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Key factors affecting the hospital performance: a qualitative study using fuzzy logic

Mohamad-Ali Afsharkazemi · Jila Manouchehri · Mojtaba Salarifar · Amir Ashkan Nasiripour

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Abstract Identifying the key factors affecting the hospital performance helps better planning for hospital high performance. The purpose of this study is to provide a combination of qualitative and quantitative methods to investigate the hospital performance. In the qualitative section of this study, factors associated with hospital performance were detected using literature review, interviews, and expert panels. The findings analyzed by one sample t test and categorized by framework analysis method. In the quantitative section of this study, both direct and indirect relationships between factors were measured by using fuzzy Decision Making Trial and Evaluation Laboratory technique to detect influencing and influenced factors. Finally the key factors affecting the hospital performance were detected.

Keywords Hospital performance · Fuzzy logic · Qualitative study · DEMATEL technique

M.-A. Afsharkazemi
Faculty of Management, Tehran Central Branch, Islamic Azad University, Tehran, Iran
e-mail: afshinafshar44@yahoo.com

J. Manouchehri (✉)
Quality Improvement Department, Tehran Heart Center, Tehran University of Medical Sciences, Al Ahmad & Northern Karegar Cross, Tehran, Iran
e-mail: manoochehrij@yahoo.com

M. Salarifar
Tehran Heart Center, Tehran University of Medical Sciences, Tehran, Iran
e-mail: salari1959@yahoo.com

A. A. Nasiripour
Department of Health Services Management, Science and Research Branch, Islamic Azad University, Tehran, Iran
e-mail: nasiripour@srbiau.ac.ir

1 Introduction

Improving population health is among the goals for health systems in most developing or developed countries which meet them through delivery of comprehensive, high-quality, timely, and cost-effective medical care to all citizens. General hospitals are provided with 80 % of the resources available to the health care system; however, perform only 20 % of the health activities (World Health Organization 1999).

In general hospitals, like other publicly operated health services, typical problems include technical inefficiency, allocative inefficiency, and poor responsiveness to stakeholders (user patients) (Preker and Harding 2003). In developing countries the problem with healthcare sector is deeper than western world because in addition to low quality and high cost of services, other aspects such as fair access to medical care appear to be important (Ozturk and Swiss 2008).

Iranian health care delivery system is largely financed through public budget, and hospitals spend most of the health care expenditures (World Health Organization 2007); however, patient total out-of-pocket payment is considerable. The fourth Iranian Development Plan set the goal to reduce the out-of-pocket payment from 51 to 30 %, and to decrease households faced with catastrophic expenditure from 2.9 to 1 % in a 5 year period ending in 2008. In spite government spending on health has increased during the last decade, almost 55 % of health expenditures is still paid out of pocket (Mehrdad 2009). Moreover, despite improving insurance coverage during the above-mentioned period, households faced with catastrophic expenditure have not been declined (Ibrahimipour et al. 2011). Therefore, currently, improvement in health system performance, in particular hospital treatment, is still a top priority in the national health-policy debates.

Various measurements have implemented in order to improve hospital performance in different countries with different health care systems. On the basis of evidence from previous studies a number of factors associated with hospital performance has been detected including quality improvement strategies (Sunol et al. 2009; Glickman et al. 2007); leadership style and the manager's characteristics (Wolf 2008; Sanfilippo et al. 2008); effective communication, organizational culture, staff motivation and priority to service delivery (Wolf 2008); human resource management (Wolf 2008; West et al. 2006); power distribution among top management team (Smith et al. 2006); non-organizational factors such as type of ownership, competition and interaction with insurance organizations (Jiang et al. 2006); cultural characteristics of hospital (Mannion et al. 2005); personality traits, professional commitment and job performance of administrative staff in hospital (Huang 2003); and organizational factors such as leadership skills, organizational culture, effective relationships within parts of the organization with clarity over each part or individual task (West 2001). The findings of these studies regarding independent determinants of hospital performance are valuable; however, none of them has investigated a combination of all effective factors on hospital performance. In this paper: First, we found a combination of the factors associated with performance in a high performance hospital. Second, both direct and indirect relationships between factors measured, and finally using Fuzzy logic the key factors affecting the hospital performance detected.

