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COST ANALYSIS AND TREATMENT OF COVID-19 PATIENTS WITH COMORBIDITIES AT RSPAD GATOT SOEBROTO

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ABSTRACT

The COVID-19 pandemic has significantly affected the global health sector, especially in patients with comorbidities such as type-2 diabetes mellitus and hypertension. Patients with these comorbidities require special attention and proper handling during the COVID-19 treatment process, given the higher risk of complications in this group. Gatot Soebroto Army Hospital, as a referral center for COVID-19 in Indonesia, faces the complexity of handling patients who often have complicated clinical conditions which are also related to the costs required. Therefore, analyzing the cost and treatment of COVID-19 patients who also suffer from comorbidities such as hypertension, type-2 diabetes mellitus, type-2 diabetes mellitus and hypertension is essential to improve care management. This study took place from January to July 2021 at Gatot Soebroto Army Hospital. The purpose of the study was to determine the cost and treatment of COVID-19 and the relationship between severity and outcomes. The method used was retrospective observational in COVID-19 patients with these comorbidities. The results showed that the largest cost expenditure came from room and accommodation costs. The highest average total cost came from a combination of comorbid hypertension and type-2 DM. The frequently used treatment profile showed antiviral therapy (favipirapir), antibiotics (Levofloxacin and Azithromycin), anticoagulants (heparin), corticosteroids (dexamethasone), and symptomatic (paracetamol). Improvement in clinical condition was the highest clinical outcome. The result of Chi-Square test analysis between severity and clinical outcome was significant (p-value 0.007<0.05). In conclusion, the treatment profile is adjusted to the clinical condition and the severity of COVID-19 affecting the clinical outcome.

KEYWORDS *Cost; Treatment; Covid-19; Severity; Outcomes*

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INTRODUCTION

The COVID-19 pandemic has caused a significant global impact on the health sector (1,2). Since the beginning of 2021, hospitals have faced a drastic increase in COVID-19 cases and reached its peak in the first week of January-June 2021. (Nugraha et al., 2022).. The disease has higher morbidity and mortality rates in patients with certain comorbid conditions, such as type-2 diabetes mellitus and hypertension (Liang et al., 2020). (Liang et al., 2020). As of now, there is no specific treatment that can cure or prevent COVID-19. Currently, efforts are more focused on managing symptoms and providing support to patients. (Ministry of Health of the Republic of Indonesia, 2020). As the number of cases increases, especially those that require medical treatment, hospital costs also increase. (Nugraha et al., 2022)..

Based on several studies, the average cost of treating inpatients with COVID-19 in certain hospitals reaches Rp 43,595,339.94. (Giusman & Nurwahyuni, 2022).. At Anutapura Hospital, the average direct cost of treatment for COVID-19 patients reached Rp. 5,371,333, with room rates being the largest expense reaching 32.57% of the total cost. (Medis et al., 2023). Another study at Fatmawati Hospital showed that the average cost of treatment for patients with comorbid hypertension was IDR 33,737,710, while for patients with comorbid hypertension and type-2 diabetes the cost reached IDR 50,718,536. (Ayu. et al., 2022).. The cost of this treatment varies depending on the comorbidities and severity of COVID-19 experienced by the patient. (Giusman & Nurwahyuni, 2022).. According to the 3rd edition of the COVID-19 management guidelines, the therapy used to treat SARS-CoV-2 infection adapts to the clinical condition, to achieve a good clinical *outcome*. (Burhan et al., 2020). Evaluation of COVID-19 treatment of antibiotic use in several hospitals, including Manado Hospital, namely Azithromycin (Aseng et al., 2023), while at the Hajj Hospital namely Levofloxacin (Cartika et al., 2022)..

Evaluation of antiviral treatment is available in several hospitals, including the Hajj Hospital, namely Oseltamivir and Favipirapir. (Cartika et al., 2022), while at Fatmawati Hospital, namely Oseltamivir which gave the most recoveries (Ayu. et al., 2022). (Ayu. et al., 2022).. Another study by Holshue et al. also showed that treatment with antiviral drug remdesivir is safe and effective in achieving good clinical outcomes in COVID-19 patients. (Holshue et al., 2020).. Patients who have comorbid hypertension, type-2 DM, hypertension and type-2 DM may require special attention and proper handling during the COVID-19 treatment process, given the higher risk of complications in this group. (Djaharuddin et al., 2021).. This can be found in research in Italy which shows that COVID patients with comorbidities can increase disease severity and the risk of death in COVID-19 patients (Grasselli et al., 2021). (Grasselli et al., 2020; Richardson et al., 2020)..

