

Indicators of Hospital Performance Evaluation: A Systematic Review

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Abstract

Background and Objectives: The reliability of hospital assessment results depends on the appropriateness of the indicators used. In this study, we systematically review the literature to identify the major indicators of hospital performance evaluation, as employed in performance assessment literature.

Methods: Literature databases including PUBMED, Scopus, Science Direct, Google scholar, DOJA, and OVID were searched using “hospital,” “indicator,” “criteria,” “evaluation,” “measurement,” and “performance” as keywords. The selected articles were critically appraised by two reviewers. The indicators were then extracted from selected articles.

Findings: From the total of 8362 articles with relevant content, 4761 were selected based on the title. These were further filtered based on the specific objective of the research and eliminating the duplications, to obtain 249 mostly relevant papers. Among these, 23 articles which fulfilled the inclusion criteria were reviewed. A total of 218 indicators were found to be used in the literatures. The average length of stay and bed occupancy rate were used in hospital performance assessment most frequently.

Conclusions: Our results indicated that evaluators were mostly interested in use of quantitative indicators in hospital performance assessment. In addition, a diverse range of indicators was used for evaluating hospital services quality. It is recommended that hospital managers select a combination of quantitative and qualitative indicators for accurate monitoring of their hospital performance.

Keywords: Performance assessment, Indicator, Hospital, Hospital Management

Background and Objectives

Despite the scientific and technological developments, health systems are challenging with problems such as patients dissatisfaction and service inefficiency [1]. In all health systems, hospitals are important sectors providing vital services. In the health system, hospitals absorb considerable percentage of resources. In the developing and developed countries, 40 and 80% of resources are allocated to hospitals, respectively [1, 2]. Hospitals impact the health systems' efficacy. So assessment of hospitals performance is of paramount importance [1].

Assessment of performance in an organization is criti-

cally important in order to achieve its goals. It is essential for an organization to be consciously aware of its surrounding situation and quality of performance, especially in complex and dynamic contexts [3, 4]. In an organization, lack of a multidimensional assessment system is considered a disease [3]. Primary endeavors to assess performance of hospitals back to 1859. At that time, Florence Nightingale measured the quality of healthcare services through calculating infection and mortality rates [3]. Clinical and economical assessment of hospital performance is beneficial to payment systems, policymakers, hospitals, and physicians. Assessment also assists the managers in promoting quality of performance and control [5].

Performance of an organization is assessed based on the performance indicators. Indicator-based performance assessment leads to the promotion of performance in hospitals and health system. Precise selection of indicators impacts on improving the quality of services and accuracy

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of assessment [4]. Indicators measure variations directly and indirectly [3]. Indicators of performance can be applied to achieve internal and external goals. An example for applying indicators in order to achieve internal goals is the managers' use of indicators as informational tools for observation, assessment, and promoting performance in short-term and long-term periods. Response to investigators, consumers, and community is an example of applying indicators to achieve external goals [2]. Hospital indicators reflect utilization of services and performance [6]. In other words, indicators are used to measure efficacy and level of success in an organization [6, 7]. In hospitals, indicators reflect performance. So it is necessary to concentrate on these indicators, and investigate and compare them regularly [8]. Promotion of indicators of hospital performance reflects appropriate management of resources, efficacy, and effectiveness of the performance of personnel [9].

Various models are available for hospital performance assessment. In several studies, various indicators have been applied to assess and compare performance in hospital. We conducted this literature review study to investigate and introduce some of these indicators.

Methods

This is a literature review of articles about the hospital performance assessment indicators.

Data sources and Search

Studies were identified by searching the electronic databases and scanning the reference lists of the articles. This search was conducted in PUBMED, Scopus, Science Direct, Google scholar, DOJA, and OVID databases. The last search was run on 14 May 2014.

Search strategy

Search strategy was a combination of "hospital," "performance," "assessment," "evaluation," "measurement," "indicator," and "criteria" keywords. The OR Boolean, and operators were placed between the keywords in the searches.

We limited the searches to English language peer-reviewed journals from January 2000 to December 2013.