1.1 Tehran Heart Center (THC)

This study was conducted at THC which is a major referral and educational cardiac hospital affiliated to Tehran University of Medical Sciences (TUMS). The center was officially inaugurated in 2002, currently comprises ten open heart surgery rooms, Cardiac Cath Lab with

six cardiovascular labs and one electrophysiology lab, four ICUs (88 beds), five CCUs (72 beds), seven post-CCUs (157 beds), and five surgical wards (120 beds). Overall, in a 9 year time period from 2002 to 2010, the mean bed occupancy rate in the hospital was 86 %. At the same time, THC approximately had annual volumes of: 18,000 inpatient admissions, 9,000 coronary angiographies, 3,700 coronary artery bypass surgeries, and 2,000 angioplasties. In this study, THC was chosen as a public hospital with high performance for the following reasons:

- The hospital has been running for over 9 years (2002–2010) with acceptable statistical indicators better than those offered by national standards. For instance, the mean bed occupancy rate in Iran is 65/3 % for over the country, 68/4 % for Tehran province, and 70 % for TUMS's hospitals (Jozokli 2004), whereas this index for THC has averagely been 84 % within last 6 years.
- With regard to qualitative indicators, from 2002 to 2010, THC has been taken grade one in annual accreditation by TUMS for nine consecutive years and was awarded the ISO9001:2000 certificate in October 2004 (Manouchehri Moghadam et al. 2010). In addition, respecting the patients' rights as well as focusing on planning and implementing quality improvement interventions, in 2009, THC ranked first in quality improvement efforts by "Clinical Governance" model.
- In addition to statistical and qualitative indicators, in a high-performance hospital, accessibility of needed health care services to all members of the population is another important issue. Health insurance coverage is among measures of access. THC is a public hospital that charge patients no higher fees than the national tariffs; the hospital accepts health care insurance offered by three major public health insurance companies in Iran, i.e., Social Security Organization, Medical Service Insurance Organization, and Military Service Health Organization, and also has signed agreement with most of private insurance organizations offering complementary health insurance.
- Although THC affiliated to TUMS, the hospital has financial and administrative autonomy receiving no budget from the university. Thus, according to the World Bank, conceptual framework of hospital organizational reforms (Preker and Harding organizational modalities), THC may be considered as corporatized hospital that mimics the decision-making structure of private corporations while ownership remains with the government.

1.2 Fuzzy logic and Decision Making Trial and Evaluation Laboratory (DEMATEL) technique

Decision making is generally based on individual judgment; however, human perceptions on various issues are not easy to be represented as exact numerical values particularly in the field of social science. Using fuzzy logic to evaluate the opinions of the decision makers has at least in part solved this problem (Tseng and Lin 2009).

On the other hand, evaluation in managerial concepts usually involves subjective and qualitative judgment. So, understanding and analyzing the interrelationships between hospital performance factors needs a sensible and logical manner. To address these interrelationships and uncertainty issues, the DEMATEL, a mathematical computation method, can convert the relations between cause and effect of criteria into a visual structural model and also handle the inner dependences within a set of criteria as a wise way (Tseng and Lin 2009). DEMATEL is a comprehensive technique for making and analyzing a structural model which unveil causal relationships between components of a complex system (Wu and Lee 2007). It can prioritize the criteria based on the type of relationships and severity of the influences of each

criteria on another. With these advantages, this study applies a combined fuzzy logic and DEMATEL technique to assess the expert group opinions regarding relationships between factors affecting the THC performance. Considering the research subject there is no cause and effect relations; therefore, influencing and influenced factors will eventually detected.

2 Methodology

This case study conducted in 2010 at THC in two qualitative and quantitative sections. In the qualitative section (described trough phase 1–3 in research process), factors associated with hospital performance were determined using literature review, interviews, and expert panels and the findings analyzed by one sample *t* test. In the quantitative section (described trough phase 4 in research process), Fuzzy DEMATEL technique was applied to detect influencing and influenced factors.

2.1 Research process

2.1.1 Phase 1: Item generation

In this phase both "literature review" and "interview" with hospital managers were used.

Data regarding variables associated with hospital performance were gathered thorough relevant literature review, and a list of influencing factors provided. Then, according to the list, the main topics for interviews were extracted as follow: leadership and top managers' characteristics; staff management; autonomy in decision making; encouragement and punishment mechanisms; organizational culture; problem solving methods; continuous training; quality management system; and hospital information system (HIS).

