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EFFICIENCY EVALUATION OF LISTED HOSPITAL COMPANIES IN THE CAPITAL MARKET: INTRODUCING A NEW HOSPITAL ADMINISTRATION AND FINANCING

Meghdad Rahati [a], Iravan Masoudi Asl [b*], Masoud Aboulhallaje [c], Mehdi Jafari [b,d]

[a] *Department of Health Services Management, Faculty of Management, South Tehran Branch, Islamic Azad University, Tehran, IRAN.*

[b] *Department of Health Services Management, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, IRAN.*

[c] *Health Services Management, Budgeting and Performance Monitoring Center, Ministry of Health and Medical Education, Tehran, IRAN.*

[d] *Health Manager Development Institute, Ministry of Health and Medical Education, Tehran, IRAN.*

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ABSTRACT

The capital market has an important role in the economy and stagnant money and capital flow through a company at a low cost. Because no studies have been published on listed hospital companies, researchers have sought to identify them, evaluate their efficiency and the determinate relationship between efficiency and profitability and liquidity ratios. This study was done in 2018. The statistical sample is 49 hospital companies listed on capital markets that were evaluated for the availability of financial data for 2013-2016. The DEA technique and regression in a panel data model has been used. The findings show that efficiency during the four years was 0.41, 0.77, 0.82 and 0.81 respectively, and there is a significant relationship between profitability and liquidity ratios and efficiency. In the world, hospitals are administrated as public companies in the capital market, in addition to other models. Some of these companies have one and some have more than one hospital in the capital market as active holdings. The increase and relatively good efficiency of hospital companies, given the direct correlation between efficiency and profitability and liquidity ratios, indicate the potential of companies to fulfill financial obligations and a positive evaluation of the companies' performance.

Disciplinary: Health Management, Management Sciences (Financial Management).

*Corresponding author (Iravan Masoudi Asl).Tel: +98-9125060486. Email: Masoudi_1352@yahoo.com

1. INTRODUCTION

Different models of hospital administration and a variety of ownership and utilization have been implemented and evaluated in many countries. The World Bank defines four organizational models for the administration of public hospitals: budget hospital (administrative units affiliated to higher regional or national levels), Autonomous hospital (a budget hospital with more authority and responsibility to managers), corporate hospital (imitation of the private sector decision-making system at a public hospital) and private hospital (Preker & Harding, 2009). Other types of hospital administration include the private-public participation model (a long-term contract between the public and non-governmental sectors for the construction and administration of the hospital through the sharing of risks and benefits) and chain Hospitals or hospital holdings (A company which at least has controlling shares of subsidiaries and through their control, promote the value of company) (Abullhlaj & et al, 2015)

Among the models, the corporate model is a new topic in the hospital administration. A corporate model is formed for business purposes and its capital consists of equivalents or equal shares. Business Companies can be divided into special and joint-stock companies. The difference between them is that in the joint-stock company, the founders provide part of the company's capital through the sale of shares to people through the capital market. In the meantime, the importance of the capital market can be pointed out. This market plays a vital role in the economies of the countries and not only do the stagnant money and capital flow through the company, but they also act as an indicator of the economic prosperity of countries and provide access to a cheap source of finance. The capital market will enhance the excellence and growth of companies in a competitive and transparent environment and, while increasing their credibility in the community, it will contribute to growth (Securities and Exchange Organization, 2016). Also, admitting companies in the capital market will lead to an optimal allocation of capital, GDP growth and employment, wealth increase and economic well-being of the society (Shakibaee & Golmohamadi, 2014; Barbosa, 2018; Shabestari & Malekzadeh, 2019).

One of the important issues in the capital market is efficiency. If the capital market is efficient, the price of securities is determined fairly, and the allocation of capital, which is the most important factor in the production and development of the economy, is performed optimally (Daniali & Mansouri, 2012). Since there has been no study on hospitals company in the capital market, and also with regard to the benefits of the capital market, this work has sought to identify listed hospital companies in the capital market and evaluate their efficiency in countries selected, upon reviewing their performance and introducing a new way of administration and financing for hospitals.

2. METHODOLOGY

The present study is descriptive and analytical, quantitative, inductive and applied.

2.1 HYPOTHESIS OF THE STUDY

In this research, a significant relationship between efficiency and profitability and liquidity ratios was calculated. The research hypotheses were formulated as follows.

