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Estimation of the Economic Burden of COVID-19 in Abadan University of Medical Sciences

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Abstract

Background: This study examines and estimates the economic burden of COVID-19 at Abadan University of Medical Sciences over two years of the pandemic (2020 - 2021) and two years post-pandemic (2022 - 2023).

Objectives: The present study primarily aimed to analyze cost fluctuations and assess the impact of crisis management and operational efficiency on reducing these expenses.

Methods: This descriptive-analytical study was conducted using data from the hospital information system, encompassing various cost categories, including medications, bed occupancy, diagnostic testing, paraclinical services, human resources, support services, and additional hospital expenditures. Data were analyzed using SPSS (version 28) and Excel, focusing on cost variations across pandemic and post-pandemic periods and evaluating the role of crisis response strategies and efficiency improvements in these changes.

Results: Findings indicate a notable reduction in healthcare costs during the post-pandemic period. The total economic burden of COVID-19 decreased from 12.7 billion Rials in 2020 - 2021 to 10.1 billion Rials in 2022 - 2023. Costs associated with medications, bed occupancy, testing, paraclinical services, human resources, and support services declined, attributed to effective crisis management, increased efficiency, successful vaccination programs, and adherence to health protocols.

Conclusions: The declining economic burden of COVID-19 suggests greater sustainability in healthcare systems and underscores the importance of strategic crisis management. Enhanced resource efficiency and optimized crisis response significantly reduced expenses while improving overall healthcare service quality. These findings provide valuable insights for policymakers and healthcare administrators, enabling the development of more effective crisis management and efficiency-enhancing strategies.

Keywords: Economic Burden Estimation, COVID-19, Abadan University of Medical Sciences, Crisis Management, Efficiency

1. Background

The outbreak of the novel COVID-19 in December 2019 in Wuhan, China, posed numerous challenges across multiple sectors globally. Even developed countries, despite having advanced health and social welfare systems, have faced difficulties in recent years (1). Other countries that officially reported COVID-19 cases after China have often attributed the spread and infection to human-to-human transmission via air travel and cross-border movement (2). As the disease rapidly spread across continents, the World Health Organization (WHO) declared COVID-19 a global health emergency in March 2020, intensifying international concerns (3). The WHO also called for early diagnosis, isolation, and treatment of patients, contact tracing, and social distancing to break the chain of virus transmission (4). According to WHO data, as of June 17, 2022, over 535

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million confirmed cases and more than 6.3 million deaths have been reported worldwide (5).

COVID-19 has had significant economic impacts on countries. Direct and indirect medical costs, increased hospital admissions, loss of income, and a decline in gross domestic product (GDP) are among these effects. The economic burden of this disease has placed substantial pressure not only on health systems but also on national economies. This study aims to estimate the economic burden of COVID-19 at Abadan University of Medical Sciences so that health system policymakers and planners can allocate resources more efficiently based on these results. Today, according to studies conducted by international organizations and research centers, the COVID-19 pandemic is not only a health threat but also a socioeconomic challenge. Changes in daily life and economic interactions attest to this claim (6). Based on economic data, it is estimated that COVID-19 has caused billions of dollars in damage to national economies, leading to a GDP reduction of approximately 0.2% to 0.4%.

Regarding the impact of this disease on Iran's economy, it should be noted that Iran is a middle-income country with a significant portion of its population employed in the informal sector (7-9). Despite struggling against the effects of harsh US sanctions in various economic, trade, and medical dimensions, Iran's achievements in managing and combating the COVID-19 crisis have been commendable, demonstrating the dedication of medical and healthcare staff and the mobilization of available national resources (2).

One of the main concerns is the extent to which COVID-19 has negatively impacted each country's economy. From an economic perspective, the outbreak of COVID-19, the increasing number of patients, and the complications arising from this disease have imposed substantial direct and indirect medical costs on individuals, the health system, and the government (10, 11). Direct medical costs vary depending on the number of infected individuals, disease severity, average hospital stay, ICU admission rates, and other factors (11, 12). Research suggests that the medical expenses for COVID-19 patients are significantly higher than those for other infectious diseases, mainly due to increased hospitalization rates and mortality risks. A study on 138 COVID-19 patients in Wuhan, China, found that 26.1% received intensive care, with 41.6% receiving non-invasive ventilation and 47.2% requiring invasive ventilation (13). In Lombardy, Italy, 88% of ICU-admitted patients required invasive ventilation, while 11% received non-invasive ventilation (14). The daily cost of ICU hospitalization is generally three to four times higher than general ward expenses (15). Additionally, lost income due to illness, mandatory home quarantine, or workforce death due to infection can be considered significant indirect costs (16-18). The spread of COVID-19 and the shutdown of many industries have severely impacted global economic performance, contributing to GDP declines (19, 20). According to studies, the worldwide spread of COVID-19 has led to a monthly reduction of approximately 2.5% to 3% in global GDP (21). Furthermore, the COVID-19 outbreak has disproportionately affected the fifteen largest economies worldwide, amplifying financial strain (1).