To examine the influencing factors on THC performance, an interview process was done. The study population was nine number of hospital managers who had an effective presence in the hospital management team since its foundation including chairman, treatment deputy, research director, executive director, matron, and heads of four hospital's main wards. A series of semi-structured, in-person interviews were arranged for selected managers. A formal letter was sent to each interviewee explaining the objectives of the study, and introducing an individual investigator in research team as interviewer. First interview was conducted in chairman office followed by treatment deputy, executive director, head of clinical laboratory and matron. During the process of interviews with consecutive interviewees, overlaps between responses were gradually increased where in fifth interview with the matron literally no new item mentioned. Further interviews were brought to a halt with reaching the saturation. Therefore, five interviews were conducted in total; all the interviews were performed in the interviewees' offices lasted ranging from 90 to 120 min. Interviews with hospital managers suggested a list of items influencing the hospital performance. After merging these items with hospital performance influencing factors extracted from literature and deleting repeated codes, the final list consisted of 262 items. A part of this list is shown as a sample (Table 1).

2.1.2 Phase 2: Verifying the items

The items gathered from previous step were divided into eight categories and reviewed in eight separate expert panels with number of expert participants ranging from 9 to 11. Based on the experience and specialty, some experts participated in more than one panel. Twenty two experts were selected among 60 senior managers and middle managers regarding the

Table 1 Performance influencing factors at Tehran Heart Center extracted from both literature and interviews with hospital top managers. (15 items for example)

No	Influencing factors	References
1	Top management constancy	A, B, E, (Mannion et al. 2005), (Wolf 2008)
2	Continues attention to balance between revenues and costs	A, (Jiang et al. 2006)
3	Top manager's authority in all major decisions	B, (Smith et al. 2006)
4	Motivating middle managers by participating in decision making	A, C, (West et al. 2006)
5	Manager's commitment and responsibility	C, (Huang 2003)
6	Parity of organizational structure and function	C, D, (Sanfilippo et al. 2008)
7	Good relationship between top and middle managers	A, C, D, (Wolf 2008)
8	Organizational and financial autonomy	A, B, C, D, E
9	Full time doctors	A, B, (Ozturk and Swiss 2008), (Petterson 2009)
10	Interaction with insurance organizations	C, (Jiang et al. 2006)
11	Top manager's relevant and efficient experiences	A, B, (Smith et al. 2006)
12	Top manager's commitment to hospital high performance	B, D, E, (Wolf 2008)
13	No-blame culture and emphasize on learning from failures	A, E, (Wolf 2008)
14	Advanced and relevant technology	A, B, E, (Goldstein et al. 2001)
15	Hospital adoption of IT applications	A, C, (Menachemi et al. 2008)

(A, B, C, D, E) show interviewees (the hospital top managers)

following selection criteria: specialty or experience, organizational position, and proficiency in subject areas. In all eight panels the linguistic opinions of experts in terms of the degree of influence on hospital high performance as "Very high, High, Moderate, Low, Very low" scored 9, 7, 5, 3, 1 respectively. Given that the maximum score for each item was 9, and that the acceptable cut point was considered 75 % of the top score, H_0 and H_1 hypothesis were expressed as:

$$\begin{cases} H_0 = \overline{X} \leq 6.75 \\ H_1 = \overline{X} > 6.75 \end{cases}$$

2.1.3 Phase 3: Analyzing and categorizing the findings

In this step, after omitting 51 items with unsatisfactory cut-off point, the remaining items on the basis of their content and category merged into 81 sub-themes. Consequently, these sub-themes categorized in 12 themes using framework analysis method (Table 2).

