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ORIGINAL ARTICLE

Performance Evaluation of Iran University of Medical Sciences Hospitals Based on the PABON LASSO Model and its Comparison with National Standards

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A B S T R A C T

Background: Evaluation of hospital performance plays an important role in improving the quality and quantity of services provided. The purpose of this study is to evaluate the performance of Iran University of Medical Sciences hospitals using the PABON LASSO model in 2022.

Methods: This descriptive and cross-sectional study was conducted in 2022. Thirteen hospitals affiliated to Iran University of Medical Sciences formed the study population. Data were analyzed by $SPSS_{22}$ software using PABON LASSO model. A one-sample t-test was used for comparison.

Results: Out of 13 hospitals, 38.46% were in the first region, 23.07% were in the third region, and finally 30.76% were in the fourth region of the matrix. Based on the results, in the studied hospitals, the average length of stay (ALS) was 4 days, the bed occupancy rate (BOR) was 72.89%, and the bed turnover rate (BTR) was determined 72.14 times a year.

Conclusion: The BOR index in the studied hospitals had a higher level of desirability compared to the national standard. Using one of the active methods of problem identification in hospitals and by understanding the relationship between performance indicators, it is possible to provide a platform for policy-making and revision of current policies in order to use the maximum performance capacity.

Keywords: Efficiency, Performance Evaluation, Hospital, PABON LASSO, Bed Occupancy Rate

Introduction

Health is the right of all members of the society and is the cornerstone of sustainable social, economic, political, and cultural development of human societies, and regardless of a moral duty, it is considered a social and economic issue (1, 2). One of the centers that is in the spotlight and among the priorities for the development of the health and treatment sector are hospitals (3). As the most important element of the health system, hospitals play a key role in providing health care services and have a great impact on the efficiency of the health system (4). Hospitals account for the largest share of healthcare system costs (5); therefore, it is necessary to consider economic analysis and performance evaluation indicators of hospitals in order to optimally use the resources available in these centers. Accordingly, one of the most important methods of hospitals performance evaluation is use of the efficiency index (5). Efficiency for a hospital means how a unit with a certain input is successful in producing maximum output or how it produces constant output with minimum resources (6).

In any organization, the existence of a performance

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evaluation system is of particular importance. So that its absence in different dimensions of the organization, including evaluation in the use of resources and facilities, goals, strategies, etc. is considered as one of the symptoms of the organization dysfunction (7).

In order to evaluate the health care system, regardless of its type, each country has specific standards or criteria for providing health care services. Therefore, for effective monitoring, it is necessary to develop and use appropriate indicators (8).

Indicators are a means for internal and external evaluations of hospitals' performance. They should be designed to measure the achievement of predetermined goals (7).

Studies have shown that there are different indicators for measuring the performance of hospitals, the most important and practical of which are three indicator including bed occupancy rate (BOR), bed turnover rate (BTR), and average length of stay (ALS) (9) in the hospital (10, 11).

Several methods have been proposed for evaluating hospital performance and using the results of such evaluations (12). One of the most important and useful models for evaluating hospital performance is the PABON LASSO model. This graphic model was introduced in 1986 by Pabon Lasso in order to determine the night performance of hospital. Performance evaluation in this model is based on a diagram that is divided into four regions by two intersecting lines obtained from the average percentage of bed occupancy and rotation of bed occupancy. Axis of lengths (x) shows the average percentage of bed occupancy and the width axis (y) shows the degree of rotation of bed occupancy. Every hospital, by being located in one of these areas, can take on special characteristics, which according to these characteristics, a practical analysis of that hospital can be conducted, providing a rational basis for decision-making by hospital management (13, 14).

The placement of hospitals in the first zone shows poor performance and inappropriate allocation of resources, and it is necessary to take a step towards moving towards the third zone of the diagram by identifying factors affecting the increase in BOR and BTR. Hospitals in this zone have an excess number of beds compared to the existing demand and as a result, the appropriate strategy in order to increase the productivity of resources is to prevent the development and expansion of the hospital and, if possible, transfer a number of existing beds and use them in other hospitals. The second zone is more specific to hospitals with high BTR and low BOR, which indicates unnecessary hospitalization and excess number of patients. Hospitals in the third zone are characterized by high BOR and high BTR, and they have excellent efficiency in using available resources. The fourth zone is specific to hospitals with high BOR and low BTR (15, 16).