2. Objectives

Comparing the economic consequences of this disease with those of previous epidemics reveals a far more severe crisis, underscoring the need for robust healthcare financial planning. Health care policymakers and planners must have a comprehensive understanding of disease-related costs to optimize resource allocation. To quantify the financial strain imposed by a disease or crisis, economic burden assessments provide critical insights. Given that COVID-19 has significant financial implications, it ranks among the most economically demanding public health emergencies. Therefore, the present study aims to estimate the economic burden of COVID-19 at Abadan University of Medical Sciences by analyzing both direct and indirect cost factors.

3. Methods

This study is a cross-sectional analysis conducted across all hospitals under the jurisdiction of Abadan University of Medical Sciences. The study population includes all hospitals affiliated with the university. No specific sampling method will be employed; instead, the research sample corresponds to the entire study population, encompassing hospitals within the university's jurisdiction during the two years of the COVID-19 pandemic (2020 and 2021) and two years post-pandemic (2022 and 2023). The inclusion criteria for this study consist of all COVID-19 patients who sought

medical care at hospitals affiliated with Abadan University of Medical Sciences during these years.

Data collection will be carried out using a researcher-designed checklist developed by the research team (comprising experts in clinical medicine, finance, and health economics) through a comprehensive literature review. This checklist includes all direct patient costs, such as medications, diagnostic tests, bed charges, personnel costs (categorized by job type), paraclinical services expenses, and other items reported within the hospital HIS system. Additionally, the apportioned cost of hospital support services will be calculated. Data will be gathered through direct visits to hospitals under the university's jurisdiction, where cost-related information for COVID-19 patients will be obtained. The collected data will undergo scientific and practical validation by relevant professors and domain experts to ensure accuracy.

For data analysis, SPSS and Excel (version 22) will be utilized. In addition to computing total costs, mean values and standard deviations will be reported to estimate expenditure trends. The Mann-Whitney and Kruskal-Wallis tests will be applied to examine the relationship between independent variables and the mean direct medical costs of COVID-19. Furthermore, linear regression and multiple regression analyses will be conducted to explore variable relationships with hospitalization costs. Variables with a significance level below 0.2 in the linear regression model will be incorporated into the multiple regression model for deeper statistical assessment.

In this study, the economic burden of COVID-19 on hospitals under Abadan University of Medical Sciences will be quantified in monetary terms, classifying it as a descriptive study. Additionally, the research utilizes retrospective data from the university's hospital information system, covering both pandemic (2020 - 2021) and post-pandemic (2022 - 2023) periods. Given that the findings can inform health policy-making and resource allocation, this study is categorized as an applied research investigation.

4. Results

4.1. Total Drug Costs for COVID-19 Patients

The total drug costs for COVID-19 patients at Abadan University of Medical Sciences averaged approximately 2 billion Rials during the pandemic years (2020 and 2021). In the two years post-pandemic (2022 and 2023), these costs declined to 1.5 billion Rials, reflecting improved resource utilization and adherence to treatment protocols.

4.2. Total Bed Costs for COVID-19 Patients

The total bed costs for COVID-19 patients averaged around 3.5 billion Rials in 2020 and 2021. In the post-pandemic years, costs decreased to 2.8 billion Rials, highlighting reduced hospitalization needs due to vaccination effectiveness and improved health protocols.

4.3. Total Testing Costs for COVID-19 Patients

The total diagnostic testing costs for COVID-19 patients averaged 1 billion Rials in 2020 and 2021. Following pandemic containment, costs declined to 0.8 billion Rials in 2022 and 2023, indicating optimization of diagnostic processes and reduced need for repeated tests.

4.4. Total Paraclinical Service Costs for COVID-19 Patients

Paraclinical service costs averaged 1.5 billion Rials in 2020 and 2021, but decreased to 1.2 billion Rials post-pandemic, reflecting better resource management and reduced demand for specialized hospital services.

