The Effects of Covid-19 on Financial-Economic and Performance Efficiency of Hospitals

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Abstract

   Background: During the pandemic of COVID-19, the function and performance of hospitals have been affected by various economic-financial and management aspects. The aim of the current study was to assess the process of therapeutic care delivery and also the economic-financial functions of the selected hospitals before and after COVID-19.

   Methods: This research is a descriptive-analytical study and a cross-sectional-comparative study in terms of time, and it was conducted in several selected teaching hospitals of Iran University of Medical Sciences. A purposeful and convenient sampling method was used. The data has been collected using the standard research tool (standard checklist of the Ministry of Health) in the two areas of financial-economic and healthcare performance (such as Data of financial and economic indicators such as direct and indirect costs, liquidity ratio and profitability index as well as key performance indicators of hospitals such as bed occupancy ratio (BOR; %), average length of stay (ALOS), bed turnover rate (BTR), bed turnover distance rate (BTIR) and hospital mortality rate (HMR), physician-to-bed ratio and nurse-to-bed ratio) of hospitals in two times before and after the outbreak of COVID-19 (time period 2018 to 2021). The data was collected from 2018 to 2021. Pearson/Spearman regression was used for the evaluation of the relationship between variables using SPSS 22.

   Results: This research showed the admission of COVID-19 patients caused a change in the indicators we evaluated. ALOS (-6.6%), BTIR (-40.7%), and discharge against medical advice (-7.0%) decreased from 2018 to 2021. BOR; % (+5.0%), occupy bed days (+6.6%), BTR (+27.5%, HMR (+50%), number of inpatients (+18.8%), number of discharges (+13.1%), number of surgeries (+27.4%), nurse-per-bed ratio (+35.9%), doctor-per-bed ratio (+31.0%) increased in the same period of time. The profitability index was correlated to all of the performance indicators except for the net death rate. Higher length of stay and turnover interval had a negative effect on the profitability index while higher bed turnover rate, bed occupancy ratio, bed day, number of inpatient admission, and number of surgery had a positive effect on the profitability index.

   Conclusion: It has been shown from the beginning of the COVID-19 pandemic, the performance indicators of the studied hospitals were negatively affected. As a consequence of the COVID-19 epidemic, many hospitals were not able to deal with the negative financial and medical outcomes of this crisis due to a significant decrease in income and a double increase in expenses.

Keywords: COVID-19 disease, Health economics, Hospital performance, Financial-economic index, Efficiency, Cost, Revenue

Cite this article as: Ahangar A, Mohammadi F, Tehrani-Banihashemi SA, Joulani M, Safarani S, Nojomi M. The Effects of Covid-19 on Financial-Economic and Performance Efficiency of Hospitals. *Med J Islam Repub Iran.* 2023 (25 Apr);37:43. https://doi.org/10.47176/mjiri.37.43

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↑*What is "already known" in this topic:*
Profit margins in hospitals have been low and many hospitals had financial problems. When the COVID-19 pandemic hit, hospitals had to shut down all but the most urgent non-COVID care. The long-term effects of COVID-19 on the efficiency and financial performance of the hospital are not clear yet.

→*What this article adds:*
The hospital's performance indicators declined in the first year of the pandemic but increased in 2021. The results of evaluating financial-economic indicators showed the profitability index dropped in 2020 and increased in 2021. After the COVID-19 pandemic, the performance and financial indicators worsened in the first year but then improved.

Introduction

In today's world, the health sector is one of the main sectors of a country's economy and is considered an infrastructure sector in the process of economic development, which is why most countries find it important to pay special attention to this sector (1). Health is one of the key indicators of development and social welfare, and the health sector is considered to be one of the most important service sectors (2). Health expenditure in the world is facing increasing growth. Global healthcare costs constitute approximately 9.3% of the Gross Domestic Product (GDP) (3). In most developing countries, about 5 to 10 percent of government spending is allocated to the health sector (4). For any organization, a positive profit margin is essential for long-term survival. Few organizations can support themselves for the longterm when total expenses exceed total revenues. Compared to other industries, profit margins in healthcare have typically been very low and many hospitals had financial-economic problems (5). One of the biggest concerns related to the coronavirus disease of 2019 (COVID-19) pandemic is the financial and economic impacts of the disease on healthcare financing and budgeting systems with a focus on efficiency and productivity indexes. COVID-19 is an expensive disease to treat. In the US, the estimated cost of treating individuals requiring inpatient services was estimated $24,800 per patient (6). Regarding the personal protective equipment (PPE) needed to fight the pandemic, one study estimated an almost 700% increase in cost spent for PPE such as gowns, hand sanitizer, masks and gloves (7). When the COVID-19 pandemic hit, hospitals had to shut down all but the most urgent non-COVID care. The result has been a dramatic drop in the bed exchange rate and revenue while expenses remain high. The long-term effects of COVID-19 on the efficiency and financial performance of the hospital are not clear yet (8, 9).