2.1.4 Phase 4: Interpret of interrelationships between final factors

In this phase, the interrelationships between main factors (12 themes) were examined by Fuzzy DEMATEL technique. The technique has been described in detail previously (Tseng and Lin 2009; Wu and Lee 2007). Briefly, in the first step, using the opinions of six experts including chairman, treatment deputy, research director, executive director, finance deputy, and matron; the direct influence of each theme on other themes were identified in linguistic

Table 2 Categorization of factors influencing on THC's high-performance

Themes	Sub-themes
C1 Managerial factors	Parity of authority and responsibility
	Management constancy
	Fulltime senior and middle managers
	Systematic approach
	Delegation of authority
	Managers' commitment and responsibility
	Internal consistency
	Managers' motivation
	Process approach
C2 Hospital characteristics	Interaction with insurance organizations
	Bed occupancy rate
	Hospital size
	Hospital specialty
	Organizational structure
	Unique educational condition
	Full time doctors
C3 Top manager's characteristics	Commitment and responsibility
	Managerial experiences
	Acceptance
	Moral characteristics
	Communication skills
	Flexibility
	Honesty
C4 Staff management	Organizational autonomy
	Recruitment strategy
	Salary
	Staff training
	Motivation mechanisms
	Type of recruitment
	Communication network
C5 Quality management system	Management commitment
	Staff participation in the improvement process
	Determining, monitoring, and analyzing quality indicators
	Daily activities toward quality management objectives
	Recognition, analyze and solving problems
	Self assessment
	Clinical guidelines
	Complaint management
C6 Equipment, infrastructure management	Medical equipment purchasing process
	Software
	High technology
	Continuous assessment of equipment and facility
	Preventive approach in medical equipment maintenance

Table 2 Continued

Themes	Sub-themes
	Infrastructure's maintenance
C7 Hospital information system	Applicability
	System coverage
	Infrastructures
	Easy access
	User's satisfaction
	Flexibility
C8 Decision making style	Decisiveness
	Quickness
	Impartiality
	Information saturation
	Problem solving
	Forecasting principals
C9 Planning	Strategic thinking
	Strategic management
	Planning process
	Feedback
	Targeting
C10 Control	Reformatory approach
	Performance monitoring
	Comprehensive control
	Effective supervision over nursing staff
	HIS
C11 Financing	Financial autonomy
	Sufficient income
	Sensitivity in acquiring income
	Sensitivity in reducing costs
	HIS
C12 Organizational culture	Senior manager
	Obvious norms and behaviors
	Feeling of identity, organizational commitment and belonging
	Fundamental values
	Organizational learning
	Perception of workplace
	Staff participation
	Adaptation
	Communication
	Staff evaluation/appraisal

variable scales (no influence, low influence, moderate influence, high influence, and very high influence) and a comparison scale for each expert designed. For instance, the first experts' opinion by linguistic variable scales has shown in Table 3.

Table 3 Direct influence of each theme on the other themes: the assessment of the first experts' opinion by linguistic terms

Themes	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
C1 Managerial factors	NO	V.H	H	V.H	H	H	L	H	H	H	V.H	H
C2 Hospital characteristics	H	NO	L	H	H	H	L	L	V.L	H	H	L
C3 Top manager's characteristics	V.H	H	NO	V.H	H	H	H	H	H	H	H	H
C4 Staff management	H	H	H	NO	H	L	L	H	H	H	H	L
C5 Quality management system	H	H	H	H	NO	H	H	H	H	V.H	H	H
C6 Equipment, infrastructure management	H	H	L	H	H	NO	L	L	L	L	H	L
C7 Hospital information system	H	H	H	H	H	H	NO	H	V.L	H	H	L
C8 Decision making style	H	L	H	H	H	L	V.L	NO	L	L	L	V.L
C9 Planning	L	L	L	L	L	H	H	L	NO	H	L	L
C10 Control	H	L	L	H	H	V.L	V.L	H	H	NO	H	L
C11 Financing	V.H	H	H	V.H	H	V.H	H	H	H	L	NO	L
C12 Organizational culture	H	L	L	H	L	L	L	H	H	L	L	NO

Table 4 The fuzzy linguistic scales

Linguistic variable scales	Crisp values	Triangular fuzzy numbers
Very high influence	4	(0.75, 1, 1)
High influence	3	(0.5, 0.75, 1)
Low influence	2	(0.25, 0.5, 0.75)
Very low influence	1	(0, 0.25, 0.5)
No influence	0	(0, 0, 0.25)

Table 5 The normalized direct-relation matrix (for the first expert)

Themes	C1			C2			⋯	C11			C12		
C1	0	0	0.25	0.75	1	1	⋯	1	0.75	1	1	0.5	0.75
C2	0.5	0.75	1	0	0	0.25	⋯	0.5	0.75	1	0.25	0.5	0.75
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C11	0.75	1	1	0.5	0.75	1	⋯	0	0	0.25	0.25	0.5	0.75
C12	0.5	0.75	1	0.25	0.5	0.75	⋯	0.25	0.5	0.75	0	0	0.25

Step 2, as shown in Table 4, all linguistic variable scales were expressed in crisp values (0–4), then all data converted into positive triangular fuzzy numbers (Wu and Lee 2007). So six direct relation matrix by triangular fuzzy numbers obtained.