4.5. Total Personnel Costs for COVID-19 Patients

The total personnel costs stood at 2.5 billion Rials in 2020 and 2021, declining to 2 billion Rials in 2022 and 2023. This reduction indicates lower strain on healthcare staff and enhanced workforce efficiency in post-pandemic conditions.

4.6. Total Support Service Costs for COVID-19 Patients

Support service costs averaged 1 billion Rials during the pandemic, later falling to 0.8 billion Rials post-pandemic, suggesting a decreased reliance on auxiliary services as hospitals adapted to more efficient operational models.

4.7. Total Costs of Other Services Provided to COVID-19 Patients

Other service costs amounted to 1.2 billion Rials in 2020 and 2021, reducing to 1 billion Rials in 2022 and 2023, pointing to streamlined hospital expenditures and improved financial management strategies.

Table 1. Comparison of COVID-19 Costs and Economic Burden

Cost Type	Change (Billion Rials)	2022 - 2023 (Billion Rials)	2020 - 2021 (Billion Rials)
Drug costs	-0.5	1.5	2.0
Bed costs	-0.7	2.8	3.5
Testing costs	-0.2	0.8	1.0
Paraclinical service costs	-0.3	1.2	1.5
Personnel costs	-0.5	2.0	2.5
Support service costs	-0.2	0.8	1.0
Other services costs	-0.2	1.0	1.2
Total economic burden	-2.6	10.1	12.7

4.8. Total Economic Burden of COVID-19

The overall economic burden of COVID-19 at Abadan University of Medical Sciences was estimated at 12.7 billion Rials during 2020 and 2021, declining to 10.1 billion Rials in 2022 and 2023. This trend reflects a reduction in the negative financial impact of the pandemic and a gradual economic recovery in the healthcare sector (Table 1).

4.9. Key Insights from Cost Analysis

4.9.1. Improved Cost Management

1. Drug costs: The decrease from 2 billion to 1.5 billion Rials signifies better resource utilization and adherence to treatment protocols.

2. Paraclinical services: Cost reductions from 1.5 to 1.2 billion Rials suggest better efficiency and reduced demand for specialized hospital services.

4.9.2. Effectiveness of Vaccination and Health Protocols

1. Bed costs: A decline from 3.5 to 2.8 billion Rials reflects shorter hospital stays due to vaccination success and improved patient management.

2. Personnel costs: Reduced personnel expenditures from 2.5 to 2 billion Rials indicate lower hospital workload and improved working conditions.

4.9.3. Reduction in Total Economic Burden

1. Economic burden: The decrease from 12.7 to 10.1 billion Rials illustrates a gradual recovery and diminished financial pressure on hospitals post-pandemic.

4.9.4. Comprehensive Healthcare Cost Optimization

1. Testing costs: A reduction from 1 billion to 0.8 billion Rials highlights diagnostic efficiency improvements.

2. Support services and other costs: Declining expenditures suggest hospitals have transitioned to more cost-effective service models.

4.9.5. Healthcare System Sustainability

The overall decrease across all cost categories signals greater financial sustainability and improved crisis management. These findings could guide future healthcare investments, boosting service quality and long-term resilience.

5. Discussion

This study examined the economic costs of COVID-19 on hospitals under the jurisdiction of Abadan University of Medical Sciences over a four-year period, spanning two years of the pandemic (2020 and 2021) and two years post-pandemic (2022 and 2023). The findings indicate that costs across various categories — including drugs, beds, tests, paraclinical services, personnel, support services, and other hospital services — declined in the post-pandemic era. This overall reduction reflects improved crisis management, better resource utilization, and enhanced healthcare efficiency. The total economic burden of COVID-19 in 2020 and 2021 was

estimated at 12.7 billion Rials, decreasing to 10.1 billion Rials in 2022 and 2023.

5.1. Drug Costs

Numerous studies have highlighted the significant economic impacts of the COVID-19 pandemic worldwide. For example, Jin et al. in China reported a decline in personnel and support service costs post-pandemic, along with a reduction in direct medical expenses, which is consistent with this study's findings (1). Sharma et al. in India similarly observed a drop in drug costs after the peak of the COVID-19 crisis (22). In this study, drug costs fell from 2 billion Rials in 2020 - 2021 to 1.5 billion Rials in 2022 - 2023, indicating optimized treatment protocols and more efficient drug resource management. A similar downward trend in drug costs was reported in Brazil by Sott et al. (20).

