CASE STUDY

Efficiency Analysis of Operating Rooms via Data Envelopment Analysis: A Case Study of Iran

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Abstract

Background Operating rooms play a crucial role in hospitals, directly and indirectly affecting the performance of other departments. They account for more than 33% of the total costs and 60-70% of the total revenue of hospitals. Therefore, improving the efficiency of operating rooms can significantly enhance the utilization of hospital resources. This study aims to investigate the efficiency of operating rooms in hospitals affiliated with the University of Medical Sciences, as well as in non-university public and private hospitals in West Azerbaijan province, to help future decisions in operating room management.

Methods This descriptive-analytical applied study was conducted as a cross-sectional evaluation of operating rooms in all hospitals in West Azerbaijan province. Inputs and outputs of operating rooms were determined by reviewing various articles and interviewing relevant experts. Data were collected using forms and checklists designed by the researchers. The efficiency of operating rooms was then calculated using Data Envelopment Analysis with variable returns to scale (input-oriented) and Deap2.1 software, applying the assumption of variable returns to scale and an input-oriented approach.

Results The average technical, managerial, and scale efficiency of operating rooms in hospitals in West Azerbaijan province were 0.929, 0.959, and 0.969, respectively. Inefficient hospitals had excess inputs, indicating that the initial and target values of inputs for operating rooms with technical efficiency less than one were different. Scale efficiency (0.969) contributed more to the overall efficiency of operating rooms compared to managerial efficiency (0.959). That is, larger hospitals generally operated closer to optimal scale.

Conclusion Enhancing scale efficiency, for example, through the optimal use of existing capacity, should be prioritized over managerial efficiency. DEA results can guide staffing levels, operating room scheduling, and accreditation standards to reduce waste and improve service delivery.

Keywords Data envelopment analysis, Efficiency, Hospitals, Iran, Operating rooms

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1 Introduction

Achieving universal health coverage (UHC) requires policies and programs that support effectiveness and efficiency in service delivery.[1,2] The healthcare industry faces new challenges every day, and its expenses constitute a major part of the gross domestic product (GDP) in many countries.[3] Hospitals have the largest share of health expenses.[4] The increase in health costs and the resulting budgetary pressures have raised questions about the efficiency of health and medical services. Performance measurement is the only way to determine the efficiency of a country's health system.

The operating room is one of the most vital and expensive parts of a hospital, attracting special attention from managers.[5] It significantly impacts the overall performance of the hospital, as 60 to 70% of hospital admissions are related to surgical interventions, which account for more than 40% of a hospital's total costs.[6] Inefficient use of operating rooms leads to long waiting lists, high cancellation rates, frustration among operating room personnel, and consequently increased costs. This problem is exacerbated in developing countries where there is a high unmet need for surgery.[7]

The operating room is also the financial center of any hospital. While it represents a large portion of a hospital's expenses, it also generates a significant part of its income. Maximizing its efficiency has important consequences for cost savings, patient satisfaction, and the morale of the medical team.[5] Therefore, the good performance and high efficiency of the operating room play a crucial role in improving hospitals and the quality of services provided to patients. Investigations show that operating room costs are high, while the income generated is relatively low compared to the incurred costs.[8] This underscores the necessity of conducting the present research. In this regard, the existence of a model to provide feedback for improving the performance of the operating room seems very necessary and logical.

In general, efficiency refers to the ratio of production to the resources consumed over a certain period of time. [9] Meanwhile, technical efficiency (TE) measures how resources are converted into output and how health system goals such as improving health outcomes, accountability, fair financial participation, quality, and justice are achieved.[10] Scale efficiency (SE) is obtained when a decision-making unit (DMU) operates at its optimal size.[11]

Data Envelopment Analysis (DEA) is the most commonly used non-parametric approach for efficiency analysis. In this method, the efficient frontier curve is created from a series of points determined by linear programming. To determine these points, two assumptions, constant and variable returns to scale (VRS), can be used. After a series of optimizations, the linear programming method determines whether the desired DMU is located on the efficiency line or outside it. In this way, efficient and inefficient units are separated from each other.[12]

The healthcare system is one of the interconnected social welfare systems in the country.[13] The performance of hospitals and their components has been a concern for policymakers and health system managers for years. One major consequence of suboptimal resource consumption is the reduction in society's willingness to participate in financing the system, particularly the health insurance system.[14] Currently, there is no system in place to evaluate the use of operating rooms in Iran.

