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Trend of Hospital Performance in Northern Iran: A 5-Year Assessment Using Pabon Lasso Model

Sara Emamgholipour[1], Abolhasan Afkar[2], Mandana Eskandari[2], Maryam Tavakkoli[2*]

[1] Department of Management and Health Economics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran. [2] Social Determinants of Health Research Center, Guilan University of Medical Sciences, Rasht, Iran.

Abstract

Background and Objectives: The large contribution of hospitals to the function and expenditures of the health sector makes their constant monitoring and evaluation inevitable to improve the overall performance of the health system. Built on that, the present study aimed to evaluate the trend of performance of hospitals affiliated with the public hospitals (in Guilan province, Iran) affiliated with Ministry of Health and Medical Education (MOHME) using the Pabon Lasso framework.

Methods: All (21) hospitals affiliated to Guilan University of Medical Sciences (GUMS) were monitored within 2010-2015. Data of bed occupancy rate (BOR), bed turnover rate (BTR), and average length of stay (ALS) of these hospitals were collected using a form completed by the university's Office of Vice-chancellor for Clinical Affairs. The Pabon Lasso diagram was set up by dividing the area between BOR (horizontal) and BTR (vertical) axes into four Zones based on the average of BOR and BTR values. A second Pabon Lasso diagram was also set up with the cut-off point being standard average BOR and BTR values as suggested by MOHME. The data of BOR and BTR of the target hospitals were then mapped onto the diagrams.

Findings: The number of hospitals in Zone 1 has decreased from 6 to 3, and the number of hospitals in Zone 3 has increased from 5 to 6 during 2010 to 2015. Based on MOHME's evaluation criteria, the average BOR of the surveyed hospitals has increased from the moderate level in 2010-2011 to the favorable level in 2014-2015. Moreover, the 5-year average BTR of these hospitals maintains far above the minimum favorable threshold, and the 5-year average ALS of these hospitals falls in the moderate range. In 2014-2015, while 23.8% of the hospitals are located in Zone 3, 71.42% are located in Zone 2, and there is no hospital located in Zone 1.

Conclusions: Our results suggest that the performance of GUMS hospitals has been on an increasing trend in the recent years. Nonetheless, when considering MOHME's evaluation criteria, most of the hospitals are still located in the second Zone of Pabon Lasso Model, which corresponds to low BOR and high BTR. This information recommends avoidance of further bed development, and rather using under-utilized beds in high demand healthcare services in order to achieve higher hospital performance in future years.

Keywords: Hospital performance, Bed capacity, Bed occupancy rate, Bed turnover rate, Average length of stay, Pabon Lasso model

Background and Objectives

Health care system plays a crucial role in the welfare of community. According to the World Bank, total health expenditure in Iran increased from 4.59% of gross domestic product (GDP) in 2000 to 6.68% in 2013.[1] Hospitals are known as the largest and most expensive operating units in the healthcare system, and account for up to 80% of total healthcare expenditures in the developing countries.[2,3] Like many other countries, the excessive costs of healthcare in Iran have become a great concern for the government[4] as well as the hospital administrators. Effective response to this challenge requires use of appropriate performance evaluation and decision-making tools. This becomes more important when considering that according to the World Health Organization (WHO) and the World Bank, failure in appropriate management of resource is a larger source of the health organizations' inefficiency as compared with limited budget.[5] In

*Corresponding Author: Maryam Tavakkoli, Social Determinants of Health Research Center, Guilan University of Medical Sciences, Rasht, Iran, Tel: +98 911 810 50 47, Email: maryam.tavakkoli2012@gmail.com

the present complex and dynamic environment, thus, performance self-assessment is crucial to avoid or alleviate such inefficiency.[6]

Various methods have been evolved for evaluating hospital performance.[7] Among them, the Pabon Lasso model has become popular due to (1) simplicity of use and (2) simultaneously taking into account three important hospital performance indicators, including bed occupancy rate (BOR), bed turnover rate (BTR), and average length of stay (ALS), enabling multifaceted analysis of hospital performance (Table 1).[8-16]

Sixty-seven percent of the Iranian hospitals and 71% of hospital beds are held by the Ministry of Health and Medical Education (MOHME).[17,18] Therefore, constant monitoring and improvement of these hospitals can make a significant contribution to overall improvement of the Iranian health system. Built on that, the present study aimed to survey the trend of performance of all hospitals of Guilan University of Medical Sciences (GUMS) affiliated with MOHME in the resent 5 years (2010-2015) using the Pabon Lasso framework.

