

Performance of Tunisian Public Hospitals: A Comparative Assessment Using Pabón Lasso Model

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Abstract

Background and Objectives: Constant monitoring of healthcare organizations' performance is an integral part of informed health policy-making. Several hospital performance assessment methods have been proposed in the literature. Pabon Lasso Model offers a fast and convenient method for comparative evaluation of hospital performance. This study aimed to evaluate the relative performance of hospitals in Tunisia, using Pabon Lasso Model.

Methods: A cross-sectional descriptive study was conducted during 2011-2012 to measure the hospitals performance in Tunisia. A sample of 40 public hospitals was surveyed. The assessed hospital performance indicators included Bed Occupation Rate (BOR), Bed Turnover Ratio (BTR), Average Length of Stay (ALS). The relevant data were collected using a standard forms approved by the Tunisian Ministry of Health. For each hospital the data were extracted from the Hospital Information Systems. The data were plotted on Pabon Lasso diagram and the performance of each hospital was analyzed by visual inspection. The data were summarized using descriptive statistical methods.

Findings: Average values of 62.3, 58.1% and 3.8 days, was observed for the BTR, BOR, and ALS, respectively. While nineteen hospitals (47.5%) were located in zone 1 of the Pabón Lasso diagram, three (7.5%) were located in zone 2, eleven (27.5%) in zone 3, and seven (17.5%) in zone 4. In addition, 50% of the studied hospitals had low performance in terms of either bed occupancy rate or bed turnover ratio or both.

Conclusions: This study ranked the surveyed hospitals of Tunisia with respect to their overall performance and reveals the relative strength and weakness of each hospital. The speed and convenience of Pabon Lasso measurement method facilitate constant monitoring of overall hospital performance. Moreover, large-scale application of this method, can offer an overall view of the health system performance, which could be used by policy-makers in future plantings.

Keywords: Hospital performance; Bed Occupation Rate, Bed Turnover Ratio, Average Length of Stay, Public hospital, Pabón Lasso Model

Background and Objectives

Assessing the healthcare system performance is an essential element in improving these systems in the developing countries [1]. Factors like inefficiencies and failure to meet patients' expectations continually threaten healthcare systems [2]. Hospitals play a key role in providing healthcare services, and can positively impact the efficiency of these systems [3-5]. However, efficiency is key to the performance measurement as it is defined as "the

process of quantifying the efficiency and effectiveness of past actions" [6]. Efficiency refers to the resource utilization, while effectiveness mostly evaluates the outcomes [6]. Efficiency is also considered in planning to contain hospital costs, because it is swallowing a high proportion of healthcare funding [7].

However, in the developing countries, the running cost of hospitals in the health sector is between 50 to 80%. Tunisia is no exception to this. Despite the best efforts of healthcare providers and authorities, problems associated with allocative and technical efficiencies, mal-distribution of limited resources and hospitals services, issues related to public-private mix in the funding and delivery of healthcare services, problem with the existing governance arrangements, and

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similar other issues have largely threatened the productivity of hospitals, and the achievement of equity in access; this continues to pose a significant threat to hospitals, locally, nationally and even at the global level [2, 8]. Nearly all Tunisian public hospitals face these challenges in delivery of quality services. What remains unclear is how these hospitals are performing in these situations, and what factors are essential for their survival.

Estimation of efficiency in medical field is more difficult than in other fields since the output is difficult to measure due to the non-parametric measurable characteristics of hospital products. In the literature, the performance of hospitals can be evaluated using ratios that mainly measure capacity utilization, or frontier techniques such as data envelopment analysis (DEA) and stochastic frontier methods including production and cost functions that are more robust [9]. Ratio analysis involves the piecemeal examination of different key ratios, such as average cost per inpatient day, bed occupancy rate (BOR) or cost per child immunized. Although easy to use, these ratios have some pitfalls. First, the requirement for identical measurement units makes the identification and measurement of inputs and outputs difficult. Second, the ratios are only meaningful and easy to understand in single input and single output situations. Comparisons of multiple outputs by means of ratio analysis require priori weights and/or standardizing measurements to get an overall indicator. The arbitrariness and pre-determination of these weights and standardizations have often been questioned.

