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Key performance indicators in hospital based on balanced scorecard model

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A B S T R A C T

Introduction: Performance measurement is receiving increasing verification all over the world. Nowadays in a lot of organizations, irrespective of their type or size, performance evaluation is the main concern and a key issue for top administrators. The purpose of this study is to organize suitable key performance indicators (KPIs) for hospitals' performance evaluation based on the balanced scorecard (BSC).

Method: This is a mixed method study. In order to identify the hospital's performance indicators (HPI), first related literature was reviewed and then the experts' panel and Delphi method were used. In this study, two rounds were needed for the desired level of consensus. The experts rated the importance of the indicators, on a five-point Likert scale. In the consensus calculation, the consensus percentage was calculated by classifying the values 1-3 as not important (0) and 4-5 to (1) as important. Simple additive weighting technique was used to rank the indicators and select hospital's KPIs. The data were analyzed by Excel 2010 software.

Results: About 218 indicators were obtained from a review of selected literature. Through internal expert panel, 77 indicators were selected. Finally, 22 were selected for KPIs of hospitals. Ten indicators were selected in internal process perspective and 5, 4, and 3 indicators in finance, learning and growth, and customer, respectively.

Conclusion: This model can be a useful tool for evaluating and comparing the performance of hospitals. However, this model is flexible and can be adjusted according to differences in the target hospitals. This study can be beneficial for hospital administrators and it can help them to change their perspective about performance evaluation.

Keywords: Hospital, Balanced scorecard, Performance, Indicator

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Introduction

Health care system has become one of the world's largest, costly and fastest-growing industries as it forms a massive part of a country's economy (1). Healthcare system is one of the most noticeable section of service sectors. In the most developing countries, more than five percent of gross domestic products (GDP) is allocated to health care sector. Hospitals consume more than 50 percent of total health resources, so they are an important unit of the health system (2-4). Health care organizations have to deal with an unstable environment due to various factors such as the rapid transformation of technology, demographic factors and change in lifestyles (5). Evaluation of the performance of hospitals is of paramount importance because of the hospitals' impact on the efficacy of health systems (6). Performance measurement system is a process of assessing the organization progress in achieving the goals and objectives. The idea of measuring performance is not only to identify the current performance of the business, but also to enable the business to perform better in the future (7, 8).

Performance evaluation is receiving increasing verification all over the world. Nowadays in a lot of organizations, irrespective of their type or size, performance evaluation is the main concern and a key issue for top administrators (9, 10). Performance evaluation is an assessment model to compare past plans and implementation of strategies, operating activities of organizations with executive abilities, participating rate and competing rate of the employees. In addition, this assessment model is helping the organizations to plan future strategies and set up performance targets of the employees in order to achieve the final target of the entire organizations (11). It can

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equip the managers with the information they need for the evaluating, controlling and monitoring of hospital's current situation and effective technique to assess and supervise hospital activities (6, 12). Evaluation of hospital performance is beneficial to payment systems, policymakers, hospitals, and physicians. The assessment also assists the managers in promoting the quality of performance (13).

The main property of a perfect performance evaluation system is the accuracy of its outcomes. Thus, it is important to choose the proper methods and reasonable indicators that reflect the purpose of the performance evaluation (14). A set of indicators that properly reflect the organizational performance should be set up to fully utilize the function of performance measurement. (15).

Organizational performance is not a simple phenomenon; rather, it is a complex and multidimensional concept (16). Various models have been used to manage the organizational activity and performance, including total production analysis, Analytical Hierarchical Process (AHP), ratio analysis, Delphi analysis, Data Envelopment Analysis (DEA), Six Sigma, Total Quality Management (TQM), and Balanced Scorecard (BSC), (1, 15, 17). The balanced scorecard is seen as a powerful tool for organizational change and as an effective performance measurement system.

Balanced scorecard developed in 1992 as a management accounting tool that translates an organization's mission, strategies, and goals into performance measuring. The BSC consisted of four perspectives such as financial, internal process, learning and growth and customer (5, 15, 18). Balanced scorecard perceived as the most proper framework is able to provide remarkable information relevant to the organizational internal and external factors that will subsequently contribute to the organization's success (1). The BSC is used increasingly for measuring and reporting health system performance. In this method, indicators are located in different perspectives, which provides a balanced view of performance and guides strategic decisions at the hospitals (19-21). This is for setting up a complete performance evaluation system and forming a whole set of performance indices to assess strategies so that the strategies and prospect of organizations could be achieved (11).

