Cost Of Illness COVID-19 Inpatient Installation at the UGM Academic Hospital

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ABSTRACT

COVID-19 has become a worldwide pandemic, especially in Indonesia. The high number of COVID-19 cases in Indonesia has a financial impact, as the government must shoulder the cost of dealing with it. The study aimed to determine the direct cost and total cost (cost of illness) of COVID-19 patients at RSA UGM Yogyakarta from a hospital perspective, as well as the differences in total direct cost of hospitalized COVID-19 patients based on age, gender, length of stay, severity, and comorbidity. The cross-sectional study design of the analytic observational research method is based on a hospital perspective. Data was collected retrospectively from the patient's medical record, detailed healthcare expenditure data, and patient claim files. The data was analyzed using univariate, bivariate, and multivariate methods. The study's findings requested the number of inpatient COVID-19 patients as many as 104 samples that satisfied the inclusion specifications, as well as the total direct medical costs of Rp. 2.346.150.137 with an average cost of Rp. 22.559.154 for each patient. The most expensive components were pharmaceutical and BMHP prices of Rp. 958.410.599 (40.85%) and medical support costs of Rp. 725.163.700 (30.91%). Age, length of stay, severity of comorbidities, and usage of antivirals all have an impact on direct medical costs.
Keywords: COVID-19; hospital costs; hospital perspective; hospitalization

INTRODUCTION

On December 31, 2019, COVID-19 was first detected in Wuhan. The World Health Organization (WHO) has classified this disease a Public Health Emergency of International Concern (PHEIC) because to the disease's rapidly spreading and high death rate (Jin et al., 2020). According to the World Health Organization (WHO), there have been 430.257.564 confirmed cases of COVID-19 recorded from all nations worldwide till February 2022, with 5.457.775 confirmed cases in Indonesia (WHO, 2022). According to a study conducted at RSUD NTB, the total cost of treatment for COVID-19 patients was Rp 45.589.962. Because the cost is relatively high, preventive actions are required to lower the occurrence of COVID-19 in NTB. (Rahmawati et al., 2022).

Research in the USA that aims to estimate the direct medical costs of COVID-19 treatment obtained the results of costs incurred by patients is USD 3.045 , cost of handling COVID-19 is relatively high because it requires special isolation rooms, and other expensive treatment costs such as antiviral therapy, oxygen therapy and intensive care with ventilators to treat severe and critical patients (Bartsch et al., 2020). The financing reference for hospitals that provide COVID-19 services is specified in the Decree of the Minister of Health of the Republic of Indonesia No 238 of 2020 concerning Technical Guidelines for Claims for Reimbursement of Service Costs for Patients with Certain Emerging Infectious Diseases for Hospitals Providing COVID-19 Services. The Indonesian Ministry of Health revealed the payment pattern in COVID-19 claims, namely by claiming INA-CBG rates that are provided top-ups based on treatment time, which is computed as cost per day for effective and efficient financing (Kemenkes, 2020). In 2021, total hospital cost claims for COVID-19 patients totaled 90,20 trillion, qualified claims totaled 87,78 trillion, and unpaid claims totaled 25,10 trillion (Hairani, 2022). This shows the cost of treatment for COVID-19 patients is extremely expensive, which has an impact on hospitals' ability to pay claims; therefore, a cost of illness analysis research can be one of the alternatives utilized to determine the primary cost components as well as variable costs of diseases (Andayani, 2013)

RSA UGM Yogyakarta is a type B hospital and a COVID-19 referral hospital. Like other COVID-19 referral hospitals, RSA UGM provides services for COVID-19 patients, where services for COVID-

19 patients are given a fee waiver in accordance with the Decree of the Minister of Health of the Republic of Indonesia Number 238 of 2020 (Kemenkes, 2020). Based on this background, researchers are encouraged to conduct research with the aim of analyzing the total direct medical costs and constituent cost components as well as factors affecting the cost of inpatient COVID-19 patients at RSA UGM. This study is considered to be valuable in providing information on the expenditures required for the treatment of COVID-19 patients as a consideration in funding planning and in improving standards for the implementation of the COVID-19 disease.

