

## Direct Medical Cost Inpatient ACS-STEMI at Sardjito Hospital 2017-2018

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**Abstract:** Cardiovascular disease is the main cause of human death worldwide. This disease is also a major burden in health financing, due to direct costs of treatment and hospitalization. One type of cardiovascular disease is Acute Coronary Syndrome (ACS). The incidence of ACS in Indonesia is still the highest with a prevalence rate of 7.2% and continues to increase every year. This study aimed to determine the average direct medical costs of new ACS-STEMI patients who are hospitalized at Dr. Sardjito Hospital Yogyakarta period 2017-2018 and the factors that influence the cost of the treatment statistically. This research was an observational study with a descriptive retrospective research design using data from medical records and the finance (accounting) department. The sampling technique used in this study was purposive sampling based on patients who met the inclusion criteria. A total of 495 patients matched the inclusion criteria and the average of the components of direct medical costs incurred by inpatients was IDR48,926,665 with an average length of stay of 5 days. Statistical test results showed that the categories of gender, age, and payment method were not significantly associated with the average total cost of care for ACS-STEMI patients ( $p>0.05$ ). Meanwhile, the categories of length of stay and treatment regimen were significantly correlated to the average total cost of care for ACS-STEMI patients ( $p<0.05$ ). The average total cost of new ACS-STEMI patients undergoing inpatient treatment amounted to IDR48,926,665 which was significantly influenced by the category of the length of hospitalization and therapeutic regimen.

**Keywords:** acute coronary syndrome; cost; inpatient; STEMI

### 1. Introduction

Cardiovascular disease is the leading cause of human death worldwide. According to estimates from the World Health Organization (WHO) in 2015, there were 17.7 million people who died from cardiovascular disease, representing 31% of all deaths from non-communicable (catastrophic) diseases. From this proportion, 7.4 million people died, which was associated with ischemic heart disease (Garcia *et al.*, 2018). Cardiovascular diseases consist of coronary heart disease (CHD), heart failure, ventricular arrhythmias, and death due to sudden cardiac arrest, rheumatic heart disease, abdominal artery aneurysms, peripheral arterial disease, and congenital heart disease. Among all cardiovascular diseases, CHD is the most dominant manifestation experienced by humans (Wong, 2014). Funding for catastrophic diseases according to data from the Social Security Administering Agency (BPJS) in 2016 indicated the cost reached nearly 14.6 trillion rupiahs in Indonesia. The largest cost was allocated to heart

disease, which showed an increase in financing in 2016 compared to 2015, amounting to 6.9 trillion rupiahs (48.25%) to 7.4 trillion rupiahs (50.7%) (Indonesian Ministry of Health, 2017). One of the manifestations of CHD is an acute coronary syndrome (ACS) which consists of ST-Elevation Myocardial Infarction (STEMI), Non-ST-Elevation Myocardial Infarction (NSTEMI), and Unstable Angina (UA). These three manifestations are the events that most often cause a person to be referred to the hospital (Carey, 2016).

The ACS is caused by atherosclerosis, which is the process of plaque formation that affects the intima of the artery, resulting in the formation of a thrombus so that the lumen becomes narrowed from its previous size. This can cause disruption of blood supply and in the end, the strength of heart muscle contraction decreases. If the thrombus ruptures before total necrosis of the distal tissue occur, a myocardial infarction occurs (Asikin *et al.*, 2016). The underlying pathology of STEMI is an imbalance between oxygen supply and demand from the myocardium, which can lead to thrombotic vessel occlusion. Plaque rupture is the most common underlying source of thrombotic occlusion in ACS. The EKG, which is used to differentiate early STEMI from NSTEMI, shows injury in a pattern that reflects the degree of occlusion and subsequent ischemia. STEMI occurs when there is complete occlusion, resulting in myocardial injury and necrosis (Hedayati *et al.*, 2017). Rupture of atherosclerotic plaque resulting in partial or complete occlusion of the epicardial coronary artery is the most common mechanism causing ACS. Plaque disruption exposes subendothelial collagen which results in platelet activation and the coagulation cascade leading to thrombus formation (Makki *et al.*, 2013). The occurrence of ACS can be associated with several risk factors which include non-modifiable factors and modifiable factors. Non-modifiable factors include gender, age, generation. Meanwhile, the modifiable factors include smoking habits, hypertension, diabetes mellitus, dyslipidemia, and obesity (Indrawati, 2014).

In tracking direct medical costs, the pharmacoeconomics scientific approach can be used as an illustration to measure a treatment intervention given to patients. There are various terms used in pharmacoeconomic analysis; one of which is the most important variable cost. Variable costs are divided into four categories: direct medical costs, direct non-medical costs, indirect costs, and intangible costs. In general, direct medical cost categorical variables are often compared to other categorical cost variables in pharmacoeconomic research, which include drug costs, doctor visits, hospitalization costs, and others (Andayani, 2013). Dr. Sardjito Hospital, which is located on Kesehatan Street, Mlati District, Sleman Regency, Yogyakarta is a type "A" hospital that supports and completes the national health service infrastructure.