Screening

First, titles of all articles were reviewed by two of the authors, and then abstracts of the selected articles were reviewed. Full text of the articles was studied, and articles in the area of hospital performance indicator, which were most relevant to the study aims, were reviewed perfectly.

Finally, using the STROBE instrument, the quality of the selected articles was assessed (Figure 1). In all these steps, the articles were reviewed by two of the authors, and then the attributes and themes identified in any article were written in extraction tables.

One reviewer author extracted the following data from the included studies, and the second author checked the extracted data. Disagreements were resolved by discussion between the two reviewer authors; if no agreement could be reached, it was planned that a third author would decide.

Information was extracted from each included study on: (1) characteristics of studies (including title, authors, year, and type of study) and (2) indicators and results.

Results and Discussion

A total of 23 studies were identified for inclusion in the review. The search of databases provided a total of 8362 citations. First, titles of all articles were reviewed and 7886 were excluded due to inconsistency with the study aims. After adjusting for duplicates, 249 articles remained. Of these, 146 studies were discarded because after reviewing the abstracts, it appeared that these papers did not clearly meet the criteria and also lack of indication to hospitals performance indicators in their results. Twenty-three studies were discarded because full text of the study was not available or the paper could not be feasibly translated into English or the paper was not in English language or type of article was not original. The full text of the remaining 80 citations was examined in more detail. It appeared that 53 studies did not meet the inclusion criteria as described. Then using the STROBE instrument, quality of the 27 remained articles was assessed and 23 of them had the quality needed. Finally, 23 studies met the inclusion criteria and were included in the literature review.

A total number of 23 articles on methods of hospital performance assessment were investigated: 5 articles on data enveloping analysis (DEA), 3 articles on Papen Lasso model, 3 articles on balanced score-cards model (BSC), 3 on analytical hierarchy process technique (AHP), and 1 article on the integrated model of DEA and Papen Lasso. One study on BP-ANN methodology, one study on ratio analysis, and one study on grounded theory approach were done. Five studies had not used any model or methodology. A total number of 218 indicators were applied in the studies such as average length of stay with 12 repetitions, bed occupancy rate with 9 repetitions, patient satisfaction and bed turnover with 7 repetitions, and no-socomial infection rate with 6 repetitions. The results are shown in Tables 1 and 2.

Table 1 Details of articles

First Author (year)	Study design	Country (Setting)	Participants	Data collection Method (or data source)
Chun-Ling Chuang (2011) (10)	Cross sectional	Taiwan	-	Statistical Analysis of Hospital Utilization published by Department of Health (DOH)
A Goshtasebi (2009) (11)	cross-sectional	Iran	six State-run hospitals in the province of Kohgiluyeh & Boyer-Ahmad	two ad hoc questionnaires
Bruno Yawe (2010) (12)	cross-sectional	Uganda	25 district referral hospitals from three regions	HMIS databases of each hospital
Chunhui Li (2013) (13)	cross-sectional	China	14 level-3 public non-profit hospitals located in Hubei Province	Hubei Medical Service Information Quality Control Center (HMSIQCC)
Mohammadkarim Bahadori (2011) (1)	cross-sectional descriptive	Iran	23 hospitals Uremia University of Medical Sciences	statistical almanac of the Uremia University of Medical Sciences
Fadi El-Jardali (2011) (14)	mix- method	Lebanon	Readiness assessment surveys in 52 hospitals were conducted (55.9%)/ pilot testing and evaluation were completed in 14 hospitals.	checklist & questionnaire
Hui-Yin Tsai (2010) (15)	mix- method	Taiwan	4 metropolitan hospitals	Checklist & expert panel
Raana Gholamzadeh Nikjoo (2013) (3)	quantitative-qualitative	Iran	20 expert panels (Response rate 75%)	1.search 2.Email
Peivand Bastani (2013) (2)	cross-sectional descriptive	Iran	150 hospitals affiliated with Ministry of Health and Medical Education (Response rate 92.7%)	nine dimensional questionnaires supported by world wide web
Zaboli R (2011) (16)	observational cross-sectional	Iran	military hospital of Tehran that had participated in per case payment plan	researcher-made questionnaire & checklists
Abhijit Basu (2010) (17)	cross-sectional	UK	a single UK hospital	Trafford General Hospital's Trust Board
Jeremy Henri Maurice Veillard (2013) (18)	Qualitative	8 European countries	140 hospitals from (Belgium, Estonia, France, Germany, Hungary, Poland, Slovakia and Slovenia)	Semi-structured interviews
Amir Ashkan Nasirpour (2010) (19)	cross-sectional	Iran	13 Teaching hospitals affiliated to TUMS	questionnaire
Elham Dadgar (2012) (20)	qualitative	Iran	20 professionals participated	interview and Focus Group Discussions (FGD)
Rowena Jacobs (2013) (21)	cross-sectional	UK	English NHS acute hospital Trusts	questionnaire
Shriniwas Gautam (2013) (22)	cross-sectional	Columbia	sample includes 33 (out of 36) CAHs and 27 (out of 28) other non-CAH rural hospitals.	1.information Missouri Hospital Association 2. Missouri Department of Health and Senior Services (MDHSS)
Javier Garcia-Lacalle (2013) (23)	cross-sectional	Spain	27 of the 29 Andalusian Health Service (SAS)	-