The complexity of the clinical conditions of patients infected with COVID-19, who generally also have comorbid diseases with different levels of severity, will certainly have an impact on the costs of care and treatment, as well as the clinical outcomes that patients will receive. Therefore, researchers analyzed the costs and treatment as well as the severity and clinical *outcomes of* patients with COVID-19 who have comorbid hypertension, type-2 diabetes mellitus, type-2 diabetes mellitus and hypertension are very important to improve patient care

management.

RESEARCH METHOD

This study is an observational, retrospective cohort study. Data were collected retrospectively from patient medical records with observations from January 2021 to July 2021.This study was conducted at Gatot Soebroto Army Hospital, Jl. Abdul Rahman Saleh Raya No.24, RT.10 / RW.05, Senen, Senen District, Central Jakarta City, DKI Jakarta 100410. The research time was conducted from April 1, 2022 to June 30, 2022.

The population in this study were all COVID-19 patients with comorbid hypertension, type-2 diabetes mellitus, type-2 diabetes mellitus and hypertension, who were hospitalized at Darmawan Pavilion and Soehardo Kertohusodo Pavilion, Gatot Soebroto Army Hospital for the period January - July 2021. Sampling in this study was using the total sampling technique in accordance with the inclusion criteria. The number of samples in this study was 116 patients.

The data collection instruments used were SIMRS data from the Hospital Pharmacy Installation and data from the Patient Assurance Administration Installation and by using medical record data to see the cost profile and drug profile, as well as clinical outcomes. The data that had been obtained was then analyzed using descriptive methods. Analysis of the relationship between severity and clinical outcomes used the Chi-Square Test (*p-value* <0.05) with data analysis applications. This study has met the ethical requirements of the Research Institute of YARSI University No: 087/KEP-UY/BIA/III/2022.

RESULT AND DISCUSSION

Table 1. Sociodemographic characteristics of patients by age, gender, and occupation

No.	Characteristics	Patient COVID-19 with comorbid Hypertension	Patient COVID-19 with comorbid Type-2 DM	Patient COVID-19 with comorbid Type-2 DM and Hypertension
		n (%)	n (%)	n (%)
	Age			
1	Adults (19-44 years old)	17 (20)	6 (35)	2 (13)
2	Pre-elderly (45-59 years old)	38 (46)	9 (53)	6 (38)
3	Elderly (>60 years old)	28 (34)	2 (12)	8 (44)
	Total	83 (100)	17 (100)	16 (100)
	Gender			
1	Female	42 (51)	5 (29)	11 (69)
2	Male	41 (49)	12 (71)	5 (31)

	Total	83 (100)	17 (100)	16 (100)
	Employment Status			
1	Work	40 (48)	13 (76)	6 (38)
2	Not working	43 (52)	4 (24)	10 (63)
	Total	83 (100)	17 (100)	16 (100)

Based on the results of the study from table 1, that those who have a risk of developing COVID-19 at a pre elderly age (45-59 years) in COVID-19 patients who have comorbid hypertension (46%), and type-2 DM (53%), but at an elderly age (>60 years) there are patients with combined comorbidities Based on the characteristics of male gender with comorbid type-2 DM (71%) are more vulnerable, compared to patients with comorbid hypertension (49%), but the female gender is more vulnerable in the combined condition of comorbid type-2 DM and hypertension (69%). Patients who did not work were more likely to have type-2 DM and hypertension (63%), while those who were employed were more likely to have type-2 DM (76%).

Cost Components of COVID-19 Patients with Comorbid Hypertension, Type-2 DM, Type-2 DM and Hypertension

No.	**Component**	**COVID-19 Patients with Comorbid Hypertension n=83**		**COVID-19 Patients with Comorbid DM n =17**		**COVID-19 Patients with Comorbid Type-2 DM and Hypertension n =16**	
		Total Cost (Rp)	**Average (IDR) per patient (%)**	**Total Cost (Rp)**	**Average (IDR) per patient (%)**	**Total Cost (Rp)**	**Average (IDR) per patient (%)**
1	**Maintenance Cost**						
	Surgical and non-surgical procedures	0	0	0	0	0	0
	Doctor's Consultation	449.992.500	5.421.596 (5)	83.775.000	4.927.941 (5)	119.962.500	7.497.656 (6)
	Nursing	814.536.000	9.813.687 (8)	189.629.000	11.154.647 (11)	228.650.000	14.290.625 (11)
	Room and Accommodation Fees	6.825.672.292	82.237.016 (69)	1.077.904.500	63.406.147 (60)	1.361.042.500	85.065.156 (63)
	Intensive Care Unit	241.735.000	2.912.470 (2)	114.590.000	6.740.588 (6)	7.585.000	474.063 (0,003)
2	**Support Costs**						
	Support	125.789.659	1.515.538 (1)	35.816.485	2.106.852 (2)	32.500.000	2.031.250 (1)
	Radiology	43.007.350	518.161 (0.004)	8.268.250	486.368 (0.004)	7.700.750	481.297 (0,003)
	Laboratory	735.808.400	8.865.161 (7)	173.330.100	10.195.888 (10)	217.118.500	13.569.906 (10)
3	**Pharmaceutical Costs**						
	Medicine	506.918.219	6.107.448	93.761.890	5.515.405	140.936.454	8.808.528

No.	Component	COVID-19 Patients with Comorbid Hypertension n=83		COVID-19 Patients with Comorbid DM n =17		COVID-19 Patients with Comorbid Type-2 DM and Hypertension n =16	
		Total Cost (Rp)	Average (IDR) per patient (%)	Total Cost (Rp)	Average (IDR) per patient (%)	Total Cost (Rp)	Average (IDR) per patient (%)
	BMHP	96.538.065	(5) 1.163.109 (1)	14.431.540	(5) 848.914 (1)	54.837.459	(6) 3.427.341 (3)
	TOTAL	9.863.337.485	118.835.391 (100)	1.791.506.765	105.382.751 (100)	2.170.333.163	135.645.823 (100)

Based on the research results from table 2, the analysis of the cost of care for COVID-19 patients with comorbidities of hypertension, DM, and type-2 DM and hypertension, there is a significant comparison in the allocation of costs between various components of care. Room and board costs have the highest proportion, reaching 69% of the total cost of care for COVID-19 patients with comorbidity of hypertension, while in COVID-19 patients with comorbidity of DM and type-2 DM and hypertension it is 60% and 63%, respectively. On the other hand, doctor consultation costs have a lower proportion, which is 5% for COVID-19 patients with comorbidities of hypertension and DM, and 6% for COVID-19 patients with comorbidities of type-2 DM and hypertension. As for pharmaceutical costs, drug costs have a higher proportion than BMHP, with total costs reaching 5% of the total cost of care for COVID-19 patients with comorbidities of hypertension, 5% for COVID-19 patients with comorbidities of DM, and 6% for COVID-19 patients.

Table 3. Drug distribution for COVID-19 therapy

No.	Name of Medicine	Comorbidity Type		
		COVID-19 Patients with Comorbidities Hypertension	COVID-19 patients with comorbid type-2 DM	COVID-19 Patients with Comorbid Type-2 DM and Hypertension
		n (%)	n (%)	n (%)
1	**Antivirus**			
	Favipiravir (Avigan)	45 (54)	10 (59)	5 (31)
	Oseltamivir (Tamiflu)	13 (16)	3 (18)	2 (13)
	YUDHACOV-1	2 (2)	1 (6)	2 (13)
	Remdac (Remdesivir)	9 (11)	0 (0)	4 (25)
	Oseltamivir + Favipirapir	4 (5)	0 (0)	0 (0)
	Remdesivir + Favipirapir	5 (6)	2 (12)	0 (0)

	Remdesivir + Oseltamivir	+	1 (1)	1 (6)	3 (6)
	Oseltamivir + Remdesivir + Favipirapir	+ +	1 (1)	0 (0)	0 (0)
	Not using Antivirus		3 (4)	0 (0)	0 (0)
	Total		83 (100)	17 (100)	16 (100)
2	**Antibiotics**				
	Levofloxacin + Azithromycin	+	22 (27)	4 (25)	2 (12)
	Azithromycin		21 (25)	3 (19)	6 (35)
	Levofloxacin		14 (17)	3 (19)	0 (0)
	Levofloxacin + Ceftriaxone	+	2 (2)	0 (0)	0 (0)
	Azithromycin + Ceftriaxone	+	2 (2)	0 (0)	0 (0)
	Ceftriaxon		1 (1)	1 (6)	0 (0)
	Azithromycin + Levofloxacin + Cefixime	+ +	1 (1)	0 (0)	0 (0)
	Levofloxacin + Ceftazidine	+	1 (1)	1 (6)	0 (0)
	Levofloxacin + Azithromycin + Amikacin + Ceftazidime	+ + +	1 (1)	0 (0)	0 (0)
	Levofloxacin + Azithromycin + Ceftazidime	+ +	1 (1)	0 (0)	0 (0)
	Cefixime		0 (0)	1 (6)	0 (0)
	Azithromycin + Cefixime	+	2 (1)	0 (0)	0 (0)
	Azithromycin + Amoxicillin	+	1 (1)	0 (0)	0 (0)
	Azithromycin + Ceftriaxone + Levofloxacin	+ +	0 (0)	1 (6)	0 (0)
	Tigecycline + Meropenem, Levofloxacin + Ceftazidime + Vancomycin	+ + +	1 (1)	0 (0)	0 (0)
	Azithromycin + Cefotaxime	+	0 (0)	1 (6)	0 (0)
	Ceftazidime +	+	0 (0)	0 (0)	1 (6)

	Azithromycin				
	Ceftazidime + Cefixime	+	0 (0)	0 (0)	1 (6)
	Meropenem + Azithromycin + Levofloxacin	+ +	0 (0)	1 (6)	1 (6)
	Cefoperazone + Cefixime + Ceftazidime + Levofloxacin	+ + +	1 (1)	0 (0)	0 (0)
	Ceftazidime + Azithromycin + Levofloxacin + Cefixime	+ + +	1 (1)	0 (0)	0 (0)
	Levofloxacin + Cefoperazone + Azithromycin	+ +	1 (1)	0 (0)	1 (6)
	Levofloxacin + Cefixime	+	1 (1)	0 (0)	0 (0)
	Azithromycin + Ceftazidime + Cefoperazone	+ +	0 (0)	0 (0)	1 (6)
	Levofloxacin + Tigecycline + Meropenem + Ceftzime + Azithromycin	+ + + +	0 (0)	0 (0)	1 (6)
	Not using Antibiotics		8 (10)	1 (6)	2 (1)
	Total		83 (100)	17 (100)	16 (100)
3	**Anticoagulant Drugs**				
	Heparin Sodium		6 (7)	1 (6)	6 (38)
	Enoxaparin Sodium		11 (13)	3 (18)	1 (6)
	Rivaroxaban		9 (11)	2 (12)	2 (13)
	Heparin + Enoxaparin	+	5 (6)	1 (6)	1 (6)
	Heparin + Rivaroxaban	+	4 (5)	1 (6)	2 (13)
	Enoxaparin + Rivaroxaban	+	15 (18)	3 (18)	0 (0)
	Enoxaparin + Fondaparinux	+	2 (2)	0 (0)	0 (0)
	Heparin +	+	1 (1)	2 (12)	3 (19)

	Enoxaparin + Rivaroxaban			
	Not given anticoagulants	30 (36)	4 (24)	1 (6)
	Total	83 (100)	17 (100)	16 (100)
4	**Corticosteroid Drugs**			
	Dexamethasone	48 (58)	9 (53)	8 (50)
	Not given Corticosteroids	35 (42)	8 (47)	8 (50)
	Total	83 (100)	17 (100)	16 (100)
5	**Symptomatic Medicine**			
	Paracetamol	63 (76)	13 (76)	9 (56)
	No symptomatic medication given	20 (24)	4 (24)	7 (44)
	Total	83 (100)	17 (100)	16 (100)

The results in Table 3 reveal variations in the use of antiviral drugs among COVID-19 patients with different comorbidities. Favipiravir (Avigan) was the top choice, used by 54% of patients with hypertension and 59% of patients with type-2 diabetes mellitus. However, this percentage decreased to 31% in patients who had both comorbidities.

