ASSESSMENT OF IRAQI HOSPITALS PERFORMANCE USING PABON LASSO MODEL

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ABSTRACT:

Background: Pabon Lasso Model is regarded as the utmost useful and important method for hospitals’ performance assessment, which is a graphical model determining the relative hospitals’ performance by using three indicators: Bed Occupancy Rate (BOR), Bed Turnover rate (BTOR) and Average Length of Stay (ALS).

Objectives: The study aims to shed light on Iraqi hospital utilization and performance by using pabon lasso model to compare between them.

Methods: The study is a cross-sectional hospital-based descriptive analytic study, done inside 28 hospitals covering different Iraqi regions. Data of these hospitals - for the year 2019 - were collected from the health statistics department of each hospital, then analyzed by using pabon lasso model.

Results: The distribution of hospitals among the 4 regions of Pabon lasso diagram: 11 hospitals (39%) are located in zone 1, which is the least inefficient zone, 3 hospitals (11%) are located in zone 2, 12 hospitals (43%) are located in zone 3 which is the most efficient zone and 2 hospitals (7%) are located in zone 4.

Conclusions: Only 43% of hospitals are efficient according to Pabon lasso model and there is underutilization of hospitals’ beds despite the Iraqi hospitals’ beds shortage.

Recommendations: Iraqi hospitals need to improve their performance and efficiency by good hospital management, follow hospital admission policies and standard with upgrading of health services to reach that of EMRO and world. Pabon lasso model and bed utilization indices should be used routinely by hospital administrators and decision makers.

Key words: hospitals, Iraq, pabon lasso, assessment.

I. BACKGROUND:

Iraq Demography: Iraq is one of middle east, eastern Mediterranean region countries with “total population of 39127889, Population growth rate is 2.4, Percentage of urban population is 69.8%, Percentage of rural population is 30.2%, Percentage of population less than 15 years is 40.5% accounting 15833657 child, Child bearing age women (15-49) year is 9552799 female (MOH 2019).

Secondary and tertiary health care: Total number of governmental hospitals and Specialized centers with inpatients beds is 286, Total number private hospitals is 143, Total number of governmental hospitals’ beds is 46627, The number of governmental predisposing hospital beds without emergency is 39180, Government hospitals beds’ occupancy rate is 56.5%, governmental hospital ratio per 100000 of the population is 0.7 hospital, Ratio of hospital bed/1000 population is 1.2 and Rate of admitted patients/1000 population is 80.9 (MOH 2019).

In developing countries, public hospitals, as the largest operating unit of health systems, expend more than 50% of the whole budget of health care. 80% of these funds are consumed in hospitals whose efficiency is not more than 50% of their ability. This is due to a mixture of issues related to the supply, such as the unnecessary
construction of hospitals without prior need-assessment, and poor services quality; it is also caused by demand-related factors such as geographical, financial and cultural barriers to access of people. One of the chief concerns of health system managers and policy-maker in these countries is to improve the hospitals’ efficiency and performance. There are several approaches used for performance evaluation of hospitals. Single of the best suitable implements for performance comparison of hospitals is pabon lasso model (Bahadori M. et al 2011).

Pabon lasso Model: Pabon Lasso (1986) had developed a model or graph that makes use of the utmost significant and practical indicators: BOR, BTOR and ALS of patients in hospitals. The plotting of BTOR on the vertical axis, BOR on the horizontal axis and the use of mean values of these two ratios to divide the graph into four quadrants is what is known as Pabon Lasso graph (Lasso P. 1986).

Coordination of these 2 indicators demonstrates position on the diagram of every hospital. Line that passes through origin (a series of straight lines radiating outward from the origin) is a hospital function. Inverse slope of this line equals ALS in that hospital, and is stated at the end of this line (Imamgholi S. et al 2014). Each one of the three indicators can deliver valuable info to explain hospital services performance (Tanner, M. 2014). The use of a single indicator is the simplest way to determine the efficiency of the hospital. Even so, this way is tend to be biased. For example, the BOR that can be meant the higher efficiency of resource use, but also can be caused by unnecessary hospitalization for the patient. Therefore, it is required the use of several indicators to measure efficiency (Iswanto A. 2015).

