

Original Article

Selecting Hospital's Key Performance Indicators, Using Analytic Hierarchy Process Technique

Raana Gholamzadeh Nikjoo M.Sc.¹, Hossein Jabbari Beyrami Ph.D.^{2*}, Ali Jannati Ph.D.¹,
Mohammad Asghari Jaafarabadi Ph.D.³

1. Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran
2. Department of Community Medicine, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran
3. Medical Education Research Center, Department of Statistics and Epidemiology, Faculty of Health and Nutrition, Tabriz University of Medical Sciences, Tabriz, Iran

Received: 1/16/2013

Accepted: 5/28/2013

Abstract

Introduction: Hospitals performance indicators will help monitoring, evaluation and decision making and therefore must be selected and ranked accurately. The aim of the present study is to identify and to select key hospitals performance indicators.

Materials and Methods: This is a quantitative-qualitative study in which literature review and expert panel has been done to identify all performance indicators. We prioritize performance indicators by Analytical Hierarchy process (AHP) technique. The data were analyzed by Excel 2007 and Expert Choice 11 software.

Results: Hospital performance indicators are classified to three areas as Quality- Effectiveness, Efficiency-Financing and Accessibility–Equity. Indicators such as the rate of hospital average length of stay based on different diagnosis and the mean rate of inpatient waiting time are considered with highest priority performance indicators of public hospitals.

Conclusion: Identifying hospitals key performance indicators provides an opportunity for health stakeholders to identify critical and problematic points with lower costs as well as time and to recognize the best correction action.

Keywords: Health Services Administration; Quality of Health Care; Benchmarking; Quality Assurance, Health Care

* **Corresponding author:** *Tel:* +984113364668, *Email:* Hosseinhosseinj@yahoo.com

Introduction

The lack of evaluation systems in various dimensions is known as one of the symptoms of organization disease. Thus to know about the condition and marketability of his activities, every organization especially in complicated and dynamic contexts needs urgently to evaluate systems and frameworks [1]. Recently due to increasing demands of health care services, limitation of resources, existence of various professions and enormous costs, higher attention given to hospital evaluation issues [2]. Additionally, based on the widespread studies carried out by World Bank Organization, hospitals consume about 50 to 80 percent of allocated budget for health sectors [3, 4]. This issue doubles the importance of evaluating hospitals performance. The initial efforts to assess the performance of hospital go back to the year 1859 when Florence Nightingale measured the quality of care throughout the study of mortality and infection rate [5].

In order to evaluate health care, each country has different characteristics from the others as these Features may be different between regions too. Indicators are those variants which assist directly and indirectly to measure changes. It determines one stand point and measures changes upon it [6, 7]. Information prepared by performance indicators reflects the quality of health care systems and thus works as a guidance to determine the needed future actions and research types which are designed by politicians and experts [8]. There are many projects tended to be done in European

countries and the entire world to identify hospitals indicators. In addition to those projects there are others which have been supported by WHO and the organization of economical cooperation and development (ODECD) [9-12]. Paying attention to the fact that almost countries have all their own native projects in developing of their national complex of performance indicators of healthcare system [13]. Unfortunately, we could not find any investigation about the identification of hospital performance indicators and their ranking in our country, So the present study has been done in order to prioritize hospitals performance indicators based on AHP technique.

Materials and Methods

This is a quantitative-qualitative study in which depending on the different stages of research, various tools have been used. In order to identify hospitals performance indicators, first related literature was reviewed and then experts panel was used (qualitative part). AHP technique was applied in order to prioritize performance indicators (quantitative part).

Literature review

To identify different kinds of hospitals performance indicators a review of literature was done during 28-30 December 2010. Inter science, Pub Med, Springer Link, Elsevier, Proquest, Scopus, Emerald, Google scholar, SID and Irandoc databases were searched, with key words of performance indicators and hospital and with Persian equivalent of them in

Persian databases as SID and Irandoc. The documents which were duplicated for the period of January 1980 to December 2010 were rejected. This strategy resulted 18208 articles. Selecting articles in English and Persian language and pointing to hospital performance indicator were our inclusion and exclusion criteria. First, titles of the all articles were reviewed and 12207 were excluded due to inconsistency with the study aims and duplicating among databases, then abstracts of remaining articles were studied and 5944 articles were excluded again due to lack of indication to hospitals performance indicator's in their results, finally 15 articles in area of hospital performance indicator which were most relevant to the study aim were reviewed perfectly. All articles are reviewed by two of the authors and after that attributed and themes identified in any articles were written in extraction tables. (Appendixes 1)