The results of a study by Mousavi Rigi et al. on four hospitals with more than 100 beds affiliated with Bushehr University of Medical Sciences showed that the health system transformation plan had an increasing trend in the BOR and ALS , which indicates a better status of the indicators under study after the implementation of the plan in the hospitals under study (17).

According to another study in Tunisia, out of a total of forty hospitals, nineteen hospitals were in the first region, three hospitals were in the second region, eleven hospitals were in the third region with optimal efficiency, and seven hospitals were in the fourth region (18).

Considering the importance of the topic, the present study evaluated the performance of hospitals covered by Iran University of Medical Sciences using the PABON LASSO model. This study helps policy makers in formulating plans to increase hospital productivity by evaluating the actual performance of hospitals and determining strategies for more effective use of available resources.

Materials and Methods

This cross-sectional and descriptive analytical study was conducted in 2022. The research community was all hospitals of Iran University of

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Medical Sciences (13 hospitals). The data were collected by obtaining permission from the medical records unit of the relevant hospitals and the deputy of treatment of Iran University of Medical Sciences. In this study, to obtain accurate and reliable information, from input data (number of active beds, active day beds, occupied day beds, number of discharges) and output data as performance indicators (BOR, BTR, ALS, and net mortality rate) were collected and recorded based on a list. The inclusion criterion was hospitals affiliated to Iran University of Medical Sciences, and the exclusion criteria were lack of sufficient information and non-cooperation between the hospital and the deputy of treatment.

In the PABON LASSO diagram (Diagram 1), the data related to the BOR of each hospital is placed on the coordinate axis in the horizontal X axis, the data of the frequency of bed rotation in the vertical Y axis, and the ALS in the Z axis (19-21), and a three-dimensional diagram is created, which is difficult to draw in two-dimensional space. Based on the mathematical relationship between these three indicators, the ALS is a line that reaches from the origin of the coordinates to the location of the hospital in each of the four districts and continues to the opposite side (22) and then its value increases from left to right and from bottom to top (23).

Diagram 1. The functional status of the studied hospitals based on the PABON LASSO model

Zones	**Functional status**	**exposition**
Zone 1	Bed occupancy rates along with low bed turnover rates.	Are characteristic of hospitals where the supply of beds exceeds the demand for medical services.
Zone 2	Low bed occupancy rates and above bed turnover rates.	indicating unnecessary hospitalization of patients and additional bed capacity in medical centers. One of the characteristics of obstetrics and gynecology centers and departments.
Zone 3	High bed occupancy rates and high bed turnover rates	These hospitals are good despite the fact that they have used the minimum possible number of beds.
Zone 4	High bed occupancy rate and low bed turnover rate	Indicating long-term hospitalization of low-use patients Outpatient facilities and imposing high costs Features of psychiatric and geriatric treatment centers.

The data were collected using the PABON LASSO model and in order to compare the functional indicators of the studied hospitals with the standards approved by the Ministry of Health, Treatment and Medical Education (21, 24). Data analysis was done using SPSS software version 22 and with sample t-test. The significance level was less than 0.05.

In addition, this study has been approved by the ethics committee (IR.IUMS.REC.1401.498) in Iran University of Medical Sciences. Also, the researchers have emphasized observing the ethical principles and assuring the experts regarding the exclusive use of the research results in line with the introduced goals of the study.

Results

The average BOR, BTR, ALS, and net mortality rates in the studied hospitals were 72.89±13.13, 72.14±22.55, 4±1.3, and 20.96±16.90, respectively. A statistically significant difference was observed between the BTR and the Ministry of Health standard criterion for optimal quality (24 times per year (*P-values*≤0.001). The ALS was not significantly different from the Ministry of Health standard for desirable quality (3.5) (*P-values*=0.180). The average BOR was not statistically significantly different from the standard desirability score (70%) (*P-values*=0.56). Therefore, the average quality of BOR and ALS indicators in the studied hospitals was desirable, but the BTR was not at a desirable level.