## 2. Methods

This research was a retrospective non-experimental study based on data from medical records and the finance (accounting) department at Dr. Sardjito Hospital Yogyakarta in the period of 2017 and 2018. The cost parameter used was direct medical costs with the perspective of the hospital as a health service provider.

### 2.1. Population and sample

The population of this study was all registered patients with the ACS who were identified with ICD-10 ACS-STEMI and underwent hospitalization. The samples taken in this study were in accordance with the inclusion and exclusion criteria considerations. The inclusion criteria in this study were patients who were registered with the new ACS-STEMI I21.0; I21.1-3; I22.0-1; and I22.8. Meanwhile, the exclusion criteria for this study were patient data whose data could not be followed-up to a predetermined tracking time (lost to follow-up). The sample obtained has been fulfilled, namely 495 from the calculation of the minimum sample using Sloving method. The sampling technique used in this research was purposive sampling, which was based on certain considerations that met the inclusion and exclusion criteria. The data collection technique in this study used the data contained in the medical records of inpatients with ACS-STEMI and financial data in the accounting system section of the Dr. Sardjito Hospital.

### 2.2. Tools and materials

The tools used in data collection were the patient's medical record file, and data from the finance department, and the SPSS version 25 (IBM Corp., Armonk, NY). The data referred to treatments used in ACS-STEMI patients who are treated at the Sardjito Hospital.

### 2.3. Data analysis

Statistical data analysis was carried out by univariate test on each research data variable, and Spearmen test to find out an association between cost ant other variable.

## 3. Results and Discussion

The subjects obtained in this study were in accordance with the inclusion criteria which included as many as 495 patients. The basic characteristics of patients in the form of gender, age, and invasive interventions are presented in Table 1.

Table 1 shows that there is a clear difference in the incidence of ACS-STEMI in the gender category. Men tend to be more likely (81.6%) to experience ACS-STEMI compared to women (18.4%). This trend is in line with the research of Andrikopoulos *et al.* (2016) which showed that the patients with ACS-STEMI tended more to be males (79.6%) compared to females. There are several factors that can cause men to have a higher chance of experiencing CHD, namely due to an unhealthy lifestyle such as smoking and drinking alcohol. According

to a statement from the Departemen of Health Human Service of USA (2010) that men are at 10 times greater risk of experiencing CHD than those who do not smoke. This is because of the content of harmful substances in cigarettes such as carbon monoxide, nicotine, and oxidant gases. Carbon monoxide causes a lack of oxygen so that circulation becomes abnormal. Additionally, nicotine can make the blood cause blood clots and can harden the arteries in the heart, while excessive drinking can increase blood pressure, so that the muscles become weak and arteries clogged.

**Table 1.** ACS-STEMI patient baseline characteristics in Dr. Sardjito Hospital Yogyakarta in the period of 2017 and 2018.

Characteristics	n	%
Sex		
Male	404	81.6
Female	91	18.4
Age		
< 60 year	249	50.3
≥ 60 year	246	49.7
Length of Stay (day)		
1 – 10	450	90.9
11 – 20	36	7.3
21 – 30	7	1.4
31 – 40	1	0.2
41 – 50	1	0.2

The age data category in Table 1 shows that the incidence of ACS-STEMI was greater in those under 60 years old (50.51%) compared to those aged more than or equal to 60 years (49.49%). This finding is in line with the study of Tofler *et al.*, (2017) which showed that the age characteristics of STEMI patients under 65 years were greater (51.22%) compared to patients aged above or equal to 65 years (48.78%). Meanwhile, Length of Stay (LoS) data shows that the percentage of hospitalized patients for 1-10 days was the largest (90.9%) and 31-40 days and 41-50 days were the least, with the average patient stay of 5 days.

The methods of payment made by patients were basically different. Some used general payment methods and were covered by insurance such as the National Health Insurance (JKN), Social Health Insurance (Jamkesmas), and private insurance. The percentages of patient payment methods can be seen in Table 2.

Table 2 shows that the most widely used payment method was the national health insurance (93.1%), and the least used payment method was insurance from the private sector (0.8%). This trend is because since 2014 the government has launched a health insurance program (JKN) that aims to provide the Indonesian people with proper and adequate services.

**Table 2.** Patient distribution by payment method in Dr. Sardjito Hospital Yogyakarta. \*national health insurance: payment with JKN, \*social health insurance: payment with Jamkesmas/Jamkesda, \*others: payment with private insurance.

Payment Method	n	%
General	15	3.0
National health insurance	461	93.1
Social health insurance	15	3.0
Others	4	0.8

In this study, there were two main therapeutic regimens used to treat patients with ACS-STEMI, namely monotherapy (ticagrelor) and the combination (clopidogrel+ salicylic acid). The percentage level of the category of patient treatment can be seen in the Table 3.