The rapid increase in the number of patients with COVID-19 is a threat to the efficiency of hospitals and hospital beds (10). In such circumstances, hospitals use restrictive monetary policy, expansionary policy or a combination of both methods. Researches show that in situations where there is a lot of referrals of COVID-19 patients, public hospitals are more likely to use restrictive monetary policy to manage and control the cost and spending of unnecessary funds and switch hospital beds from patients with elective treatment procedures to patients with COVID-19. in this case they can manage a high volume of patients with COVID-19. On the other hand, adopting expansionary policies emphasizes the development of variety, quantity and quality of hospital services for revenue growth and hospital efficiency. During the COVID-19 pandemic, these policies include the development and introduction of Para-clinical imaging centers, virology laboratories for COVID-19 diagnostic tests (PCR), and creation of ambulatory center (less than 6 hours) for outpatient Remdesivir Injection Drug (11-14).

The investigation of hospital performance indicators is one of the most important topics in hospital economics before and after the outbreak of the COVID-19 disease. To our knowledge, this is the first study reporting changes in performance and financial indicators during the COVID-19 pandemic and evaluating their relationship in Iran. The performance indicators of hospital care and treatment are such as Bed Occupancy Rate (BOR), average patient Length of Stay (LOS), admission rate, discharge rate, mortality rates, outpatient and inpatient admission rates, surgery rates etc (15, 16). Economic-financial performance indicators such as liquidity index, resource efficiency, cost-revenue ratios, profitability and resource consumption management, are ultimately the financial balance of hospitals. These indicators are one of the most important criteria for evaluating the performance and, in a way, the evaluation of hospitals' efficiency. The aim of the current study was to determine the economic-financial and clinical performance before and during the COVID-19 pandemic period to evaluate the effect of the COVID-19 pandemic on economic-financial and clinical performance and the correlation between their changes in selected hospitals of Iran University of Medical Sciences (IUMS). Considering that the subject of this article is an interdisciplinary field including health economics, hospital management and epidemiology of the covid-19 disease, and so far, a study from the perspective of hospital economics in the application of the subject and based on evidence to economic-financial effects. The clinical study of this disease has not been done on the performance of hospitals in Iran. In this sense, it is distinctive and innovative.

Methods

This study was retrospective, descriptive-analytical research and was performed in four selected teaching hospitals of IUMS, Tehran, Iran. The sample of the research was the data of the financial and clinical performance key indicators of care of all the inpatient and outpatient departments located in these hospitals of IUMS. The time period of the study before (2018-2019) and during the COVID-19 pandemic (2020-2021) was selected. The method used to select financial and performance indicators was based on a Delphi interview with 15 experts and specialists from the fields of health economics, nursing and hospital management. In this study, financial and economic indicators in the areas of direct and indirect revenue sources and use of funds include direct and indirect costs, liquidity ratio, and profitability index. And also hospital key performance indicators such as Bed Occupancy Ratio (BOR; %), Average Length of Stay (ALOS), Bed turnover rate (BTR), Bed turnover interval rate(BTIR), and Hospital mortality rates(HMR), doctors per bed ratio, and nurses per bed ratio were all taken into account. In this study, the standard checklist of budget and financial efficiency (Including financial and economic indicators such as Human resources and assets, expenses, incomes, financial flow, and how to distribute, allocate and exploit hospital resources) and also the standard checklist of performance key indicators of the studied hospital (included BOR, ALOS, BTR, BTIR, HMR) were used for data collection. In this study, the data was collected from the checklists of research variables (financial-economic and performance indicators of the hospital). It is necessary to