Table 1 Details of articles

First Author (year)	Study design	Country (Setting)	Participants	Data collection Method (or data source)
K.R. Sinimole (2012) (24)	quantitative-qualitative	India	four large hospitals in Kottayam District	expert panel questionnaire
Shao-Jen Weng (2009) (25)	cross-sectional	USA	using the Al-Shammari data set: 15 hospitals in Jordan	Panel-based Benchmarking
Vahé A. Kazandjian (2012) (26)	cross-sectional	USA	USA, Europe hospitals from the UK, Austria, Flanders, the Netherlands and Portugal. East Asia: hospitals from Taiwan & Singapore	Data are submitted to the QIP ¹ on a quarterly basis
Amir Ashkan Nasiripour (2012) (27)	adaptive and descriptive research	Iran	80 professionals participated (Response rate 67.5%)	review literature and a series of semi-structured interviews, questionnaire
Peter Davis (28)	cross-sectional	New Zealand	35 public hospitals	the New Zealand Ministry of Health (MOH)'s National Minimum Dataset
Ahmad Barati Marnani (29)	cross-sectional	Iran	23 Iranian hospitals	two special checklists

¹ Quality Indicator Project

Indicators are the most important tool for hospital performance assessment. Correct analysis of the indicators is of paramount importance in making decisions and improving the quality of hospital performance [6]. Indicators show the current condition as well as the hospital performance [3]. This literature review investigates studies on indicators for hospital performance assessment. Results suggested that the average length of stay, nosocomial infection rate, patients' satisfaction, bed occupancy, and bed turnover rate were the most useful indicators. The average length of stay is a simple and important indicator; it is practically a useful indicator for quality control, care management, and care effectiveness in the hospital. This indicator indirectly indicates resource utilization and management efficacy [30]. Martin and Smith in their study suggest hospital features and demographic characteristics of patient as the two determinants of the length of stay. Any patient is prescribed to spend a particular length of stay. It depends on the rapidity of diagnosis and treatment processes, availability, and appropriateness of alternative cares after discharge. Early diagnosis shortens the length of stay and decreases the care expenses [31]. Shorter length of stay leads to higher rate of admissions and more healthcare services provided for patients with no need to establish new hospitals [30]. Concerning the reverse association between the average length of stay and the bed turnover indicators, shorter average length of stay can positively impact on the bed turnover rate [32] so that more use of a hospital bed would be provided, and in turn, the efficiency of hospital may be increased.

Nosocomial infection rate is one of the important indicators in healthcare systems. Fayazi found that nosocomial infection is a direct cause of mortality. The Britain National Health Care Organization (BNHCO) has estimated that nosocomial infections are responsible for annually \$986,360,000 economic burden on the health system, 96% in inpatient departments, and 6% after discharge [17]. In the United States of America (USA), 247 mortality cases occur each day, and 1 out of 136 inpatient infections is due to nosocomial infection. Nosocomial infection rate is estimated to be 5–15% in the developed countries vs. 25% in the developing countries. Annually, more than 2 million nosocomial infections are reported worldwide with treatment expenses up to \$17,000,000,000–29,000,000,000 [33, 34].