Nonetheless, only few studies have investigated the use of multiple indicator ratios to evaluate the hospital sector in Tunisia [10, 11]. No studies on capacity utilization using the Pabón Lasso technique (1986) have been conducted in Tunisia before. This study provides evidence on the performance efficiency of 40 public hospitals in Tunisia using the Pabón Lasso technique that uses concurrently three indicators including: 1) Bed Occupancy Rate (BOR), 2) Bed Turnover Rate (BTR), and 3) Average Length of Stay (ALS). This technique has the potential to help policymakers control high costs, and to inform them to seek efficient solutions with the best possible results for the costly expenditures in hospitals.

Literature review

Ratio measurements have been designed to measure the technical efficiency of hospitals. These ratios mainly measure the capacity utilization or frontier techniques such as

data envelopment analysis. Commonly used performance indicator ratios include ALS, which measures the average duration of inpatient hospital admissions (mean number of days from admission to discharge), BOR, which measures the percentage of beds occupied by the patients in the year, reflecting the efficiency in the use of hospital resources, and BTR, which measures the average number of inpatients per bed in the year, as an indicator of the efficiency of hospital resource use [9, 12, 13]. Although easy to use, it has to be stressed that an assessment based on only one of the ratios of hospital bed capacity utilization may be flawed and misleading. For example, BOR may be relatively high in the presence of unnecessarily high average length of stay emanating from such factors as poor nursing care, improper scheduling of diagnostic and therapeutic interventions, and development of nosocomial infections. Thus, though BOR may indicate that there is a good level of capacity utilization, the reality is that this is due to inefficiency of the hospital. Therefore, to avoid such misleading conclusions, it becomes necessary to make use of all three indicators simultaneously so as to have a better picture [12, 14].

In 1986, Pabón Lasso developed a new method that makes use of these three indicators concurrently in assessing the overall performance of a hospital. Interpretation of performance using this graphical method is based on a chart, which is divided into four parts by two crossing lines: the horizontal axis shows the mean for BOR, and the vertical axis shows the BTR. Each hospital assigns itself special features by being positioned in one of the four parts (Zones) of the chart. This kind of analysis is useful for quick identification of the hospitals with weak performance, and highlighting areas to direct rectification of their inefficiencies. It follows from the functional relationship of the three measures that the slope of the line linking the origin to any of the observations (any point on the graph) represents the reciprocal of the ALS of the hospital under consideration.

The setting of the cut-off points at the mean values of BOR and BTR may be contentious. However, Pabón Lasso also suggests using other cut-off points (e.g. allowing a margin of one standard deviation from the mean) [15]. Figure 1 represents the possible features of hospitals located in each of the four Zones.

Methods

A cross-sectional descriptive study was conducted during 2011-2012 to measure the hospitals performance in Tunisia. This study included 40 public hospitals and indexes used to assess the performance indicators includ-

Table 1 Summary statistics: inputs and outputs by hospital ownership

Ownership	Doctors		Nurses		Beds		Impatient days		Outpatient visits	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Public Hospital	10	9.1	33	27.1	198	98.6	53942	15258	134652	145413
Private Hospital	6	4.3	21	15.4	133	60.5	31654	13461	23681	10649
Total	8	6.8	27	22.6	171	88.4	43551	21395	88462	116673

ing the BOR, BTR and ALS of all hospitals using standard data-gathering forms approved by the MoH for each hospital, and extracted via the Hospital Information Systems (HIS) within the hospitals' admission and discharge units. Pabón Lasso model was used to assess hospital performance. Data analysis was performed, and graphs were plotted using STATA 10 software package.

As it was discussed above, the Pabón Lasso technique has the potential to show the relative performance of hospitals in a graphical manner. The assessment and interpretation of performance in this method is based on a graph, which is divided into four parts by two horizontal and vertical axes: the horizontal axis shows the mean for BOR, and the vertical

axis shows the BTR. Because of the mathematical relationship between the indicators under study, the ALS increases uniformly from left to right and from top to bottom at the right side of the graph. Each hospital may be located in one of the four quadrants of this graph based on the average of these quantities.

