Performance Ratio Analysis: A National Study on Iranian Hospitals Affiliated to Ministry of Health and Medical Education

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Abstract

Background: This study was designed to present and compare Iranian hospitals` performance applying ratio analysis technique.

Methods: This cross-sectional survey was conducted to present an instant image of 139 Iranian hospitals` performance status applying ratio analysis as one of the non parametric technical efficiency assessment methods in 2008. Data was collected using nine dimensional questionnaires supported by world wide web to achieve main hospital ratios. Final analysis was performed applying classic statistics and relevant statistical tests on significant level of 0.05.

Results: Four hospital performance indicators were estimated in the studied hospitals as follows: Bed turnover rate (BTR) was fluctuated from 64.5 to 114.8 times for hospitals located in rich and poor areas respectively. Moreover Bed Interval Rate (BIT) was calculated 1.36 versus 2.4 in the poor and rich areas. Average length of stay (ALS) was computed 1.82 for the poor regions but 3.27 for the rich ones furthermore, a positive statistical significant correlation was seen between ALS and the hospital size ($P=0.001, r=0.28$). Average bed occupancy rate (BOR) was 57.8% and its variation was from 31.4% to 64.5% depending on the hospital size so that there was a positive statistical significant relationship between the hospital size and BOR ($P=0.006, r=0.32$).

Conclusion: Regarding that BOR, ALS, BTR and BIT along with mortality rates are mentioned as the most considerable performance indicators, applying analytic frameworks more than considering single and raw indicators are severely recommended.

Keywords: Ratio analysis, Efficiency, Hospital, Iran

Introduction

Hospitals are considered as the most significant section of the health care systems all over the world providing complex and vital services (1), at the same time, they are mentioned as the largest consumer of the rare sources allocated to the health sector (2) in another word, hospitals specially in developing countries are accountable for almost 50 to 80 percent of the all healthcare system costs (3).

According to the hospitals` significance and regarding the constant increase in the health expenditures and its relevant financial problems that mostly belong to this biggest consumer (4), extra attention to hospital performance is required.

Performance indicators can be applied for two main internal and external purposes. The Internal ones are related to the hospitals` managerial functions as health services delivery organizations and in this way, these internal indicators are used as an informational tool for managers to monitor, evaluate or improve the long term or short term functions. In contrast, the external purposes are related to accountability questions asked by other stakeholders such as the financier, consumers or the public (5).

Although there is no doubt using performance indicators to demonstrate a real and complete image of the hospital performance, different indexes are considered appropriate as a performance criterion mainly categorized in three branches of efficiency, effectiveness and quality(6). Among them, efficiency is used vastly though its definition is almost ambiguous (7).

Efficiency is simply explained as the ratio of outputs to inputs, however the efficiency of each hospital production unit consists of two essential elements: technical efficiency and allocative one (8). The former can be measured as the hospital performance indicator using different methods; one is applying hospital performance ratios.

Ratio analysis as one of the non parametric technical efficiency assessment methods, includes the separate examination of various key measures such as average cost per inpatient day, bed occupancy rate, average length of stay, bed turnover ratio and so on (9).

This is a simple applied method for presenting general status of the hospitals only in the condition of single inputs and single outputs. In contrast, in the situation of multiple inputs or outputs, ratio analysis will be possible only if there is standardized measurement to get an overall indicator (10).

Against this limitation, some of these ratios are commonly used by hospitals demonstrating rapid investigation and identification of those with poor performance and can be helpful to offer recommendations for decreasing inefficiency (11).

According to the serious emphasis of different studies on raising attention to hospital efficiency analysis as one of the major performance indica-

tors (4), this study was conducted to present a general view of Iranian hospitals` performance applying related ratios as one of the efficiency assessment instruments.

Materials and Method

It was a cross-sectional descriptive analytic survey conducted as a situational analysis tool in 2008 and at the same time designing a comprehensive information database in order to present an immediate picture of hospitals` performance for Iranian policy makers.

All the Iranian educational or non educational hospitals affiliated with Ministry of Health and Medical Education (MOHME), regardless of their bed numbers were included as the study population. The other inclusion criteria were the essential prerequisites for applying designed software supported by World Wide Web and classified available information for data entry in the stated software.

In the first phase, among 530 hospitals affiliated with MOHME, 200 ones claimed to possess the above prerequisites and were eager to contribute in this project. After complementary investigations by the ministerial specialized expert panel, 150 hospitals were selected to enter the survey having all the inclusion criteria simultaneously.

All the managers in these 150 hospitals were instructed personally to coordinate the process of filling the above software records, more electronic and phonic consultations were available whenever it was necessary. The software supported by World Wide Web was designed in nine general dimensions, forth of them were partially used in this survey: hospital human resources, utilized physical space, active bed status and patient information. These categories were divided to smaller sub categories according to the aim of the study applying expert views.

All the online filled forms were saved in the ministerial resource database, rechecked by pre determined experts and those were not completed thoroughly referred to complement with extra explanation if necessary.