Step 3, the direct relation matrix for each expert was normalized (Table 5). The normalized direct relation matrix X can be obtained based on the direct relation matrix A, through the following formulas,

$$X = K \cdot A \tag{1}$$

$$k = \frac{1}{\max\limits_{1 \le i \le n} \sum_{j=1}^{n} a_{ij}}, \quad i, j = 1, 2, \ldots, n \tag{2}$$

Table 6 The average matrix

Themes	C1				C2		⋯		C11			C12	
C1	0	0	0.02	0.05	0.07	0.08	⋯	0.06	0.08	0.08	0.05	0.07	0.08
C2	0.03	0.05	0.08	0	0	0.02		0.04	0.06	0.08	0.01	0.03	0.05
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C11	0.05	0.08	0.08	0.03	0.05	0.07	⋯	0	0	0.02	0.02	0.04	0.07
C12	0.02	0.05	0.07	0.02	0.04	0.06	⋯	0.02	0.05	0.07	0	0	0.02

Table 7 Maximum numbers of the average matrix

Themes	C1	C2	C3	⋯	C10	C11	C12
C1	0.000	0.078	0.078	⋯	0.012	0.000	0.078
C2	0.000	0.000	0.020	⋯	0.043	0.000	0.000
C3	0.008	0.075	0.000	⋯	0.012	0.008	0.075
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C10	0.000	0.090	0.019	⋯	0.008	0.000	0.000
C11	0.000	0.078	0.078	⋯	0.082	0.012	0.000
C12	0.000	0.000	0.020	⋯	0.012	0.043	0.000

Table 8 Median numbers of the average matrix

Themes	C1	C2	C3	⋯	C10	C11	C12
C1	0.000	0.110	0.110	⋯	0.043	0.000	0.110
C2	0.023	0.000	0.051	⋯	0.074	0.023	0.000
C3	0.035	0.106	0.000	⋯	0.043	0.035	0.106
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C10	0.019	0.122	0.051	⋯	0.000	0.019	0.122
C11	0.000	0.110	0.110	⋯	0.043	0.000	0.110
C12	0.023	0.000	0.051	⋯	0.074	0.023	0.000

Table 9 Minimum numbers of the average matrix

Themes	C1	C2	C3	⋯	C10	C11	C12
C1	0.031	0.126	0.126	⋯	0.074	0.031	0.126
C2	0.055	0.031	0.082	⋯	0.106	0.055	0.031
C3	0.066	0.126	0.031	⋯	0.075	0.066	0.126
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C10	0.051	0.126	0.082	⋯	0.031	0.051	0.126
C11	0.031	0.126	0.126	⋯	0.074	0.031	0.126
C12	0.055	0.031	0.082	⋯	0.106	0.055	0.031

Table 10 The total relation matrix

(D)			(R)			$(D_i + R_i)$			$(D_i - R_i)$		
L	M	U	L	M	U	L	M	U	L	M	U
1.832	3.015	8.052	1.683	2.773	7.710	3.515	5.788	15.762	0.149	0.241	0.342
1.445	2.389	6.877	1.457	2.408	6.848	2.902	4.797	13.725	−0.012	−0.020	0.029
1.910	3.134	8.211	1.352	2.239	6.456	3.259	5.373	14.667	0.554	0.895	1.756
1.550	2.558	7.357	1.689	2.783	7.668	3.239	5.341	15.025	−0.139	−0.224	−0.312
1.656	2.740	7.791	1.676	2.772	7.826	3.332	5.512	15.617	−0.020	−0.032	−0.035
1.380	2.284	6.582	1.610	2.656	7.424	2.990	4.940	14.006	−0.230	−0.372	−0.842
1.530	2.526	7.133	1.424	2.356	6.790	2.955	4.882	13.923	0.106	0.170	0.343
1.494	2.468	7.098	1.601	2.641	7.379	3.095	5.109	14.478	−0.107	−0.173	−0.281
1.602	2.642	7.471	1.618	2.668	7.500	3.220	5.310	14.972	−0.016	−0.098	−0.030
1.557	2.570	7.261	1.690	2.785	7.714	3.247	5.355	14.974	−0.133	−0.214	−0.453
1.669	2.750	7.605	1.736	2.858	7.889	3.404	5.609	15.494	−0.067	−0.108	−0.283
1.475	2.437	7.017	1.561	2.576	7.251	3.036	5.013	14.268	−0.086	−0.139	−0.234