As Figure 1 shows, the hospitals in the first zone have low BOR and BTR compared to their mean. This zone reveals that the excess beds in hospitals are due to the current demand. Zone 2 shows the hospitals with higher BTR and lower BOR than the average rate. This zone represents that there is unnecessary hospital admission and an oversupply of hospital beds, or the beds are specialized for treat-

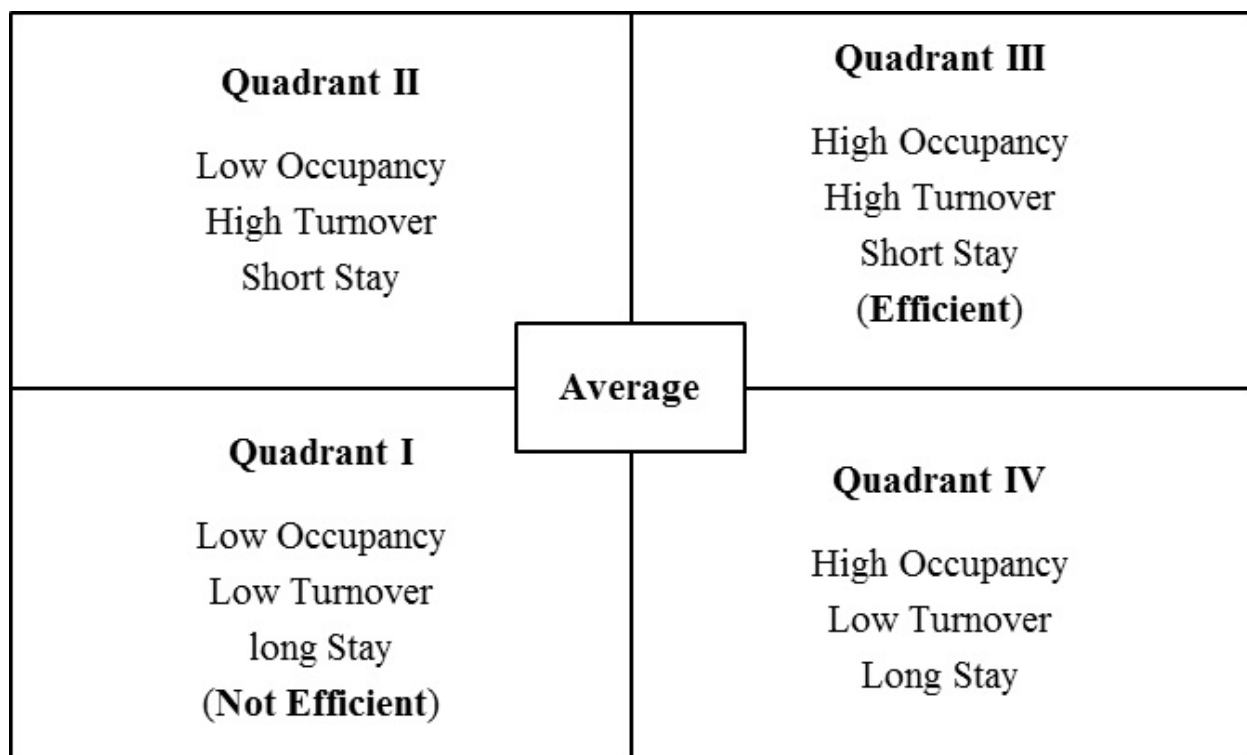
**Figure 1** Pabón Lasso diagram (mean values).

Table 2 Capacity utilization ratios by ownership type

Ownership	Bed turnover ratio		Bed occupancy rate (%)		Average length of stay (days)	
	Mean	SD	Mean	SD	Mean	SD
Public Hospital	68.14	42.53	65.13	30.75	3.77	4.35
Private Hospital	49.62	29.65	47.62	25.92	4.21	1.96
Total	62.31	36.87	58.10	21.54	3.80	4.42

ing the patients who did not really need it and/or just have outpatient visits. Hospitals in the third zone have both high BTR and high BOR. This zone characterizes hospitals that have reached an appropriate level of efficiency. Zone 4 shows hospitals that have low BTR and high BOR. These hospitals are responsible for providing services to the patients suffering from a serious chronic disease or their length of stay is higher than usual.