Nosocomial infections also affect other hospital performance indicators such as patient safety, length of stay, organizational expenses, and mortality rate. The risk of some nosocomial infections depends on the patients' condition, medical processes, and organizational features. According to the conducted studies in Norway, more than 5% of inpatients were infected with nosocomial infections. In high income countries, the prevalence of nosocomial infections in case mix population is 7.6% [35].

The prevalence of nosocomial infections is different among hospitals and departments due to different number of treated case mix and size of the hospital. The rate of nosocomial infections is higher in the third level educational hospitals in comparison to smaller hospitals [35].

Nosocomial infections threaten as well as patients, their family and healthcare providers [36]. However, nosocomial

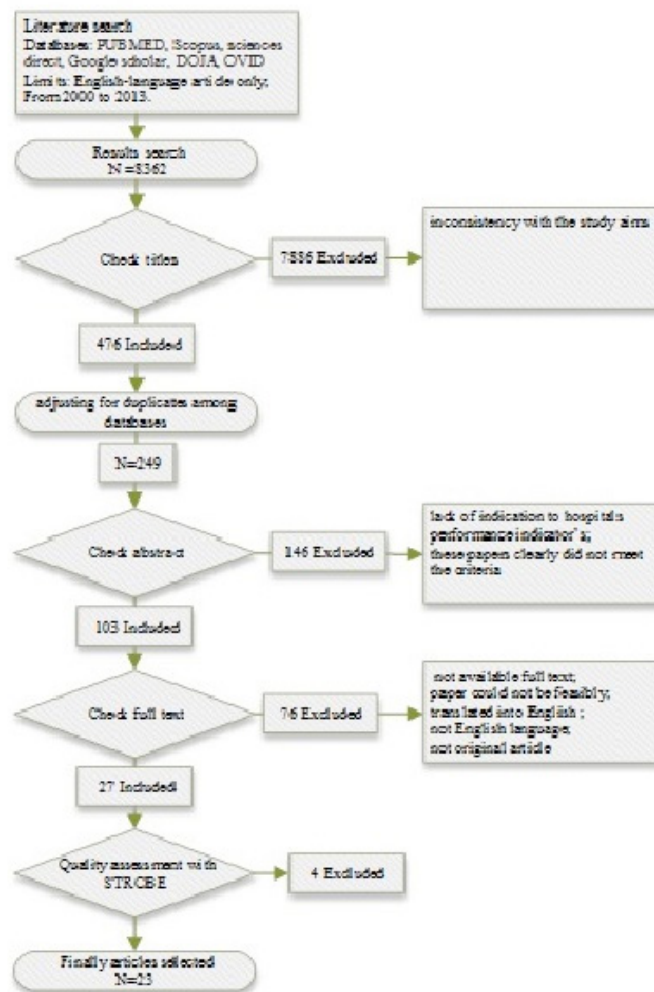


Figure 1 Literature review procedure.

infections cannot be eliminated; they are controllable through implementing strategies in medical team and patients such as washing hands, personal health improvement, hospital environmental health improvement, and appropriate prescription of antibiotics [33].

Another important hospital performance indicator is Patient satisfaction. It has become a driver of quality as affordable care organizations expand, and healthcare market competition grows. Patient satisfaction is vital for continuous monitoring and quality improvement of healthcare delivery systems [37].

The origin of patient satisfaction concept backs to the 1950s. Today patient satisfaction is essentially important for healthcare providers [38, 39].

Concerning consumer satisfaction as a major aspect of quality improvement of services [40], patient satisfaction is considered as an indicator for the assessment of quality and efficacy in healthcare systems. Effective interaction between the determinants of patient satisfaction will improve this indicator [41].

During the last 25 years, consumer satisfaction has been

considered as an index for quality assessment in many governmental sectors [39].

Patient satisfaction is largely depended on the medical team's appropriate behaviors and performance as well as the technological developments [42]. In some healthcare centers, personnel training courses have been established to improve the relationship and interaction between personnel and patients in order to improve patient satisfaction [41].