The BSC model indicates that a single performance indicator could not show the performance of a complex organization such as hospitals (9, 22). The advantages of the BSC are classified into three aspects, i.e. communication and teamwork, commitment, and feedback and learning. The BSC enables the senior management to clarify vision, develop teamwork, expand strategy, and foster the obligation to customer focus in the organization (23, 24).

Thus, organization performance is a multi-criteria decision-making (MCDM) issue. MCDM is relatively new to be used for the evaluation of performance. MCDM aims at using a set of criteria for decision problem (10). One of the MCDM methods is simple additive weighting (SAW) which is known as a simple and most often used multi-attribute decision technique (25-27). The purpose of this study was to organize suitable key performance indicators (KPIs) for hospitals' performance evaluation based on the BSC perspectives using SAW.

Methods

This is a mixed method study in which, depending on various phases of the investigation, various tools have been used (2013-2014). In order to identify the hospital's performance indicators (HPIs), first related literature was reviewed and then the experts' panel and Delphi method were used. The SAW technique was used to rank the indicators and select hospital's KPIs.

Literature review

The literature review was carried out to identify relevant studies by searching electronic databases. We conducted a search of the literature for articles on PubMed, Scopus, Sciences direct, Google scholar, DOJA, SID, Iranmedex, Magiran, and Medlib databases.

Keywords used for searching was a combination of "hospital," "performance," "assessment," "evaluation," "measurement," "indicator," and "criteria." The Boolean OR AND operators were placed between keywords in the searches.

First, the titles of all articles were reviewed by two of the authors, and then abstracts of the selected articles were reviewed. Then, the full text of the selected articles was studied and articles in the area of HPIs, which were most relevant to our study's objective, were selected. The quality of the selected articles was assessed by the Strengthening the Reporting of Observation Studies in Epidemiology (STROBE) instrument. STROBE instrument was produced in 2007 to improve the quality of observational study reporting and allow for critical assessment by others of the strengths and weaknesses in study design, conduct, and analysis (28). STROBE addresses the three main types of observational studies: cohort, case-control and cross-sectional studies (29).

Expert panel

We asked an experts' panel with five experts in the field of health services administration from "health care management" and "community medicine" departments of Shiraz University of Medical Sciences (SUMS) to identify HIPs from the extracted indicators of literature review based on four BSC perspectives. Seventy-seven indicators were selected during the internal expert panel.

Delphi methods

We used a Delphi method to reach a consensus among a panel of experts. With Delphi method, the consensus is achieved through a series of rounds. In this study, two rounds were needed for the desired level of consensus.

We selected the experts for the Delphi survey to assess the validity of the indicators. The experts comprised 17 professionals from industry and academia. All of the experts had more than five years of related experience and seven of them had more than fifteen years. In addition, twelve of experts from industry had been managers/ directors of hospitals, and five from academia were professors/researchers with healthcare management

background. We guaranteed anonymity by assigning a code number to each participant. All of the participants were anonymous volunteers.

The data were collected using paper based survey. So, each expert completed two rounds of the Delphi survey. The first round was developed from indicators compiled as a result of the expert panel. Experts were given five days to complete the surveys. From the results of the first round and comments listed by respondents, the second round was developed. During the second round, individual and group results from the first round were presented to the panel members and asked to indicate if they agreed or disagreed with each of remained indicators. All items which did not receive agreement from 80% of the panel respondents were removed from the list of indicators.

In Delphi method, data were analyzed by descriptive statistics using Excel software. The experts rated the importance of the indicators, on a five-point Likert scale ("Not important," "Somewhat important," "Relative important," "Very important," and "Extremely important," respectively). The required level of consensus was defined. Two necessary conditions had to be fulfilled: (1) a mean value of at least 4 ("Very important" and "Extremely important") and (2) a consensus percentage of at least 80%. In the consensus calculation, the consensus percentage was calculated by classifying the values 1-3 as not important (0) and 4-5 to (1) as important.

Simple Additive Weighting (SAW)

The SAW, which is known as a weighted linear combination or scoring methods, is a simple and most often used multi-attribute decision technique. The SAW is based on the weighted average. The advantage of simple additive weighting is that it is a proportional linear transformation of the raw data (25-27). The method of data collection applied in this phase was a questionnaire, using the Likert scale from 1 to 5 ("Not important," "Somewhat important," "Relative important," "Very important," and "Extremely important," respectively). The questionnaires were completed by the participants of the Delphi method. The process of SAW consisted of the following steps (25-27):

Step 1:

Determining and computing the weight of the criteria were used as a reference in decision-making, namely Ci.