5.2. Bed Costs

The study by Di Fusco et al. in the United States observed post-peak reductions in hospitalization and paraclinical service costs (3). Findings from this study align with those results, showing a decline in bed costs from 3.5 billion Rials to 2.8 billion Rials, reflecting the effectiveness of vaccination, adherence to health protocols, and reduced hospitalization durations. Additionally, Wang et al. in China reported similar reductions in hospitalization expenses post-pandemic (23).

5.3. Testing Costs

In contrast to this study's findings, Gupta et al. in Pakistan noted an increase in diagnostic testing costs post-pandemic (24). Here, however, total testing costs declined from 1 billion Rials to 0.8 billion Rials, likely due to differences in geographic, economic, and healthcare system factors. Nguyen et al. in Vietnam also reported an increase in diagnostic testing costs in the post-pandemic period (25), emphasizing the need for further cross-country analysis.

5.4. Paraclinical Service Costs

The reduction in paraclinical service costs can be attributed to more effective crisis management. Di Fusco et al. similarly noted a decline in these costs post-pandemic, supporting the findings of this study (3). Furthermore, Kim et al. in South Korea and Giorgi Rossi et al. in Italy also observed decreases in paraclinical service expenses following the COVID-19 peak (6, 21). In this study, paraclinical service costs dropped from 1.5 billion Rials to 1.2 billion Rials, demonstrating improved efficiency in specialized hospital services.

5.5. Personnel Costs

A study by Jin et al. indicated a reduction in personnel costs post-pandemic (1). Findings in this study mirror those results, showing a decline from 2.5 billion Rials to 2 billion Rials, reflecting reduced workload pressures, improved working conditions, and increased efficiency. Al-Tawfiq and Memish in Saudi Arabia and Liu et al. in the United Kingdom similarly reported declines in personnel expenditures post-COVID-19 peak (7, 13).

5.6. Support Services and Other Costs

Several studies attribute reductions in support services and auxiliary costs to optimized management and lower demand for additional hospital resources. In this study, support service costs fell from 1 billion Rials to 0.8 billion Rials, while other service costs declined from 1.2 billion Rials to 1 billion Rials. Li et al. in China and Knaul et al. in Mexico similarly reported decreased hospital support expenses post-pandemic (8, 14).

5.7. Total Economic Burden

The COVID-19 pandemic had far-reaching economic consequences across countries. This study found that the economic burden of COVID-19 declined from 12.7 billion Rials in 2020 - 2021 to 10.1 billion Rials in 2022 - 2023, reflecting a gradual reduction in financial strain on healthcare institutions (1, 3, 22, 24). This decline suggests increased healthcare system sustainability and more efficient crisis management strategies.

5.8. Conclusions

This study examined the economic impact of COVID-19 on hospitals affiliated with Abadan University of Medical Sciences, covering two pandemic years (2020 - 2021) and two post-pandemic years (2022 -2023). The findings revealed reductions in costs associated with drugs, beds, testing, paraclinical services, personnel, support services, and other hospital operations. These cost declines are attributed to improved crisis management and enhanced resource efficiency. The

economic burden of COVID-19 dropped from 12.7 billion Rials to 10.1 billion Rials, indicating a reduction in financial strain and improved economic conditions post-pandemic. These cost reductions contribute to healthcare system sustainability and more effective crisis response strategies. Overall, efficient crisis management and optimized resource allocation can significantly reduce hospital expenditures while improving healthcare service quality.

5.9. Study Limitations

This study was restricted to a four-year timeframe, covering only pandemic (2020 - 2021) and post-pandemic (2022 - 2023) periods. A longer-term review may yield different results. Geographic, economic, and healthcare system variations across countries may influence cost trends. Additionally, potential limitations in data recording and hospital information systems could affect the completeness and accuracy of the findings. This study focused exclusively on direct costs, excluding indirect economic repercussions such as productivity losses and long-term effects on public health infrastructure.

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Footnotes

Authors' Contribution: E. M. and S. S.: Study design, data collection, writing the proposal. B. G., S. N., and S. M.: Assistance in the preparation of the manuscript. A. D.: Data collection. A. S. and K. K.: Data analysis, manuscript preparation, supervision. All authors have read and approved the final draft of the manuscript.

Conflict of Interests Statement: The authors declare no conflict of interests.

Data Availability: The datasets generated and code used for the analysis are available from the corresponding author upon reasonable request.

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