1- Profitability ratios have a significant effect on efficiency in listed hospital companies.

2- The liquidity ratios have a significant effect on efficiency in listed hospital companies.

2.2 SAMPLE SELECTION

The statistical population of the study is hospital companies listed in the capital market.

According to a systematic review, 87 hospital companies were identified in the capital market. Among these, 49 companies were selected as a sample based on the availability of financial data. The selected companies had the following features:

1) At the time of the study, the company was in one of the security exchanges of the world.

2) The financial period ended in December.

3) At the time of the study, the company's activity or the financial year did not change.

4) Companies have been active in the field of hospitals or hospital operators.

2.3 DATA COLLECTION

The research was derived from the Yahoo Finance, Google Finance, Morningstar, Bloomberg, 4-Traders, Top foreign stocks, Money control, Ft Markets, and Aseanup databases, based on the actual stock market information, and consistent with the financial statements of hospitals. The research was done during 2013-2016.

2.3.1 TOOLS

In order to evaluate the efficiency of hospital companies, the nonparametric method of Data Envelopment Analysis (DEA) was used with the CCR input-axis model. Data Envelopment Analysis is a tool for measuring the relative efficiency of homogenous decision-making units that has multiple inputs and outputs. Since introducing this tool, many models have been introduced to measure performance, but all of these models are based on CCR and BCC models. For the relative evaluation of units, two fundamental characteristics must be determined: returns to scale and the nature of the pattern (input-output-axis). The CCR model evaluates the relative efficiency of units with constant returns to scale (each set of inputs produces the same number of outputs) and the BCC model evaluates the relative efficiency of units with variable returns relative to the scale (any number of inputs can produce the same number of outputs or less) (Dargahi & al, 2010) (Mohamadi & Dastyar, 2015) The choice of input and output nature is determined by the control of the organization on each input and output (Mehregan, 2011).

Since managers and decision-makers do not have much influence on outputs in the health sector, the selected model is input- axis model to evaluate the technical efficiency. However, they can have a great influence on the number and composition of input. Pham stated three reasons for using input-axis model in hospitals.

1. Demand for health services is growing and demand estimates for these services are difficult.
2. Managers have more control over resources (inputs) than services (outputs).
3. Hospitals are obligated to be accountable to the demands of public health, so costs need to be reduced and the resources need to be used economically. (Pham, 2013).

In order to measure the relative efficiency of hospital companies, the financial ratios were used as inputs and outputs, demonstrated in Table 1. To test the hypotheses, we employed a regression model in the form of compound data (to as compound data, which is a combination of cross-sectional data and time series). The F-lemmer test was used in the combination data method to choose between the panel and the pooling method. If a panel method was chosen, the Hausman test was used to select between Fixed Effects and Random Effects (Aflatoonan, 2018).

*Corresponding author (Iravan Masoudi Asl).Tel: +98-9125060486. Email: Masoudi_1352@yahoo.com Volume 11 No.3 ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8 Paper ID:11A03L http://TUENGR.COM/V11/11A03L.pdf DOI: 10.14456/ITJEMAST.2020.52

The statistical analysis was performed using DEA Solver Pro and EViews software.

Table 1: Variables of Data Envelopment Analysis Model (Abolhalaj, 2010)

Variable Type	Variable name	Definition	**Formula**
Input	Current Liabilities	Obligations expected to be settled during the normal operating period or within one year from the balance sheet date[1]	-
Input	Current Assets	Assets created during current activities and are expected to become cash in less one year [1]	-
Output	Quick Ratio	The ability of the company to pay off short-term debts using current assets with a rapid liquidity capability [2]	$\frac{\text{Current Assets} - \text{Inventory}}{\text{Current liabilities}}$
Output	Current Ratio	Company's ability to pay off short-term debts using current assets [2]	$\frac{\text{Current Assets}}{\text{Current liabilities}}$
Output	Return on Investment (ROI)	Profit from investment in the form of a percentage of the initial cost [2]	$\frac{\text{(Net Return on Investment)}}{\text{Cost of Investment}}$
Output	Return on Equity (ROE)	The company's efficiency in creating Net profit for Shareholders [2]	$\frac{\text{Net profit}}{\text{shareholder's equity}}$
Output	Return on Assets (ROA)	The ability of management in the efficient use of assets [2]	$\frac{\text{Net profit}}{\text{Total Asset}}$

3. FINDINGS OF THE STUDY

Hospital companies listed in the capital market were described in Table 2. The Company was described based on the names of the stock market, the year of admission to the stock market, the place of activity of the company and the number of hospitals in each company.