In this study, the four selected criteria were necessity, specificity, relatively, and measurable.

Step 2:

Making a decision matrix (m × n) that includes m indicators and n criteria. Calculating the normalized decision matrix for positive criteria (1) and negative criteria (2):

$$r_{ij} = \frac{x_{ij}}{x_j^{max}} \quad i=1, \dots m \quad j=1,\dots n \qquad (1)$$

$$r_{ij} = \frac{x_j^{min}}{x_{ij}} \quad i=1,\dots m \quad j=1,\dots n \qquad (2)$$

Step 3:

Assessing each indicator, Ai by the following formula:

$$A\_i=\sum cj \,.xij \qquad (3)$$

Where xij is the score of the ith indicator according to the jth criteria, Cj is the weighted criteria.

Results

Results of literature review and expert panel

A total of 39 studies were identified for inclusion in the review. The search of databases provided a total of 14,842 citations. Initially, the title of all the articles was checked out and 13,985 were excluded owing to contradiction with the study objectives. After adjusting for duplicates, 309 articles were remained. Of this number, 173 articles were omitted because after reviewing the abstracts it emerged that these articles clearly did not meet the criteria and there was a lack of indication to hospitals' performance indicators in their results. Sixteen articles were rejected because the full text of the article was not accessible, the paper could not be feasibly translated into English, the paper was not in the English language, or the type of the article was not original. The full texts of the remaining 120 articles were studied in more detail. It emerged that 64 article did not meet the inclusion criteria. Then, using the STROBE instrument, we assessed the quality of 56 remained articles and 39 of them had the quality needed. Finally, 39 studies (23 English and 16 Persian) met the inclusion criteria and were included in the literature review (Figure 1). Two hundred ninety-eight indicators were obtained from a review of selected literature.

Finally, throughout the internal expert panel, 77 indicators were selected. These performance indicators were classified into four perspectives of BSC: finance (20), the customer (5), internal process (37), and learning and growth (15).

Evaluation criteria by Delphi method

Twenty criteria were selected by the first Delphi round and 30 criteria by the second Delphi round. Results of the two rounds are shown in Table 1.

Simple Additive Weighting

First, the weights of the criteria were computed by using five experts' opinion with Interview: Necessity (C1) 0.4, Specificity (C2) 0.15, Relatively (C3) 0.15, and Measurable (C4) 0.3.

Then, we calculated the normalized decision matrix for the criteria used in this study; the criteria were positive, so we used formula 1, and the result is shown in Table 2.

The SAW method evaluates each alternative (Ai) by formula 3. In this step, indicators of each BSC perspective are ranked separately. Finally, in SAW method, the best indicators were P1, F9, G3, and C2 in the internal process, finance, learning and growth and customer perspective, respectively. The results of SAW method are shown in Table 3.

Key performance indicators

Based on the results in Table 4, 22 indicators were selected for KPI of hospitals. Ten indicators were selected in the internal process perspective and 5, 4, and 3 indicators in finance, learning and growth, and customer, respectively. The result is shown in Table 4.

