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Pharmacotherapy Analysis for Hospitalized Patients with COVID-19 (Prescriptions, Costs, and Outcomes)

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Abstract

Background: The COVID-19 pandemic has caused many economic problems worldwide, in Iran as well, causing Hospitals to face many financial problems.

Objectives: Based on documented data on pharmacotherapy, costs, and its effectiveness, this study aimed to analyze the costs and outcomes of hospitalized patients with COVID-19 under pharmacotherapy in Iran.

Methods: This research was a retrospective analytical descriptive study. Relevant data of the COVID-19 hospitalized patients' were extracted from the Hospital's Medical Records Department. All items of direct medical costs, such as visits, nursing services, consuming materials, laboratories, imaging, medical operations, medications, and beds, were extracted by reviewing COVID-19 hospitalized patients' files in different wards of the Shohada Ashayer Hospital in Khorramabad city in 2021.

Results: A total of 399 patients were examined in this study. The total direct medical costs per patient was 338.63 US$. Of note, the highest cost was related to medicine (32.56%), more than the cost of bed (22.77%). The most commonly used drugs were Lopinavir (95%) and Azithromycin (90%), and the highest medicine cost per patient was related to Immunoglobulin (64.32 US$) and Remdesivir (46.91 US$).

Conclusion: Medicine and hospitalization costs accounted for the largest share of the total treatment costs of patients. Therefore, reducing bed costs requires home treatments and outpatient injections. Furthermore, due to rising drug costs, prescriptions should be based on standard treatment protocols.

Keywords: Azithromycin, Cost analysis, COVID-19, Hospitalized patients, Lopinavir, Medicines, Outcomes, Remdesivir

1. Background

Coronavirus was first detected in China in July 2019 and the World Health Organization announced a global epidemic. The virus was dangerous and deadly among the previously identified species and quickly affected all countries around the world (1, 2). Mortality and the high prevalence of the disease caused unparalleled disruption in people's lives (3). The disease had various socio-economic and cultural effects on different strata of societies (4). One of the economic consequences of this disease was the severe recession and unemployment in all countries, especially developed countries in Europe and the United States; therefore, its economic effects increased direct costs of treatment and indirect costs, such as job loss or reduced income (5, 6). In terms of COVID-19 and its hospital costs, it affected the health system and other sectors, and politicians paid attention, and budgets were allocated to its treatment (6). The staggering costs of treating the disease along with its high prevalence caused the most severe financial pressures on hospitals (7, 8). Considering the rising costs of medicine and other hospital expenses and limited resources, health cost analysis for optimal cost management and correct decision-making is undeniable (5). Due to the novelty of the covid-19 pandemic accordingly, new treatment methods were used around the world (9, 10), but, there is no correct estimate of the treatment costs of this disease, so policymakers and managers of health systems are uninformed in relation to accurate calculation of the costs and budget, so it is necessary to make a scientific value of the cost of treatment for hospitals and patients (1, 11). In different studies, depending on the severity of the disease and the duration of hospitalization, the patients' expenses varied as were calculated from 700 to more than 2,000 USD (12-14). It is possible to prevent the waste of many resources by proper cost analysis (15, 16).

2. Objectives

Therefore, the purpose of this study was a comprehensive analysis of all medicinal and treatment costs of patients admitted to the Shohada Ashayer Hospital as the largest and first central hospital for the treatment of COVID-19 patients in Lorestan province in Khorramabad, Iran. This hospital has more than 20 specialized and sub-specialized departments and more than 350 active beds, which is the largest teaching hospital in Lorestan, Iran.

3. Methods

This research was a descriptive-analytical and cross-sectional study. It examined the total costs and

the consequences of hospitalized patients in the Central Hospital for the treatment of COVID-19 patients in Khorramabad. A total of 399 patients who met the inclusion criteria (No transfer from other hospitals, having a relatively stable state of health, absence of serious conditions at the time of research, the primary cause of hospitalization was COVID-19 and no other diseases) were included in the study in summer 2021. The method of data collection was census so that all eligible patients were included in the study, so sampling was not done, then the data were analyzed at the end of 2021. All patients' expenditures were extracted from the medical and accounting documents. The mentioned documents included information such as bed, medication, Imaging, laboratory costs, nursing, counseling, and visits.

3.1. Statistical Analysis

The SPSS (Version 21; IBM SPSS Statistics for Windows) and Microsoft Excel were used for data entry and analysis. The variables described as frequency (%) or mean ± standard deviation. Total costs were calculated based on Rial currency. Then, despite the Iran's high inflation rate and variation in exchange rates, the data were converted into dollars (The official exchange rate on this date: 1 Dollar-USD equals 300,000 Rials). Independent sample t-test, Chi-Square test and Pearson correlation were used for data analysis. A $P < 0.05$ was considered statistically significant.