With input and output data, the efficiency of each company was measured using the CCR input-axis model for the four consecutive years 2013-2016, as shown in Table 4. According to the data obtained, the efficiency of 14 hospital companies in 2013, 13 companies in 2014, 15 companies in 2015 and 14 companies in 2016 was one (score of one represents the highest performance). The data shows that the average efficiency of hospital companies will be 0.77, 0.74, 0.82 and 81.8 in 2013, 2014, 2015 and 2016 respectively.

In the following, the research hypotheses were tested using a regression model in the form of panel data. In this regard, since the data are presented in a Time series (2016-2013), the reliability of the variables should be ensured to avoid false regression. The reliability of the variables means that the mean and variance of variables over time and the covariance of variables have been constant over the years. For reliability, Levine, Lin and Chv (LLC) tests were used. The hypotheses H0 and H1 for this test are:

H0: unit root exists and the variable is not reliable.

H1: unit root does not exist and the variable is reliable.

Table 2: Company Profile hospital in the capital market.

Row	Company	Stock market	Admission to stock exchange	Activity location	Number of hospitals
1	Community Health Systems, Inc.	New York and Nasdaq	1991	United States	152
2	HCA Healthcare, Inc.	New York and Berlin	1969	United States and England	177
3	Quorum Health Corporation	New York	1991	United States	31
4	Select Medical Holdings	New York	1997	United States	103
5	Tenet Healthcare Corporation	New York	1994	United States	97
6	Universal Health Services, Inc.	New York	1981	USA, UK, Puerto Rico and Virgin Islands	26
7	Life Point Health, Inc.	Nasdaq	2013	United States and England	71
8	Sun Link Health Systems, Inc.	AMEX	1995	United States	4
9	MEDNAX Inc.	New York	1995	United States	5
10	Medical Facilities Corporation	Toronto	2004	Canada - United States	5
11	Banmédica SA	Santiago	2001	Chile, Colombia and Peru	10
12	Clinica las Condes SA	Santiago	2009	Chile	1
13	Georgia Healthcare Group PLC	London	2015	George	37
14	NMC Health Plc	London	2012	UAE, Spain	7
15	Mediclinic International plc	London, Johannesburg and Namibia	1986	UK, South Africa, Namibia, Switzerland and UAE	73
16	Fresenius SE & Co.KGaA	Frankfurt	1986	Germany, Spain and USA	110
17	Rhön-Klinikum Aktiengesellschaft	Frankfurt	1989	Germany	38
18	Capio AB	Stockholm, Nasdaq Stockholm	2000	Sweden, Norway, Denmark, France and Germany	38
19th	Euromedica SA company	Athens, London	1999	Greece	12
20	IASO SA	Athens	2000	Greece	1
21	EMC Instytut Medyczny SA	Warsaw, Stockholm and France	-	Poland	8
22	Dom Lekarski SA	Warsaw	-	Poland	2
23	Ramsay Health Care Limited	Australia	1997	Australia, United Kingdom, Indonesia, Malaysia and France	223
24	Virtus Health Limited	Australia	2013	Australia, Ireland, UK, and Singapore	6
25	Life Healthcare Group Holdings Ltd	Johannesburg, Berlin, Frankfurt	2005	South Africa	64
26	Netcare Limited	Johannesburg	1996	South Africa and UK	116
27	IHH Healthcare Berhad	Malaysia and Singapore	2010	Malaysia, Singapore, Turkey and India	46
28	KPJ Healthcare Berhad	Malaysia	2007	Indonesia, Bangkok, Bangladesh and Australia	29
29	Raffles Medical Group	Singapore	2000	Singapore, China, Japan, Vietnam and Cambodia	1
30	RHT Health Trust	Singapore	2012	Singapore - India	2
31	Aikchol Hospital	Thailand	1992	Thailand	2
32	Bangkok Dusit Medical Services	Thailand	1991	Thailand and Cambodia	45
33	Chularat Hospital	Thailand	2013	Thailand	5
34	Chiang Mai Ram Medical Business	Thailand	-	Thailand	1
35	Mahachai Hospital PCL	Thailand	1996	Thailand	1
36	Nonthavej Hospital PCL	Thailand	1994	Thailand	1
37	Ramkhamhaeng Hospital PCL	Thailand	1991	Thailand	1
38	Samitivej PCL	Thailand	1990	Thailand	6
39	Vibhavadi Medical Center PCL	Thailand	1989	Thailand	1
40	Srivichai vejvivat PCL	Thailand	-	Thailand	3
41	Siloam International Hospitals	Indonesia	2013	Indonesia	20
42	Sarana Meditama Metropolitan Tbk PT	Indonesia		Indonesia	3
43	Concord Medical Services Holdings Limited	New York	2014	China	
44	Aier Eye Hospital Group Co., Ltd.	Shanghai	2015	China, Hong Kong and America, Germany, Austria, Spain and Italy	201
45	China Resources Phoenix Healthcare	Hong Kong	2013	China and Hong Kong	48
46	Apollo Hospitals Enterprise Limited	Mumbai Volkswagen Stock Exchange	1982	India	69
47	Dhanvantri Jeevan Rekha Ltd	Indian and Delhi National Exchanges	1996	India	1
48	Dr.Agarwal's Eye Hospital Limited	Indian National Stock Exchange	1995	India, Mozambique, Madagascar, Seychelles, Zambia, Uganda, Swaziland, Tanzania, Ghana, Nigeria and Rwanda	78
49	Shifa International Hospitals Ltd	Pakistan	1989	Pakistan	1