Step 4, average matrix (Wu and Lee 2007) of all six normal fuzzy matrixes was calculated (Table 6).

Step 5, average matrix with fuzzy numbers converted into three matrices L, M, and U which included the maximum, median, and minimum numbers of the average matrix, respectively (Tables 7, 8, 9).

Step 6, each three matrices L, M, and U were changed to total-relation matrices by using the formula (3), in which the "I" is denoted as the identity matrix.

$$T = X\,(I - X)^{-1} \tag{3}$$

Step 7, then the sum of rows and the sum of columns of three total-relation matrices were separately denoted as (D) matrix and (R) matrix respectively. Calculating the sum and difference of two matrices (D) and (R) resulted in two new matrices $(D_i - R_i)$ and $(D_i + R_i)$, with triangular fuzzy numbers (Table 10).

Step 8, finally using defuzzification technique developed by Opricovic ans Tzeng (2003), fuzzy numbers reconverted into crisp scores using following formula:

$$X_{Crisp} = \frac{L_{ij} + \left[\left(M_{ij} - L_{ij}\right) + \left(U_{ij} - L_{ij}\right)\right]}{3} \tag{4}$$

Step 9, applying defuzzification technique, crisp scores of $(D_i - R_i)$ and $(D_i + R_i)$ for 12 themes were calculated (Table 11).

Step 10, constructing the causal diagram by using the crisp scores of $(D_i - R_i)$ as the vertical axis and $(D_i + R_i)$ as the horizontal axis. The horizontal axis indicates the importance of criterion while the vertical axis may divide factors into influencing group and influenced group (Fig. 1).

So if the $(D_i - R_i)$ number is negative, the factor belongs to the effect (influenced) group, otherwise, the factor classified as the cause (influencing) group. And if the amount of the $(D_i + R_i)$ is more, the factor may have more intensity of relation and more importance (Tseng and Lin 2009; Wu and Lee 2007).

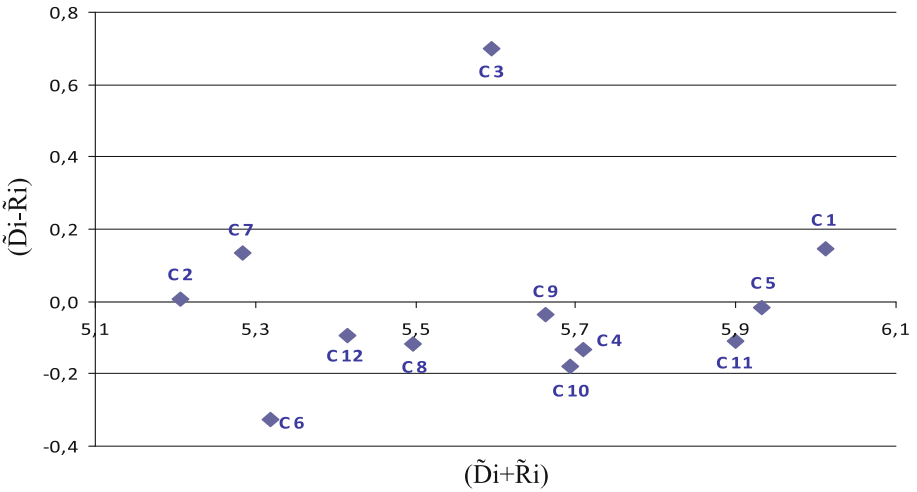

Fig. 1 The causal diagram

Table 11 The main factors associated with high-performance of THC divided by Influencing and Influenced factors