**Table 3.** Distribution of treatment characteristics of ACS-STEMI patients in Dr. Sardjito Hospital Yogyakarta

Treatment Characteristics	n	%
Monotherapy	91	18.4
Combination	404	81.6

Table 3 shows that the use of the combination regimen was greater (81.6%) than the monotherapy regimen (18.4%). These results are in line with the study of Nafrialdi *et al.*, (2018) which showed that the use of a combination therapy regimen of clopidogrel and aspirin in patients with ACS was greater (68.3%) compared to ticagrelor monotherapy (31.7%).

Direct medical expenses incurred by ACS-STEMI patients who are hospitalized at the Dr. Sardjito hospital for the 2017-2018 period includes several components that are classified into drug costs, support costs, treatment costs, and medical consumables costs. The components of direct medical costs are listed in Table 4.

**Table 4.** Average direct medical cost (IDR) for ACS-STEMI patients of Dr. Sardjito Hospital Yogyakarta

Component	mean $\pm$ standard deviation	%
Drug	3,054,643.98 $\pm$ 4,158,551.082	6.23
Support	12,889,834.14 $\pm$ 21,379,847.42	26.31
Nursing	9,547,501.67 $\pm$ 9,015,657.527	19.49
Medical consumables	23,502,068.94 $\pm$ 18,622,727.35	47.97
Total	48,994,048.78 $\pm$ 42,399,637.71	100

The percentage of direct medical cost components based on Table 4 shows that the largest average cost, respectively, was the medical consumables (BMHP) cost component (47.97%), followed by support (26.31%), treatment (19.49%), and medicine (6.23%), and the average total direct medical costs were IDR48,994,049 with standard deviation (SD)  $\pm$  42,399,638. The results of this study are in line with research conducted by Aurelia & Pujiyanti, (2017) which shows data on the use of medical consumables and drugs is the component that gets the largest

portion with 33.24%, costs for support and nursing are 23.72%, as well as other costs in the form of maintenance of tools and equipment. indirect costs show a small percentage.

The normality test for the distribution of the data in this study showed that it was not normally distributed even though the data had been transformed, so the Spearman nonparametric test was done, to test and determine which factors influenced the total cost statistically. The data can be seen in Table 5.

**Table 5.** Factors that affect direct costs for ACS-STEMI patients in Dr. Sardjito Hospital Yogyakarta

Variable	Cost	Note
Sex	$r = -0.020$ $p = 0.655$ $n = 495$	insignificant correlation
Age	$r = 0.051$ $p = 0.259$ $n = 495$	insignificant correlation
Length of Stay	$r = 0.252$ $p = <0.001$ $n = 495$	significant correlation
Payment Method	$r = 0.004$ $p = 0.934$ $n = 495$	insignificant correlation
Therapeutic Regimen	$r = -0.260$ $p = <0.001$ $n = 495$	significant correlation

Based on the data in Table 5, the results show that the gender category was not significantly correlated to the total cost of treatment ( $p=0.655$ ), with a very weak correlation strength and a negative correlation direction ( $r=-0.020$ ). The age category also did not have a significant correlation to the total cost of treatment ( $p=0.259$ ). Additionally, the strength of the correlation was very weak and the direction of the correlation was positive ( $r=0.051$ ). Likewise, the variable method of payment had no significant correlation to the total cost of treatment ( $p=0.934$ ), with a very weak correlation strength and a positive correlation direction ( $r=0.004$ ). Meanwhile, the category of the length of care showed a significant relationship ( $p<0.001$ ) to the total cost of care with a weak correlation strength and a positive correlation direction ( $r=0.252$ ). The therapy regimen also showed a significant relationship ( $p<0.001$ ) to the total cost of care with a weak correlation strength and a negative correlation direction ( $r=-0.260$ ). These findings indicated that the length of treatment and therapy have a significant correlation to the total cost of ACS-STEMI treatment. This shows that the length of treatment and the provision of total therapy, which has an impact on the length of treatment, will increase the cost of drugs, treatment costs, and the cost of using medical materials, thus affecting the total cost of treatment. The cost of inpatient care for new AHF patients has a high cost. the average

inpatient care of AHF patients is about 7 days with room rental costs of 36% of the total AHF treatment costs as a whole. This shows that the longer the patient is hospitalized, the greater the costs incurred (Rihova *et al*, 2013).

#### 4. Conclusion

Based on research conducted at Dr. Sardjito Hospital on the total direct medical costs for inpatients with ACS-STEMI for the period 2017-2018, treatments obtained an average direct medical cost of IDR48,994,049 with SD  $\pm$  42,399,638 and hospitalization reached an average length of stay of 5 days. Factors, which were significantly correlated that affected the total cost of treatment based on the Spearman test included the categories of the length of treatment and therapy. These findings were considered significant, although the strength of the correlations was weak and the direction of the correlation was positive with the total costs incurred.

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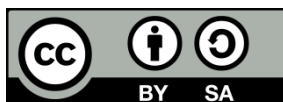
#### Conflict of Interest

The authors have no conflict of interest to disclose.

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