Despite the extensive literature on healthcare and health economics, there is a significant lack of evidence regarding the efficiency of hospital operating rooms in relation to specific concepts of healthcare, organization, and financing. This gap may be due to the lack of reliable data and the belief that economic principles are not suitable for these environments. This study aims to address this knowledge gap by examining the efficiency of operating rooms and providing estimates of the relative efficiency of public and private hospitals in West Azerbaijan province. The findings of this study can assist managers and policymakers in developing plans to improve the performance of operating rooms.

2 Methods

The current study was descriptive-analytical and applied, conducted as a cross-sectional study in 2023. The inputs and outputs required to assess the efficiency of the operating room were identified through a literature review and expert interviews. The research inputs included the number of employees (surgical staff and anesthesia staff) and the number of surgical beds. The research outputs comprised the number of outpatient surgeries, inpatient surgeries, emergency surgeries, deceased patients, hospital infections, surgical and anesthesia errors, the time between the patient's request from the ward and arrival in the operating room (minutes), the time between the patient's arrival in the operating room and transfer to the operating bed (minutes), the time between transfer to the operating bed and the start of the operation (minutes), the time between the end of the operation and transfer to recovery (minutes), the time between transfer to recovery and transfer to the ward (minutes), the delay in the start of the first operation (minutes), and the turnover time of the surgical bed (average time from the patient's exit to the next patient's entry). Finally, the researchers visited the operating rooms of the hospitals and the Deputy of Treatment to complete the forms and questionnaires separately for each hospital. Data analysis and calculation of operating room efficiency were conducted using Data

Envelopment Analysis (DEA), assuming VRS and input orientation by DEAP version 2.1. In scenarios where managers have more control over inputs, input-oriented models are predominantly used. The use of VRS models allows for the separation of TE into two components: SE and managerial efficiency. TE refers to achieving the maximum output with a given amount of inputs or minimizing the use of inputs for a given level of output. Pure TE reflects the managerial performance of operating rooms, while SE indicates the optimal use of each input.[15] The mentioned efficiencies range between 0 and 1. The closer the efficiency is to 1, the more efficient it is; conversely, the closer it is to 0, the less efficient it is.[16] The mathematical relationship in data envelopment analysis is as follows:

$$\min \theta$$
$$\text{s.t} \sum_{j=1}^{J} x_{nj}\lambda_j \le \theta x_{nk}, \qquad n = 1, \ldots, N$$
$$\sum_{j=1}^{J} y_{mj}\lambda_j \ge y_{mk}, \qquad m = 1, \ldots, M$$
$$\lambda_j \ge 0 \qquad j = 1, \ldots, J$$

In this model, the objective is to minimize θ. Here, x_nj represents the nth input value for unit j, and y_mj represents the mth output value for unit j. This model aims to produce outputs with the least possible input.

3 Results

The average, minimum, and maximum values of the input and output variables used to measure the efficiency of operating rooms in hospitals in West Azarbaijan province are presented in Table 1. This study evaluated all hospitals with active operating rooms in West Azarbaijan province, totaling 32 hospitals. Among these, six hospitals were educational and medical (18.75%) and 26 hospitals were medical (81.25%). Additionally, 22 hospitals (68.75%) were academic, while 10 hospitals (31.25%) were private or affiliated with other government agencies.

Table 1 Descriptive statistics of input and output variables

Variable	Obs	Mean	Std. dev.	Min	Max
Number of outpatient surgeries	32	632.6875	1125.8	0	4970
Number of inpatient surgeries	32	4043	5018.4	59	20511
Number of emergency surgeries	32	655.5625	854.07	0	4099
Number of patients who died due to surgery	32	0.96875	2.8225	0	13
Number of infections after surgery	32	33.59375	54.848	0	302
Number of surgical and anesthesia errors	32	2.84375	5.8481	0	28
Time between the patient's request from the ward and entering the operating room (minutes)	32	15.15625	5.1563	5	25
Time between the patient entering the operating room and transfer to the operating bed (minutes)	32	10.3125	4.9084	5	25
Time between transfer to the operating bed and the start of the operation (minutes)	32	9.84375	3.9112	5	20
Time between the completion of the operation and transfer to recovery (minutes)	32	9.0625	4.2951	5	20
Time between transitions from recovery to ward (minutes)	32	34.53125	9.5343	25	60
Delay in the start of the first operation (minutes)	32	18.75	13.619	5	60
Surgery bed turnover time (minutes)	32	10.625	5.3506	0	20
Number of surgical beds	32	4.65625	3.3946	2	21
Number of surgical staff	32	22.9375	22.673	7	135
Number of anesthesia staff	32	15.625	14.23	5	85