Results and discussion

Descriptive statistics

In total, 40 Tunisian hospitals (30 public and 10 private) were assessed. Table 1 shows a descriptive statistics of

the relevant inputs and outputs by hospital ownership. It is observed from Table 1 that public hospitals have a wide variation in terms of size and resource endowment (doctors, nurses and beds). The input and output profile of the hospitals was influenced by the ownership type of the hospitals. Public hospitals are larger than the private ones in terms of bed capacity, and have more staff.

Furthermore, public hospitals produce more outputs as measured by outpatient days and inpatient visits. This is, however, more than proportionate to their relative resource endowment. For example, while public hospitals have about 2.5 times more beds than the private hospitals, their output in terms of inpatient days is about 2.0 times more than that of the private hospitals.

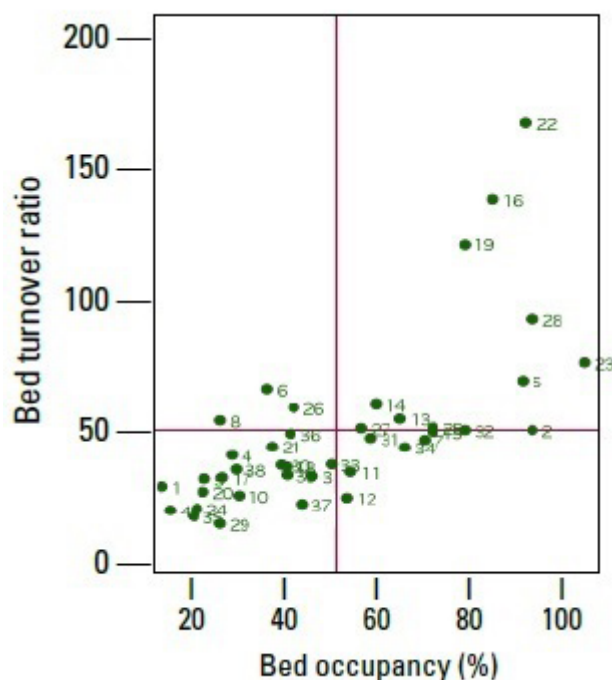


Figure 2 Pabón Lasso diagram (mean values).

Capacity utilization ratios

There is a wide variation in the performance of the hospitals as measured by capacity utilization measures. The review of collected data showed that the average BTR, BOR and ALS were 62.31, 58.10% and 3.80 days, respectively. Table 2 shows the capacity utilization measures for the studied hospitals. However, despite the data given in Table 2, it seems that public hospitals have higher BOR and BTR. The ALS for both types of hospitals was within the range of 3-5 days recommended for acute care hospitals. The occupancy rates are far below the conventionally accepted norm of 80-85%, indicating the presence of a significant proportion of unutilized capacity.

Table 3 shows the performance indicators for the studied hospitals. Accordingly, the highest and lowest BTR relate to Monji Slim Hospital (185) and Tataouine Hospital (15), respectively. Also the highest and lowest BOR belong to Fattouma Bourguiba Hospital (105.3) and Medjez El Bab Hospital (15.2), respectively. In addition, Farhat Hached (6.4) and Monji Slim (1.9) hospitals enjoy the highest and lowest ALS, respectively.

As discussed earlier, analysis based on only one of the above mentioned capacity utilization ratios may not give a comprehensive picture. Hence, simultaneous analysis of hospital performance indicators using the Pabón Lasso diagram shows that from the total of 40 hospitals, nineteen hospitals (47.5%) are located in Zone 1, indicating lack of efficiency. Three hospitals (7.5%) are located in Zone 2. Eleven hospitals (27.5%) including are located in Zone 3, showing a high level of efficiency, and seven hospitals (17.5%) including are located in Zone 4 (Figure 2).

As illustrated in Figure 3, only 27.5% of the hospitals are located in the desirable region of the Pabón Lasso diagram (right upper region), while close to 50% of the hospitals are located in the left lower region, which is the most undesirable situation that is characterized by low BTR ratio and low BOR. When the cut-off for BOR is increased to the conventionally suggested benchmark of 85%, the number of those hospitals located in the desirable (efficient) region decreases to only 12.5%, while the proportion of the hospitals located in the most undesirable region increases to 65%.