Methods

This descriptive study was conducted during 2010-2015 to evaluate and compare the performance of 21 hospitals affiliated to GUMS. Data of BOR, BTR and ALS of 21 hospitals affiliated with GUMS were collected using a form completed by the university's Office of Vice-chancellor for Clinical Affairs. The Pabon Lasso diagram was laid out by dividing the area between BOR (horizontal) and BTR (vertical) axes into four Zones.[19] The cut-off point for dividing the plane was obtained as intersect of average BOR and BTR. A second Pabon Lasso diagram was also laid out with the cut-off point being the intersect of standard average BOR and BTR as recommended by MOHME. The data of BOR and BTR of the target hospitals were then mapped onto the diagrams.

The localization of hospital indicators in the four zones of Pabon Lasso diagram was interpreted as the following:

Zone 1 (low BOR, low BTR), bed overutilization compared with demand

Zone 2 (low BOR, high BTR), excessive bed capacity and unnecessary hospitalization

Zone 3 (high BOR, high BTR), efficient utilization of beds

Zone 4 (high BOR, low BTR), long patient stay due to either inefficiency or type of services.

Results and Discussion

Table 2 presents the BOR, BTR and ALS profile of the GUMS hospitals during 2010-2015. As seen in 2014-2015, the BOR ranges from 27.26% to 91.77% among the hospitals. In addition, BTR varies from 11.82% to 126.07%, and ALS ranges from 1.81 days to 24.56 days.

Figure 1 illustrates the Pabon Lasso chart for the GUMS hospitals in 2014-2015. As seen, 14.28% of the hospitals are located in Zone 1 where hospital bed supply is more than services demand indicating that patients may prefer to refer to other hospitals. Thus, improving the quality of services and merging the wards might improve the hospitals' performance.[20,21]

Figure 1 also shows that 45.6% of the hospitals (Seyyed-alshohada, Amir-almomenin, Velayat, Vali-asr, Beheshti Anzali and Ansari) are located in Zone 2, indicating that there are unnecessary inpa-

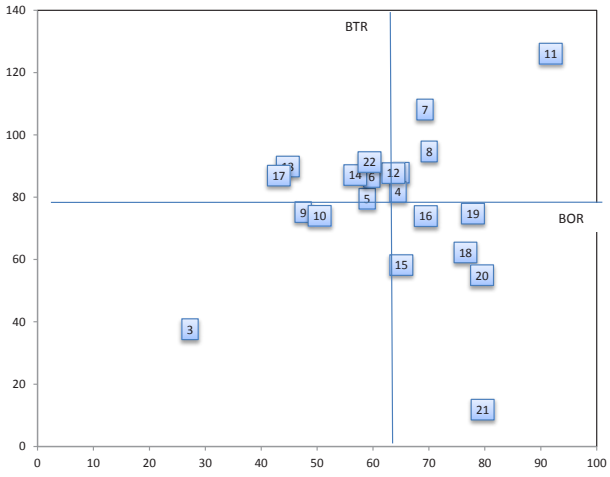

Figure 1. Pabon Lasso Diagram Based on Average Values of BOR and BTR.

Table 1. Hospital Bed Performance Indicators

Indicators	Description	Formula
Average length of stay	Mean number of days from admission to discharge	ALS = Inpatient days/admissions
Bed occupancy rate	Measure of utilization of the available bed capacity, percentage of beds occupied by patients in a defined period of time	BOR = Inpatient days/bed days ×100 Inpatient days = admissions × ALS Bed days in year = number of beds × 365
Bed turnover ratio	Measure of productivity of hospital beds, average number of inpatients per bed in the year	BTR = Total patient admissions/number of beds