Figure 1. Details of literature review process

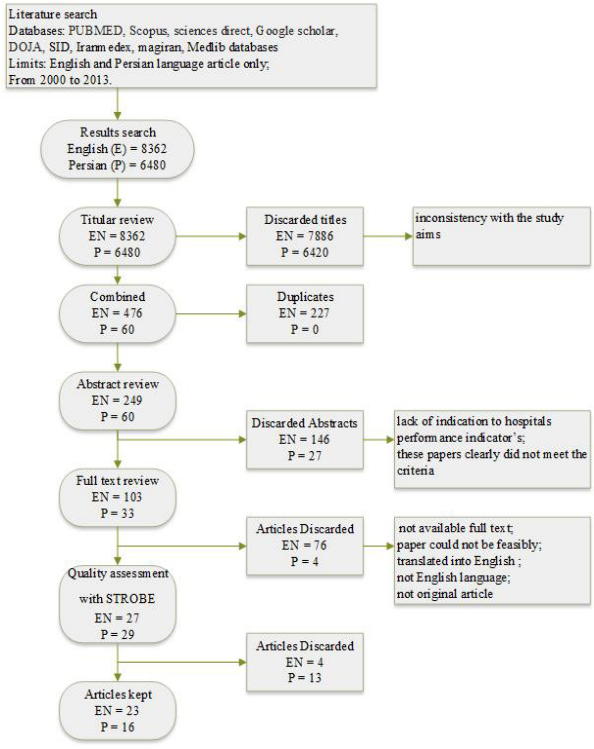

Table 1. Selected indicators of hospital performance by Delphi method

BSC perspectives	Indicators		Indicators	
Finance (F)	F1	Ratio of total revenue to total costs	F6	Current cost per bed
	F2	% Deductions of hospital	F7	the ratio of capital expenditures to current costs
	F3	Average hospitalization expenditures	F8	the cost of drugs and materials
	F4	Average outpatient expenditures	F9	%Personnel costs of total costs
	F5	Average expenditures per bed per day	F10	Total fixed cost for per Bed occupancy
Internal Process (P)	P1	average Length of stay	P15	Wrong-site surgery
	P2	Bed Turnover Interval	P16	Leaving a foreign object during surgery
	P3	Bed occupancy	P17	Medication errors
	P4	bed turnover	P18	wrong in the type of blood group
	P5	Mortality rate	P19	Patient falls rate
	P6	Cancelled operations	P20	Hospital accidents prevalence rate
	P7	% Repeated surgeries	P21	Sentinel event rate
	P8	Discharge with Personal satisfaction	P22	Needlesticks and sharps injury
	P9	Hospital infection rate	P23	the legal complaint from a hospital
	P10	Clinical errors	P24	Doctors on-call at night
	P11	Readmission rate	P25	Waiting time for admission operation room
	P12	% Occupational accidents	P26	Mean Length of stay in emergency department
	P13	Pressure Ulcers rate	P27	Emergency Room (ER) waiting time
	P14	Medical errors	P28	Waiting time from triage to see doctor
Learning and Growth (G)	G1	Staff satisfaction rate	G6	the amount of the electronic medical record
	G2	Staff turnover	G7	number of days of sick leave to total employees ratio
	G3	Training expenditures per capita	G8	Employee absenteeism rate
	G4	key Jobs Contains substitute	G9	Rate of employee sick-leave
	G5	Average hours of Internet use		
Customer (C)	C1	The facilities for families and visitors	C4	Other Stakeholders satisfaction
	C2	Patients satisfaction percentage	C5	Social satisfaction
	C3	Rate of Patient complaints		

Table 2. The normalized decision matrix

		C1	C2	C3	C4		C1	C2	C3	C4
Finance (F)	F1	0.9807	0.9744	0.9956	1	F6	0.6959	0.8148	0.7239	0.8063
	F2	0.9464	0.9404	1	0.9473	F7	0.6959	0.8510	0.7782	0.9115
	F3	0.8565	0.8680	0.8695	0.9305	F8	0.8565	0.9574	0.8869	0.9642
	F4	0.8736	0.8680	0.8152	0.8947	F9	1	1	0.9782	0.9831
	F5	0.9271	0.9936	0.9608	0.9473	F10	0.7494	0.8340	0.6891	0.7536
Internal Process (P)	P1	0.9737	0.9938	0.9917	1	P15	0.9576	0.9259	0.9404	0.9
	P2	0.8407	0.8909	0.8562	0.9	P16	0.9415	0.8909	0.8377	0.884
	P3	0.9415	1	0.9917	0.984	P17	0.9415	0.8909	0.8891	0.75
	P4	0.9677	0.9094	0.8377	0.95	P18	0.9737	0.9423	0.9589	0.916
	P5	0.8729	0.9773	0.9589	0.984	P19	0.9415	0.9094	0.9589	0.9
	P6	0.8911	0.9094	0.9075	0.934	P20	0.8064	0.7037	0.8726	0.684
	P7	0.8407	0.9094	0.9075	0.9	P21	0.8064	0.7037	0.7864	0.716
	P8	0.9072	0.9259	1	0.934	P22	0.7721	0.8230	0.8562	0.766
	P9	0.9737	0.8580	0.9589	0.85	P23	0.8407	0.8395	0.8562	0.884
	P10	1	0.7716	0.9240	0.7	P24	0.8911	0.8909	0.9075	0.9
	P11	0.8225	0.8744	0.8213	0.884	P25	0.8729	0.8395	0.8377	0.834
	P12	0.7217	0.7037	0.7864	0.75	P26	0.9919	0.9259	0.9240	0.9
	P13	0.7721	0.7366	0.7864	0.766	P27	0.9576	0.9259	0.9075	0.9
	P14	0.9415	0.7716	0.9404	0.65	P28	0.9737	0.8744	0.8726	0.834
Learning and Growth (G)	G1	1	0.8687	1	0.8201	G6	0.9115	0.7979	0.8800	0.8565
	G2	0.8589	1	0.9184	0.8565	G7	0.8252	0.7979	0.8201	0.9100
	G3	0.9305	0.9020	0.8800	1	G8	0.8947	0.8166	0.8800	0.9464
	G4	0.7536	0.7125	0.8201	0.7494	G9	0.8063	0.8166	0.8393	0.9464
	G5	0.5957	0.6937	0.6402	0.7665					
Customer (C)	C1	0.8163	0.8423	0.8155	0.8047	C4	0.7306	0.8047	0.8511	0.7835
	C2	1	1	1	1	C5	0.8326	0.7247	0.7777	0.6282
	C3	0.9857	0.9411	0.9622	0.9011					