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Table 1. Functional indicators of Iran University of Medical Sciences hospitals in 1401

Hospital		Bed occupancy percentage	The rate of rotation of the bed	Average length of stay	Net death rate	Zone of the hospital
Hospital (A)		79.1	52	5.55	33.83	Zone 4
Hospital (B)		58.6	130	1.64	2.12	Zone 2
Hospital (C)		88.6	60	5.36	13.11	Zone 4
Hospital (D)		56.4	67	3.09	10.88	Zone 1
Hospital (E)		76.6	110	2.55	2.97	Zone 3
Hospital (F)		64.0	62	3.78	0.27	Zone 1
Hospital (G)		89.6	58	5.59	42.59	Zone 4
Hospital (H)		84.7	46	6.76	34.85	Zone 4
Hospital (I)		57.7	56	3.77	36.33	Zone 1
Hospital (J)		92.2	81	4.18	0	Zone 3
Hospital (K)		68.3	63	3.95	51.29	Zone 1
Hospital (L)		51.6	64	2.94	7.63	Zone 1
Hospital (M)		72.2	72	3.64	26.72	Zone 2
Average		72.89±13.13	72.14±22.55	4±1.3	20.96±16.90	
Significant value compared with the desirability index (*P*)		0.56	0.001	0.180		
Performance index of hospitals based on the ministry standards	Desirable	More than 70	More than 24	Less than 3.5		
	average	60 to 70	17 to 24	3.5 to 4		
	undesirable	Less than 60	Less than 17	More than 4		

According to the results, Hospital (J) had the highest BOR (92.2%) and Hospital (B) had the highest BTR and the lowest ALS (1.64). Meanwhile, Hospital (L) had the lowest BOR (51.6%) (Table 1).

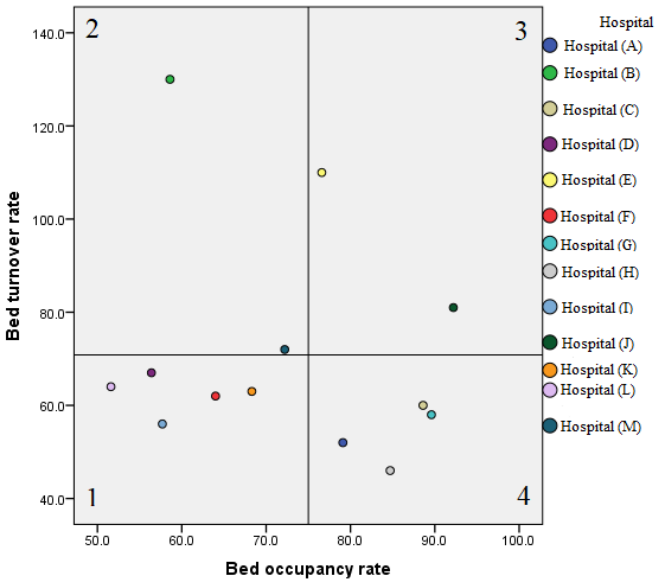

Diagram 2. The location of medical education centers of Iran University of Medical Sciences in the Pabon Lasso diagram in 2022

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Diagram 2 shows the location of Iran University of Medical Sciences hospitals based on the Pabon Lasso model. Based on the information obtained from the 13 studied hospitals, 5 hospitals (38.46%) were located in the 1st zone. These hospitals were Hospital (K), S Hospital (F), Hospital (I), Hospital (D) and Hospital (L). In these hospitals, the number of hospital beds was higher than the demand for them. Hospital (B) was located in zone 2. This area indicates the unnecessary admission of patients and the extra bed capacity in the hospital. Three hospitals (23.07 %) including Hospital (E), Hospital (J), and Hospital (M) were located in zone 3, indicating that these hospitals have good efficiency. Four hospitals (30.76 %) including Hospital (A), Hospital (H), Hospital (C), and Hospital (G) were located in zone 4, indicating long-term ALS, low use of outpatient facilities, and the imposition of high costs.

Discussion

In this study, the performance of Iran University of Medical Sciences hospitals was compared based on three indicators including BOR, BTR, and ALS using the PABON LASSO model. There was no statistically significant difference between the BOR and the ALS according to the standard criteria of the Ministry of Health, and only the amount of bed rotation with the standard criteria of the Ministry of Health for the desired quality had a statistically significant difference.

Considering that the performance indicators can be used for the important goals of policy making and proper planning when they are examined in an analytical model and in relation to each other, this study tried to use the PABON LASSO model analysis by combining the three considered indicators in a suitable way, to have a quick evaluation of the overall performance of the hospitals covered by Iran University of Medical Sciences.

Comparing the position of the studied hospitals in four regions of the Pabon Lasso diagram showed that 5 hospitals (38.46%) were located in zone 1, which had a low BOR and a low BTR. In fact, these hospitals have little and limited use of their hospital capacity, in other words, there is a large number of beds against low demand. Perhaps the reason for this is the lack of sufficient motivation in the staff, which can lead to not accepting patients or directing and referring them to other centers. In fact, hospitals in this area have poor efficiency and inappropriate allocation of resources. Other studies have shown that 36% of hospitals in East Azerbaijan (25), 28.75% of hospitals in Lorestan province (19), 50.3% of hospitals in Kohgiluyeh and Boyer Ahmad (26), and also 16% of hospitals in Qazvin were located in zone 1 (27).

In this study, a hospital was located in zone 2 model. In this hospital, the BTR was high, but the BOR was low, and this issue indicated hasty and unnecessary hospitalizations, leading to some of the beds being filled with patients who do not need much hospitalization. This rate was 12.8% (25) in the study of East Azerbaijan city, 21.24% (19) in the city of Lorestan, and zero percent (26) in the study of Kohgluye city. In Kazemi's study, no hospital was located in the second region of the diagram (28). In Dargahi et al.'s study, 2 hospitals were located in zone 2 (29).

According to the findings of this study, three hospitals (23.07%) are located in zone 3. In addition to the high BOR, hospitals in this area also had a high BTR, and this indicated the good performance of these hospitals. In Kazemi's study, 2 hospitals were located in zone 3, one third of the hospitals were located in the third region of the diagram. In other studies, 33.33% of Kohgiluyeh and Boyer Ahmad hospitals (26), 35.71% of Lorestan hospitals (19), 38.4% of East Azerbaijan hospitals (25), and 33.33% of Qazvin province hospitals were located in zone 3 (27).

In this study, 4 hospitals (30.76) were located in zone 4, and although the BOR was high in these hospitals, the BTR was still low. In the mentioned hospital, there was high proportion of patients with severe diseases. There were probably major problems in the management system. In other studies, 16.66% of hospitals in Kohgluye (26),

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14.28% of hospitals in Lorestan (19), 33.33% of hospitals in Qazvin (27), and 12.8% of hospitals in East Azerbaijan were located in this area (25). A broad strategy to improve the performance of hospitals located in this area is to move towards providing outpatient services and try to overcome shortcomings and improve management (30).

Conclusion

According to the research findings, overall, the BOR and ALS in hospitals of Iran University of Medical Sciences were not in a favorable condition compared to the national standard, and the BTR was in a favorable condition. According to the compiled chart, most of the hospitals were not in a desirable condition. Therefore, by examining and evaluating the managerial and economic performance of the hospitals that had a good position in the chart or other domestic and foreign hospitals with favorable performance, it is possible to identify the factors affecting this success and desirability. By modeling these factors, progress can be made as quickly as possible in various therapeutic, economic, and managerial indicators.

Research Limitations

One of the limitations of this study is the non-cooperation of some hospitals in providing information to the researcher.

Implications of the study

The findings of the research can be used in planning of programs of the Ministry of Health, Treatment and Medical Sciences as well as universities of medical sciences. The findings of this research can improve the quantitative and qualitative indicators as well as the standards of care provided by the hospital and ultimately improve the performance of the hospitals.

Ethical Considerations

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy) were thoroughly observed by the authors. The study is approved by the working group/committee of ethics in research of Iran University of Medical Sciences. Code of ethics in research: IR.IUMS.REC.1401.498

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Authors' contributions

A.R, I.M, M.J, designed research; A.R, conducted research; A.R, I.M, and M.J analyzed data; and A.R wrote the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interests.

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