Main factors	$D_i + R_i$	$D_i - R_i$
Influencing factors		
C1 Managerial factor	6.012	0.145
C3 Top manager's characteristics	5.594	0.700
C7 Hospital information system	5.283	0.136
C2 Hospital characteristics	5.207	0.007
Influenced factors		
C5 Quality management system	5.932	−0.016
C11 Financing	5.899	−0.108
C4 Staff management	5.709	−0.132
C10 Control	5.694	−0.178
C9 Planning	5.687	−0.013
C8 Decision making style	5.497	−0.116
C12 Organizational culture	5.415	−0.096
C6 Equipment, infrastructure management	5.319	−0.328

Hence, with the help of a causal diagram acquired by mapping the dataset of the $(D_i + R_i)$, $(D_i - R_i)$, we may visualize the complicated causal relationships of factors into a visible structural model, providing valuable insight for planning.

Finally, the main factors associated with high-performance of THC divided by Influencing (C1, C2, C3, C7) and Influenced (C4, C5, C6, C8, C9, C10, C11) factors by described logic as shown in Table 11.

3 Results and discussion

Identifying the influencing factors on hospital performance helps better planning for achieving high-quality/low-cost performance. We performed the present study to explore key factors

affecting the THC hospital performance; 12 themes and 5–10 sub-themes within each theme were detected. Interactions between influencing and influenced factors were also investigated. Among 12 factors, we found four following factors to be influencing that with regard to the value of $(D_i + R_i)$, in order of importance were: managerial factors, top manager's characteristics, HIS, and hospital characteristics. Remaining eight were influenced factors including quality management system, financing, staff management, control, planning, decision making style, organizational culture, and equipment/infrastructure management. As noted by Wu and Lee (2007), if we would like to achieve high performance in terms of the influenced group factors, we should first control and pay a great attention to the role of influencing group factors. Focusing on influencing factors, herein, we discus the factors associated with high performance in THC, and attempt to investigate the effects of factors such as circumstances of the hospital management or even the Iranian health care system on the findings of the present study.

3.1 Managerial factors

In line with previous studies (Mannion et al. 2005; Huang 2003; West 2001), in this study, managerial factors were identified as the most influencing factors for hospital performance. This theme had nine sub themes such as management constancy, parity of authority and responsibility, and delegation of authority.

High senior management team turnover is suggested to be linked to low performance of hospitals (Mannion et al. 2005). Fortunately, THC management team has remained intact since the inauguration of the hospital 9 years past whereas strategic management more often fails in the public organizations in Iran due to a high turnover of managers (Danaee Fard et al. 2011).

Top management team power distribution plays a major role in organizational performance (Smith et al. 2006).

The balance between responsibilities and powers granted to senior managers, although evident in health system of western world, has been identified as a problem in Iran. According to the limited degrees of autonomy granted to the public hospitals especially with regard to financing and planning, senior managers are being given more responsibility but not any more power (Jafari Sirizi et al. 2011). However; unique structural organization has resulted in managerial autonomy in THC. The senior manager has explicit power for strategic decision making, and hiring middle managers (except for finance director that is directly installed by TUMS).

Additionally, individual characteristic is significantly associated with personality traits, and professional commitments which affect job performance of managers with different levels and in turn affect hospital performance (Huang 2003).

The freedom by senior management to select the right leadership for different posts within the hospital is of essential importance. As a cultural characteristics, strong empowered middle management who are not under-developed and emasculated appear to be linked in some way to hospitals' high performance (Sanfilippo et al. 2008; Mannion et al. 2005). Another means of obtaining effective quality-improvement in high performance of a hospital is incentive structures of the organization (Glickman et al. 2007) which includes maintain an open door policy and constant appreciation for a job well done (Wolf 2008).

Senior management team in THC appears managed to develop successful incentive plans to maintain middle managers' motivation by means of key factors such as management constancy and autonomous, selecting right leadership, and by empowering and delegation of authority.