Table 3. The ranked indicators of hospital performance

	Indicators	Score	Rank	Indicators	Score	Rank	Indicators	Score	Rank
Finance (F)	F1	0.9878	2	F5	0.9482	4	F9	0.9916	1
	F2	0.9538	3	F6	0.7510	10	F10	0.7543	9
	F3	0.8824	6	F7	0.7962	8			
	F4	0.8703	7	F8	0.9085	5			
Internal Process (P)	P1	0.9873	1	P11	0.8486	22	P21	0.7609	27
	P2	0.8683	18	P12	0.7372	28	P22	0.7905	24
	P3	0.9705	2	P13	0.7671	25	P23	0.8558	20
	P4	0.9341	6	P14	0.8284	23	P24	0.8962	15
	P5	0.9348	5	P15	0.9330	7	P25	0.8509	21
	P6	0.9092	12	P16	0.9011	14	P26	0.9442	4
	P7	0.8788	16	P17	0.8686	17	P27	0.9280	9
	P8	0.9319	8	P18	0.9495	3	P28	0.9017	13
	P9	0.9170	11	P19	0.9268	10			
	P10	0.8643	19	P20	0.7642	26			
Learning and Growth (G)	G1	0.926351	2	G4	0.762387	8	G7	0.845834	7
	G2	0.888308	4	G5	0.6684	9	G8	0.896349	3
	G3	0.939537	1	G6	0.873293	5	G9	0.854866	6
Customer (C)	C1	0.816629	3	C3	0.950148	2	C5	0.746904	5
	C2	1	1	C4	0.775676	4			

Table 4. Key Performance Indicators (KPI) of hospital performance

BSC perspectives	Indicators		Indicators	
Finance (F)	F1	Ratio of total revenue to total costs	F8	the cost of drugs and materials
	F2	% Deductions of hospital	F9	%Personnel costs of total costs
	F5	Average expenditures per bed per day		
Internal Process (P)	P1	average Length of stay	P8	Discharge with Personal satisfaction
	P3	Bed occupancy	P9	Hospital infection rate
	P4	bed turnover	P10	Clinical errors
	P5	Mortality rate	P26	Mean Length of stay in emergency department
	P6	Cancelled operations	P27	Emergency Room (ER) waiting time
Learning and Growth (G)	G1	Staff satisfaction rate	G3	Training expenditures per capita
	G2	Staff turnover	G8	Employee absenteeism rate
Customer (C)	C1	The facilities for families and visitors	C3	Rate of Patient complaints
	C2	Patients satisfaction percentage		

Discussion

According to the results, 22 indicators were selected for KPI of hospitals using the opinion of the experts' panel. Ten indicators were selected in internal process perspective and 5, 4, and 3 indicators in finance, learning and growth, and customer, respectively.

Hospital indicators represent the hospitals' performance in different areas. So, it is essential to attend these indicators (17, 30). Through this study, hospital indicators were classified based on balance scorecard under four categories as finance, internal process, learning and growth, and customer. This classification is consistent with other studies (9, 31).

In this study, 22 indicators were approved for KPIs in balance scorecard. The mean indicators in the comparative study were 29. A study indicated that almost 30 indicators were used (32). Most researchers agree with 20- 25 indicators although up to 30 indicators may be preferred (33).

In the development of BSC, the number of indicators is not considered the main criterion, but it is also important to choose the indicators with sufficient attention so that the key and vital indicators are not removed (31).

Ten performance indicators of finance perspective were ranked using SAW technique. Then, according to the experts' ideas, the first five indicators were selected as KPIs. KPIs in this perspective were personnel costs of the total cost (%), the ratio of total revenue to total cost, a discount off the hospital (%), average expenditures per bed per day, and cost of drug and materials, respectively.