![Pabon-Lasso diagram](image_url)

Figure 1: Pabon-Lasso diagram, Location of indicators of hospital efficiency on the four zones of Pabon Lasso model (Mohebbifar R, et al 2014).

It should be highlighted that evaluation grounded on only one hospital capacity indicator of bed utilization may be misleading and inadequate. E.g. “high BOR may not certainly means optimal utilization of beds which indicates good performance, somewhat may indicate long term needless hospitalization of patient or deprived nursing care, late diagnostic and therapeutic interventions or development of hospital acquired infections. Therefore, despite BOR may show good use of bed capacity, but in fact, it occurs due to poor or inefficient hospitals’ performance. Thus, to avoid such a confusing conclusion, and to have a more clear picture, synchronized use of all three indicators is required” (Tripathi CB. 2016).

Because of mathematical correlation between these three indicators, combination of them will increase their expressive power. Pabon Lasso had designed a graph to represent these combined three indicators for quickly identifying of technically non efficient hospitals in Colombia (Tanner, M. 2014). This graph that combines the 3 indicators is a rectangular in shape contains four zones having next features:

**Zone 1** (the least inefficient zone): Represents hospitals that have average BOR and BTOR lower than acceptable, that indicates extra beds of hospitals in relation to current demands. In this condition, hospitals lack efficiency required.
Zone 2: Denotes hospitals having high BTOR and low BOR, representing needless hospitalization and hospital beds are excessively supplied. Excess available beds, needless hospitalization or usage of beds for conditions for example patients’ observation. Patients with simple clinical condition can be seen hospitalized in hospitals of this zone.

Zone 3 (the most efficient zone): Comprises hospitals with both high BOR and BTOR, and have upright efficiency. In efficiency terms, this zone is regarded a satisfactory zone, and there is decrease in unused bed capacity (Imamgholi S. et al 2014).

Zone 4: Displays hospitals with high BOR, and low BTOR, signifying that these hospitals provide services for patients who have chronic severe disease or they stay admitted for time (unreasoningly high ALS). Thus “lengthy hospitalization, little utilization of current resources and high costs are features of hospitals located in this zone. Usually, psychiatric and geriatric medical centers are in this group” (McKee, M. 2000).

Methods: This study is a cross-sectional hospital-based descriptive study, with analytic component, done inside 28 hospitals selected from six governorates covering different Iraqi regions, excluding Kurdistan three governorates because they follow their own regional ministry of health with somewhat different health system. The six governorates were selected by non-random adjusted sampling (judgment and convenience) 2 from every Iraqi stratum: north, middle and south. Baghdad, Nieneva and Basra were selected judgmentally because they are the largest Iraqi governorates. In addition, Kirkuk, Wasit, &Missan were selected conveniently.

Hospitals: There are 201 different governmental hospitals and tertiary centers having beds all over Iraq, except Kurdistan region (MOH 2019). Four governmental hospitals of different types, were randomly selected from each governorate: general, specialized, teaching and district hospitals, making a total of 28 hospitals (except Baghdad, 8 hospitals were selected). Military hospitals were excluded due to data access restrictions. Private hospitals were also excluded due to its different utilization system.

General data include: number of all beds, the actual number of active beds ready for use, number of active bed-days, number of occupied bed-days, number of admissions, and performance data include: BOR, BTOR and ALS. Data of these hospitals - for the year 2019 - were collected from the health statistics department of each hospital, and then analyzed using SPSS for windows software (version 24) and Microsoft excel for presenting the related graphs according to pabon lasso model.
**Results:** Table 1 shows that all 28 studied hospitals are governmental. Only (9) of them (32%) are specialized, and the rest are general. There are 7 district hospitals, all of them are general. 15 hospitals (53%) are teaching. The overall number of the active beds, active bed-days, occupied bed-days, and the number of admissions were 5960, 2172115, 1203036, and 538262, respectively. ALS: 2.22 days, BOR: 58%, and BTOR: 100 times per bed/year.
Figure 3: Efficiency Zones for the 28 Iraqi Hospitals distributed according to Pabon Lasso model. Every number refers to a hospital’s ID number.

