PHARMACON
Jurnal Farmasi Indonesia
Pharmaceutical Journal of Indonesia

Pharmacon: Jurnal Farmasi Indonesia
Vol. 22 No. 1 (2025),, pp. 77-83
DOI:10.23917/pharmakon.v22i1.8551
p-ISSN: **1411-4283**, e-ISSN: **2685-5062**

Cost Analysis of Inpatient Stroke Treatment at a Regional General Hospital Based on INA-CBG's tariff in 2023

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ARTICLE HISTORY:
Submitted : 2025-06-20
Accepted : 2025-06-22
Published : 2025-06-30

KEYWORDS:
Actual cost; Cost analysis; Stroke; INA-CBG's 2023 tariff

Citation:
Hadning, I., Mouretha, V., Viviandhari, D., Kusumaningtyas, T.A., (2025). Cost Analysis of Inpatient Stroke Treatment at a Regional General Hospital Based on INA-CBG's tariff in 2023. Pharmacon: Jurnal Farmasi Indonesia, 22(1), 77-83. https://doi.org/10.23917/pharmacon.v22i1.8551

ABSTRACT

Stroke in Yogyakarta has the second highest prevalence rate in Indonesia, which requires long-term care and rehabilitation at a high cost. Stroke patients treated in classes 1, 2 and 3 are known to have experienced an increase in INA-CBG rates based on Minister of Health Regulation Number 3 of 2023. However, some hospitals often experience discrepancies between actual costs and INA-CBG's rates. Therefore, this study is the first to assess the cost of inpatient stroke treatment using the INA-CBG's tariff based on the Minister of Health Regulation Number 3 of 2023. This study aims to determine the average actual cost, the appropriateness of the average actual cost, and the difference in actual costs at a Regional General Hospital according to the INA-CBG's tariff in 2023. The research method used an observational design with a cross-sectional approach and retrospective data collection on stroke patients hospitalized from January to September 2023. Data were analyzed using the descriptive analysis method and one sample t-test if the data were normally distributed and the Wilcoxon test if the data were not normally distributed. Based on the study's results, it is known that the average actual cost does not exceed the INA-CBG tariff, so the hospital is profitable.

INTRODUCTION

Stroke remains a primary global health concern. In terms of disability, stroke ranks third globally and is the second most prevalent cause of mortality (Utama & Nainggolan, 2022). The prevalence rate of stroke patients is known to reach the highest incidence rate occurred in Asia, a continent containing more than 60% of the world's population (Rochmah et al., 2021). The prevalence (per mile) of stroke based on a doctor's diagnosis in the population aged ⩾15 years by province in Indonesia continues to increase. The Special Region of Yogyakarta ranks second in Indonesia for stroke incidence, with a rate of 14.6% (Ministry of Health, 2019).

Stroke happens when the brain's blood arteries burst or become blocked, impairing brain function (Ministry of Health, 2019). Then, patients with a history of stroke have a risk of recurrent stroke, which, according to epidemiological research at the University of Indonesia, reaches 19.9% of all cases and can occur during or after the recovery process of neurological function, which lasts between 3 to 18 months (Suhadi & Purboningsih, 2020). This causes stroke to be one of the health challenges that requires significant costs and long-term care and rehabilitation.

Complex stroke therapy often becomes a double burden for the government. According to the World Economic Forum, Indonesia will

continue to experience economic losses due to non-communicable diseases such as stroke, which amounted to IDR 58,542 trillion from 2012 to 2030 (Ministry of Health, 2017). This shows that studies related to the analysis of stroke treatment costs need to be carried out (Hadning et al., 2020).

Various efforts have been made to reduce the economic burden of stroke, including implementing the JKN system or National Health Insurance. In this JKN program, the INA-CBG's (Indonesian-Case Based Group's) tariff is applied. According to the disease diagnosis classification, BPJS Kesehatan pays Advanced Referral Health Facilities the INA-CBG's pricing for service packages (Ministry of Health, 2023).