Expert panel

We hold 3 expert panels with 5 experts in the field of health care management from health care management and social medicine departments of Tabriz University of medical sciences to identify hospital performance indicators and complete these indicators list. 113 indicators were extracted through nominal group technique during two, three hours sessions. (Appendixes 2) In third session, this indicators gather together with indicators were obtained from literature review and their content validity were examined by 5 criteria's as clarity, relatively, simplicity, measurability and sensitivity. It was decided to choose public

hospitals key performance indicators with grades obtained from necessity of indicators criteria, as a base and being aware that if such grades become below than 50% of necessity mean, then that indicator would be excluded and if the indicator would not be standard in other criteria, then some changes based on that criteria would be happened so it was decided to exclude some indicators from the list at that meeting. 39 indicators were selected during internal expert panel, these selected indicators were entered in to questionnaires and send to 20 external experts (Administrators employed in health organizations) who had PhD degree in health care management or health policy making or health economic and they have adequate experience in hospital performance indicators by post. Our deadline was 1 month for completing content validity and performance indicators classification questionnaires, and we alarmed deadline of completion questionnaire by electronic mail (Email) two days before. 75% of questionnaires were collected after one month, this questionnaires' data were interned to excel 2007 software and after analysis, number of performance indicators were decreased to 16 as table 1 and three performance areas (Quality-Effectiveness, Efficiency-Financing and Accessibility-Equity) were defined, by combining experts opinion and taking into consideration common classification in the literature.

Analytic Hierarchy Process (AHP) Technique

Third step of the research was determining the selected performance through AHP

questionnaire. AHP is a standard technique for multiple choice decisions making, in this technique scores obtained from expert panel entered to Expert Choice software for quantitative synthesis and leading in ranking of the performance indicators. AHP captures both subjective and objective evaluation measures, providing a useful mechanism for checking performance indicators, consistency relative to considered alternatives, thus reducing bias in decision making. It is introduced by Saaty (1997) to help decision making have an accurate and easy selecting among choices^[14].

we used this technique , and we sent these questionnaire to 20 individuals of internal and external experts of above, after one month questionnaire were collected and results of paired comparisons were entered to excel 2007, after that, the mean for each performance indicators were calculated. These

means were entered to expert choice 11 software (Expert Choice InC ,Arlington, USA) and performance indicators (in three performance area) as well as the other areas such as weight, priority relative to each other and consistency were calculated. Before any synthesis, it is required to ensure that, ranking consistency of experts view are determined

Results

During the study of articles and expert panel, about 196 performance indicators of hospitals were obtained. Throughout internal expert panel, about 39 indicators were selected and they were decreased to 16 after the external expert panel. Performance indicators, as it was mentioned, are classified into 3 areas of: Quality- Effectiveness, Efficiency-Financing and Accessibility- Equity simultaneously with confirmed content validity (Table1).

Table1. The selected performance indicators by content validity confirmation

Type of Indicator	Title of Indicator	Type of Indicator	Title of Indicator
Efficiency- Financing	Beds occupation ratio	Quality- Effectiveness	The pure rate of hospital mortality
	Beds exchange interval		Readmission number based on diagnose differences
	Average length of stay Based on different diagnosis		Hospital infection rate based on ward / diagnose/ procedure
	Relationship between private income and total costs in hospital		Patients satisfaction percentage
	Hospitals the pharmaceutical costs relation to total costs to hospitals		Staffs satisfaction percentage
Accessibility- Equity	Average outpatients waiting time	Hospital accidents prevalence rate	
	Average inpatients waiting time	legal complaint from hospital within one year	
	Relation between total number of staffs to active beds	Success to hospitals in obtaining certificates of management quality	

The selected performance indicators were included into AHP questionnaire and completed by experts.