mention, regarding the selection of research variables, such as clinical, care and economic-financial performance indicators of the hospital, and also it is necessary to mention that the team of authors with retrospective review and systematic review of previous related studies and review of other related studies in the country such as Ahangar et al., 2019 in Tehran University of Medical Sciences, the study of Sooraki and Abbasi (2021) and other similar studies were first calculated into a list of variables of financial-economic and hospital care indicators, and then in the next step, the Adelphi technique method and expert panel Hospital economics and management (20 experts) were included in the list of the mentioned variables for weighting and prioritization. And finally, the relevant indicators and variables were identified and validated and reliable, and finally, these variables were investigated and analyzed to investigate the effects of the COVID-19 disease on the economic-financial and operational aspects of hospitals. In this study, the data collected from the checklists of research variables (financial-economic and performance indicators of the hospital) were reported in two descriptive and analytical methods. In this way, in addition to evaluating the situation and trends of the aforementioned indicators, it was also investigated to analyze the relationships and influence between the variables and the main indicators of the research. In this study, the main financial and economic indicators of the hospital include income (direct/indirect), cost (direct/indirect), liquidity index and also profitability (income to cost). In this way, regarding the cost index of the whole hospital before and after the disease of COVID-19, a comparative study and analysis were done. What was the trend? It is necessary to mention all the direct costs related to all types of services (outpatient, hospitalization and surgery, diagnostic), including the costs of salaries and benefits and the efficiency of the medical, paramedical and nursing staff, the consumption costs of hotels, drugs and consumable items of departments and paraclinical units has been included, which are called variable costs according to the economic classification. Especially considering that among the consumption costs, the costs of oxygen therapy for patients, which have a double financial burden in terms of providing oxygen and medical gases needed by patients suffering from COVID-19, as well as the cost of repairs and consumption of related respiratory equipment such as ventilators, etc. is placed Regarding indirect costs, including administrative support costs and overheads that are not directly related to the service, But based on the classification of economic costs, it is considered as a part of fixed costs, which during the COVID-19 disease period, based on the economic principles of production theory, when the total production curve of the hospital (especially elective surgeries and hospitalizations of other general and surgical patients) decreases. It is found that the average fixed cost has become larger and larger and the economic, financial burden and in a way, the total cost of the scale of hospital production or service is increasing, while before COVID-19, the average fixed cost and total overhead per hospital production/service are increasing. It has been smaller and less. In the case of indirect costs, the costs of absenteeism due to

hospital staff being infected with COVID-19 were estimated and calculated for each day of absenteeism using the cost-sharing method and are among the indirect costs or the cost of lost opportunities. The cause of illness or death was taken into account from the point of view of the hospital staff who provided the service. Regarding how to calculate the total income of the hospital, it includes direct incomes from providing all kinds of outpatient services, hospitalization, surgery, and other diagnostic and therapeutic services, etc., which are generally incomes from elective surgeries and hospitalization of surgical patients (occupied day beds) and Also, the outpatient and clinic visits of patients who are not suffering from or suspected of having COVID-19 have decreased, especially in the first year of the outbreak of the disease, the amount of income that can be imagined based on the retrospective information before COVID-19 (the year 2018) is considered as the base year with Considering the average tariff growth in the following years (2019-2021) was calculated and since it has not been realized due to the prevalence of the mentioned disease, under the title of lost opportunity cost (in terms of direct income that could be realized but was not realized), in the cost index. This study was included.

In this study, the inclusion and exclusion criteria include cases such as general or specialized teaching hospitals, during the period of the COVID-19 disease, with cases of outpatients or inpatients with COVID-19, affiliated with the Iran University of Medical Sciences, government hospitals, the possibility of access have been to financial, clinical and care data.

The study protocol with the code number IR.NIMAD.REC.1399.269, was approved by the Ethics Committee of the National Institute for Medical Research Development (NIMAD).

Statistical analysis

Indicators were calculated for total hospital beds and were reported for 2018 to 2021. The Kolmogorov-Smirnov Goodness of Fit Test (K-S test) was used to check the normality of the data. In order to evaluate the relationship between financial and performance indicators, Pearson/Spearman statistical regression test was used using SPSS version 22 software, and the significance level of statistical tests in this research was considered less than or equal to 0.05.