Table 2 presents the efficiency scores of operating rooms in the investigated hospitals, calculated using the DEA-VRS method with Deap2.1 software in 2023. Among the investigated hospitals, the operating rooms of 19 hospitals (59.37%) achieved maximum TE.[1] The operating rooms of nine hospitals (28.12%) had a TE score between 0.8 and 1, while the operating rooms of four hospitals (12.5%) had a TE score below 0.8. In the year under review, 59.37% of the operating rooms were fully efficient, whereas 40.63% were far from maximum efficiency. The lowest TE score recorded was 22. The results also indicated that 27 hospitals (84.37%) had operating rooms with maximum managerial efficiency.[1] while five hospitals (15.62%) did not achieve maximum managerial efficiency. Additionally, 19 hospitals (59.37%) had an SE score of 1, and 13 hospitals (40.62%) had an SE score below 1. The average TE, managerial, and SE scores for the operating rooms in hospitals in West Azerbaijan province were 0.929, 0.959, and 0.969, respectively.

According to Table 2, 20 hospitals (62.5%) had operating rooms with constant returns to scale, 10 hospitals (31.25%) had decreasing returns to scale, and two hospitals (6.25%) had increasing returns to scale. This indicates that nearly 63% of the operating rooms operated at an optimal scale during the year in question. In hospitals with constant returns to scale, increasing the production factors by a certain ratio leads to a proportional increase in the output.

Table 2 TE, managerial, and SE scores of operating rooms in the examined hospitals using the DEA-VRS model

R	Hospital operating room	TE	Managerial efficiency	SE	Returns to scale (RTS)
1	Imam Khomeini of Urmia	0.815	1	0.815	Decreasing RTS
2	Motahari	1	1	1	Constant RTS
3	Seyyed al-Shohada	1	1	1	Constant RTS
4	Kosar Women's Comprehensive	1	1	1	Constant RTS
5	Azerbaijan	0.986	1	0.986	Decreasing RTS
6	Solati	1	1	1	Constant RTS
7	Shafa	0.956	1	0.956	Decreasing RTS
8	Shams	1	1	1	Constant RTS
9	Milad	0.968	1	0.968	Decreasing RTS
10	Imam Reza	1	1	1	Constant RTS
11	Arefian	0.758	1	0.758	Decreasing RTS
12	Artesh	0.842	1	0.842	Increasing RTS
13	Omid	0.923	0.925	0.998	Decreasing RTS
14	Khatam al-Anbia of Salamas	0.645	0.667	0.967	Decreasing RTS
15	Imam Khomeini of Chaipareh	1	1	1	Constant RTS
16	Shahid Beheshti of Chaldaran	1	1	1	Constant RTS
17	Shohada of Shout	1	1	1	Constant RTS
18	Imam Khomeini of Poldasht	1	1	1	Constant RTS
19	Fajr of Mako	1	1	1	Constant RTS
20	Imam Khomeini of Naghadeh	1	1	1	Constant RTS
21	Hazrat Fatemeh of Naghadeh	1	1	1	Constant RTS
22	Imam Khomeini of Mahabad	0.445	0.446	0.999	Constant RTS
23	Hazrat Fatemeh of Miandoab	0.837	1	0.837	Decreasing RTS
24	Shahid Rathi of Shahindejh	0.908	0.916	0.991	Increasing RTS
25	Mehr of Tekab	1	1	1	Constant RTS
26	Shahid Qolipour of Boukan	0.678	0.734	0.925	Decreasing RTS
27	Imam Khomeini of Sardasht	1	1	1	Constant RTS
28	Soleimani of Piran-shahr	0.959	1	0.959	Decreasing RTS
29	Nabi Akram of Oshnavieh	1	1	1	Constant RTS
30	Imam Khomeini of Khoy	1	1	1	Constant RTS
31	Ayatollah Khoyi of Khoy	1	1	1	Constant RTS
32	Amir al-Mominin Khoy	1	1	1	Constant RTS
	Average	0.929	0.959	0.969	

The results of the calculations regarding the surplus or excessive use of inputs are presented in Table 3. The inefficient operating rooms in the studied hospitals had surplus inputs. In other words, the initial and target values of the inputs for the operating rooms with TE less than one were different. For example, to achieve maximum TE, the operating rooms at Imam Khomeini Hospital in Urmia should reduce the number of beds, surgical staff, and anesthesia staff by 3.887, 65.496, and 26.848, respectively.