Nasiripour et al. showed that income per inpatient, income per outpatient, cost coverage; preventive maintenance cost of the total budget and current cost per bed are financial indicators used to assess hospitals performance (9). Fadi El-Jardali et al. explained that the most important performance indicators to assess the hospitals financing are the cash-flow rate, total profit margin, debt service coverage, discount on total billed (%), and amounts by a third-party payer (19).

Raeisi et al. selected five indicators of financial perspective; two indicators (% discount of hospital and % personnel costs of total cost) were compatible with our results (31). In a study of Iravani Tabrizipour et al., eight indicators were selected and only one indicator (% discount off the hospital) was compatible with our results (34).

Our findings are different in financial indicators in the study of Peters et al. They were facilities with user fee guidelines and facilities with exemptions for poor patients. Also, the findings of this study are not compatible with financial indicators in the study of Kocakulah and Austill; they were gross operating profit, days of available liquidity, and return on stockholder's equity (35).

Ten of the most important selected KPIs in the internal process perspective include the average length of stay, bed occupancy, mean length of stay in the emergency department, mortality rate, bed turnover, discharge with personal satisfaction, Emergency Room (ER) waiting time, hospital infection rate, canceled operations, clinical errors, respectively.

Nasiripour et al. showed the length of stay, outpatient per doctor, canceled operations, big surgery percent, in-patient per doctor, employee productivity, and bed occupancy (9). Raeisi et al. and Iravani Tabrizipour selected 14 and 10 indicators to internal process perspective, respectively (31, 34).

Inpatient mortality, unscheduled visits to the operating room, drug events per thousand of doses distributed, and fall off beds per 100 patient-days in the investigation of Kocakulah and Austill were selected as indicators of internal process perspective (35). Fadi El-Jardali et al. demonstrated 18 indicators in clinical utilization and outcomes perspective (19). Arab et al. certified in their research that the staying time in the hospital is a significant indicator which is utilized widely nowadays(36).

Our experience demonstrates that most indicators are in internal process perspective. These findings are compatible with Kaplan and Norton's view about the necessity of the number of indicators in perspective internal processes (37).

The tertiary perspective of balance scorecard is learning and growth. KPIs in this perspective were Training expenditures per capita, staff satisfaction rate, employee absenteeism rate, and staff turnover, respectively.

Nasiripour et al. reported training expenditures per capita, sickness absence rate, employee satisfaction, percutaneous injuries, training expenditures, and information technology (IT) efficiency (9). Raeisi et al. and Iravani Tabrizipour selected eight and seven indicators to internal process perspective, respectively (31, 34).

Fadi El-Jardali et al. used staff satisfaction rate, staff turnover rate, employee absenteeism, and rate of employee sick-leave (19).

In customer perspective, selected indicators were patients' satisfaction percentage, rate of patients' complaints, the facilities for families and visitors, respectively, that are compatible with the findings of the study conducted by Raeisi et al., Barati et al., and also with the findings of Nasiri et al. (9, 31, 38). Fadi El-Jardali et al. used patient's satisfaction rate and discharge against medical advice (19). Peters et al. used overall patient satisfaction, patient perception of quality index, and written shura-e-sehie activities in the community (39).

Evaluation of the customers' opinions is basically important because there is a serious competition between hospitals in the conditions of admission patients, reduction of medical costs, and earning more money (30).

A limitation of this study was lack of proper definition for strategic objectives. So, these indicators might not suitable for all hospitals. However, BSC model is flexible and can be adjusted according to differences in target hospitals. Furthermore, the study selected the key indicators for developing the balanced scorecard for hospitals rather than evaluation and comparison of hospital performance. Therefore, it is recommended that in future studies this model ishould be used to evaluate and compare the hospitals performance.

Conclusion

Our research has presented KPIs on BSC model, which can be used for the performance assessment in hospitals. This study can be beneficial for hospital administrators and it can help them to change their thinking about performance evaluation. Identifying the hospitals' KPIs provides an opportunity for hospital administrators to recognize critical points with lower costs and time. Thus, the areas of improvement for each hospital could be identified. This model can be a useful tool for evaluating and comparing the performance of hospitals. However, this model is flexible and can be adjusted according to differences in target hospitals. We recommend that hospitals should use our work as a framework for evaluating their own performance. Future studies could use this framework for evaluating hospitals performance, identifying the functional weakness of hospitals, and ranking hospitals.

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Conflict of Interest

None declared.

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