The results showed that all studies had used several indicators for performance assessment in hospitals. It could be said that hospitals perform well when they consider several aspects of their performance such as average length of stay, bed occupancy rate, and nosocomial infection rate, and patient satisfaction as well.

Researchers have used different models for hospital performance assessment such as DEA, Papen Lasso model, BSC, and AHP.

DEA is a particular assessment technique in sectors with similar inputs and outputs. As a managerial method, DEA

Table 2 Methodology and indicators of articles

Methodology	Indicators	No. of paper
DEA	<p>Input 1. No. of Patient Beds, 2. No. of Physicians, 3. No. of Other Medical Professionals, 4. No. of Nurses 5. Total full-time equivalent employees 6. Number of hospital staffed beds 7. Price of Labor 8. Price of Capital 9. Bed days 10. Health personnel, 11. Other Employees</p> <p>output 1. No. of Inpatient Days, 2. No. of Outpatient/Emergency Visits, 3. No. of Person-time Using Expensive Medical Devices, 4. In-Hospital Survival Rate 5. Case mix index adjusted inpatient days 6. Total nonemergency outpatient visits 7. Outpatient visits 8. Emergencies 9. Stays 10. Diagnoses 11. Operations 12. Number of patient days 13. number of minor operations 14. Number of major operations 15. Admissions, 16. Outpatient Dept. Attendances, 17. Deliveries</p>	1, 3, 16, 17, 19
Pabon Lasso	1. average length of stay 2. bed occupancy 3. bed turnover	2, 5, 10
Back propagation, artificial neural networks (BP-ANN)	<p>Input 1. Percentage of health technicians, 2. Doctors-nurses ratio, 3. Beds-nurses ratio, 4. Percentage of fixed assets in total assets (%) 5. Average number of open beds</p> <p>Process 1. The percentage of appropriate written nursing documents 2. Percentage of passing student in nurses' training 3. Percentage of passing student in doctors' training 4. Percentage of class A medical records in all medical records 5. The percentage of appropriate prescriptions 6. Percentage of antibacterial prescription 7. Rate of CT inspection 8. Rate of MRI inspection 9. Rate of X-ray inspection 10. Clinical chemistry laboratory scoring 11. Hematology laboratory scoring 12. Immunology laboratory scoring 13. bacteriological laboratory scoring</p> <p>Output 1. Therapeutic response rate (%) 2. Proportion of inpatients diagnosed within 3 days (%) 3. Mortality (%) 4. Proportion of nurses with basic qualification (%), 5. Success rate of rescue (%) 6. Incidence of nosocomial infection (%), 7. Percentage of agreement between admission and discharge diagnoses 8. Medical institution bed utilization ratio (%), 9. Medical institution bed turnover ratio, 10. Daily number of clinic patients for each doctor 11. Daily number of hospitalization bed-days for each doctor 12. Average number of days in hospital, ≤15 days 13. Average outpatient expenditures 14. Average hospitalization expenditures 15. Average expenditures per bed per day 16. Percentage of medicine income of the total income, 17. The asset-liability ratio (%) 18. Percentage of expenditures in service revenue 19. Income generated by each staff member 20. Medical income per 100 Yuan of fixed assets</p> <p>effect 1. Patient satisfaction (%) 2. Compensation as a percentage of total income (%) 3. Medical accident rate per 10,000 inpatients</p>	4
Balanced scorecard	<p>Clinical utilization and outcomes 1. In-patient mortality 2. Readmission for same diagnosis 3. Repeat surgical procedures 4. Patient falls 5. Caesarean section 6. Medication errors 7. Length of stay 8. Readmission to the ICU 9. Failed Extubation 10. Pressure Ulcers 11. Post-operative Hemorrhages and Hematomas 12. Birth Trauma-Injury to Neonate 13. Obstetric Trauma-Vaginal Delivery with Instrument 14. Obstetric Trauma-Vaginal Delivery without Instrument 15. Success rates for stroke 16. Success rates for fractured femur 17. Intensive Care Unit (ICU) mortality rate</p> <p>Financial performance and condition 18. Occupancy 19. Overtime 20. Cost per patient day 21. Cash-flow</p> <p>System integration and human resources 22. Surgical site infections 23. Needle sticks and sharps injury 24. Staff turnover 25. Staff satisfaction 26. Waiting time from ER to bed (admission) 27. ER waiting time 28. Employee absenteeism 29. Rate of employee sick-leave 30. Documentation of Medical Records 31. Information Technology Satisfaction Survey 32. Hand Hygiene—Measuring Alcohol Consumption 33. Access and Exit Block to the ICU 34. Percent of total admissions transferred out to another hospital 35. Central line-associated laboratory confirmed primary bloodstream infection (CLA-LCBI) 36. Transfer time from ward to ICU 37. Sentinel events 38. Patient safety culture rate 39. Percent long stay patient</p> <p>Patient satisfaction 40. Patient satisfaction</p>	6