3.2. Ethics Approval

The present study was carried out in the Shohada Ashayer Hospital, affiliated to Lorestan University of Medical Sciences, Khorramabad, Iran. (Ethical code: IR.LUMS.REC.1399.377).

4. Results

Table 1 shows the patients demographic and outcome data. The mean age of patients who died was higher than patients who were cured (P=0.001). Although the dead patients were hospitalized longer, there was no significant difference between the dead and cured patients (P=0.330; Table 1).

Table 2 displays that the total direct cost of treatment per patient was 338.63 USD. The cost of medicine is 43.89%, and it is the largest share of the total cost. In addition, the most used medicine was Lopinavir (95% of patients with 27 doses); then. Azithromycin (90%). Immunoglobulin and Remdesivir had the highest costs (44.79% and 32.6%, respectively; [Table 3 and Figure 1].

Table 1. Outcome of treatment of the hospitalized patients

		Total (n=399)	Outcome		*P*-value
			Cured N(%) 365(91.5%)	Dead N(%) 34(8.5%)	
Age of the patient (year)		52.8 ± 15	51 ± 15	64 ± 17	0.001*
Duration of hospitalization (day)		9.3 ± 6	9 ± 5	12.2 ± 8	0.330*
Sex	Male	215(54%)	193(90%)	22(10%)	0.186**
	Female	184(46%)	172(94%)	12(6%)	

* Independent sample t-test, ** Chi square test

Table 2. Distribution of all direct medical cost items of each patient with COVID-19 (USD)

Items of costs		Cost (USD)	Percent of all
1	Visit	17.40	5.14
2	Nursing services	6.75	1.99
3	Consuming materials (medical and non-medical)	7.87	2.32
4	Laboratory	10.68	3.15
5	Imaging	5.34	1.58
6	Medical operation	0.89	0.26
7	Medication	148.62	43.89
8	Bed	64.17	18.95
9	other costs	76.90	22.71
Total		338.63	100.00

*Other costs include the cost of medical consultant, rehabilitation, anesthesia fee

Table 3. Cost of medicine items of each patient with COVID-19 (USD)

Items of medicine		Mean doses per patient	Percentage of prescribed patients	Cost (USD)	Percent of total cost
1	Azithromycin	9	90	0.35	0.24
2	Dexamethasone	13	79	0.81	0.56
3	Lopinavir / Ritonavir	27	95	22.54	15.70
4	Interferon beta	2.5	22	6.77	4.71
5	Remdesivir	4.7	8	46.91	32.67
6	Favipiravir	19	8	1.78	1.24
7	Hydroxychloroquine	5.9	6	0.12	0.08
8	Immunoglobulin	15.1	5	64.32	44.79
Total		Mean=12	--	143.59	100

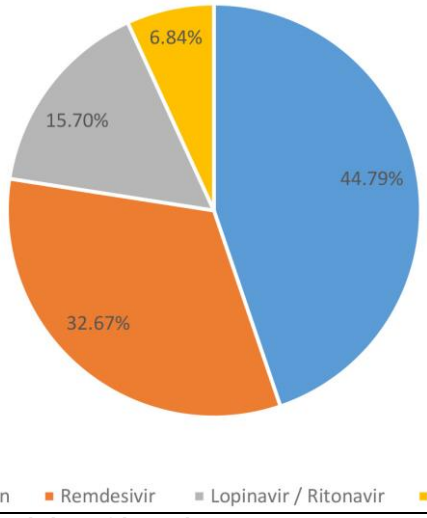

Figure 1. The share of each drug of the total cost
*Other drugs with amounts less than 15%

Table 4 manifests that no significant relationship was observed between gender and all cost variables. A significant relationship was observed between costs and outcome of treatment, and that the drug and total cost in dead patients was higher than the treated patients.