After entering data into the software, the following results were obtained: Based on

experts idea, area of quality- effectiveness (%100), Accessibility- Equity (%35) and Efficiency-Financing (%33) were respectively selected as priority performance indicators' areas with consistency ration of 0.006.(Figure 1)

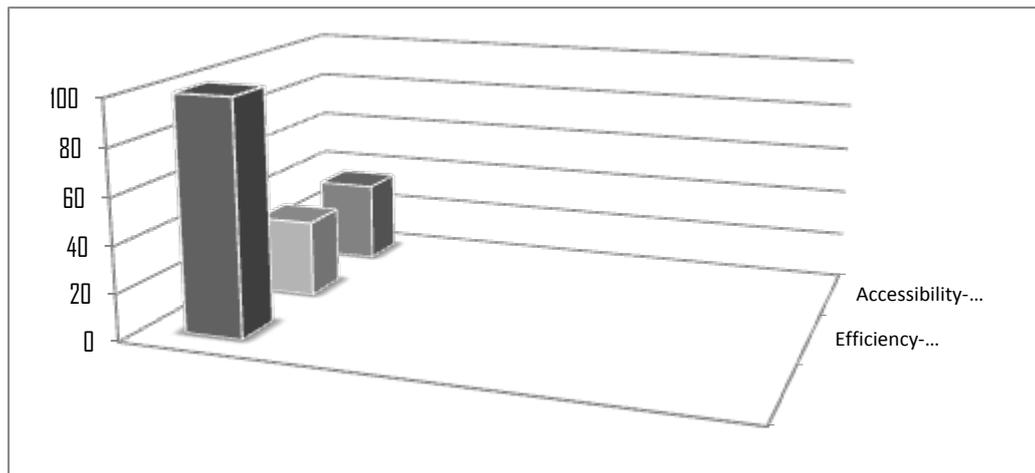


Figure1. Prioritization of three areas(Quality- Effectiveness, Efficiency-Financing and Accessibility–Equity) of hospitals performance indicators

Table 2. prioritizing of the hospitals performance indicators

Areas of Performance Indicators	Indicators, Percent (%)	Consistency Rate	
Quality-Effectiveness	The pure rate of hospital mortality	63	
	Readmission number based on diagnose differences	20	
	Hospital infection rate based on ward / diagnose/ procedure	100	
	Patients satisfaction percentage	53	0.02
	Staffs satisfaction percentage	21	
	Hospital accidents prevalence rate	72	
	legal complaint from hospital within one year	25	
Success to hospitals in obtaining certificates of management quality	23		
Accessibility-Equity	Average outpatients waiting time	74	
	Average inpatients waiting time	100	
	Relation between total number to staffs to active beds	54	
Efficiency-Financing	Beds occupation ratio	99	
	Beds exchange interval	82	
	Average length of stay Based on different diagnosis	100	0.06
	Relationship between private income and total costs in hospital	97	
	Hospitals the pharmaceutical costs relation to total costs to hospitals	53	

Throughout the Quality- Effectiveness constituent, selected indicators were: the rate of hospital infections (%100), hospital accidents prevalence rate (%73), pure degree for hospital mortality (%63), and patients satisfaction percentage (%53). All these indicators were considered as prioritized indicators in this area with consistency rate of 0.02.

In Accessibility- Equity area the indicators like average outpatients waiting time (%100), and average inpatients waiting time (%74), with consistency rate of 0.09, were selected.

In Efficiency-Financing area our indicators included: average length of stay based on different diagnosis (% 100), beds occupation ratio (%99), and relationship between private income and total costs in hospital (%97), with consistency rate of 0.06. (Table 2)

Discussion

Hospital indicators show the performance of hospitals in various fields. Thus it is necessary to consider these indicators from all possible dimensions. Hospital indicators not only reveal hospital performance but also they show ongoing and existing situations^[6]. Through the present study all hospital indicators were classified under three categories as: Quality - Effectiveness, Efficiency-Financing and Accessibility - Equity. This classifying is consistent in some areas with other studies^[11, 12, 15, 16].

Among performance indicators of Quality- Effectiveness area, the high priority indicator was the rate of hospital infections. Difficle believes direct comparison of regions for

hospital infection rate is impossible because there is a remarkable variety in age and population of that district. So, one should be careful to use this indicator to evaluate the various hospitals performances^[16].

Basu et al in their research emphasized that infection rate is one of the most important indicators in healthcare systems and it can determine the quality of care in hospitals too. another study have pointed out the importance of this indicator^[17].

Feyyazi et al expressed that hospital's infections as a direct reason for deaths, and then it could be observed the importance of this indicator^[18]. Based on estimation by British National Health Care Organization (BNHCO), hospital infections impose about 986.36 million dollars on health care systems per year, and about 96 percent of these costs go back to dwelling time in hospitals and remained 6 percent happens after discharge^[17].