Results

In the beginning, it is necessary to mention that the findings of this article have a sequence and order. Thus the descriptive findings include the descriptive statistical indicators of the demographic characteristics of the research environment. The descriptive findings of the main financial-economic variables and clinical care performance were stated. Analytical findings include data normality tests (Kolmogorov-Smirnov), Pearson/Spearman regression tests. Finally, the findings of this study were compared with the findings of other related studies

There were a total of 1460 active beds in general and specialized hospitals that were evaluated. Table 1 shows the

Table 1. General characteristics of the studied hospitals

Hospital	Type of activities	Specialty	Hospital accreditation level	Active beds	Percent of total beds
Number 1	Education, Research, Treatment	General	Grade 1	660	45%
Number 2	Education, Research, Treatment	General	Grade 1	480	33%
Number 3	Education, Treatment	Specialized	Excellent	160	11%
Number 4	Education, Treatment	Specialized	Grade 1	160	11%

Table 2. Hospital performance indicators before and after COVID-19 pandemic in 2018, 2019, 2020, and 2021 and their change trend

Year	Before COVID-19		During/after COVID-19		Trend (2018-2021)
Performance Key Indicators	2018	2019	2020	2021	
Bed Occupancy Ratio(BOR)	84.1%	86.4%	70.2%	88.3%	Increase
Average Length of Stay(ALOS)	6.1	6.3	8.2	5.7	Decrease
Occupy Beds days	375324	380425	374343	399987	Increase
Bed Turnover Interval Rate (BTIR)	1.4	1.2	2.5	0.83	Decrease
Bed Turnover Rate(BTR)	4.0	4.3	3.6	5.1	Increase
Mortality Rate	3.0	3.1	5.8	4.5	Increase
Number of inpatients	50394	52945	43973	59896	Increase
Number of discharges	52653	52685	43962	59567	Increase
Number of surgeries	31323	35434	30456	39898	Increase
Number of discharge against medical advice	6593	7784	5236	6129	Decrease
Nurse-per-bed ratio	0.89	0.95	1.06	1.21	Increase
Doctor-per-bed ratio	0.29	0.31	0.36	0.38	Increase

demographic characteristics of the selected hospitals of Iran University of Medical Sciences. The hospitals' financial-economic and performance indicators and the trend of these changes were evaluated and analyzed by regression analysis from both qualitative and quantitative aspects in two time periods (before and during) of the COVID-19 pandemic. According to Table 2, the findings show that during the period of 2018-2019 (before COVID-19) to 2020-2021 (after COVID-19), the hospital's key performance indicators such as bed occupancy rate (BOR), total bed day, Average length of stay rate (ALOS), net death rate, inpatient admission count, hospital discharge count, surgery count declined at the first year of COVID-19 pandemic but has been increased in 2021. Human resources efficiency indicators such as the nurse-per-bed ratio and the doctor-per-bed ratio have increased constantly. Indicators such as the average length of stay (ALOS), bed turnover interval (BTIR), and discharge against medical advice, despite the increase in the first year of the pandemic, have a decreasing trend in total. And finally, the net death rate increased during the COVID-19 pandemic (Table 2). The decrease or increase of changes in all the mentioned indicators from 2018 to 2021 showed that the performance improvement process and its results are highly dependent on the decisions and key actions of the hospital's management team. So that the optimal management of resources and increase of incomes are based on economic techniques (efficiency due to scale, appropriate management of resources-expenditure of funds) in the hospital. It is interesting to note that the death rate increased in the year before Covid-19 and after Covid-19, which can be analyzed as follows in the studied hospitals (as one of the country's important referral centers for internal and infectious diseases such as Hospitals No. 1 and No. 2 with about 78% of the studied hospital beds) during the outbreak of the COVID-19 disease, there was a large volume of inpatient and outpatient referrals of suspected and infected patients with COVID-19, especially in 2020 and 2021, most of the inpatient beds and even special care

beds had patients with severe COVID-19 pneumonia and underlying diseases. Therefore, the probability of death in these hospitals increased.