This study is urgent due to the high number of stroke cases requiring complex therapy. This study's primary goal was to evaluate the INA-CBG tariff in 2023. Previous research on cost analysis at a Regional General Hospital with the 2014 INA-CBG tariff showed that the average cost was lower than the predetermined tariff (Yunianti, 2015). With the implementation of the new INA-CBG tariff in 2023, further research is needed to evaluate the changes made by hospitals about the tariff. This study is the first to assess the tariff update. In addition, this study aims to identify improvements that hospitals have made in response to the implementation of the new tariff so that it is expected that hospitals will not experience losses.

METHODS

Study Design

This study was conducted with ethical approval from Panembahan Senopati Bantul Hospital, listed in No. B/400.7.22/01015. This study's research design is cross-sectional and observational. The retrospective data collection method involved tracking the medical history and cost of stroke patients' treatment who participated in the JKN program between November 2023 to January 2024. A comprehensive sampling system was used to fulfil the study's inclusion and exclusion requirements. Inclusion criteria were inpatients diagnosed with stroke who had INA-CBG's codes G-4-13-I/II/III, G-4-14-I/II/III, G-4-15-I/II/III, patients who had complete medical records and / or data from other health service units that could complement patient medical records and therapy payment data. Exclusion criteria were patients who had passed away, patients who were referred to the hospital or forcibly discharged, patients who changed treatment classes.

Data Analysis

Analysis of average actual costs and the suitability of average real costs was carried out using descriptive analysis. The comparison of actual costs and INA-CBG's tariffs in 2023 was conducted using the Wilcoxon test for data that is not normally distributed, while the one-sample t-test was applied to normally distributed data. If the significance value is <0.05, the results are said to have a significant difference. If the significance value is >0.05, then the data is said to have no significant difference.

RESULT AND DISCUSSION

Characteristics of Inpatient Stroke Patients in a Regional General Hospital

According to the study's findings, 219 patients at a Regional General Hospital completed the criteria needed for inclusion. The inpatient stroke patients' characteristics are displayed in **Table 1**. The most common type of stroke found was ischemic stroke (73.5%) compared to hemorrhagic stroke (7.3%) and unspecified stroke (19.5%). This is in line with research by (Haiga et al., 2022), which indicates that the percentage of ischemic stroke cases is 57.6% more higher than hemorrhagic stroke 42.4%. Ischemic stroke occurs due to blockage in the arteries. A hemorrhagic stroke occurs due to a ruptured blood vessel in the brain that causes bleeding, resulting in damage to the brain and impaired nervous system function (Aulyra

Table 1. Characteristics of Inpatient Stroke Patients

Characteristics	N=219	%
Types of Stroke		
Hemorrhagic Stroke	16	7.3
Ischemic Stroke	161	73.5
Unspecified Stroke	42	19.2
Age		
35-44	13	6
45-54	29	13
55-64	72	33
65-74	62	28
≥75	43	20
Gender		
Male	125	57
Female	94	43

Table 2. Cost Components of Class 1 Stroke Patients

Cost Component	Average Costs IDR (x1,000)											
	G-4-13-I		G-4-13-II		G-4-14-I		G-4-14-II		G-4-15-I		G-4-15-II	
	n=1		n=1		n=14		n=12		n=4		n=3	
	Average	%	Average	%	Average	%	Average	%	Average	%	Average	%
Non-Surgical Procedures	0	0	0	0	0.001714	0,04	0	0	0	0	16	0
Room /Accommodation	2,210	36	1,043	13	1,228	25	1,778	25	1,190	27	1,452	25
Consultation	475	8	601	8	319	7	471	7	255	6	368	6
Nursing	356	6	662	6	187	4	347	5	163	4	351	6
Radiology	1,120	18	1,120	14	1,256	26	1,278	18	1,233	28	1,253	21
Laboratory	645	11	645	8	697	14	1,109	15	684	16	863	15
Blood Services	0	0	0	0	0	0	0	0	0	0	0	0
Rehabilitation	75	1	75	1	48	1	66	1	19	0.4	50	1
Medicine	761	13	1,566	20	860	18	1,754	24	557	13	960	16
Medical Devices	303	5	830	10	168	3	300	4	145	3	180	3
Intensive Care	122	2	1,378	17	103	2	115	2	122	3	122	2
Hemodialysis	0	0	0	0	0	0	0	0	0	0	282	5
Total	**6,066**	**100**	**7,919**	**100**	**4,866**	**100**	**7,220**	**100**	**4,367**	**100**	**5,896**	**100**