measures efficacy in all sections, realizes efficient section, and introduces it as a reference for inefficient sectors to improve efficacy. The investigated section can be a sector of one organization or an independent organization [43].

The Pabon Lasso model encompasses three indicators: bed turnover rate, bed occupancy rate, and average length of stay. This is a particular model for global performance assessment in hospitals, and classifies hospitals in four orders [44].

The BSC model was introduced by Kaplan and Norton. It is made up of four aspects, namely financial aspect, consumer aspect, internal processes, and learning and growth aspect. This model converts imperceptible properties in to perceptible values for stakeholders. In this model, objectives and indicators are determined based on the organization's mission, vision, and strategies [45].

It can be concluded that among the available models for

Table 2 Methodology and indicators of articles, *continued*

Methodology	Indicators	No. of paper	
Delphi & FAHP	Quality performance	1.Medical structure 2.Medical process 3.Medical outcome	7
	Efficiency performance	1. Bed turnover 2. Total number of surgeries 3. Number of outpatient 4. deducted rate of NHI	
	Financial performance	1. Instrument expenses 2. Medicines expenses 3.personnel expenses	
Literature review & Analytical Hierarchy process (AHP)	Quality-Effectiveness	1.The pure rate of hospital mortality 2.Readmission number based on diagnose differences 3.Hospital infection rate based on ward / diagnose/ procedure 4.Patients satisfaction percentage 5.Staffs satisfaction percentage 6.Hospital accidents prevalence rate 7.legal complaint from hospital within one year 8.Success to hospitals in obtaining certificates of management quality	8
	Efficiency-Financing	1. Beds occupation ratio 2. Beds exchange interval 3. Average length of stay Based on different diagnosis 4. Relationship between private income and total costs in hospital 5. Hospitals the pharmaceutical costs relation to total costs to hospitals	
	Accessibility-Equity	1. Average outpatients waiting time 2. Average inpatients waiting time 3. Relation between total number of staffs to active beds	
Ratio analysis	1. Bed Turnover Ratio (BTR) 2. Bed Turnover Interval (TI) 3. Average Length of Stay 4. bed occupancy rate	9	
-	Finance	1.Income and expenditure 2.Cash flow 3.Gross margin 4.Debtors	11
	Efficiency	1.Length of stay 2.Day case rates 3.Theatre utilization rates 4.Diagnostics utilization rates 5.Drug prescriptions	
	Workforce	1.Headcount and salary bill 2.Use of agency/ bank 3.Sickness 4.Vacancy 5.Staff turnover 6.Diversity	
	Patients' Experiences	1.Outcome and satisfaction 2.Complaints	
	Clinical quality	1.Mortality 2.Readmission 3.Infection 4.Serious untoward incidents 5.Litigation and claims	
Grounded theory approach	1. Caesarean section rate 2.Prophylactic antibiotic overuse and underuse 3.In hospital mortality rate for selected conditions 4. Readmission rate for selected conditions 5.Day surgery rate for specific procedures 6.Admission after day surgery for selected procedures 7. Unplanned readmission to intensive care unit within 48 hours of discharge 8.Median stay for specific conditions 9. Needle sticks injuries 10. Staff smoking-prevalence 11. Exclusive breastfeeding at discharge 12. Patient satisfaction survey results 13. Operating theatre use	12	

performance assessment, the BSC model includes more various indicators to make multi-dimensional assessment of hospital performance.