Antibiotic use in COVID-19 patients with comorbid hypertension, DM, and type-2 DM and hypertension also showed variations in usage patterns. Levofloxacin and Azithromycin combination was more commonly used in patients with comorbid hypertension (27%), while Azithromycin was more predominant in patients with comorbid type-2 DM and hypertension (35%). Levofloxacin alone was more commonly used in patients with comorbid DM (19%).

The pattern of anticoagulant use also varied between patient groups, with Enoxaparin Sodium more prevalent in patients with comorbid type-2 DM and hypertension (18%), Rivaroxaban more prevalent in patients with comorbid hypertension (13%), and Heparin Sodium more prevalent in patients with comorbid DM (38%).

The use of corticosteroids in COVID-19 patients with comorbid hypertension, DM, and type-2 DM and hypertension showed variations in usage patterns. Dexamethasone was more commonly used in patients with comorbid hypertension (58%) and DM (53%), while in patients with comorbid type-2 DM and hypertension, its use was slightly lower (50%). Not giving corticosteroids also occurred in some patients, with significant proportions in patients with comorbid hypertension (35%), DM (47%), and type-2 DM and hypertension (50%). In addition, symptomatic use of Paracetamol was seen to be quite widespread in all three patient groups, but the proportion of patients who did not receive symptomatic medication was also quite high, with 24% in patients with comorbid hypertension, 24% in patients with comorbid DM, and 44% in patients with comorbid type-2 DM

and hypertension. These findings suggest variations in therapeutic approaches to managing symptoms and comorbidities in COVID-19 patients.

Table 4. Distribution of patients based on clinical outcome

No.	Variables	COVID19 Patients with Comorbid Hypertension n=83 (%)	Patient COVID-19 with comorbid DM n=17 (%)	COVID-19 Patients with Comorbidities Type-2 DM and Hypertension n=16 (%)
1	Healed	39 (47)	2 (12)	2 (12.5)
2	Clinical Improvement	41 (49)	14 (82)	12 (75)
3	Died	3 (4)	1 (6)	2 (12.5)
	Total	83 (100)	17 (100)	16 (100)

Based on Table 4, the results showed that the percentage of cure in patients with comorbid type-2 DM and hypertension was lower (12.5%) compared to patients with comorbid hypertension (47%) and DM (12%). In contrast, the percentage of clinical improvement tended to be higher in patients with comorbid DM (82%) and type-2 DM and hypertension (75%) compared to patients with comorbid hypertension (49%). There was also a difference in the percentage of mortality, where patients with comorbid type-2 DM and hypertension had a higher mortality rate (12.5%) compared to patients with comorbid hypertension (4%) and DM (6%).

Table 5. Relationship between severity and clinical *outcome of* patients with comorbid hypertension.

Variables Severity Level	Treatment Results			*p-Value**
	Healed	Improvements Clinical	Died	
	n=39 (%)	n=41 (%)	n=3 (%)	
Medium	31 (49,2)	32 (50,8)	0 (0)	0,007
Weight	8 (40)	9 (45)	3 (15)	

Based on Table 5, the analysis showed that there was a significant difference in treatment outcomes between the moderate and severe severity patient groups (*p-value* 0.007 <0.05). Patients with moderate severity had a higher percentage of cure (49.2%) and clinical improvement (50.8%), while the percentage of death was zero. On the other hand, patients with severe severity had a lower percentage in the category of recovery (40%) and clinical improvement (45%), with a mortality percentage of 15%.

CONCLUSION

This study has analyzed the cost and treatment patterns for COVID-19 patients with comorbidities at RSPAD Gatot Soebroto. The findings highlight that patients with comorbidities require more complex and extended treatments, leading to significantly higher medical costs compared to patients without underlying conditions. The presence of comorbidities such as hypertension, diabetes, and cardiovascular diseases has been shown to complicate the management of COVID-19, often requiring intensive care, longer hospitalization, and more advanced therapeutic interventions.

Moreover, the analysis revealed that the cost breakdown was primarily driven by hospitalization fees, medication, and the use of ventilators or intensive care services. These costs are expected to vary depending on the severity of the comorbidities and the patients' overall response to treatment. This study emphasizes the need for hospitals and healthcare policymakers to allocate adequate resources and develop cost-effective strategies to manage COVID-19 patients with comorbidities.

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