Table 4 presents the operating rooms of peer hospitals compared to those of inefficient hospitals. The utilization of production factors in each peer hospital is lower than that in an inefficient hospital. Operating rooms in hospitals with an efficiency score of 1 can serve as models for similar but inefficient hospitals. It is possible to enhance the efficiency of operating rooms that are currently inefficient without incurring additional costs, simply by optimizing the use of inputs. For instance, the inefficient operating rooms at Imam Khomeini Hospital in Urmia can emulate the efficient operating rooms at Motahari, Kosar, and Ayatollah Khoyi hospitals as peers. Additionally, information from the operating rooms of peer hospitals can be used to better assess and improve the operating rooms of inefficient hospitals.

Table 3 Surplus amounts of operating room input in the studied hospitals

Row	Hospital operating room	Initial values of inputs			Target values of inputs			Surplus amounts of inputs		
		Number of surgical beds	Number of surgical staff	Number of anesthesia staff	Number of surgical beds	Number of surgical staff	Number of anesthesia staff	Number of surgical beds	Number of surgical staff	Number of anesthesia staff
1	Imam Khomeini of Urmia	21	135	85	17.113	69.504	58.152	3.887	65.496	26.848
2	Motahari	4	15	13	4	15	13	0	0	0
3	Seyyed al-Shohada	3	16	10	3	16	10	0	0	0
4	Kosar Women's Comprehensive	6	45	26	6	45	26	0	0	0
5	Azerbaijan	8	35	21	6.525	29.489	20.712	1.475	5.511	0.288
6	Solati	3	9	10	3	9	10	0	0	0
7	Shafa	5	19	11	4.779	16.385	10.514	0.221	2.615	0.486
8	Shams	4	8	5	4	8	5	0	0	0
9	Milad	6	23	22	5.81	22.27	18.101	0.19	0.73	3.899
10	Imam Reza	7	35	23	7	35	23	0	0	0
11	Arefian	6	27	19	4.545	20.453	14.393	1.455	6.547	4.607
12	Artesh	3	8	5	2.173	6.417	4.209	0.827	1.583	0.791
13	Omid	4	14	14	3.691	12.917	9.134	0.309	1.083	4.866
14	Khatam al-Anbia of Salamas	5	21	14	3.225	13.546	8.666	1.775	7.454	5.334

15	Imam Khomeini of Chai-pareh	4	16	7	4	16	7	0	0	0
16	Shahid Beheshti of Chal-daran	2	7	5	2	7	5	0	0	0
17	Shohada of Shout	3	10	6	3	10	6	0	0	0
18	Imam Khomeini of Poldasht	2	7	6	2	7	6	0	0	0
19	Fajr of Mako	5	18	14	5	18	14	0	0	0
20	Imam Khomeini of Nagh-adeh	4	20	10	4	20	10	0	0	0
21	Hazrat Fatemeh of Nagh-adeh	2	14	6	2	14	6	0	0	0
22	Imam Khomeini of Mahabad	7	39	22	3.117	16.26	9.797	3.883	22.74	12.203
23	Hazrat Fatemeh of Mian-doab	6	38	28	5.024	22.607	17.769	0.976	15.393	10.231
24	Shahid Rathi of Shahindejh	3	18	13	2.724	13.588	10.13	0.276	4.412	2.87
25	Mehr of Tekab	3	14	12	3	14	12	0	0	0
26	Shahid Qolipour of Boukan	5	24	20	3.392	16.282	11.712	1.608	7.718	8.288
27	Imam Khomeini of Sardasht	3	13	12	3	13	12	0	0	0
28	Soleimani of Piranshahr	3	19	13	2.867	18.159	11.299	0.133	0.841	1.701
29	Nabi Akram of Oshnavieh	2	15	8	2	15	8	0	0	0
30	Imam Khomeini of Khoy	4	22	19	4	22	19	0	0	0
31	Ayatollah Khoyi of Khoy	4	14	14	4	14	14	0	0	0
32	Amir al-Mominin of Khoy	2	16	7	2	16	7	0	0	0

Table 4 Operating rooms of peer hospitals compared to operating rooms of inefficient hospitals