It is observed that even when the mean occupancy rate of the group of hospitals in the study is used as the benchmark, most of the hospitals lie in the region placed below the means of the occupancy rate and turnover ratio (left lower region). This implies one or more of the following scenarios: (1) excess bed supply, (2) less need for hospitalization, and (3) low demand for or utilization of hospital services.

Table 3 Performance indicators of the hospitals during 2011-2012

Hospital ID	Hospital's name	Ownership	BTR	BOR	ALS
1	Medjez El Bab	Public	35	15.2	2.0
2	Farhat Hached	Public	53	92.5	6.4
3	Sidi Bouzid	Public	35	46.2	5.1
4	Jendouba	Public	43	30.6	2.7
5	Habib Bourguiba	Public	76	91.7	4.6
6	Aziza Othmana	Public	68	35.4	2.3
7	Carthage	Private	49	70.5	5.4
8	El Manar	Private	60	25.8	2.1
9	Mohamed Tlatli	Public	32	23.7	2.6
10	Ibn El Jazzar	Public	29	32.1	4.2
11	Montplaisir	Private	37	54.6	5.6
12	Hamem Lif	Private	26	54.2	6.8
13	Essalama	Private	54	65.3	4.4
14	Les oliviers	Private	63	40.7	2.3
15	Kasserine	Public	51	72.4	5.2
16	Sahloul	Public	135	84.6	2.4
17	Tozeur	Public	34	26.9	3.3
18	Menzel Bourguiba	Public	36	40.5	4.1
19	Habib Thameur	Public	128	78.1	2.4
20	Tebourba	Public	30	23.3	3.6
21	Tahar Star	Public	47	37.6	3.4
22	Monji Slim	Public	185	94.1	1.9
23	Fattouma Bourguiba	Public	78	105.3	5.1
24	Siliana	Public	23	21.4	3.5
25	Mohamed Sassi	Public	54	71.8	5.1
26	Ibn Annafis	Private	62	44.3	2.8
27	Bizerte	Public	55	56.8	4.0
28	Hedi Chaker	Public	95	93.7	3.8
29	Tataouine	Public	15	26.1	5.4
30	Tahar Maamouri	Public	38	39.5	3.8
31	Meigne	Private	49	59.8	4.4
32	El Farabi	Private	51	79.3	5.6
33	Zaghouan	Public	38	51.4	4.8
34	Avicenne	Private	13	19.3	5.3
35	Zarzis	Public	20	21.4	4.1
36	Abderrahmen Mami	Public	53	41.6	3.2
37	El Kef	Public	22	46.2	7.5
38	Beja	Public	33	30.1	3.2
39	Houcine Bouziane	Public	36	43.6	4.5
40	Kebilli	Public	21	15.8	2.6

It is also observed that when the benchmark occupancy rate is increased to 85%, the number of hospitals with the above mentioned scenarios increases. Given the scope of the study, it is not possible to identify the exact nature of the problem. However, whether due to less need for hospitalization or low demand for hospital services, there is an excess supply of hospital beds that merits further investigation. Given the low bed density in the country, we would expect the presence of unmet need for hospitalization; therefore,

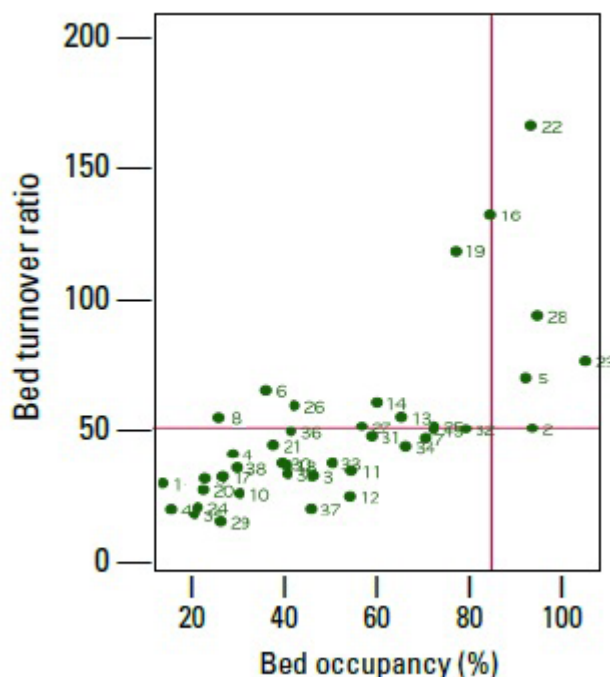


Figure 3 Pabón Lasso diagram after increase of bed occupancy and bed turnover ratio to the conventionally suggested benchmark of 85%.