Table 2. Bed performance of GUMS Hospital During 2010-2015

Hospital	Bed Occupancy Rate					Bed Turnover Rate					Average Length of Stay				
	2014-2015	2013-2014	2012-2013	2011-2012	2010-2011	2014-2015	2013-2014	2012-2013	2011-2012	2010-2011	2014-2015	2013-2014	2012-2013	2011-2012	2010-2011
22 Aban	64.98	52.82	55.80	59	58.98	87.85	76.76	79.18	78.32	78.32	2.70	2.51	2.58	2.7	2.75
31 Khordad	27.27	25.47	16.87	26.6	26.58	37.64	43.40	39.98	56.43	56.43	2.64	2.14	1.73	1.7	1.72
Amini	64.48	56.21	59.07	52.3	52.30	81.69	79.61	81.49	74.29	74.92	2.88	2.58	2.58	2.5	2.55
Ansari	58.94	51.15	57.23	58.1	58.14	79.53	70.97	74.98	73.37	73.37	2.71	2.63	2.79	2.9	2.89
Beheshti	59.78	56.64	65.68	65.2	65.17	86.53	87.40	93.72	84.84	84.84	2.52	2.37	2.56	2.8	2.80
Beheshti	69.29	63.61	71.41	68.7	68.69	108.13	96.53	105.44	100.13	100.13	2.34	2.41	2.48	2.5	2.50
Emam Khomeini	70.04	64.00	60.41	57	57.03	94.69	93.30	90.56	89.41	89.41	2.70	2.50	2.44	2.3	2.33
Emam Hasan	47.51	44.68	45.92	47.2	47.15	75.21	66.26	67.59	70.33	70.33	2.31	2.46	2.49	2.4	2.45
Kosar	50.46	45.38	38.82	34.4	34.35	74.03	67.08	54.27	52.91	52.91	2.49	2.47	2.62	2.4	2.37
Nourani	91.78	86.11	82.75	75.4	75.42	126.07	119.06	111.63	104.54	104.47	2.66	2.64	2.71	2.6	2.64
Resalat	63.63	67.82	70.27	38.6	38.60	87.75	98.16	102.63	68.31	68.31	2.65	2.52	2.51	2.1	2.06
Seyedalshohada	44.76	47.30	50.38	45.9	45.87	89.85	94.56	98.50	81.11	81.11	1.82	1.83	1.87	2.1	2.06
Valiasr	56.82	42.23	27.72	47.2	47.21	87.11	74.47	70.14	101.08	101.08	2.38	2.07	1.45	1.7	1.70
17 Shahrivar	65.06	57.96	62.15	72.6	72.61	58.22	50.14	50.93	53.74	53.64	4.08	4.22	4.47	4.9	4.94
Alzahra	69.43	62.83	61.38	50.8	50.75	73.94	74.09	79.42	73.17	73.17	3.43	3.10	2.80	2.5	2.53
Amiralmomenin	43.15	51.74	52.49	41.8	41.78	86.92	90.23	136.19	74.36	73.77	1.81	1.58	1.41	2.1	2.07
Dr. Heshmat	76.53	78.16	80.28	84.8	84.81	62.25	78.81	72.24	69.13	69.13	4.49	3.62	4.09	4.5	4.48
Poursina	77.87	71.59	79.87	92	91.96	74.71	71.85	119.42	112.28	112.15	3.80	3.64	2.45	3	2.99
Razi	79.50	78.22	90.78	89.2	89.16	54.99	56.90	77.43	80.19	79.91	5.28	5.02	4.31	4.1	4.07
Shafa	79.60	76.02	76.15	82	81.98	11.83	11.70	12.86	14.58	14.56	24.56	23.73	23.20	20.5	20.55
Velayat	59.37	57.32	71.91	67.2	67.20	91.30	56.84	51.40	34.81	34.81	2.37	3.68	5.12	7	7.05
Mean	62.87	58.92	60.83	59.81	59.80	77.63	74.20	79.52	73.68	73.66	3.93	3.80	3.75	3.78	3.79
Standard deviation	14.83	14.42	18.25	18.40	18.40	23.96	22.93	28.54	23.00	22.98	4.80	4.64	4.56	4.03	4.04

tient admissions or the hospital beds are occupied by outpatients. However, some hospitals due to their nature of activity should admit outpatients (obstetrics and gynaecology, etc). Under these circumstances, activation of specialist and outpatient clinics is recommended.[19,22]

It is also visible from Figure 1 that 28.57% of the hospitals (Beheshti Astara, Emam Khomeini, Nourani, 22 Aban, Resalat and Amini) are located in Zone 3, which is the *zone of efficiency*. As improvement of efficiency has no limit, the administrators of these hospitals should reinforce current policies to achieve higher hospital efficiency.[23,24]

As shown in Figure 1, 28.57% of the hospitals (Poursina, Alzahra, Heshmat, Razi, 17 Shahrivar and Shafa) are located in Zone 4. The place of Shafa hospital in this Zone is expected as it is a psychiatric hospital with long length of patient stay and high BOR. The location of other hospitals in Zone 4 may be due to admission of chronic patients or unnecessary long stay. Applying modern management techniques and providing advanced new medical services are recommended.[21]

Table 3 shows the trend of hospital performance based on BOR, BTR and ALS within the last 5 years. As seen, while the number of hospitals in Zone 1 has decreased from 6 to 3, the number of hospitals in Zone 3 has increased from 5 to 6 during the same period.

Table 4 presents the criteria recommended by MOHME to evaluate the performance of hospitals based on BOR, BTR, and ALS. Based on these criteria, the average BOR of the GUMS' hospitals has increased from the moderate level in 2010-2011 to the favorable level in 2014-2015. Moreover, the average BTR of the hospitals in question maintains far above the minimum favorable threshold during the last 5 years. In addition, the 5-year average ALS of these hospitals remains at moderate level.