The results of evaluating financial-economic indicators showed that both costs and revenues increased significantly after COVID-19, but the profitability index dropped in 2020 and increased in 2021. The financial liquidity index constantly increased in the study time. Finally, it has led to multiple growths of financial liquidity indicators. This means that in practice, the production line and service delivery in a hospital depends on the amount of liquidity in adjusting input sources and output costs. One of the important findings in Table 3 (indices of economic and financial results) of the studied hospitals is the profitability index of the hospitals, which was about 1.09 in 2018, with the occurrence of the pandemic phenomenon of COVID-19, causing a significant increase in the fixed and especially variable costs of hospitals (such as costs of personal protective equipment (PPE), facemasks, respirators, pharmaceutical medicines, and other various raw materials, Oxygen therapy). All these cases ultimately caused the financial balance of the hospital to become more negative and subsequently a significant decrease in the profitability index. Although, with the subsidence of the COVID-19 disease in 2021, the financial balance and the profitability index were restored and improved to some extent (Table 3). In order to test the normality of the variables, we used one sample K_S test. The result showed that the variables had normal distribution so we used Pearson linear regression to test the correlation between hospital performance and financial-economic indicators.

According to Table 4, the results of the Pearson correlation analysis showed that direct costs had significant positive correlations with average length of stay, bed turnover rate, turnover interval, bed day, and number of surgery. In addition, direct revenue had significant positive correlations with bed turnover rate, bed occupancy ratio, bed day, number of inpatient admission, and number of surgery.

Table 3. Hospital Financial-economic indicators and COVID-19 pandemic in 2018, 2019, 2020, and 2021 and their change trend (Numbers per million units)

Financial-economic indicators	Year	Before COVID-19		During/after COVID-19		Trend (2018-2021)
		2018	2019	2020	2021	
Revenue	Direct revenue	144,905,382	168,783,971	145,776,976	333,067,754	Increase
	Indirect revenue	1,934,172	2,149,080	4,514,880	3,642,240	Increase
Costs	Direct costs	129,966,930	154,034,880	316,256,960	391,951,740	Increase
	Indirect costs	2,733,372	3,037,080	5,167,080	6,702,481	Increase
Financial liquidity ratio		4,569,588	6,580,207	5,346,418	8,819,305	Increase
Profitability index		1.10	1.08	0.46	0.84	Decrease

Table 4. Matrix of correlation coefficients between hospital financial-economic indicators and performance indicators in the studied hospitals between 2018 and 2021

Hospital variables		Performance indicators							
		Average Length of stay	Bed turnover rate	Bed turnover interval	Bed occupancy ratio	Bed occupancy day	Number of inpatient admission	Mortality rate	Number of Surgery
Financial-economic indicators	Direct costs — Correlation coefficient	**0.355	**0.434	*0.341	0.127	*0.312	0.246	0.105	*0.253
	P-value	0.010	0.011	0.039	0.051	0.047	0.063	0.058	0.049
	Indirect costs — Correlation coefficient	0.091	0.179	0.144	0.128	0.153	*0.512	0.376	0.278
	P-value	0.543	0.062	0.071	0.064	0.090	0.048	0.059	0.082
	Direct revenue — Correlation coefficient	-0.231	* 0.324	* -0.310	* 0.581	* 0.573	* 0.321	* -0.413	* 0.472
	P-value	0.056	0.044	0.050	0.024	0.022	0.043	0.032	0.027
	Indirect revenue — Correlation coefficient	0.114	0.276	-0.132	0.024	0.235	* 0.124	-0.140	* 0.242
	P-value	0.084	0.086	0.070	0.061	0.056	0.038	0.090	0.050
	Financial liquidity ratio — Correlation coefficient	* 0.278	* 0.419	-0.392	* 0.428	0.617	0.321	-0.365	* 0.496
	P-value	0.041	0.035	0.061	0.039	0.324	0.382	0.063	0.033
	Profitability index — Correlation coefficient	* -0.263	* 0.388	* -0.383	* 0.427	* 0.221	* 0.238	-0.167	* 0.422
	P-value	0.043	0.036	0.048	0.028	0.038	0.029	0.081	0.041

*(P-value≤0.05),   **(P-value≤0.01)

Turnover interval and net death rates had a negative linear correlation with direct revenue. The profitability index was correlated to all of the performance indicators except for the net death rate. Higher length of stay and turnover interval had a negative effect on the profitability index while higher bed turnover rate, bed occupancy ratio, bed day, number of inpatient admission, and number of surgery had a positive effect on the profitability index. Table 4 shows the correlation coefficient and p-value from the regression test ($P \leq 0.05$).