Table 1: Bed utilization variables & efficiency indicators in studied hospitals.
During 2019, there are 177 governmental hospitals in Iraq without Kurdistan region, that contain 32091 predisposing beds, and estimated 54.4% bed occupancy rate (MOH 2019). From the 177 Iraqi governmental hospitals that provide secondary health care services, only 28 (16%) hospitals were included in the study, 4 hospitals from each 6 selected governorates (except Baghdad, where 8 hospitals were selected). 68% of hospitals are general and the remaining 32% are specialized: 14% of them are specialized for Gyn. and pediatrics, 11% are specialized for pediatrics and the remaining 7% are surgical. This picture is approximate to overall picture of Iraqi hospitals, that there is 119 general hospital 68%, 15 Gynecology and pediatrics hospital 8.5% and 12 hospitals (39%) of hospitals studied are placed in this zone, which is the greatest inefficient quadrant that is characterized by low BOR and BTOR compared to their mean. The hospitals situated in this quarter undergone excessive un-utilized hospitals’ beds. There is excessive beds with high bed capacity compared to demand. Patients who are apparently need hospital admission are either rejected or shifted to other hospital. Hospitals expansion is not needed, doctors are frequently unsatisfied and not motivated, and the hospital is inefficient. This

II. DISCUSSION

During 2019, there are 177 governmental hospitals in Iraq without Kurdistan region, that contain 32091 predisposing beds, and estimated 54.4% bed occupancy rate (MOH 2019). From the 177 Iraqi governmental hospitals that provide secondary health care services, only 28 (16%) hospitals were included in the study, 4 hospitals from each 6 selected governorates (except Baghdad, where 8 hospitals were selected). 68% of hospitals are general and the remaining 32% are specialized: 14% of them are specialized for Gyn. and pediatrics, 11% are specialized for pediatrics and the remaining 7% are surgical. This picture is approximate to overall picture of Iraqi hospitals, that there is 119 general hospital 68%, 15 Gynecology and pediatrics hospital 8.5% and 12 pediatrics hospital 6.8% (MOH 2019).

In the studied sample, 25% are district general hospitals (away from governorates’ centers) and the other 75% are located in the centers of governorates. All teaching hospitals (54%) are located in governorates’ centers to be close to medical college of the same governorate, in addition to specialized hospitals to serve overall governorate’s population.

The various 28 studied hospitals are scattered on these four dissimilar quadrants, as in figure 3:

**Zone 1**: there are (39%) of hospitals studied are placed in this zone, which is the greatest inefficient quadrant that is characterized by low BOR and BTOR compared to their mean. The hospitals situated in this quarter undergone excessive un-utilized hospitals’ beds. There is excessive beds with high bed capacity compared to demand. Patients who are apparently need hospital admission are either rejected or shifted to other hospital. Hospitals expansion is not needed, doctors are frequently unsatisfied and not motivated, and the hospital is inefficient. This

<table>
<thead>
<tr>
<th>No.</th>
<th>Hospital Name</th>
<th>Specialty</th>
<th>Beds</th>
<th>General</th>
<th>Teaching</th>
<th>Average Bed Occupancy Rate</th>
<th>Average Bed Turnover Rate</th>
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<td>10</td>
<td>Al-No`oman General</td>
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<td>19</td>
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<td>47815</td>
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<tr>
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<td>General teaching</td>
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</table>
is agreed by the results of a systemic review of hospitals’ efficiency in EMR that demonstrate that extra beds supplement and unsuitable hospitals volume are several of the main reasons of inefficient hospitals (Ravaghi H, et al. 2019).

Zone 2: (11%) are located quadrant-II. These hospitals are distinguished by high BTOR, low BOR and short ALS. This can be explained that there may be excessive not necessary hospitals’ admissions or treatment of those who have acute illness. Obstetrical and gynecological hospitals and short-term inpatient centers are typically located in this region (with predominance of normal deliveries). They have many vacant and extra beds in addition to too much and quick hospitals admissions. Most of those beds may be used for patients with no requirement to hospital admission or for their likely clinical checkup (Mehrtak M, et al. 2014).

Zone 3: (43%) are located in quadrant-3 which is the most efficient zone. These hospitals exhibited proper efficient performance level with elevated BOR and BTOR rates. High BOR and BTOR indicates hospital’s efficiency or its capability to use existing resources efficiently, with somewhat few empty beds whenever (Lasso P. 1986) and (Mohebbifar R, et al. 2014).