At last 139 of these hospitals forwarded their fully completed forms in the variables required for the analysis. These variables were entered to the finalized sheets according to their main category.

Final analysis for achieving related performance ratios and presenting an analysis of ratios were fulfilled with current software such as EXCEL from Office 2007 and SPSS version 17 applying classic statistics and related statistical tests at the significant level of 0.05.

There were some ethical implications in the research method that are considered and managed as follows:

1- There was not pointed to any names of the hospitals or their University of Medical Sciences, in contrast in regard of information confidentiality , data was presented in two main categories of poor and rich areas and educational / non educational hospitals elsewhere.

2- Poor areas are imputed to those hospitals that are affiliated with grade 3 Universities of Medical Sciences and Rich areas are imputed to the other hospitals affiliated with grades 1 and 2 Universities of Medical Sciences all over the country.

3- Raw results achieved from each University of Medical Sciences were given to them for fur-

ther decision making only in the condition of existing formal request.

Results

Although any portion of organizational output to input can be considered as an efficiency ratio (12), some are most relevant and current demonstrating a whole view of hospital performance. In this study we go through the main efficiency ratios achieved by Iranian public hospitals in 2008.

Results show that there is a wide variation in the size of the studied hospitals as measured by the number of their active beds such that 23 of these hospitals have fewer than 50 beds, 61 cases have between 51 to 150 beds, 36 ones possess 151-300 beds and only 19 hospitals have more than 300 beds. Furthermore Mazandaran University of Medical Sciences has the most number of the smallest hospitals (with 4 hospitals under 50 beds) in the other hand, Tehran and Shahid Beheshti Universities of Medical Sciences have the most number of the largest hospitals (each with 4 hospitals more than 300 beds). Other descriptive results indicate that among these 139 hospitals, 68 ones are educational and the others (71 hospitals) belong to the non educational category. It is also important to mention that 105 hospitals are situated in the rich areas and only 34 hospitals are located in the poor regions (Table1).

Table 1: Frequency distribution of the studied hospitals and their active beds

Type of Hospitals	Educational				Non Educational			
Type of areas	hospitals		Beds		Hospitals		beds	
	n	%	n	%	n	%	n	%
Poor	5	7.4	726	4.3	29	40.8	2033	29.3
Rich	63	92.6	16020	95.7	42	59.2	4895	70.7
Total	68	100	16746	100	71	100	6928	100

Four hospital performance indicators were estimated in the studied hospitals applying Excel software such that Bed Turnover Ratio (BTR) was 114.8 times for hospitals located in poor areas and 64.5 times for those situated in rich regions throughout the year 2008. Moreover Bed Interval Rate (BIT) was calculated 1.36 versus 2.4 in the poor and rich areas respectively. Average length of

stay (ALS) was computed 1.82 for the poor regions but 3.27 for the rich as the third indicator (Table 2). Table 3 indicates that the highest rate of ALS was belonged to the educational hospitals in the rich area with more than 300 beds (4.33 days) in contrast, those non educational hospitals with 51-300 beds located in poor areas had the lowest ALS with 1.29 days.

Table 2: Hospital indicators in different areas

Hospital ratios	Poor areas		Rich Areas	
	Educational	Non Educational	Educational	Non Educational
Bed Turnover Ratio(BTR)	60.7	60.2	58.2	85.1
Bed Turnover Interval (TI)	2.6	2.6	2.6	1.9
Average Length of Stay	2.4	1.56	2.67	2.38

Table 3: Average length of stay according to the hospital types

Average Length of Stay	poor		Rich		Sum		
	educational	Non educational	educational	Non educational	educational	Non educational	Total
Under 50 beds	-	1.93	2.22	2.09	2.22	2	2.04
51-150 beds	2.87	1.29	2.1	2.4	2.19	1.82	3.03
151-300 beds	4.13	2.58	3.75	3.07	3.77	2.88	3.53
More than 300 beds	-	-	4.33	1.98	4.33	1.98	3.76

Average bed occupancy rate was 57.8% among these hospitals such that the lowest bed occupancy rate was belonged to the under 50 bed hospitals (31.4%) versus the highest ratio that was pertained to the more than 300 bed hospitals (64.5%) (Table 4).

Table4: Bed occupancy rate on the base of hospital types

Hospital types	Bed Occupancy Rate
Educational	58.5
Non Educational	56.1
Poor	57.2
Rich	57.8
Under 50 beds	31.4
51-150 beds	51.6
151-300 beds	58.6
More than 300 beds	63.4

Finally, there were no significant statistical relationship between BOR and type of hospitals as educational or non educational and also the location of these hospitals in poor or rich areas. But BOR and hospital size measured by their number of active beds, had a positive statistical significant relationship (P=0.006, r=0.32) alongside a positive significant correlation between ALS and hospital size (P=0.001,r=0.28) in the confidence interval of 95%.