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Table 3: Descriptive statistics of inputs and outputs of companies

Descriptive Statistics	Inputs			Outputs				
	Balance sheet items			Profitability ratios			Liquidity ratios	
	Current assets	Current liabilities	Equity	Return on Investment (%)	Return on Equity (%)	Return on Investment (%)	Current ratio	Quick Ratio
Maximum	218.19	575.20	355.72	10.01	4.87	13.4	1.68	1.24
Minimum	29.68	44.28	-175.20	-7.05	-61.09	-15.8	1.41	0.99
Average	105.15	208.44	190.19	3.45	-27.55	3.87	1.58	1.14

Table 4: Relative Efficiency of Hospital Companies Based on Model CCR input-axis model

Row	Company	CCR- 2013	CCR- 2014	CCR- 2015	CCR- 2016
1	Community Health Systems, Inc.	0.92	0.95	1	1
2	HCA Healthcare, Inc.	1	1	1	1
3	Quorum Health Corporation	1	1	1	0.82
4	Select Medical Holdings Corporation	0.91	0.91	0.94	1
5	Tenet Healthcare Corporation	0.80	0.71	0.72	0.85
6	Universal Health Services, Inc.	0.89	0.86	0.96	0.89
7	LifePoint Health, Inc.	0.61	1	1	0.9 4
8	SunLink Health Systems, Inc.	0.47	0.49	0.77	0.34
9	Mednax Inc.	1	0.89	1	1
10	Banmédica SA	0.53	0.39	0.75	0.82
11	Clinica las Condes SA	0.96	0.85	0.75	0.75
12	Georgia Healthcare Group PLC	0.57	0.80	0.72	0.72
13	NMC Health Plc	0.63	0.52	0.93	0.96
14	Mediclinic International plc	0.98	0.98	1	0.79
15	Fresenius SE & Co.KGaA	0.70	0.68	0.87	0.78
16	Rhön-Klinikum Aktiengesellschaft	0.79	1	0.54	0.57
17	Capio AB	0.44	0.43	0.47	0.51
18	Euromedica SA	1	1	1	1
19	IASO SA	0.58	0.23	0.73	0.59
20	EMC Instytut Medyczny SA	0.53	0.44	0.46	0.30
21	Dom Lekarski SA	0.40	0.35	0.72	0.53
22	Ramsay Health Care Limited	0.70	0.64	0.85	0.95
23	Virtus Health Limited	1	1	1	1
24	Life Healthcare Group Holdings Ltd	1	1	1	1
25	Netcare Limited	1	0.54	0.85	0.77
26	IHH Healthcare Berhad	1	1	1	0.90
27	KPJ Healthcare Berhad	0.39	0.31	0.52	0.54
28	Raffles Medical Group	0.87	0.77	0.62	0.56
29	RHT Health Trust	0.87	1	0.67	1
30	Aikchol Hospital PCL	1	1	1	1
31	Bangkok Dusit Medical Services PCL	0.83	0.79	0.82	0.89
32	Chularat Hospital PCL	1	1	1	0.94
33	Chiang Mai Ram Medical Business PCL	0.60	0.51	0.75	0.79
34	Mahachai Hospital PCL	0.60	0.52	0.73	0.75
35	Nonthavej Hospital PCL	1	1	1	1
36	Ramkhamhaeng Hospital PCL	0.77	0.82	0.97	1
37	Samitivej PCL	0.85	0.89	0.99	1
38	Vibhavadi Medical Center PCL	0.60	0.47	0.76	0.84
39	Srivichai vejvivat PCL	0.51	0.58	0.57	0.74
40	Siloam International Hospitals	0.95	0.66	0.54	0.86
41	Sarana Meditama Metropolitan Tbk PT	1	0.85	1	0.82
42	Concord Medical Services Holdings Limited	0.38	0.51	0.37	0.51
43	Aier Eye Hospital Group Co., Ltd.	0.65	0.76	1	1
44	China Resources Phoenix	0.75	1	0.96	0.93
45	Apollo Hospitals Enterprise Limited	0.74	0.77	0.79	0.77
46	Lotus Eye Hospital and Institute Limited	1	0.86	0.93	1
47	Dhanvantri Jeevan Rekha Ltd	1	0.66	0.74	0.71
48	Dr.Agarwal's Eye Hospital Limited	0.41	0.31	0.90	0.36
49	Shifa International Hospitals Ltd	0.74	0.53	0.71	0.92