Zone 4: The study further revealed that small portion of hospitals (7%) are localized in fourth quadrant, that are distinguished by high BOR, low BTOR and long ALS. A hospital in this quadrant is predictable to have long term admissions with diminished resources’ utilization in addition to high costs. Most chronic illnesses with inessential long hospital’s admission and inefficient provision of services can lead to this condition (Mehrtak M, et al. 2014).

For comparison with other studies using Pabon lasso model:

Iranian studies show: Moradi G. et al in 2016 found that more than 50% of the hospitals studied belong to Kurdistan University of Medical Sciences haven’t gotten their optimum BOR (above 70 percent), and they recommend that “short-term and suitable strategy for improving the efficiency is to stop further expansion of hospitals as well as developing the number of hospital beds” (Moradi G., 2017). In 2011, Sajadi et al. found “an improvement in function of hospitals affiliated with Isfahan University of Medical Sciences between 2005 and 2006, as the hospitals mostly increased their BOR and decreased the ALS to shift towards zone 3 in Pabon Lasso chart” (Sajadi HS, 2011). A study on general hospitals located in Eastern Azerbijan Province, shows that (39%) are in the 1st zone, (5.5%) in the 2nd zone, (44.5%) in the 3rd zone and (11.1%) are in the 4th zone (Mehrtak M, et al. 2014).

A study on 40 public hospitals in 2012 in Tunisia shows that from the total of the 40 hospitals, (47.5%) are located in 1st Zone, (7.5%) are located in 2nd Zone, (27.5%) are located in Zone 3 and (17.5%) are located in 4th Zone (Younsi M, et al. 2014).

In Malawi, an efficiency study for 40 hospitals revealed that 27.5 percent of hospitals are located in the efficient zone and about 50 percent in inefficient zone (Asbu E, 2012).

A study in south Nigeria shows that nearly 20 percent of the hospitals are located in the least efficient zone:1, 30 percent of the hospitals are situated in zone:2; although only 10 percent of the hospitals are located in the efficient zone:3 and 40 percent of the hospitals are situated in zone:4 (Henry E. et al. 2020).

A general look to the pabon lasso diagram (figure 3) for the 28 studied hospitals, can reveal that the most non efficient zone-1 contains only one district hospital that is Al Qurnah hospital (no.28) which is the most efficient among them (because it is located in the most upper right of first quadrant), on the other hand, the zone does not contain any hospital from the northern region. When compared with the zone 3 which is the most efficient region, it reveals that the zone contains five district hospitals of the seven district hospitals included in this study, also it contains seven northern hospitals of the eight northern hospitals included in the study.

This may be explained that the district hospitals have no surplus beds, and the citizens living in the same area served by district hospitals prefer to go to them rather than travelling to the referral hospitals in the centers of governorates, especially that ministry of health in Iraq act for putting the specialist doctors having diploma in these hospitals in addition to general practitioners.

Regarding the seven northern hospitals, the four studied hospitals of Kirkuk governorate are working efficiently because of optimal utilization of their resources (beds) due to dealing with immigrants from other governorates as
a result of security impairment conditions (Lafta R, et al. 2016), in addition to their population within their coverage area. The other three northern area hospitals related to Mosul governorate which are Al Salam general teaching, Al Jumhoory teaching for surgery and Al Qayyarah general hospital, all of them are working in different small building (alternative places) rather than that before 2014 due to destruction of their building during three years’ war (2014 - 2017), so they are not working in their full previous bed capacity, and it is difficult to see empty bed at all times, making the BOR and BTOR relatively high. For example, Al Salam general teaching hospital, before 2014 had more than 400 bed when compared with similar hospitals all over Iraq (the same hospital design in present in all 18 Iraqi governorates), while in 2019, the current study recorded only 188 active beds!

The study concluded that, there is underutilization of hospitals’ beds and short ALS, despite the Iraqi hospitals’ beds shortage. Only 43% of hospitals are efficient according to Pabon lasso model. Northern hospitals are more efficient compared to middle and southern regions’ hospitals.

REFERENCES: