

# Cost of Treatment of Ischemic Stroke Based on Clinical Pathway and Unit Cost by Activity-Based Costing Method in Hospital “Bt”

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## ABSTRACT

In the JKN-KIS era demanded quality and cost control. One appropriate tool is the implementation of clinical pathways and controlling costs per treatment activity based on the unit cost by activity based costing method, called the cost of treatment. On another aspect, faced with catastrophic diseases which cost a lot, not only for treatment but also for treatment in hospital and after discharge. Stroke is one of the catastrophic diseases which is did quality and cost control through the cost of treatment. Objective: The purpose of this study calculate cost of treatment of ischemic stroke based on clinical pathway and unit cost by activity based costing method. Methods: Type of this research was observational using cross sectional approach. The analysis units of this study was hospital “Bt” at year 2017. Data analysis using descriptive. Results: The results showed that cost of treatment of ischemic stroke on one care episode for 8 days was IDR 9.660.805. In detail, patient assessment was IDR 1.093.905, care treatment was IDR 785.489, medical support examination was IDR 1.407.414, medicines was IDR 3.081.333, medical rehabilitation was IDR 3.160.665, and nutrition consultation was IDR 132.000. The conclusion was cost of treatment of cerebral infarct based on clinical pathway and unit cost by activity based costing method higher than INA CBGs tariff.

**Keywords:** *cost of treatment, ischemic stroke, clinical pathway, unit cost by ABC method*

## 1. INTRODUCTION

Stroke is a catastrophic disease that spends a lot of money, not only for treatment but also for treatment while in hospital and after discharge from the hospital, making it a burden for the patient's family. Suryati in her study showed the estimated of increasing of 71,4% of stroke cases in 2020 than 2007, is predicted to have an impact on increasing the economic burden 3,7 trillion rupiahs to 29,2 trillion rupiahs (with Indonesia's inflation rate 4,2% per year) [1]. The results of Riskesdas 2007 found that the largest component of inpatient costs was the cost of accommodation in the inpatient room (44%), the cost of medicine and consumable medical materials (23%) and supporting tests (23%) with an average length of stay of 7 days [2].

A more organized stroke service is needed to produce a better quality of stroke services and controllable cost. One of the quality controls is providing excellent services with an organized multidisciplinary organizational system, which will improve service quality and reduce the burden of stroke [3]. One strategy to improve service quality is to implement the clinical pathways [4]. A clinical pathway is a sequence

of clinical services provided to patients from entry to discharge from the hospital [5]. Some other definitions declare that a clinical pathway CPWs are used to reduce variation, improve quality of care, and maximize the outcomes for specific groups of patients (K.Lawal, 2016). Clinical pathway is a key element of services based on Evidence-Based Medicine (EBM), best practices and patient expectations, through communication, coordination and sequencing of activities from multidisciplinary teams, patients and families, in the form of recording, monitoring and evaluating variants according to the resources that needed [7]. Clinical pathways as a component of hospital accreditation assessments [8].

The information about the costs of treating particular disease based on unit costs and clinical pathways in hospitals is still very limited. Research is needed to describe the real costs that required during treatment and in accordance with medical service standards. This study analyzes the unit cost of treatment of ischemic stroke patients based on clinical pathways in the "Bt" hospital, unit costs are calculated using an activity-based costing method that has never been done before.

The purpose of this study calculate cost of treatment of ischemic stroke based on clinical pathway and unit cost by activity based costing (ABC) method in hospital "Bt"

## 2. METHOD

Type of this research was a survey using a cross-sectional approach. The location of this study was the "Bt" hospital which was conducted in 2016. The sample for the formation of a clinical pathway in this study was ischemic stroke patients who were treated at the "Bt" hospital in 2012-2015. The unit analysis in calculating the unit cost of the ABC method of this study was the hospital "Bt". This research variable consisted of the clinical pathway, the unit cost of each action and cost of treatment. The data of cost that used in this study consists of direct cost data (costs of medical materials, medical devices, medical personnel salaries) and indirect costs consisting of investment costs (building data, non-medical equipment data, vehicle in hospitals data), operational costs (non-medical human resources salaries, non-medical consumables, general costs), maintenance costs, and other costs. Research data collected using form.