Note: All cost values are expressed in thousands of Indonesian Rupiah (IDR ×1,000)

Familah et al., 2024). Typically, ischemic stroke can turn into hemorrhagic stroke due to reperfusion of damaged tissue, dysfunction of the blood-brain barrier, or supply from collateral arteries, usually occurring within 2-14 days, especially in the first week. Then, the highest rate of stroke patients consecutively occurred in the age range of 55-64 years (33%), 65-74 years (28%), and ⩾75 years (20%). Age is one of the stroke risk factors. This happens because the incidence of stroke will increase with age. The incidence of stroke rises two times greater at the age of more than 55 years (Hastuti et al., 2022). This can occur due to the degeneration process, which often triggers the hardening of plaques that stick to the blood arteries, which triggers a

Table 3. Cost Components of Class 2 Stroke Patients

Cost Component	Average Costs IDR (x1,000)											
	G-4-13-I		G-4-14-I		G-4-14-II		G-4-14-III		G-4-15-I		G-4-15-II	
	n=2		n=6		n=1		n=1		n=4		n=2	
	Average (IDR)	%	Average (IDR)	%	Average (IDR)	%	Average (IDR)	%	Average (IDR)	%	Average (IDR)	%
Non-Surgical Procedures	0	0	4	0,07	0	0	24	0,2	0	0	0	0
Room/ Accommodation	1,457	10	1,203	20	1,165	22	993	7	593	17	846	17
Consultation	998	7	473	8	391	7	928	7	256	7	427	8
Nursing	1,139	8	356	6	286	5	691	5	141	4	318	6
Radiology	1,120	8	1,256	21	1,000	19	1,505	11	1,240	35	1,410	28
Laboratory	1,179	8	707	12	779	15	3,255	23	607	17	704	14
Blood Services	0	0	0	0	0	0	0	0	0	0	0	0
Rehabilitation	0	0	50	1	119	2	150	1	38	1	0	0
Medicine	3,263	23	1,654	28	847	16	3,096	22	455	13	1,149	22
Medical Devices	709	5	224	4	519	10	893	6	130	4	208	4
Intensive Care	1,522	11	81	1	122	2	2,522	18	92	3	61	1
Hemodialysis	2,535	18	0	0	0	0	0	0	0	0	0	0
Total	**13,920**	**100**	**6,008**	**100**	**5,227**	**100**	**14,056**	**100**	**3,551**	**100**	**5,123**	**100**

Note: All cost values are expressed in thousands of Indonesian Rupiah (IDR ×1,000)

Table 4. Cost Components of Class 3 Stroke Patients

Cost Component	Average Costs IDR (x1,000)																	
	G-4-13-I		G-4-13-II		G-4-13-III		G-4-14-I		G-4-14-II		G-4-14-III		G-4-15-I		G-4-15-II		G-4-15-III	
	n=7		n=3		n=2		n=68		n=52		n=7		n=17		n=10		n=2	
	Average	%	Average	%	Average	%	Average	%	Average	%	Average	%	Average	%	Average	%	Average	%
Non-Surgical Procedures	0	0	0	0	12	0.08	0.352	0.01	2	0.03	7	0.13	0	0	6	0.14	0	0
Room/ Accommodation	673	14	1,102	12	629	4	481	12	635	11	538	10	439	12	524	13	548	10
Consultation	422	9	815	9	919	6	289	7	464	8	513	10	267	7	333	8	446	8
Nursing	351	7	979	11	1,280	9	245	6	399	7	246	5	189	5	248	6	262	5
Radiology	1,154	25	1,120	12	1,160	8	1,288	32	1,252	21	1,327	25	1,184	32	1,195	29	1,320	25
Laboratory	661	14	1,098	12	1,716	12	679	17	1,008	17	951	18	713	19	760	19	1,187	22
Blood Services	0	0	0	0	0	0	0	4	212	4	0	0	0	0	0	0	0	0
Rehabilitation	21	0.5	175	2	19	0	28	1	63	1	37	1	13	0.4	26	1	150	3
Medicine	1,104	24	2,157	24	4,059	28	718	21	1,266	21	1,222	23	630	17	719	18	1,148	22
Medical Devices	229	5	649	7	1,128	8	155	4	262	4	201	4	131	4	174	4	131	2
Intensive Care	76	2	922	10	3,602	25	87	4	261	4	168	3	103	3	98	2	122	2
Hemodialysis	0	0	0	0	0	0	0	1	82	1	0	0	0	0	0	0	0	0
Total	**4,691**	**100**	**9,016**	**100**	**14,523**	**100**	**3,969**	**100**	**5,904**	**100**	**5,209**	**100**	**3,670**	**100**	**4,083**	**100**	**5,312**	**100**