METHOD

Analytical observational research method based on hospital perspective with *cross-sectional* research design. Data collection was taken retrospectively from medical records, detailed data on medical costs, and patient claim files. The population in this study is all inpatient COVID-19 patients at RSA UGM Yogyakarta for the July-December 2021 period. The inclusion criteria in this study were all hospitalized patients with a diagnosis of COVID-19 aged 18-65 years. The exclusion criteria in this study were patients with incomplete medical records and financing data.

This study used *consecutive sampling technique.* Determination of the number of samples in the number of known populations using the Lemeshow formula and obtained the minimum sample in this study is 101 samples (Lemeshow, 1997).

$$n = \frac{Z^2 1 - \frac{\propto}{2} \times p(1-p) \times N}{d^2 (N-1) + Z^2 1 - \frac{\propto}{2} \times p(1-p)}$$

Medical costs in this study are *direct* medical costs with cost calculations using *bottom up* approach which includes components of administrative costs, accommodation costs, medical service costs, medical support costs, as well as drug and BMHP costs based on the hospital's perspective.

Descriptive analysis is used to describe the demographic characteristics, disease characteristics of patients, and cost components that sums total direct medical costs. *Mann Whitney* testing to determine the difference in total medical costs is directly reviewed from gender factors. While *kruskal wallis* test aims to see the difference in total medical costs directly reviewed from age, length of stay (LoS), severity, comorbid severity, and antiviral use. Linear regression analysis to see the effect of several independent variables on dependent variables using *statistical software.*

RESULTS AND DISCUSSION

From the results of the study, subjects who met the inclusion criteria were 104 samples. Based on the demographic characteristics of hospitalized patients (Table I) the proportion of men (52,9%) is higher than women (47,1%). In line with the narrative research of 27.696 COVID-19 cases in Indonesia, it is stated that the percentage of men is 54,5% and women are 45,4% (Karyono & Wicaksana, 2020). This is because the influence of the X chromosome on women has a lower susceptibility to viral infections than men. The X chromosome in females plays an important role in the innate immune response and adaptive immune response (Klein & Flanagan, 2016).

The average age of the research subjects was 45,9 years with the highest proportion being the age group of 18-45 years (39,4%). In cases that occurred in Indonesia, as many as 26.454 cases of COVID-19 showed that the age range of 18-59 years had a proportion of more than 75% compared to the age of >60 years with a proportion of 15% and ages 0-17 years had a proportion of 10% (Karyono & Wicaksana, 2020).

According to The Centers for Disease Control and Prevention (CDC), working-age groups are more susceptible to exposure, because for work some people have to travel and meet many people. This is associated with close contact and travel history to infected areas is a risk factor for COVID-19 exposure (Centers for Disease Control and Prevention,2020). The length of hospitalization of patients is quite wide, which is 2-30 days with an average hospitalization of 10,2 days. The largest proportion of the length of hospitalization in this study was in the 7-14 group as many as 71 people (68.3%). In line with research at RSUD Hadji Boejasin , the proportion of the length of stay <14 days is 76% higher than >14 days by 24%, this is because patients have a good immune system that shortens the

Table I. Demographic Characteristics of COVID-19 Patients at RSA UGM Yogyakarta July-December 2021

Variable	Number of Subjects (%)
Demographic Characteristics	
Gender	
Man	55 (52,9%)
Woman	49 (47,1%)
Age (average 45.9 years)	
18-45 years	41 (39,4%)
46-55 years	25 (24,0%)
56-65 years	38 (36,5)
LoS (average 10.2 days)	
< 7 days	18 (17,3%)
7-14 days	71 (68,3%)
> 14 days	15 (14,4%)
Characteristics of the disease	
Severity	
Light	4 (3,8%)
Keep	60 (57,7%)
Heavy	37 (35,6%)
Critical	3 (2,9%)
Comorbid Severity	
CCI 0-2 point	50 (48,1%)
CCI 3-5 point	48 (46,2%)
CCI 6-8 point	5 (4,8%)
CCI 9-11 point	1 (1%
Antiviral Use	
No Antiviral	17 (16,3%)
By Favipiravir	18 (17,3%)
With Remdesivir	58 (55,8%)
By Remdesivir Favipiravir	11 (10,6%)

duration of nurses, and patients who receive treatment have passed the incubation period while still at home and symptoms of COVID-19 or the end of incubation appear when entering the hospital.

Based on the disease characteristics of 104 study subjects, the highest proportion of moderate comorbid severity was obtained as many as 60 people (57,7%). Research in Japan states that the severity of COVID-19 is influenced by several factors, including older age, the presence of comorbidities such as hypertension or diabetes mellitus, decreased albumin levels and an increase in *Neutrophil-lymphocyte ratio* (NLR) and *C-reactive protein* (CRP) (Hirashima et al., 2021).

The largest proportion of comorbid severity was the CCI category 0-2 points by 50 people (48,1%). The components in the CCI score are age and comorbidities such as chronic obstructive pulmonary disease (COPD), diabetes mellitus, congestive heart failure, acute myocardial infarction, gastrointestinal tract disease, etc. The highest proportion of antiviral use was remdesivir by 58 people (55,8%). Research in East Java states the effectiveness of treatment is assessed by comparing the length of treatment and loss of symptoms in patients, where the average results of treatment with the use of favipiravir are 11,22 days and remdesivir 13,13 days (Halimbar et al., 2023)

From the characteristics of the constituent cost component of total direct medical costs (Table II) consisting of components of medical action costs, medical service costs, medical support costs, drug and consumable medical material (BMHP) costs, accommodation costs and additional costs, total costs for 104 research subjects amounted to 2.346.150.137 where the largest component constituent of total costs based on the components of drug costs and BMHP is Rp 958.410.599 (40,85%) and medical support costs is Rp 725.163.700 (30,91%). This is due to the comorbidities and complications that accompany COVID-19 patients so that the therapy given is not only to treat

Table II. Constituent Components of Total Direct Medical Costs for Inpatient COVID-19 Patients RSA UGM Yogyakarta July-December 2021

Variable (N= 104)	Total Cost (Rp)	%	Average costs *each patient* Rp $\pm$ SD
Total Direct Medical Costs	2.346.150.137		22.559.135,93 $\pm$ 14.900.586
Component Costs			
Medical Treatment Costs	312.521.838	13,32	3.005.017± 3.084.425
Medical Service Fee	147.269.000	6,28	1.416.048 $\pm$ 1.136.524
Medical Support Costs	725.163.700	30,91	6.972.727 $\pm$ 3.535.155
Cost of Drugs and BMHP	958.410.599	40,85	9.215.486 $\pm$ 8.150.875
Accommodation Fees	196.025.000	8,355	1.884.855 $\pm$ 1.203.486
Additional Charges	6.760.000	0,29	65.000 $\pm$ 178.652

COVID-19, therapy also treats comorbidities and these complications can affect drug costs. The results of the study in table II is in accordance with several previous studies both in Indonesia and other countries such as Africa and Iran which stated that the largest cost components are drug costs and BMHP (Budi & Nafisah, 2023; Edoka et al., 2021; Giusman & Nurwahyun, 2022; Khandehroo et al., 2022; Nugraha et al., 2022; Skarayadi Oskar et al., 2023).

This shows that in the treatment of patients, drugs and BMHP are still the main components needed in handling and caring for COVID-19 patients. The amount of medical support costs is dominated by laboratory costs, especially PCR costs, swab tests used to identify COVID-19 (Giusman & Nurwahyuni, 2022). This is in line with research at RSUD Cempaka Putih Jakarta where the second largest cost after drug costs and BMHP is medical support costs (Liza et al., 2022).

The data in table III of the normality test results with kolmogorov-smirnof showed that the data were not normally distributed (sig > 0,05), which means the test continued using the Mann Whitney and Kruskal Wallis tests to find out whether there was a difference between the independent variables and the dependent variables. Based on patient characteristics on the average cost each patient, the largest cost of gender factors was men (Rp 24.809.433), from age factors in the 56-65 years group (Rp 24.864.528), from the length of hospitalization days in the length of hospitalization >14 days (Rp 48.190.853), from severity factors in heavy severity (Rp 32.145.541), from comorbid severity factors in CCI 3-5 points (Rp 26.170.784), and from the factor of antiviral use in use with remdesivir and favipiravir (Rp 31.843.900). The results obtained are in accordance with studies in Indonesia and China which state that the cost of COVID-19 treatment in men is higher than women (Giusman & Nurwahyun, 2022); As the patient gets older, the cost of treatment increases; the longer the hospitalization results in more treatment received by patients so that the cost of treatment is higher (Giusman & Nurwahyun, 2022); the greater the severity, the greater the cost incurred for the patient (Al Mutair et al., 2022); as well as the cost of patients with comorbidities is higher than patients without comorbidities (Li et al., 2020).