R	Hospital operating room	peers								
1	Imam Khomeini of Urmia	2	4		31					
2	Motahari		2							
3	Seyyed al-Shohada		3							
4	Kosar Women's Comprehensive		4							
5	Azerbaijan	10	31	8		19				
6	Solati		6							
7	Shafa	2	19	8	3		32			
8	Shams		8							
9	Milad	2	29	27	31		8			
10	Imam Reza		10							
11	Arefian	2	32	19	17	8	31	4	29	27
12	Artesh	16	4		8					
13	Omid	2	29	8	4		31			
14	Khatam al-Anbia of Salamas	32	31	4	21	27	17		8	
15	Imam Khomeini of Chaipareh		15							
16	Shahid Beheshti of Chaldaran		16							
17	Shohada of Shout		17							
18	Imam Khomeini of Poldasht		18							
19	Fajr of Mako		19							
20	Imam Khomeini of Naghadeh		20							
21	Hazrat Fatemeh of Naghadeh		21							
22	Imam Khomeini of Mahabad	32	31	19	8	17	4		29	
23	Hazrat Fatemeh of Miandoab	31	29	19		27				
24	Shahid Rathi of Shahindejh	32	2	27	29	19		31		
25	Mehr of Tekab		25							
26	Shahid Qolipour of Boukan	27	31	8	4		29			
27	Imam Khomeini of Sardasht		27							
28	Soleimani of Piranshahr	4	27	17	2	29		32		
29	Nabi Akram of Oshnavieh		29							
30	Imam Khomeini of Khoy		30							
31	Ayatollah Khoyi of Khoy		31							
32	Amir al-Mominin Khoy		32							

4 Discussion

According to the 2010 report by the World Health Organization, between 20% and 40% of healthcare resources are wasted, primarily due to inefficient allocation and combination of resources, insufficient use of inputs, corruption, uncontrolled overuse of certain services, and inefficient service delivery processes. It is essential to evaluate the performance of hospital operating rooms to determine their optimal use of inputs and compare them with the performance of operating rooms in successful hospitals. This evaluation can help manage resources more effectively and reduce costs.

In this study, the average TE of hospital operating rooms in West Azarbaijan province, calculated using the DEA method, was 92.9%. In other words, the operating rooms of these hospitals produce the same current level of outputs with 92.9% of their resources. This indicates a partial excess capacity of the inputs in the operating rooms of these hospitals, suggesting that it is possible to improve the TE of this department by up to 7.1% without increasing costs, using the same level of inputs.

The average TE calculated in this study is higher than that in Ebrahimi et al.'s study (89.3%). It is important to note that the input and output variables in their study were different from those in the current study. Their input included the number of surgical beds and the number of operating room staff, while the output included the number of surgeries, surgery time, surgical bed turnover rate, and surgery cancellation rate.[17] Additionally, their study only calculated the efficiency of operating rooms in educational and therapeutic hospitals. In contrast, the present study includes university hospitals, non-university hospitals, and private public hospitals.

Few studies have been conducted on the efficiency of hospital operating rooms, making it challenging to compare our results with those of other studies.

Mousavi et al. conducted a study which aimed at increasing the efficiency of the operating room and reducing lost time by optimizing patient flow. They used an agent-based model to simulate the patient's process in the operating room. The study found that changing the timing of the patient's call by the surgeon, reducing the time for transporting consumables and the surgical set to the operating room, and minimizing the time for anesthetizing the patient had the most positive effects. These changes reduced the patient's stay by 9.69 minutes. Additionally, altering the timing of the patient's call by the surgeon alone reduced the patient's stay in the operating room by 7.31 minutes.[8] The results of this study are consistent with the present study, indicating that reducing the patient's stay in the operating room can decrease wasted time, increase the number of operations per shift, and enhance the overall efficiency of the operating room.

In Tabibi et al.'s study, the activity of four operating rooms over a period of 53 days at a selected teaching hospital affiliated with Yazd University of Medical Sciences was evaluated. The aim was to assess the impact of surgical operation timing on the utilization of operating room capacity. The study found that out of the 53 days examined, the operating rooms were used optimally for 7 days, under capacity for 27 days, and over capacity for 19 days.[18] Additionally, the study revealed inefficiencies in some of the operating rooms. Therefore, given the importance of operating room efficiency, calculating operating room utilization can provide valuable and practical information for managers.