Figure 2 shows the location of GUMS hospitals after adapting the cut-off points to MOHME's thresholds (BOR=70, BTR=24). As seen, while 5 (23.8%) of the hospitals are located in the *zone of efficiency* (Zone 3), no hospital is located in the *zone of inefficiency* (Zone 1). Many hospitals (71.42%) are located in Zone 2 indicating their high BTR and low BOR. This may be due to unnecessary inpatient admission or occupation by outpatients.

Table 3. Location of GUMS Hospitals on Pabon Lasso Zones During 2010-2015

Code	Hospitals	2014-2015	2013-2014	2012-2013	2011-2012	2010-2011
2	22-Aban (Lahidjan)	3	2	1	2	2
3	31-Khordad (Manjil)	1	1	1	1	1
4	Amini (Langroud)	3	2	2	2	2
5	Ansari (Roudsar)	2	1	1	1	1
6	Beheshti (Anzali)	2	2	3	3	3
7	Beheshti (Astara)	3	3	3	3	3
8	Emam Khomeini (Somesara)	3	3	2	2	2
9	Emam Hasan (Fouman)	1	1	1	1	1
10	Kosar (Astaneh)	1	1	1	1	1
11	Nourani (Talesh)	3	3	3	3	3
12	Resalat (Masal)	3	3	3	1	1
13	Seyedalshohada (Lahidjan)	2	2	2	2	2
14	Valiasr (Roudbar)	2	2	1	2	2
15	17 Shahrivar (Rasht)	4	1	4	4	4
16	Alzahra (Rasht)	4	4	3	1	1
17	Amiralmomenin (Rasht)	2	2	2	2	2
18	Dr. Heshmat (Rasht)	4	3	4	4	4
19	Poursina (Rasht)	4	4	3	3	3
20	Razi (Rasht)	4	4	4	3	3
21	Shafa (Rasht)	4	4	4	4	4
22	Velayat (Rasht)	2	1	4	4	4

Table 4. MOHME's Criteria for Hospital Bed Performance Evaluation

Indicator	Favorable	Moderate	Weak
BOR	>70	60-70	<60
BTR	>24	17-24	<17
ALS	<3.5	3.5-4	>4

Study Limitations

While Pabon Lasso model offers a useful tool to quickly monitor and compare the trend of hospital performance, the results obtained should be interpreted in the light of the fact that this evaluation tool does not take into account several important indicators of performance such as human resources productivity.

Conclusions

Our results suggest that performance of GUMS hospitals has been on an increasing trend in the recent years. Nonetheless, when considering MOHME's evaluation criteria, most hospitals are still located in the second zone of Pabon Lasso model, which corresponds to low BOR and high BTR. This information recommends avoidance of further bed development, and rather use of under-utilized bed in high demand healthcare services in order to achieve higher hospital performance in future years.

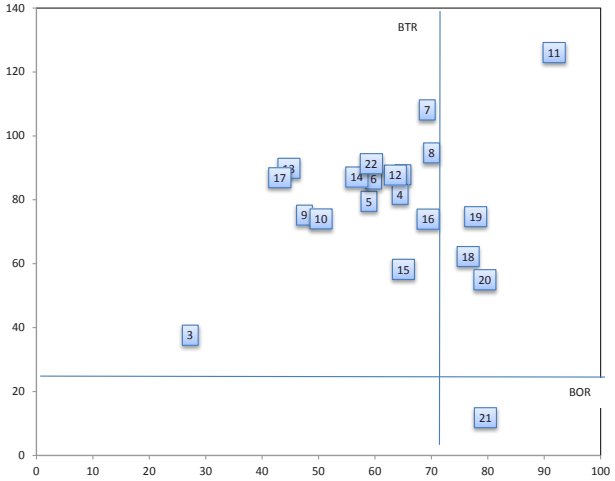

Figure 2. Pabon Lasso Diagram After Adapting Bed Occupancy and Bed Turnover Ratio to the Conventionally Suggested Benchmark.

Abbreviations

(GDP): gross domestic product; (MOHME): Ministry of Health and Medical Education; (BOR): bed occupancy rate; (BTR): bed turnover rate; (ALS): average length of stay.

Competing Interest

The authors declared no competing interests.

Author's Contributions

SE designed the study and contributed to critical revision of the manuscript. HA participated in the analysis and interpretation of the data. ME collected the data, reviewed the literature, and contributed to drafting of the manuscript. MT took part in the analysis of the data and drafting of the manuscript. All authors read and approved the final manuscript.

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