higher tendency to experience a stroke. Hypertension becomes the main cause due to obesity, smoking, and hyperlipidemia [26].

The average number of medicines item is 10.52 items. Similar research showed the number of medicines items for stroke patients as more than 10, which is considered as high [20]. High use of medicines is vulnerable to medicines interaction risk considering the age of patients that are mainly geriatric patients having a low function of kidney and liver which influence the pharmacodynamics and pharmacokinetics of medicines consumed.

The percentage of generic medicines prescribed during hospitalization was 63.42%. Previous research mentioned the proportion of generic medicines prescribed has not yet reached 100%. Public health facilities, however, are bound to the regulation made by the government; thus, the percentage of generic prescribing is higher than private facilities [27, 28]. The Ministry of Health Decree number 68 of 2010 indicates that using generic medicines is compulsory in public health facilities. This statement relates to WHO's encouragement to use generic medicines to meet 100% standards [29].

Slightly higher than generic prescribing, the essential prescribing proportion is 69.49%. Essential medicines refer to the list of medicines specified in the national essential medicines list (NEDL), which accommodates either generic or non-generic medicines. Previous research showed that the percentage of essential medicines was 74.28%, while other research mentioned a contrasting proportion of only 39.49% [27, 30]. Hence, both prescribing pattern is still far below the ideal standard stated by WHO as 100%.

The indicator of injection prescribing proportion is 41.27% on average. Research by Dian revealed that the percentage of injection prescribing was 22.0% [31]. Our results show a quite higher proportion which may have been caused by using citicoline as a neuroprotector and piracetam. Injections use tends to increase the risk of sepsis, irritation, parenteral route infection, and high, unaffordable therapeutic cost [32]. Another significant factor in hospital medicines cost is the length of stay, as also stated by other

previous research [9, 13, 14]. Patients receiving more medicines (>10) were hospitalized longer than those receiving less than five medicines [20].

In addition to previous factors, the number of diagnoses should also be considered, especially for non-NHI (national health insurance) patients. To some extent, this portrays the use of non-generic medicines for therapy. Different insurance schemes for urban employed and unemployed groups in China influence the length of stays, hospital cost, and reimbursement rate in which health insurance for employees provides more substantial benefits [15, 33].

The length of stay is assumed to be related to disease severity which might be indicated by comorbidity [15]. More comorbidities heavily escalate treatment costs [12, 14]. Patients with comorbidities spend a higher treatment cost [2, 34]. However, another contrary research states that there is no significant influence of comorbidity on total costs [35].

In this research, there is evidence of the relevance between pharmaceutical cost and funding source type ($p < 0.05$), which is also supported by other research [35]. Pharmaceutical cost in hospital care also depends on the number of medicines items and the percentage of generic and essential prescribing (p value < 0.05). The use of generic medicines as the major treatment substantially leads to cost efficiency, considering that generic medicines are usually 30–60% cheaper than branded ones [36]. Research by Ramesh (2013) indicated that branded medicines are 20–218% more expensive than generic medicines [37]. Subsequently, generic prescribing is important for reducing medicines cost [16].

5 Conclusion

The variation of medicine costs in hospitalized stroke patients is influenced by all hospital characteristics, including class, ownership, and alliance with BPJSK. Regarding patients' characteristics, only sex and age have no significant influence, while the length of stay, source of funding, and number of diagnoses reveal significant issues. Based on prescribing patterns, it is concluded that the number of medicines items and the percentage of generic and essential medicines is core issues to pharmaceutical costs. Among the three major factors, prescribing patterns show the chance to reduce medicines costs,s especially by encouraging the use of generic and essential medicines.

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