Additionally, the average managerial efficiency of operating rooms in hospitals is 0.959, compared to 0.912 in Ebrahimi et al.'s study. With effective management and the efforts of the surgical and anesthesia staff, the efficiency of the operating rooms in the studied hospitals can be increased by 4.1% without increasing the amount of inputs. The average SE of operating rooms in hospitals is 0.969, which is lower than the 0.980 reported in Ebrahimi et al.'s study. Therefore, hospitals with increasing returns to scale should enhance their level of service provision. Given the constant amount of all inputs, the ratio of increase in service provision will be greater than the increase in inputs, leading to a reduction in the total cost of operating rooms in these hospitals. Thus, increasing the provision of services will be economically justified.

In operating rooms of hospitals with a TE of 1, the initial and optimal amounts of inputs were the same, indicating no surplus of inputs. However, in operating rooms of hospitals with a TE less than 1, the initial and optimal values of their inputs differed, resulting in surplus inputs. Therefore, to achieve a TE of 1, these hospitals must reduce the surplus from the initial values of the inputs. This study found that achieving the same level of service provision in the operating rooms of provincial hospitals in fiscal year 2023 is theoretically possible after reducing the number of surgical beds by 11.42% (from 149 to 131,985 beds), the number of surgical staff by 19.36% (from 734 to 591,877 persons), and the number of anesthesia staff by 16.48% (from 500 to 417,588 persons). The use of additional beds, surgical staff, and anesthesia staff may be due to layoffs, absenteeism, attendance, or an inefficient mix of resources.

A noteworthy finding of this study is that the operating rooms of larger hospitals were more efficient than those of smaller hospitals. This is because larger hospitals achieve economies of scale by optimizing investments in infrastructure, technology, and overhead. Considering that TE is obtained by multiplying managerial efficiency and SE, it can be concluded that in this study, SE (0.969) contributed more to the total efficiency of operating rooms in hospitals in West Azarbaijan province than managerial efficiency (0.959). This finding is consistent with the results of the study by Ebrahimi et al. Therefore, to increase the efficiency of the operating rooms in the studied hospitals, planning to enhance SE should be prioritized over managerial efficiency. SE is achieved by optimizing the production capacities of hospital operating rooms.

Operating rooms in public hospitals were more inefficient than those in private hospitals, despite having advantages such as a better mix of resources, formal decision-making ability, regulated service pricing, and payment mechanisms. This finding is consistent with the results of most studies. Additionally, transferring military hospitals (Arefian and Artesh) to the Ministry of Health could increase their efficiency. Furthermore, training and improving the skills of surgical and anesthesia staff, as well as identifying and addressing surgical and anesthesia errors, can help improve the performance of operating rooms in inefficient hospitals.

The advantage of this study, compared to the few existing studies, is its inclusion of all university, non-university, and private hospitals. However, the generalization of the results should be approached with caution, as this study did not account for the type and complexity of surgeries. Therefore, future studies should focus on the type of surgeries in private, university, and non-university hospitals. Despite these limitations, this study provides valuable insights for hospital managers in planning operating room services, as there are no other studies that identify the efficiency of operating rooms in academic and private hospitals.

5 Conclusion

The DEA technique can be utilized to correlate the performance and efficiency of hospital operating rooms with their budgets, compare the performance of each hospital's operating rooms with those of other hospitals, and examine the current and past status of hospital operating rooms. Additionally, planning for the optimal use of operating room resources and eliminating excess surgical beds, surgical staff, and anesthesia staff based on the results of this technique can significantly reduce the costs of hospital operating rooms and the healthcare system. Despite the presence of excess capacity in these sections in some hospitals, new resources are still being utilized. Furthermore, hospitals with low efficiency should strive to improve service quality, increase customer satisfaction, and consequently attract patients and enhance their service volume.

Declarations

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Artificial Intelligence Disclosure
The authors declare that no artificial intelligence (AI) tools were used in the preparation or writing of this manuscript.

Authors' Contributions
All authors contributed to the conception and design of the study. Yaser Dadak, Rahim Mahmoodlou, and Hasan Yusefzadeh performed the data analysis. Hasan Yusefzadeh, Yaser Dadak, and Rahim Mahmoodlou collected the data and drafted the manuscript. Hasan Yusefzadeh critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Availability of Data and Materials
The essential data of this study are available and can be provided upon request.

Conflict of Interest
The authors declare that they have no competing interests.

Consent for Publication
Not applicable.

Ethical Considerations
This study was approved by the Ethics Committee of the Urmia University of Medical Sciences under the Code of Ethics IR.UMSU.REC.1402.303.

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