Table 5: The reliability of the variables through the LLC test	
Variable	P rob
Return on Investment (ROA)	0.00
Return on Equity (ROE)	0.00
Return on Investment (ROI)	0.02
Current Ratio(CR)	0.01
Quick Ratio (QR)	0.00

Table 5 shows that dependent and independent variables were reliable during the research period because the p-value for this test is less than a 5% significance level. Next considers the appropriate model for the regression model, from two models, Panel and Pool Data. In the pool data, the opposite of panel data, it is possible to ignore the factor of the section (company) or the factor of time (year) and combine the data with each other and estimate it by a regular least squares regression. In this regard, the F lemmer test was run to measure whether the data are panel or pool type. The hypotheses H0 and H1 for this test are

H_0: Data can be combined and a pool data model can be used.

H_1: Data cannot be combined and a panel data model can be used.

Table 6: Results of F lemmer test.			
Test	test statistic	The degree of freedom	P rob
F lemmer	7.2	48 and 140	0

In Table 6, the p-value for the F Lemmer test is less than the 5% significance level. The hypothesis of the use of pool data has to be rejected and the panel data model can be used. In order to estimate the regression, we have two methods: Fixed Effect and Random Effect. We employed the Hassman test to select the appropriate method between them. The hypotheses for this test are:

H_0: No relationship between independent variables and estimation error (random effects method)

H_1: A relationship between independent variables and estimation error (Fixed Effect method)

Table 7: Results of Hausman Test			
Test	Chi-Sq	Degree of freedom	P rob
Hazeman test	7.62	7	0.36

The results of the Hausman test are presented in Table 7. Since the p-value related to the Hasmane test is more than a 5% significance level, the panel data with random effects was selected, which indicates that there is no relationship between the independent variables and the estimation error.

In the following, the significance of the regression model was investigated, the results of which are shown in Table 8. Findings show that the correlation between the dependent variables (efficiency) and the independent variables (profitability and liquidity ratios) is strong (R= 0.768). Also, the profitability and liquidity ratios can explain 67% of the variation of efficiency (R Square= 0.67). With a 5% error rate, it can be stated that the regression model significantly predicts performance changes per year (p= 0.00).

*Corresponding author (Iravan Masoudi Asl).Tel: +98-9125060486. Email: Masoudi_1352@yahoo.com

Table 8: Results of the test of hypotheses through regression.