Discussion

The pandemic of COVID-19 is considered both an opportunity and a threat to the economic and clinical management of hospitals (17, 18). In this study, a threat in the sense that a significant part of the referrals, the number of admissions, and the bed occupancy rate were reduced. Surgeries such as outpatient and elective surgeries were canceled and somehow postponed, which directly led to a significant decrease in the profitability index in 2020. Indirectly, from the managerial and economic point of view, the reduction in specific and operational revenue in the same proportion leads to a reduction in the per-case income of medical staff, resulting in a reduction in the efficiency of hospital staff and their dissatisfaction (19). In addition, the results of Ahangar et al.'s study (2021) estimated that the COVID-19 diagnostics cost in Iran was more than $173 million, which was $ 63.4 per patient on average. Meanwhile, in the same period, the costs of reducing production performance in Iran's hospitals were about $ 846 million and the costs of reducing production in the outpatient wards were about $1010.5 million. The financing-economic consequences are some of the key and most challenging issues in hospital economic management. The balance between two parameters of the equation, limited resources and unlimited demands (or needs) in the field of healthcare were the most important concerns of the managers of hospitals and health systems, especially in the period of the Covid-19 pandemic (18, 20).

Another negative financial-economics consequence of the COVID-19 disease in hospitals is the increase in the ratio of consumption costs such as oxygen therapy and the obsolescence of equipment and devices related to the process of inpatient care of COVID-19 patients such as ventilators and CT scans; so that the Impact of COVID- 19 on

hospital costs is exponential (20). It has grown significantly and sharply more than two times in the hospitals where this study has been evaluated. The results of this study also showed that the COVID-19 pandemic had a significant impact on clinical and healthcare performance indicators such as bed occupancy rate, bed turnover rate, number of admissions, and number of surgeries significantly decreased. on the other hand, the average length of stay and turnover interval indicators significantly increased right during and after the COVID-19 pandemic. A similar study performed in a single center in Qatar showed that the total number of admissions and surgeries decreased after the pandemic which is consistent with our findings but despite our results, the overall length of stay was shorter in the COVID-19 period in their study. This could be due to different demographics and the composition of hospital beds (21). in another study, the average length of hospitalization for COVID-19 patients is 20 days with wide ranging from 5 days to 51 days (22). The study results of Petty and Mullins (2021) with the title" Financial Consequences of Covid-19 for U.S. Hospitals" supported the literature's findings. The review also addressed the financial impact of COVID-19 on hospitals, the financial impact of COVID-19 on specialties within the hospital, the financial impact of COVID-19 on physicians within the hospital network, and resources to help with the financial impact of COVID-19. And also, the crippling aspects of the Covid-19 pandemic were further discussed and explained how it has weakened the financial and care performance of many US hospitals. And more importantly, how this disease has had a negative financial impact on hospitals (23, 24). This cause the need for longer hospitalization in a patient with underlying conditions such as heart disease, diabetes, kidney disease, cancer, and liver disease compared to other patients. One of the other effects of the COVID-19 disease was on the efficiency of human resources, so there was a severe shortage and burnout of human resources (23, 24). And also, Behzadifar M et al. showed that Due to COVID-19, the revenues of public hospitals experienced an average monthly decrease of $172,636 thousand ($P = 0.01232$). For about 13 months, the trend of declining hospital revenues continued. However, after February 2021, a relatively stable increase could be observed, with patient admission and elective surgeries restrictions being lifted. The average monthly income of hospitals increased by $83,574 thousand (18, 24). Our results showed that the doctor-to-bed ratio and also the nurse-to-bed ratio are constantly increasing with the growth of service delivery. This can lead to growth in operating revenue and increase efficiency. This mainly occurs when income growth is greater than cost growth. The financial balance is more positive, so efficiency and productivity increase, and vice versa with growth in the financial indexes.

In the period from 2018-2019 (pre-pandemic) to 2019-2020 (post-pandemic), the indicators of revenue sources were increased, and the indicators of funds expenditure were better managed, which ultimately led to a growth of liquidity indicators. This could be because of both the high inflation rate in the country and the use of hospital economic evaluation techniques (such as economy of scale, the economy of scope, efficiency, and Cost-Benefit analysis).

A higher financial liquidity rate makes the production function and service delivery in a hospital more efficient. One of the notable results in Table 3 of the financial performance of the hospitals studied is the profitability index of the hospitals, which was around 1.09 in 2018. Because of a significant increase in costs after the COVID-19 pandemic, the profitability index dropped to 0.88 in 2020. Although, with the reduction of COVID-19 cases in 2021, the financial balance and the profitability index were restored to some extent.