Hospital incidents break out rate placed as a second priority at the present study. Other various studies also show the importance of this indicator^[19, 20].

Various researches provide different conclusion about the third key performance indicator in area of Quality- Effectiveness, which is the pure rate of hospital mortality. Lezzonie et al believe that the linkage between hospital mortality and quality of care services are disputed and controversial, because some hospitals would accept critical cases. Mc Kee & Hunter concluded that to compare death rate would be confusing if dissatisfaction from the common ways of data recording would be still

remained. Reasonably there is a widespread area to manipulate the present structure ^[16]. Akbarzadeh et al in their investigation expressed that health care and medical systems of each country, when they have ability to prevent disease and predictable death cases, are named as powerful hospitals. Additionally, it was conversed that those data about death cases are the initial indicators which are used by almost the countries to evaluate and assess their own healthcare systems ^[21].

Patients satisfaction percentage is fourth key performance indicator of quality- effectiveness area. Ahmadi et al in their article indicated that evaluation at customer's opinions are fundamentally important because there is a serious competition between hospital in terms of accepting patients, decrease of medical costs and making more money. Patient's recovery and appropriate medical consequences would be harmed if hospital doesn't take care about patient's satisfaction and its suggestions. Implementing patient's satisfaction indicator as a qualitative indicator, hospital try to evaluate their own performance and then compare it with the other centers and with national and global mean indicator ^[22] other studies although conform this results ^[23].

According to experts ideas in areas of Efficiency-Financing, selected indicators were; Average length of stay based on different diagnosis, Beds occupation ratio, Relationship between private income and Total costs in hospital respectively. In the same way, Arab et al emphasized in their investigation that staying time in hospital is a significant

indicator which today's is utilized extensively. Also it is one of the simplest indicators. Those indicators have been used for the various purposes such as hospital care, quality control, urgency of using hospital services and hospital planning. Thus it can be regarded as one of the beneficial hospital indicators which depicts the efficiency and performance of hospitals. Decrease of staying time tends to increase in efficiency through the demission of more patients or decrease of occupied beds. Cutting down the unnecessary lingering of patients leads to better services for more individuals and solicits the pressure of more investments or establishment of more medical centers ^[3] Sajjadi et al explained that: the most important performance indicators to assess hospitals efficiency are Bed occupation ratio, Beds exchange interval and average length of stay based on different diagnosis ^[13] More than 2 cases of total 8 indicators which have been proposed by Iran Ministry of health, are connected to bed occupation ratio and average length of stay in hospital too ^[6].

Ebadiazar et al Showed that costs at bed per day, bed occupation ratio and average length of stay in hospital, are the most principle financial indicators to assess hospitals performance too ^[24]. In present study in Accessibility- Equity area selected articles were; Average outpatients waiting time and Average inpatients waiting time. We can refer to Momizi et al research that the first priority in the field of service quality is patient's waiting time period ^[25]. Also Salari et al figured out that based on financial, psychological, medical

and health standpoints, it is not free patients long waiting time. Being not in favor of patients economically, medically, psychological long period waiting lists, this also causes increase in hospital costs^[26].

Implanting performance indicators in health and care sector is rapidly improved. This improvement can be traced back to the insistence of authorities and patients to make the quality of services higher. So health and care organizations, especially hospital, are trying to develop their performance indicators, observing the global trends in order to make reforms in health systems.

Hospitals performance can be scrutinized separately in many fields, as quality-

effectiveness, efficiency-financing and accessibility- Equity. Except for accessibility-equity area that is not only hospitals but also health and medical system as comprehensive as ministry of health concern; other areas are included in duty list of hospitals management. In each performance area, many different indicators can be determined in order to empower authorities to supervise the hospital performance frequently.

Acknowledgement

We want to thank the Vice Chancellor for Research and Technology of Tabriz University of Medical Sciences for financial support of this research.