The calculated cost of treatment was the unit cost based on actions or activities according to the clinical pathway of ischemic stroke that calculated using the ABC method. All the obtained data was inputted to the Microsoft Excel 2010 program.

## 3. RESULTS AND DISCUSSION

Cost of treatment of ischemic stroke patients was calculated in one episode of patient care from entry until discharge from the hospital. The calculated treatment costs were unit costs based on actions or activities according to the clinical pathway (CP) of ischemic stroke used in "Bt" hospital. The following were the stage of ischemic stroke treatment cost calculation based on CP and unit cost with the ABC method.

### a. Identify the Activity According to Clinical Pathway

Based on the CP form (attached, Table 1), identified activities that incur costs in one episode of ischemic stroke treatment (8 days). Table 1 shows activities in the Clinical Pathway reflect the service categories containing activities that describe multidisciplinary care provided to patients within a certain period of time.

### b. Identify the Name of the Production and Supporting Units

The production unit was units that produce the product (type) of services provided to patients. There were 7 production units in the "Bt" hospital that are related to stroke services, namely: 1) Emergency Room (ER), 2) Acute Stroke Treatment Room (AST), 3) G 2 Nerve Room (G2N), 4) H Room, 5) Radiology Installation, 6) Laboratory Installation, and 7) Medical Rehabilitation Installation.

Supporting units were units that do not directly contribute (support) product (type) services. There were 13 support units in "Bt" hospitals (1) administration,

management and secretariat, 2) medical records and health information, 3) maintenance of facilities and infrastructure, 4) integrated linen management, 5) sterilization of medical equipment, 6) pharmaceutical installation, 7) nutrition installation, 8) environmental health installation, 9) information and technology, 10) hospital management study centre, 11) extramural, 12) cleaning service and 13) security (security guard).

### c. Identify of Stroke Service Products in the Research Production Unit

There were 101 service products in the emergency room, but only 7 of them were activities in CP of ischemic stroke (taking blood samples, ECG, installing a catheter, installing NGT, installing infusion, providing oxygen, providing basic care). There were 26 service products in AST room, but only 5 of them were service products or activities that exist in CP of ischemic stroke (installing a catheter, installing NGT, providing oxygen, ECG, basic care). G2N Room was a ward for stroke patients VIP class, 1 and 2. Service products in G2S were 26 products, only 6 of them were service products or activities that exist in CP of ischemic stroke (taking blood samples, installing a catheter, installing infusions, installing NGT, providing oxygen, basic care). Room H was special for stroke inpatient room (3rd class), so all products in H room (26 products) were service products for strokes and 6 of them were in CP of ischemic stroke, which was the same as G2N rooms. Service products at radiology installation had 242 service products, and 2 of them were activities that exist in CP of ischemic stroke (MSCT-Brain, Thorax Photos). Laboratory Installation had 174 service product, and there were 6 stroke service products that exist in CP of ischemic stroke (complete blood test + LED test, electrolyte test, blood sugar level test, cholesterol test, urea+creatinine test, SGOT+SGPT test). Medical Rehabilitation had 24 service products, and 10 of them were service products that exist in CP of ischemic stroke (infrared, faradic, exercise, swallowing therapy, articulation therapy, oral motor therapy, vital stim therapy, occupation performance component, and occupation performance area, cognitive and perceptual treatment).

### d. Direct Costs per Service Type in Each Production Unit

Direct costs were costs directly used for patient services in the production unit. The total direct costs per type of service in each unit of production were outlined as a whole per unit of production in the "Bt" hospital consisting of the emergency room, acute stroke treatment room (AST), G2 Nerve room (G2N), H room, radiology installation, laboratory installation, medical rehabilitation installation. The total of direct costs in this study consisted of the cost of medical materials, employee costs and medical devices. The explanation of material costs, employee costs and medical equipment in each production unit attached. The following were the average of total direct costs per type of service per unit of production

**e. Indirect Costs**

Indirect costs were costs that indirectly consumed by the type of service provided to the patients. Indirect costs consist of 1) investment costs: buildings, non-medical equipment, vehicles; 2) operational costs: salaries of non-medical personnel, non-medical consumables, general costs (electricity, water, telephone) and official travel, and; 3) maintenance costs. The following were the description of indirect costs at each production unit.