Note: All cost values are expressed in thousands of Indonesian Rupiah (IDR ×1,000)

stroke (Rahayu, 2023). This is supported by research by (Rohmah & Rifayuna, 2021), which states that age is one of the factors that reflect a person's health condition, where the age range of 56 to 65 years has a higher risk of stroke. Stroke is also known to be experienced more by men (57%) than women (43%). Stroke can result from lifestyle factors, including smoking and excessive alcohol consumption, which contribute to blood vessel damage and increase the risk of this condition (Hasnah & Alifah, 2024). In addition, women have the hormone estrogen, which is neuroprotective, so they tend to have a lower risk of stroke compared to men (Kesuma et al., 2019). These hormonal factors and menstrual cycles may contribute to better heart and circulatory system function than men (Nurlan, 2020)

Treatment Cost Analysis

Each class's average actual cost of stroke treatment was calculated by classifying patients by severity and treatment type. Each class's actual cost components are displayed in **Table 2**, **Table 3**, and **Table 4**. Based on research results, the most significant cost components are medicine, room/accommodation, radiology and laboratory. The magnitude of these costs can be influenced by the number of patients with different secondary diagnoses, the selection of drugs for each patient, and the severity of the patient (Darmapadmi et al., 2018). The length of stay and the room's cost will rise with the severity of the patient's condition. Thus, this impacts high roo/accomodation room costs, radiology, medicine, and laboratory costs.

This is consistent with studies carried out by (Nawira, 2020), which states that the most significant cost components at Bantul Hospital lie in room/accommodation costs, drug/medical goods costs, and medical support costs (laboratory). But according to a study by (Hadning et al., 2020), the most significant cost components at PKU Muhammadiyah Yogyakarta Hospital were drug, medical equipment and room costs. The discrepancy between actual costs and INA-CBG rates were appropriately represented in the average cost patients paid throughout their hospital stay. The INA-CBG costs were compared with the actual costs based on severity and class. The findings are presented in **Table 5.**

Based on Table 5, for BPJS Kesehatan class 3 patients, code G-4-13-III shows that the average real cost is smaller than the INA-CBG's tariff with a significance value >0.05, which means that the

Table 5. The Differences in Total Actual Costs and Total INA-CBG's Rates

Code	Class	n	Total Cost (IDR ×1,000)		Average Cost (IDR ×1,000)		*p*
			Actual Cost (IDR)	INA-CBG's Tariff (IDR)	Actual Cost (IDR)	INA-CBG's Tariff (IDR)	
G-4-13-I	1	1	6,066	5,649	6,066	5,649	-
	2	2	27,840	9,897	13,920	4,948	0,655**
	3	7	32,836	29,736	4,690	4,248	0,088*
G-4-13-II	1	1	7,919	7,744	7,919	7,744	-
	2	-	-	-	-	-	-
	3	3	27,048	17,467	9,016	5,822	0,387*
G-4-13-III	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
	3	2	29,045	14,586	14,522	7,293	0,180**
G-4-14-I	1	14	68,142	95,405	4,867	6,814	0,009**
	2	6	36,046	35,815	6,007	5,969	0,970*
	3	68	269,918	348,425	3,969	5,123	0,000*
G-4-14-II	1	12	86,644	112,699	7,220	9,391	0,690*
	2	1	5,227	8,226	5,227	8,226	-
	3	52	307,027	367,187	5,904	7,061	0,000*
G-4-14-III	1	-		-	-	-	-
	2	1	14,056	10,462	14,056	10,462	-
	3	7	36,464	62,867	5,209	8,981	0,004*
G-4-15-I	1	4	17,467	22,270	4,366	5,567	0,020*
	2	4	14,202	19,507	3,550	4,876	0,030*
	3	17	62,398	71,165	3,670	4,186	0,008*
G-4-15-II	1	3	17,687	19,933	5,895	6,644	0,255*
	2	2	10,245	11,640	5,122	5,820	0,180**
	3	10	40,830	49,960	4,083	4,996	0,026**
G-4-15-III	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
	3	2	10,624	14,103	5,312	7,051	0,180**
Total Costs			1,127,744	1,334			
Difference (+/-)			+207,008				

*Data were analyzed using the one sample t-test because the data were normally distributed
** Data were analyzed using the Wilcoxon test because the data were not normally distributed
Note: All cost values are expressed in thousands of Indonesian Rupiah (IDR ×1,000

INA-CBG's tarif and the average actual cost did not differ significantly. In class 1 BPJS Health patients, code G-4-14-II shows that the average actual cost is smaller than the INA-CBG's tariff with a significance value >0.05. Class 3 with code G-4-15-III shows that the average actual cost is smaller than the INA-CBG's tariff with a significance value >0.05, which means the INA-CBG's tarif and the average actual cost did not differ significantly. To determine whether the hospital experienced a profit or loss, a comparison was made between the total actual costs borne by the hospital and the INA-CBG tariff claimed by the government. If the actual patient costs exceed the total INA CBGs tariff, there is a negative difference, which means the hospital is incurring a loss. Conversely, a positive difference indicates that the hospital has a surplus when patient costs do not exceed the total INA-CBG tariff (Hadning et al., 2024). Based on the Table 5, shows that 219 patients have a total treatment cost of IDR 1,127,744,443 and a total INA-CBG tariff cost of IDR 1,334,752,600. The difference obtained from this total is +IDR 207,008,157. This shows that the hospital is profitable because the total INA-CBG tariff can cover the total stroke treatment cost. In a previous study conducted by (Yunianti, 2015) on INA-CBG's rates for stroke patients at Bantul Hospital in 2014 based on Minister of Health Regulation Number 69 of 2013, it was found that for INA-CBG's code G-4-15-I there was a positive difference of +IDR 2,760,990 between the total actual cost and INA-CBG'S rates. Meanwhile, for INA-CBG's G-4-15-II and G-4-15-III codes, there was a negative difference between -IDR 7,214,047 and -IDR. 2,264,083. This occurs because patients with moderate and severe severity levels require medical expenses, medical device costs, length of hospitalization, medical action costs, and types of comorbidities, which impact the total cost of treatment. The

severity and complications of a disease affects the provision of more health services (Nisa & Raharjo, 2021). According to (Munawaroh et al., 2019), the more severe a disease is, the more comorbidities and complications will be directly proportional to the increase in cost.

CONCLUSIONS

Based on the study's results, it can be concluded that the overall average cost of stroke patients does not exceed the INA-CBGs tariff in 2023. So, this Regional General Hospital has successfully enhanced its services in managing stroke treatment costs according to INA-CBG tariff claims in 2023, resulting in a profit.

ACKNOWLEDGMENT

The authors gratefully acknowledge the support of Universitas Muhammadiyah Yogyakarta in this research.

AUTHORS' CONTRIBUTIONS

IH conceptualized the study, designed the methodology, and supervised the research process while contributing to data analysis, interpretation, and manuscript drafting. VM was responsible for data collection, statistical analysis, and conducting the literature review, in addition to assisting in writing and critically revising the manuscript. DV provided technical support and assisted in interpreting the data. TAK contributed to the discussion and edited the manuscript for clarity and accuracy.

CONFLICT OF INTERESTS

The authors declare that they have no competing interests regarding this publication.

ETHICAL CONSIDERATION

The authors declare that this article is original and all responsibility for claims relating to the contents of this article can be accounted for.

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