Variable	Coefficient	Std Error	t-statistic	Prob
Efficiency	1.0573	0.2473	4.2754	0
Return on Investment (ROA)	-0.0003	0.0040	-0.0921	0.9267
Return on Equity (ROE)	7.98 E- 06	0.0001	0.0571	0.9546
Return on Investment (ROI)	0.0031	0.0024	1.2661	0.2076
Current assets (E quity)	-0.0043	0.0024	-1.8211	0.0707
Current liabilities (L liabilities)	-0.0037	0.0027	-1.3719	0.1723
Quick (QR)	0.0143	0.0431	0.3312	0.7410
Current ratio (CR)	0.0622	0.0394	1.5784	0.1167
Effects Specification				
R-squared	0.7681	Mean dependent var		0.7871
Adjusted R-squared	0.6770	S.D.dependent var		0.2075
S.E.of regression	0.1179	Akaike info criterion		-1.2026
Sum squared resid	1.9468	Schwarz criterion		-0.2659
Log-likelihood	173.85	Hannan-Quinn criteria.		-0.8234
F-statistic	4335.8	Durbin-Watson stat		2.2754
Prob(F-statistic)	0.00			

4. DISCUSSION

In this research, identification of the companies of listed hospitals in the capital market and evaluation of efficiency were studied. As the findings demonstrate, in the world, in addition to the defined models, hospitals have been registered as a public company that is active in the capital market. Some of these companies having one hospital and some of these companies are active in Holding and have more than one hospital in the capital market. Some holdings are international and are operating in locations around the world. Measuring the efficiency of hospital companies showed that they are growing in the period of 2013-2016 and have a relatively good average performance (78.5%).

Since there has been no research on identifying hospital companies in the capital market and measuring their efficiency, researchers have compared the performance of hospital companies with other hospital companies not listed in the capital market. The results of studies conducted on hospital companies showed that the efficiency of hospitals has increased since becoming a company. In this regard, we can mention the Ferreira & Marques study, which shows that corporate government hospitals have the highest degree of efficiency stability (Ferreira & Marques, 2015). The efficiency of hospitals in Portugal has increased since they became corporative (Rego et al., 2010). Moreira (2008) showed that corporate hospitals have become more efficient. In their study in Sweden, improvements in production and financial resources have occurred in hospitals by corporatization (Aidemark & Lindkvist, 2004; Farzadnia et al, 2017).

The results of the research showed that there is a positive correlation between the efficiency and the ratios of profitability and liquidity. Eskandari and Mirza (2014) explained the significant effect of liquidity ratios and equity ratios on the technical inefficiency of companies is. Dadkhah et al. (2010) evaluate the efficiency of automobile parts manufacturing companies active in the Tehran Stock Exchange, concluding that there is a significant relationship between efficiency and stock returns. They argue, however, that the stock returns of efficient companies are higher than inefficient companies (Dadkhah et al., 2010) Abaszadeh et al. (2013) reviewed the relationship between capital structure and the efficiency of companies admitted in Tehran Stock Exchange and found that the debt ratio has a significant relationship with the efficiency of the companies. However, in the study of Janshad et al. (2009), which examines the efficiency of companies admitted

in the capital market, revealing that there is no significant relationship between the efficiency of cement and mining companies and the annual stock returns of companies. They stated that one of the reasons for the lack of a relationship is the limitation of the period of time (Jahanshad et al., 2009).

5. CONCLUSION

We performed the identification of hospital companies listed in the capital market, efficiency evaluation and examining the relationship between efficiency and profitability and liquidity ratios. Efficiency evaluation of hospital companies demonstrated that their efficiency is increasing and have relatively good efficiency. An increase in the efficiency of hospital companies, given the direct correlation between efficiency and profitability and liquidity ratios, indicates the potential of companies to fulfill financial obligations and a positive evaluation of the companies' performance.

4. AVAILABILITY OF DATA AND MATERIAL

Data used or generated from this study is available upon request to the corresponding author.

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Dr.Meghdad Rahati holds a Ph.D.in Health Services Management from Faculty of Management, South Tehran Branch, Islamic Azad University, Tehran, Iran. He is a researcher in Health Management and Human Resources Manager in hospital.

Dr.Iravan Masoudi Asl is an Associate Professor at the Department of Health Services Management, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran. His research is Health Management, and Health Service Management.

Dr.Masoud Aboulhallaje is an Associate Professor at the Health Services Management, Budgeting and Performance Monitoring Center, Ministry of Health and Medical Education, Tehran, Iran. He is a researcher in Health Management

Dr.Mehdi Jafari is an Associate professor at Department of Health Services Management, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran. He is Head of Health Manager Development Institute, Ministry of Health and Medical Education, Tehran, Iran.

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