the case for less need for hospitalization may not be a plausible explanation. Only a few of the hospitals are located at the right upper region, which is the desirable state of capacity utilization.

The findings clearly indicate the presence of excess bed capacity given the current level of utilization. It should, however, be noted that this does not imply the presence of excess capacity relative to need. In fact, the bed density in Tunisia is far lower than that recommended for the size of the population. There may possibly be demand-side barriers of any type (e.g. financial, geographical, cultural, etc.) that negatively influence utilization of hospital services. The evidence indicates that capacity utilization is better in public hospitals compared with the private ones. Public hospitals have more resources in terms of staff and beds compared with the non-public ones. However, their output, as measured by outpatient visits and inpatient days, is more than proportionate to their resource endowment.

Issues related to economies of scale may also contribute to capacity underutilization and inefficiency. Some hospitals may experience economies of scale (inefficiently small size) and others may experience diseconomies of scale due to their inefficiently large size. Identification of economies or diseconomies of scale is beyond the scope of the analytical technique

used, and calls for further study using frontier techniques of efficiency measurement.

Recommendations

In the light of the findings discussed above, the following recommendations are proposed with a view to improve hospital efficiency and capacity utilization: Firstly, studies need to be conducted to identify individual, household and systemic level barriers to utilizing hospital services, and institute appropriate measures that will enhance optimal use of the existing hospital capacity. Demand-creating interventions have to be instituted to counter the barriers related to health-seeking behavior of individuals and households. Systemic bottlenecks need tailor-made interventions depending on the nature of the problem. These will, in the end, stimulate demand/utilization.

Secondary, given the low bed density in Tunisia, the supply of beds may not match the population's need for hospital services. Therefore, it is not desirable to reduce the number of hospital beds. However, in the interim, that is until the demand-creating interventions bear the desired behavioral change, innovative ways of using the existing relative excess capacity need to be explored.

Third, in order to identify inefficiencies related to

scale/size, it is necessary to conduct an assessment using frontier techniques of efficiency measurement (e.g. data envelopment analysis or stochastic frontier models including production and cost functions). Furthermore, to assess changes in productivity over a period of time, efforts must be made to collect panel data.

Finally, as the Pabón Lasso technique is a valuable tool that is easy to use, it is recommended that annual health management information system (HMIS) reports must include this kind of analysis in order to provide evidence for management decision-making purposes.

Conclusions

The current study has looked into 40 hospitals in Tunisia and assessed their relative performance through the Pabón Lasso model. The use of this method helps to draw more robust conclusions by using the three indicators of hospital capacity utilization (BTR and BOR and ALS) simultaneously, as using a single performance indicator may result in incorrect and/or misleading conclusions about the overall performance of a hospital. For instance, high BOR can result from either high ALS due to the efficient use of hospital resources for needy patients, or the existence of unnecessary hospitalizations resulting in inefficient use of resources. The results showed that while some of the studied hospitals (27.5%) had significantly good performance indicators (both high BOR and high BTO), the rest had a poor performance in one or more of the performance indicators.

It is also worth noting that the indicators used in the Pabón Lasso technique simply show the utilization of hospital resources in general, and do not include the concept of healthcare quality and safety; hence, they cannot show the clinical effectiveness of services. Performance indicators may be affected by other factors such as access to transportation facilities, provision of healthcare at homes or similar communities, patients' geographical location, availability of trained hospital staff, size of hospital, shortage of workforce, training-based nature of hospitals, and existing guidelines and policies[13, 16]. Finally, it is recommended that future studies should consider these confounding variables to explore various dimensions of hospital performance in the light of aforementioned issues and challenges.

The author declares no competing interests.

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