Differences in direct medical costs were significant in age categories, length of hospitalization, severity, comorbid severity and antiviral use. The results of this study are in accordance with the research of Giusman & Nurwahyun. (2022) and *Li et al.* (2020) which states that age, length of hospitalization and severity have a significant effect on the real cost of COVID-19 patients (Giusman & Nurwahyun, 2022; Li et al., 2020). However, it is different from the study at Hospital X which states that there are significant differences between gender and the cost of treatment for COVID-19 inpatients (Giusman & Nurwahyun, 2022).

The data in table IV show that the variables length of hospitalization and degree of severity provide statistically significant results on total direct medical costs., obtained F_{count} (20,209) > F_{table} (2,10) This means that a set of independent variables is shown to significantly affect the dependent variable. The R^2 value of 0,556 means that the independent variable that affects the dependent variable is 55,6% and the remaining 44,4% is influenced by other variables outside the model. One of them is the doctors' behavior in prescribing patterns that can have an effect on medical costs, so there needs to be awareness among all parties related to patient services.

Table III. Differences in Inpatient Cost for COVID-19 Patient at RSA UGM Yogyakarta July-December 2021 Based on Patient Characteristics

Variable	Average Costs *each patient* Rp $\pm$ SD	p-value
Demographic Characteristics		
Gender (n)		
Male (55)	24.809.433 ± 18.051.621	0,628
Women (49)	20.554.325 ± 11.187.221	
Age (n)		
18-45 years (41)	19.319.894 ± 14.056.227	0,023
46-55 years (25)	24.367.294 ± 16.189.231	
56-65 years (38)	24.864.528 ± 14.668.996	
THE (n)		
< 7 days (18)	13,111,892 ± 5,470,541	0,000*
7-14 days (71)	19.539.060 ± 9.457.252	
> 14 days (15)	48.190.853 ± 16.882.868	
Characteristics of the disease		
Severity		
Light weight (4)	19.062.704 ± 6.292.969	0,000*
Average (60)	16.510.638 ± 8.184.689	
Weight (37)	32.145.541 ± 18.269.815	
Critical (3)	29.958.671 ± 22.055.343	
Comorbid Severity		
CCI 0-2 poin (50)	19.308.813 ± 13.497.150	0,011
CCI 3-5 poin (48)	26.170.784 ± 16.235.585	
CCI 6-8 poin (5)	23.237.578 ± 8.842.818	
CCI 9-11 poin (1)	8.323.890	
Antiviral Use		
No antiviral (17)	13.460.114 ± 6.559.61	0,000*
By Favipiravir (18)	16.603.037 ± 9.958.482	
By Remdesivir (58)	25.313.631 ± 15.476.812	
By Remdesivir Favipiravir (11)	31.843.900 ± 18.457.510	

Note: *significant

Table IV. Analysis of Linear Regression of Independent Variables on Total Direct Medical Costs

Variable	T	Sig (α)	F	R	R2
Gender	-0.063	0.950	20.209	0.745	0.556
Age	-1.404	0.164			
Length of Stay (LoS)	7.842^	0.000*			
Severity	4.722^	0.000*			
Comorbid Severity	0,289	0.773			
Antiviral Use	1.939	0.055			

Note: *significant, ^strong correlation

CONCLUSION

The total direct medical cost of inpatient COVID-19 patients for the July-December period in 2021 is Rp 2.346.150.137 with an average costs each patient of Rp 22.559.153,93. The highest proportion of cost components were drug and BMHP costs Rp 958.410.599 (40,85 medical support costs Rp 725.163.700 (30,91%), medical action costs Rp 312.521.838 (13,32%), accommodation costs Rp 196.025.000 (8,35%), medical service costs Rp 147.269.000 (6,28%), and additional costs

Rp 6.760.000 (0,29%). There are differences in the total cost of direct medical costs in terms of age, LoS, severity, comorbid severity, and antiviral use; however, there is no difference when viewed from the sex factor in inpatient COVID-19 patients at RSA UGM Yogyakarta for the July-December 2021 period

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