Table 4. Relationship between total and medicine cost with patients' demographic and outcome

		Total cost mean ± SD	*P*-value	Medication cost mean ± SD	*P*-value
Sex	Male	337.4 ± 57.2	0.921*	145.6 ± 45.6	0.950*
	Female	342.7 ± 67.1		140.9 ± 58.1	
Patient outcome	Cured	225.9 ± 88.9	0.025*	63 ± 41.5	0.031*
	Dead	879.6 ± 245.6		399 ± 123.7	
Age	Pearson correlation coefficient	0.277	0.001**	0.193	0.006**
Length of stay	Pearson correlation coefficient	0.874	0.001**	0.788	0.001**

* Independent sample t-test, ** Pearson correlation

5. Discussion

The results of the present study showed that the total direct cost of treatment per patient was 338.63 USD. The cost of medicine is 43.89%, which is the largest share of the total cost. In this regard, in the study of examining the costs of hospitalized patients in Addis Ababa, the cost items included personnel salaries, medical supplies and equipment, medicine, equipment services, and capital costs. On average, the hospitalization cost of each patient was 1,473 USD, and depending on the type and severity of the disease (i.e., severe, moderate, and mild), it was calculated as 2,637, 1,545, and 1,266 USD, respectively (12, 14). The average cost of hospitalized patients in this study compared to Ethiopian studies shows a significant difference based on dollars in the two studies. The main reason for this difference may be the high exchange rate and inflation in Iran. Furthermore, the number of male patients was more than female ones, and the mortality rate was higher in men. Moreover, dead patients were older. It can be concluded that as age and length of hospital stays increase, total and medicine costs increase as well. The results of the present study confirmed that the cost of medicine and the cost of a bed are the highest costs of all direct medical costs, respectively. Lopinavir and Azithromycin had the highest rates of use in the cured patients, and the average cost of both was more in the cured individuals than in fatalities. Immunoglobulin was the most used medicine in dead patients. The average cost of Immunoglobulin, Remdesivir, and Dexamethasone was significantly higher in the dead. In this study, the cost of medicine accounted for the largest share of the total direct cost of treatment (43%); this result was approved by a study by Jin, where medicine costs were ranked first (17), in other studies, pharmaceutical costs accounted for a significant share of total medical costs (4, 18). Therefore, in a study with the aim of investigating the management of COVID-19 costs in Myanmar, depending on the type of symptoms of the disease, from the severity of the symptoms to moderate and weak, it was calculated as 4290, 869, and 717 USD, respectively (13). Lopinavir and Azithromycin are the most widely used drugs in the treated patients. The number of medication items in improved people was more than the dead. But the dexamethasone was the most commonly used medicine in patients who died. The average cost of Dexamethasone,

Remdesivir, and Immunoglobulin were significantly more in the dead. The maximum cost of the drug is related to the two drugs, Immunoglobulin and Remdesivir. In a study performed by Jin conducted in 31 regions in China, medication and hospitalization costs were calculated as an important part of the total costs (17). As emphasized in various studies, drug and hospitalization costs were a significant part of COVID-19 treatment costs. In another study in Kashan in Iran, the average cost of hospitalized patients in two hospitals, were obtained at 25.7$ and 91.88$ for bed and medicine, respectively. Moreover, the mean of duration of hospitalization was six days (19). Due to the increase in the length of hospital stay in this study, compared to the study in Kashan, reducing costs can also be associated with reduced hospitalization and increased outpatient treatment. According to a study carried out by Congly, the cost of different treatment strategies for patients varied from 11,000 to 13,000 dollars in patients with severe condition and long hospitalization in intensive wards (6). In New York, variable costs were calculated depending on the type of drug, treatment strategy, and the quality of life (20). Other studies have shown that depending on the type of treatment and a QALY obtained, the cost of treatment varies from 14,000 to 70,000 for conventional treatments (21). In a study done by Rae, the total cost of hospitalization according to the type of standard care or non-invasive ventilation was calculated as 13,767 and 34,223 dollars, respectively (22), and depending on the type of other treatments, different values were reported (8, 22). As can be seen in these comparisons, there is a significant difference in Iran's expenditures with other countries; however, this difference refers to the structure of the economy and income and exchange rates. The share of drug item costs in these studies appears to be similar (23).

5.1. Limitations of the Study

To increase the validity of the results, strict inclusion criteria were used, which reduced the number of participants under study. Additionally, just hospitalized patients of a Medical and Educational Center, the largest center in the province, were entered in the study.

6. Conclusion

By increasing the length of hospital stay, the cost of hospitalization and medication increases. To reduce this amount of hospitalization costs, it seems that we should move towards reducing the length of hospitalization and increasing ambulatory care. In addition, an increase in the non-standard drug administration was observed. Consequently, it is important to pay attention to the rational use of the medicine in accordance with the standard treatment protocols and supervision of the clinical pharmacist.

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Footnotes

Conflicts of Interest: The author confirms that there were no conflict of interests.
Authors' Contributions: HH: Conceptualization and design, method, analysis and interpretation of the data, writing original draft, writing review, and critical revision of the article.

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