Discussion

Public hospitals are considered as the most important sections and at the same time, the main spenders within the healthcare systems in developing countries and so is in Iran, acting as first referral, secondary or last referral facilities depending on their capacity (13). Furthermore, in public section, 66 percent of all Iranian hospitals are affiliated with Ministry of Health and Medical Education (14). According to the importance of these hospitals, this survey was performed to achieve an instant picture of their efficiency as one of the most considerable performance indicators applying hospital ratios as efficiency assessment instrument.

However, most of the previous studies recommended not to apply a single performance indicator and ratio in order to achieve a better and more real image of the hospitals` status (15-16), the others have shown the significant correlation between the increase in technical efficiency scores and rising in hospitals` BOR as one of the most important ratios. In another words, these studies suppose this ratio as a method commonly used in assessing hospital performance (7). Moreover, further Iranian researches emphasize on the significant relationship between hospitals` BOR and

their evaluation grade determining their level of hoteling tariffs (17).

Regarding the magnitude of BOR, the present study indicated a high degree of fluctuation in hospitals` bed occupancy rate from 31.4% as the minimum level in under 50 bed hospitals to 63.4% in more than 300 bed hospitals. Concerning the present result and according to the pre stated study (7), it seems that these small hospitals are not as much efficient as they should. This finding is similar to those estimating hospital efficiency applying the other methods, as Gannon expected that the mean of technical efficiency using DEA in the larger hospitals can be 8 to 18 percent higher than the smaller ones(8).

Other relevant studies supposed the higher level of technical efficiency in the larger hospitals (more than 100 beds comparing under 100) (18-19) but it is against another study implying that using extra beds in hospitals can be considered as one of the essential factors in reducing hospital efficiency (20). It is maybe because different hospital sizes can be acceptable for different countries depending on their level of development (21).

As the present results show, The Bed Occupancy Rate (BOR) among Iranian hospitals was reported to be 57.8% in 2008 indicative of a significance difference with standard index of 85-90%.(22) and also MOHME`s optimum level of more than 70% (23) though this BOR (57.8%) is similar to the Iranian Bed Occupancy Rate in 2001 reported about 57.4% (24). that both imply a serious need to design further studies in order to understand the causes of this low rate of BOR and find the applied solutions. Furthermore, these are against the other studies reporting British hospitals` BOR about 84.6% in the year 2000 (25). These differences can be justified partly knowing that hospitals` BOR quantities can be varied from one district or country to the other.

The other findings demonstrated a variation in ALS from 1.93 to 4.33 in the studied hospitals. As this survey does not focus on a relatively homogeneous group of hospitals , this differences can be acceptable however between each homogeneous classification, those hospitals with lower ALS are regarded to perform better than those with higher ALS(7). At the same time, although this indicator can have diverse standards at different hospitals according to their specialty and kinds of patients, average length of stay less than 3.5 days considered as favorable, between 3.5 to 4, mediatory and more than 4 days as poor indicator level by Iranian Ministry of Health and Medical Education (23).

So it is noticeable that except large educational hospitals (between 151-300 and more than 300 beds) regardless of their area, the other hospitals` ALS were supposed ideal comparing MOHME`s standards that may compel a basic review in their procedures. At the same time, Concerning a positive correlation between hospital size and ALS (P=0.001,r=0.22), special managerial interventions are recommended after investigating the related causes of higher ALS in the larger hospitals.

In this study Bed Turnover Rate was varied from 64.5 times for those hospitals situated in rich regions to 114.8 times for those located in poor areas at the same time, non educational centers almost had higher BTR that can be predictable because of the different nature and mission of these hospitals.

The present Bed Turnover Interval was reported between 1.9 to 2.6 that is located in the excellent area regarding the international ideal rate of 1-3 days (7) but if considering MOHME`s standards, non educational hospitals in the rich areas (BIT=1.9) are located in the ideal zone (under 2 days) versus the other hospitals` BIT (2.6 days) which supposed in the mediocre area (between2-3days).

Despite all the potential limitations related to hospital ratio assessment as an efficiency instrument such as difficulties in showing relationships between one input with some outputs or reverse and disability in determining hospital crucial points (26), whereas BOR, ALS, BTR and BIT along with mortality rates are mentioned as the most considerable performance indicators (27), they must be investigated and followed regularly by deputy of Curative affairs of Iranian Ministry of Health and Medical Education. Although it is important to mention that lack of analytic frameworks and just relaying on a single indicator may

lead to false conclusions, so it is strongly recommended using different methods of performance evaluations together to reach a more complete view of the real status of the hospitals.

Conclusion

It is recommended to pay attention to the present results and the similar ones for the future planning and resource allocating of Iranian governmental hospitals. Furthermore it is very important to consider need assessment results for each region according to its potentialities, population under coverage and other geographical and cultural indexes. Moreover because of potential limitations of using the above ratios alone, it is greatly suggested to apply different methods of performance evaluations together to demonstrate a better picture of the hospitals` performance for their future planning.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

Acknowledgements

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