**f. Imposing Indirect Cost per Supporting Unit to Production Unit**

The following was a summary of indirect cost per FA charged to each production unit.

Table 1. Activities according to Ischemic stroke clinical pathway

Service	Service Activities	D1	D2	D3	D4	D5	D6	D7	D8
Patient Assessment	Medical assessment								
Procedures	Nurse Assessment								
	ECG installation								
	Oxygen supplements *								
	Head CT scan Checking * (thromb Checking*)								
	Lab Checking								
	Stroke panel: PDL, GDS, LDL)								
	-U <sub>1</sub> , Cr, ****								
	-Na, K, ****								
	-SGOT, SGPT*****								
	-Cholesterol, Triglycerides, HDL								
ECG check **									
DC installation									
NGI installation***									
Pharmaceutical Therapy	Provision of Antipulsetlet								
	Provision of Statins								
	Provision of Anti-coagulant ****								
	Provision of Anti-hypertension								
	Provision of Anti-edema of the brain								
	Provision of Neuroprotectant								
	Provision of Anti Convulsants								
	Provision of Multivitamin								
	Provision of Isotonic infusion (NaCl 0.9% / RL / Dextrose 5%)								
Medical Rehabilitation	Physiotherapy								
	Exercise therapy								
	Infrared								
	Staircase								
	Speech Therapy (dysphagia, dysarthria, aphasia)								
	Oral motor therapy								
	Articulation therapy								
	Swallowing therapy								
	Vitalium therapy								
	Occupational Therapy								
	GPC								
	OPA								
	Comitice and Perceptual Treatment								
Nutrition Consultation	Nutrition Consultation								

Description: D: day of treatment at the hospital.  The day of not doing services activities

Table 2. Total Direct and Indirect Costs in Production Units

No.	Production Units	Average of Total Direct Costs Per Type of Service in Each Production Unit (IDR)	Total Indirect Costs in Each Production Units (IDR)
1	The Emergency Room	57.723	664.946.844
2	Acute Stroke Treatment Room (AST)	90.092	231.770.535
3	G2 Nerve Room (G2N)	157.277	225.932.377
4	H Room	152.279	150.868.440
5	Radiology Installation	278.016	468.346.763
6	Laboratory Installation	103.768	510.148.915
7	Medical Rehabilitation Installation	36.582	225.339.686

Table 3. Cost Components Based on 13 Supporting Units

No.	Facility Activity	Total of Indirect Cost in FA (IDR)
1.	Administration & Management Services	44.916.274.480
2.	Medical Record Services & Health Information	3.605.969.719
3.	Service Maintenance Facilities and infrastructure	4.094.806.284
4.	Integrated Linen Management Services	2.448.238.545
5.	Medical Equipment Sterilization Services	1.165.746.410
6.	Pharmacy Services	6.853.313.992
7.	Nutrition Service	5.119.036.535
8.	Environmental health services	2.674.531.473
9.	Information & Technology Services	514.138.247
10.	Hospital Management Study Services	68.255.650
11.	Extramural Services	1.002.849.283
12.	Cleaning Service	356.459.307
13.	Security Guard Services	2.364.986.141

Table 4 shows that among the production units associated with ischemic stroke services, namely laboratory installations, get the highest indirect costs from the Facility Activity compared to other production units, namely 9.910.401.417 rupiahs. While the production unit that gets the lowest indirect cost from the "Bt" Hospital was the basic care provided by the Acute Stroke Treatment Room (AST) which costs 1.777.080 rupiahs. While the lowest unit cost per action

Table 2 shows that the highest average of total direct cost was found in radiology installations and the lowest average of total direct cost was found in medical rehabilitation installations. The Emergency Room spent the highest indirect costs and the lowest total indirect costs were found in H room.

The following detail of the total indirect costs in each supporting unit as facility activity (FA) (Table 3). Table 3 shows the total indirect costs in the 13 supporting units that support health services provided at the "Bt" hospital. The highest indirect costs are in the administration and management services which cost 44.916.274.480 rupiahs.

the FA is the acute stroke treatment unit, which was 471.108.922 rupiahs

Table 4. Recapitulation of Indirect Costs per FA Charged to Each Production Unit

No.	Production Unit	Total of Indirect Costs in Facility Activity that Imposed to The Production Unit (IDR)
1.	The Emergency Room	4.239.782.528
2.	Acute Stroke Treatment Room (AST)	471.108.922
3.	G2 Nerve Room (G2N)	1.351.632.982
4.	H Room	693.473.683
5.	Radiology Installation	4.314.394.151
6.	Laboratory Installation	9.910.401.417
7.	Medical Rehabilitation Installation	4.463.949.554
8.	Other Production Units	50.282.014.614

**g. Indirect Costs per Type of Service in the Production Unit**

Indirect costs per type of service in each production unit were indirect costs per type of service obtained from the relevant production unit added with indirect costs per type of service per unit of production obtained from several FAs. Here were the average indirect costs per action in the production unit. Table 5 shows that the highest average of indirect cost per action in the "Bt" RS production unit was in the Acute Stroke Treatment Room (ASTR) which costs 68.137 rupiahs.

Table 5. Average of Indirect Costs per Action in Production Units

No.	Production Unit	Average of Indirect Costs Per Action in Production Units (IDR)
1.	The Emergency Room	5.206
2.	Acute Stroke Treatment Room (AST)	68.137
3.	G2 Nerve Room (G2N)	14.931
4.	H Room	16.463
5.	Radiology Installation	795
6.	Laboratory Installation	2.101
7.	Medical Rehabilitation Installation	8.426

**h. Unit Cost Per Product (type) of Services in 7 Production Units**

Unit costs per type of service in 7 production units were obtained from the sum of direct costs and indirect costs of each type of service. Following was the calculation of unit cost per product (type) of stroke services in 7 production units. Table 6 shows that the highest unit cost per action in the production unit of

was blood sampling in H room, which was 18.748 rupiahs.

Table 6. Unit Cost per Product (type) of Stroke Services in 7 Production Units

No	Production Units	Product (Type) of Service	Direct Cost (IDR)	Indirect Cost (IDR)	Unit Cost (IDR)
1	The Emergency Room	Blood collection	17.820	2.803	20.623
		ECG	59.054	3.504	62.558
		Install the catheter	60.951	4.204	65.155
		Install NGT	81.564	6.306	87.871
		Install IV	70.190	6.506	76.697
		Provides Oxygen	59.321	2.803	62.124
		Basic care	410.985	55.636	466.621
2	Acute Stroke Treatment Room (AST)	Install the catheter **	55.793	27.339	83.132
		Install NGT **	67.448	41.008	108.456
		Providing oxygen	53.047	18.236	71.283
		ECG	58.052	22.782	80.835
		Basic care	720.885	1.056.196	1.777.080
3	G2 Neuro Room (G2N)	Take a blood sample	14.375	4.146	18.489
		Install the catheter **	51.539	6.205	57.744
		Install IV	56.074	9.307	65.380
		Install NGT **	67.448	9.307	76.754
		Providing oxygen	53.047	4.136	57.183
		Basic care	692.224	225.848	918.072
		Take a blood sample	14.187	4.561	18.748
4	H Room	Install the catheter **	51.291	8.841	60.132
		Install IV	55.701	10.262	65.963
		Install NGT **	67.075	10.262	77.337
		Providing oxygen	52.881	4.561	57.442
		Basic care	672.965	249.021	921.986
		MSTC - Brain	408.969	794	409.762
		Thorax Photo (Adult Thorax AP / PA)	147.060	705	147.776
6	Laboratory Installation	Complete Blood Test (CBT) = E-D	93.357	3.007	96.364
		Electrolyte test (Na, K)	101.574	1.396	102.971
		Blood Sugar Levels test (GDS)	84.445	1.504	85.949
		Cholesterol test (Total chol and LDL)	128.146	1.396	129.543
		Urea, creatinine test	127.574	1.396	128.971
		SGOT, SGPT examination	87.514	1.396	88.910
		Paradi	40.970	9.531	50.501
		Exercise	32.512	8.995	41.507
		Swallowing Therapy	30.202	7.874	38.076
		Articulation Therapy	69.502	7.874	77.376
		Voice Therapy	34.202	7.874	42.076
		Oral motor therapy	34.202	7.874	42.076
		Vital stim Therapy	32.935	7.874	40.808
Occupation perform. Component (OPC)	34.122	8.910	43.031		
Occupation perform. area (OPA)	34.259	8.901	43.169		
Cognitive and percep-tual treatment	34.259	8.901	43.169		

Note: \*\* if necessary

**i. Cost of Treatment of Ischemic Stroke**

The cost of treatment of ischemic stroke patients was calculated in one episode of patient care from admission until discharge from the hospital. Cost of treatment was calculated based on the unit cost per type of service or activity that exists on the CP (include cost of medication was calculated).

Cost of ischemic stroke treatment based on CP in one episode of treatment 8-day which consisting of patient assessment, management, pharmacy therapy, medical rehabilitation and nutrition consultation is amounting to 9.660.805 rupiahs. The trigger for costs was medical rehabilitation services with a proportion of 33% (IDR 3.160.665) of all services. Some of the indirect cost components were not obtained including the cost of employee uniforms, employee meals, and employee salary costs. In addition, not all medical equipment costs could be obtained because the price and year of purchase of the device were unknown or the data was not found. Therefore, the calculation of the costs generated in this study was estimated to be lower than the costs should be.

Table 7. Cost of Ischemic Stroke Treatment in the ER-AST Room-G2N Room Treatment Room Based on CP of Ischemic Stroke

Treatment Rooms		ER-AST (D1-3) and G2N (D4-8)									
Days of Treatment		1	2	3	4	5	6	7	8	1-8	
Service	Service Product (Activity)	Cost per Activity (IDR)								Total Cost per Activity (IDR)	
		2.124.396	1.181.548	1.115.548	1.086.967	1.021.586	1.021.586	1.021.586	1.087.586		9.660.805
Patient Assesment	Medical Assesment	33.000	67.750	67.750	70.333	70.333	70.333	70.333	70.333	520.167	
	Nurse Assesment	77.772	104.534	104.534	57.379	57.379	57.379	57.379	57.379	573.738	
Procedures	IV line installation	76.497			65.380					141.877	
	Oxygen supplements	62.124	71.273	71.273	57.183	57.183	57.183	57.183	57.183	490.586	
	Head CT scan Testing	409.762								409.762	
	Ro Thorax Testing	147.766								147.766	
	<b>Laboratorium Test</b>										
		- stroke panel: PDL, GDS, LDL)	311.855								311.855
		- Ur, Cr*****	128.971								128.971
		- Na, K*****	102.971								102.971
		- SGOT, SGPT*****	88.910								88.910
		- Cholesterol, Triglycerides, HDL	129.543								129.543
	ECG Test **	17.034	35.301	35.301						87.636	
	DC installation	65.155								65.155	
	NGT installation	87.871								87.871	
Pharmaceutical Therapy	Provision of Antiplatelet	27.195	27.195	27.195	27.195	27.195	27.195	27.195	27.195	217.560	
	Provision of Anti-coagulant	250.000	250.000	250.000	250.000	250.000	250.000	250.000	250.000	2.000.000	
	Provision of Statins	4.300	4.300	4.300	4.300	4.300	4.300	4.300	4.300	34.400	
	Provision of Anti-hypertension	10.497	10.497	10.497	10.497	10.497	10.497	10.497	10.497	83.976	
	Provision of Anti-edema of the brain	5.562	5.562	5.562	5.562	5.562	5.562	5.562	5.562	44.498	
	Provision of Neuroprotectant	12.705	12.705	12.705	12.705	12.705	12.705	12.705	12.705	101.640	
	Provision of Anti Convulsants	7.123	7.123	7.123	7.123	7.123	7.123	7.123	7.123	56.987	
	Provision of Multivitamin	7.784	7.784	7.784	7.784	7.784	7.784	7.784	7.784	62.272	

Treatment Rooms		ER-AST (D1-3) and G2N (D4-8)									
Days of Treatment		1	2	3	4	5	6	7	8	1-8	
Service	Service Product (Activity)	Cost per Activity (IDR)								Total Cost per Activity (IDR)	
		2.124.396	1.181.548	1.115.548	1.086.967	1.021.586	1.021.586	1.021.586	1.087.586		9.660.805
	Provision of Isotonic infusion (Nacl 0.9% / RL / Dextrose 5%)	60.000	60.000	60.000	60.000	60.000	60.000	60.000	60.000	480.000	
Medical Rehabilitation	<b>Physiotherapy</b>										
		Exercise therapy	41.007	41.007	41.007	41.007	41.007	41.007	41.007	41.007	287.049
		Infrared	32.211	32.211	32.211	32.211	32.211	32.211	32.211	32.211	225.476
		Faradix	50.501	50.501	50.501	50.501	50.501	50.501	50.501	50.501	353.506
		<b>Speech Therapy (dysphagia, dysarthria, aphasia)</b>									
		a. Oral motor therapy	42.176	42.176	42.176	42.176	42.176	42.176	42.176	42.176	295.232
		b. Articulation therapy	77.376	77.376	77.376	77.376	77.376	77.376	77.376	77.376	541.632
		c. Swallowing therapy	38.076	38.076	38.076	38.076	38.076	38.076	38.076	38.076	266.532
		d. Vitalstim therapy	40.808	40.808	40.808	40.808	40.808	40.808	40.808	40.808	285.657
		<b>Occupational Therapy</b>									
		a. OPC	43.031	43.031	43.031	43.031	43.031	43.031	43.031	43.031	301.220
	b. OPA	43.169	43.169	43.169	43.169	43.169	43.169	43.169	43.169	302.180	
	c. Treatment cognitive and perceptual	43.169	43.169	43.169	43.169	43.169	43.169	43.169	43.169	302.180	
Nutrition Consultation	Nutrition Consultation	66.000							66.000	132.000	

The results of this study were in line with the results of a study conducted by Pinzon (2014) to the 119 patients treated with CP, receiving an inpatient fee of 10.333.645 ± 13.100.382 rupiahs with a length of stay about 7,96 ± 6,73 days. The biggest cost was found in drug costs. The cost analysis shows that there was a significant increase in service costs associated with earlier rehabilitation programs, early nutrition assessment and more relevant section consultations. The costs calculated in the Pinzon study were patient discharge costs, not calculating the unit costs. This study calculates unit costs based on activities that correspond to CP of ischemic strokes that had been carried out at Bt Hospital. Unit cost calculations using the ABC (bottom-up) method were more sensitive than unit cost calculations using the top-down method because the resulting unit costs reflect the activities given to patients based on medical service standards.

In contrast to the another study of the cost of stroke treatment conducted by Susi showed that obtaining drug costs was the largest cost component in the cost of stroke treatment at Bt Hospital. This study found a cost of treatment (COT) for stroke was 1.905.273 rupiahs with a median day of care of 10 days [8]. This study did not calculate COT based on CP. Costs incurred for pure stroke were much lower than this study.

Provision of rehabilitation treatment as early as possible (48 hours of onset) was one indicator of a good stroke service process. Early rehabilitation services aim to speed up the patient's recovery time or minimize the disability of stroke patients. Most stroke patients

experience speech disorders (aphasia or dysarthria), so speech therapy was a routine therapy for stroke patients. Occupational therapy (occupational therapy) was carried out to improve the function of the patient's daily life (activities of daily living) [9]. The emergence of high funding due to earlier medical rehabilitation handling becomes rational if the services provided were in accordance with evidence-based medicine so that the quality of services was maintained.

Guidelines for Medical Service Standards state that clinical pathways were not made for the breakdown of treatment costs [10]. But after CP was made and then used for the purpose of calculating the financing was not a necessity. A more precise calculation based on activities on CP using the ABC method should be considered in determining the INA CBG's tariff. If the current tariff does not meet the needs of patient services according to medical service standards, it was feared that it will have an impact on the decline in the quality of health services.

#### 4. CONCLUSION

Cost of treatment of cerebral infarct based on clinical pathway and unit cost by ABC method higher than INA CBGs tariff. This result been used to quality control and cost control in hospital, and evaluate INA CBGs tariff. This study recommends that: 1) the data used in calculating the INA CBG tariff is only taken from the hospital that has implemented clinical pathways and the tariff are based on to update unit cost calculations, 2) encourage hospitals to calculate

the cost of treatment, 3) further research is needed on several hospitals and other diseases.

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