3.2 Top manager's characteristics

The role of senior manager in high performance of a hospital has been confirmed in several previous studies (Wolf 2008; Sanfilippo et al. 2008; Smith et al. 2006; Ravaghi and Manion 2007). We also find this theme as the second important influencing factor for high performance in THC. The leadership behavior influences organizational performance and managerial experience (Smith et al. 2006), consistent effective communications with managers and staffs (Wolf 2008), as well as personality characteristics including personal motivation, intelligence, and capacity to motivate others (Glickman et al. 2007) are among determinant characteristics of the top manager for improving the performance. In addition, the leadership behavior/culture influences employee's behavior (hospital's faculty and staff) results in customer (patients and students) satisfaction and hospital high performance (Sanfilippo et al. 2008). It is also important that leaders and staff constantly reveal their recognition and community support for one another (Wolf 2008), and it is leader's personal expertise and recognized excellence that determines the acceptability of the leader's behavior to the subordinates.

3.3 Hospital information system (HIS)

Health information technology has a potential to transform the healthcare delivery to a high-quality and efficient system and to reduce cost (Shen 2007) It has been suggested that high performing hospitals have a very robust performance management architecture, especially the highly developed HIS to monitor financial and clinical performance (Mannion et al. 2005). Also, hospitals that adopted a greater number of information technology applications were significantly more likely to have desirable quality outcomes (Menachemi et al. 2008).

HIS was designed from the onset as a comprehensive, integrated system and implemented in the THC from its inauguration. It seems that HIS improves effectiveness and timely access to clinical information, and enhances the clinical decision-making process. Moreover, due to a holistic overview of senior management, infrastructures that support for implementation of program have been provided. Therefore, it is not surprising that HIS was found to be an influencing factor for high performance of THC.

3.4 Hospital characteristics

Hospital characteristics were identified as an influencing factor for high performance of THC. Hospital performance is related to particular organizational characteristics and market forces such as hospital size, hospital specialty, type of ownership, teaching status, system affiliation, hospital competition, the number of Health Maintenance Organizations, organizational structure, and cooperation between hospital and physicians (Ozturk and Swiss 2008; Jiang et al. 2006; Ravaghi and Manion 2007; Goldstein et al. 2001).

As a corporatized hospital with financial and administrative autonomy, THC enjoys a balanced and consistent autonomy. In contrast, unbalanced organizational structure has been reported from public hospitals in Iran (Jafari Sirizi et al. 2011). The authors suggested that healthcare policy makers started the reforms in financial management or procurement market and failed to properly balance other aspects e.g. strategic decision rights and human resource management (Jafari Sirizi et al. 2011).

Optimal interaction between a hospital and insurance organizations is among the factors associated with high-quality/low-cost hospital performance (Jiang et al. 2006). THC, in its second year of running, signed agreement with health insurance companies since then has accepted health care insurance offered by four major public insurance organizations.

Hybrid system of allowing public physicians to maintain private practices has provided doctors with both the resources and the incentives to fight management reform efforts (Ozturk and Swiss 2008). A large number of public sector specialized physicians in Iran also work part-time in private practices making this an important managerial challenge for educational hospitals (Jafari Sirizi et al. 2011). However, THC is the only hospital in Iran that all its specialists work full-time and completely devote their time and energy in the hospital without permission to engage in any other public or private sector system. It deems that upholding high degree of relational contracts between THC and its professional staff explain the specialized physicians' commitment to the hospital (Petterson 2009).

Jiang et al. have reported that public, teaching, or large non-teaching hospitals are significantly less likely to have high-quality/low-cost performance (Jiang et al. 2006). THC offers post-residency fellowship training programs for cardiologists and residency training programs for residents after completing the first year of residency in other general hospitals affiliated to TUMS. However, the hospital has no internship training program for medical students. This unique condition of education may explain the high performance of THC in spite of being teaching hospital.

3.5 Limitations

One major limitation of this study was the fact that the survey was administered in one center where experts may had influenced each other's responses, in particular with regard to "managerial characteristics" theme, because there was a hierarchical relationship between senior managers and other members of management team. However, in an attempt to overcome this limitation, it was explained to the interviewees that their identity and opinions would remain confidential.

4 Conclusion

High performance is a multifaceted phenomenon and the components of performance, e.g. quality of care and financial success, are not necessarily competitive. The results of the present study reveals that hospital performance, in both quantity and quality aspects, is associated with particular organizational characteristics as well as the managerial characteristics.

We recommend that the managers and policy makers to work toward the goal of finding the key factors influencing the performance for their own hospitals using similar methodology. We also suggest that with respect to capabilities and limitations of an individual center, the managers should focus on those factors that are most likely effective on their hospital performance and plan accordingly to achieve the best results.

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