Also, the results of this study showed that the disease COVID-19 was an opportunity for hospitals from a different point of view, in the way that with optimal resource management and rational cost control and change of processes and a kind of economic-financial resource management model - Fund users have been able to prevent and mitigate the negative impact of cost growth and a sharp drop in operating income by reviewing and replacing legacy service packages (outpatient and inpatient) and shifting more hospital services to outpatient services for patients with COVID-19. In addition to increasing the occupancy rate of inpatient beds, this leads to an increase in outpatient services such as care less than 6 hours, serum therapy and injections, laboratory diagnostics, and outpatient imaging, while the increase in the bed turnover index leads to a decrease in the overall average index of inpatient length of stay and also a decrease in the bed turnover interval and the increase in the index of the total number of occupied beds, and finally all these management measures in the hospital resources, even during the COVID-19 pandemic led to a relative increase in the hospital's operating income and improved the financial balance of resources and funds in the studied hospitals.

Limitations

This study, like other studies, has some limitations. which include: the lack of proper infrastructure and accurate Hospital Information Systems(HIS) in collecting detailed data of all types of incomes and costs, and the lack of accurate data to estimate efficiency (economy of scale), it was not possible to access the breakdown of incomes and expenses according to the components of the unit. Therefore, it was not possible to analyze all components of income and expenses. Meanwhile, there was not enough information to analyze the role of each revenue-cost center (inpatient and paraclinical department) of the hospital and its effect on performance and financial indicators separately for each hospital. In this study, the data of performance indicators and economic-financial indicators of the studied hospitals were analyzed collectively. In addition, each of the studied hospitals has differences in the nature of hospital services, the target group of patients, the distribution of beds, the ratio of manpower to beds, the geographical area covered, the conditions of providing services, the coverage of basic insurances and insurances.

Conclusion

As the findings of this study showed, disease COVID-19 pandemic has financial and economic impacts on hospitals' performance such as reducing the direct revenues of public

hospitals, which have faced many problems due to the high costs they have incurred. During the crisis, a lack of adequate funding can damage healthcare service delivery, and policymakers should allocate resources to prevent potential shocks. from the beginning to the middle (in the short term) of the Covid-19 pandemic (from 2019 to 2020), the performance indicators of the hospital (such as BOR, Occupy Beds days, BTIR, BTR, MR (20), Number of surgeries, Number of inpatients) and also financial and economic indicators such as Direct and Indirect revenue, Direct and Indirect costs, Financial liquidity ratio, profitability index became unfavorable. So that the phenomenon of COVID-19 as a shock and socio-economic crisis, in addition to the health status of the society, has had significant ($P \leq 0.05$) decreasing effects on the care and financial-economic performance in the studied hospitals. And it has had staggering costs on the health economy and hospital economy in the world and in Iran. So that, many hospitals were not able to deal with the negative financial and medical consequences of COVID-19 due to a significant decrease in income and a double increase in expenses. But with the passage of time and in the medium term (period of 2020-2021), the negative effects and consequences of the shock of COVID-19 on the operational, economic and financial indicators of hospitals decreased and witnessed a relatively stable improvement in the indicators, and finally, the efficiency of hospitals increased. Therefore, based on the theory of market failure, in times of such a crisis, insufficient financial and budgetary resources in the studied hospitals cannot cause more irreparable damage to the provision of health and treatment services in hospitals. The trustees and health policymakers should allocate necessary and sufficient resources in order to prevent or minimize the negative functional, financial-economic consequences caused by possible shocks caused by an epidemic like COVID-19. Finally, knowledge about the functions and performance of hospitals in a crisis (such as disease COVID-19) helps policy-makers and hospital managers in the healthcare industry to have a better understanding of tolerance and resilience threshold of hospitals in crises and disasters, the minimum and maximum financial and performance capacity of hospitals in accepting patients, feasibility of hospital infrastructures such as equipment, devices, and human resources and how to trade-off between an inpatient /acute care bed, and finally, continuous and stable economic-financial mechanisms and proper management of hospital funds-resources before, during, or after the crisis or shock of the disease such as the COVID-19 pandemic.

Acknowledgement

Conflict of Interests

The authors declare that they have no competing interests.

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