References

1. Sajjadi H, Hariri M, Karimi S, et al. Self performance evaluation of the hospitals and training centers of Esfahan University of Medical Science by using the organization Excellence model. *Research in medical*. 2008; 32(2):227-31. [Persian]
2. Arab M, Eskandari Z, Rahimi A, et al. Causes of readmission for patients in hospitals of Tehran. *Hospital*. 2010; 9(1,2):43-55.
3. Arab M, Zareei A, Rahimi A, et al. Analysis of factors affecting the duration of stay of patients in state hospitals in Lorestan. *Hakim*. 2009; 12(4):27-31.
4. Ebadifard Azar F, Ansari H, Rezapur A. Survey of hospital bed-day cost and performance indicators in selected hospitals of Iran University of Medical Sciences. *Management and Medical Information*. 2004; 7(18):37-44.
5. Van der Bij JD, Vissers JMH. Monitoring health care processes: a framework for performance indicators. *International journal of Health Care Quality Assurance*. 1999; 12(5):214-21.
6. Jonidi N, Sadegi M, Ezadi M, et al. Comparative performance indicators of a hospital in Tehran with the national standards. *Military Medicine*. 2010; 12(4):223-8.
7. Arab M, Tajvar M, Akbari F. Relation between leadership styles and hospital performance indicators. *Journal of Gazvin University of Medical Science*. 2005; 10(4):70-5.
8. Vlieland V. *General hospitals strategic responses to performance indicators in health care*. Rotterdam: Erasmus; 2009.
9. Feyzzade A. Survey of hospital performance, additional cost or long term benefit. *Health researchers*. 2001; 1(1):3-6.

10. Geer e, Tuijl H, Rutte CG. Performance management in health care, performance indicator development, task uncertainty and types of performance indicator. *Social science & Medicine*. 2009(69):1523-30.
11. Groene O, K.H.Skau J, Frqlch A. An international review of projects on hospital performance assessment. *International journal for quality in health care*. 2008; 20(3):162-71.
12. Veillard J, Champagne F, Klazinga N, et al. A performance assessment framework for hospitals: the who regional office for Europe PATH project. *International journal for quality in health care*. 2005; 17(6):487-96.
13. Sajjadi H, Sajjadi Z, Hadi M. Is there a method for the simultaneous comparison of key hospital performance indicators? *Health Information Management*. 2011; 8(1):71-81.
14. Momeni M, Marmazi H. Quality financial services with the use of QFD and AHP. *Review of accounting and auditing*. 2007; 14(48):105-24.
15. Yusefiyan S, Najafi M. *Organizational Performance Evaluation (Hospital centers)*. Tehran: Ministry of Health and Medical Education, Department of Development of Management & Resource, Management development and Business change Center; 2008.
16. Basu A, Howell R, Gopinath D. Clinical performance indicators: intolerance for variety. *International journal of health care quality assurance*. 2010; 23(4):436-49.
17. Hagparast H. Social and economic load of hospital infections. *Management and Medical Information*. 2002; 5(12,13):77-82.
18. Feyyazi N, Mahvari K, Zaree S, et al. Study of deaths cases in Mohammadi martyr hospital in Bandar Abbas. *Hormozgan medical journal*. 2006; 10(3):195-205. [Persian]
19. Pourtaghi GH, Hekmat M, Rafaati H, et al. Hospital accidents prevalence rate and its affective agents in a military hospital staffs. *Military Medicine*. 2011; 13(1):53-7.
20. Nikpur B, Kebriyayi A, Karbasiyan R. Review the Occurrence of accident in hospital and realated factors. *tabibe sharg*. 2001; 3(1):29-34.
21. Akbarzadeye Baghban A, Masarat E, Hemmati M. The diagnosis agreement about death causes in hospital records and death certificate in Loghman hospital. *Journal of Epidemiology*. 2007; 3(1,2):39-46.
22. Ahmadi B, Zivdar M, Rafiyi S. Satisfaction of hospitalized patients with type A Tehran University of Medical Sciences: cross sectional study in 1388. *Payavarde salamat*. 2010; 4(1,2):44-53.[Persian]
23. Mosadegerad AM. Assessment of patient satisfaction of hospital services in Razi hospital of Qazvin. *Management and information in health and cure*. 2004; 1(1):28-32.
24. Ebadifard Azar F, Ansari H, Rezapur A. Study of daily bed occupancy costs and performance indexes in selected hospital of Iran university of medical sciences in 1381. *Management and Medical Information*. 2002; 7(18):37-44.
25. Momayezi M, Fakhr S. The average waiting time for patients in emergency department of Afshar and martyr Rahnamun hospitals. Paper presented at 7th congress on health care management studets; 2009; Kerman.[Persian]
26. Salari M, Hedayati P, Tagavi M, et al. Evaluation of patients waiting for laboratory services, radiology and pharmacy in a AmiralMomenin hospital emergency department Zabul. Paper presented at: 7th congress of health cate management students; 2009; Kerman. [Persian]