Conclusions

Comprehensive assessment of hospitals enables the identification of strengths and weaknesses in the system that can be used to develop new improving strategies. The results of this study allows for different stakeholders to make a comprehensive assessment of their hospital.

Various indicators are available for hospital performance assessment. Use of indicators depends on models, executive

managers' objectives, and the evaluators' point of view. Our results indicated that evaluators were mostly interested in quantitative indicators for hospital performance assessment. Our findings recommend that hospital managers select a combination of quantitative and qualitative indicators to monitor their performance precisely.

Competing interests

The authors declare no competing interests.

Authors' Contributions

Hamed Rahimi, and Zahra Kavosi contributed to conceiving and de-

Table 2 Methodology and indicators of articles, continued

Methodology	Indicators	No of articles
-	1. Average length of stay 2.inpatient bed occupancy ratio 3.rate of admissions per active bed 4.net death rate 5. Ratio of surgical operations to inpatients 6. The average waiting time for outpatient after reception 7. The average waiting time for inpatient after reception 8. Patient satisfaction rate 9. Staff satisfaction rate 10. Ratio of personnel to existing standards 11. Hospital infection rate 12.Average number of available beds 13.Percent clinical negligence expenditure 14.Total no. imaging tests per bed 15.Percent management salaries 16.Percent consultant salaries 17.Percent nurse salaries 18.Median waiting time 19.Day-case rate 20. Total inpatient mortality 21. Total preoperative mortality for all ASA classes 22. Primary Caesarean sections 23. Repeat Caesarean sections 24. Total Caesarean section frequency 25. Vaginal births after Caesarean section 26. Unscheduled re-admissions within 31 days for same or related condition 27. Unscheduled returns to ICUs 28. Unscheduled returns to the operating room 29. Unscheduled returns to ED within 72 h	13, 14, 15, 20
Fuzzy Analytical Hierarchy process	<p>Tangibles</p> <p>1. Cleanliness of the environment (inside and outside) 2.Quality of the medical equipments 3.The clothes and appearance of all staffs 4.The clothes and appearance of all first-line staffs 5.Cleanliness of the wards 6. Quality of the canteen food 7.Quality of the food for the patients 8.Sanitization and hygiene of the canteen 9.Availability of water 10.Availability of electricity 11.Provision of comfortable seating arrangement in the waiting area 12.Estimated bill accuracy 13. Final bill payment procedure 14.Parking area provided for patients and relatives 15.Security of the hospital 16.Inquiring counter of the hospital (helpfulness) 17.Provisions of wheelchairs and lifts 18.Condition of the bed provided 19.The patience shown by doctors in hearing patient details 20.The patience shown by nurses 21.The instructions provided to patients by the pharmacy staff 22. Politeness of all the service (cleaners and ward boys) staffs 23. Doctor's explanation of the details of condition of the patients 24. Clarity of the instructions by nurses 25. Doctor's efficiency in handling emergency 26.Staff's efficiency in handling the emergency 27.Timeliness of the scheduled procedures 28.Exhibits and displaying tips and instructions for health living 29.Community services rendered by the hospital</p> <p>Reliability</p> <p>1. The efficiency of doctors in treatment and further assessments 2. The long-term effectiveness of the treatment 3. Relevancy of the tests advised to undergo 4. Procedure for conducting tests</p> <p>Responsiveness</p> <p>1. Doctor's response to the request of patients 2. Presence of on-call doctors during night 3. The nurse's response to the request of patients 4. Process of medical care (very convenient and quick) 5. Dealing of the staff with emergency cases 6. Cooperation and helpfulness of administrative staff 7. Ambulance service promptness</p> <p>Assurance</p> <p>1. The planning and design of the hospital (feel safe and convenient) 2. Confidence given by the doctors 3. The extent of confidentiality between doctor and patient 4. Word of mouth and reputation of the hospital 5. Confidence given by all staff</p> <p>Empathy</p> <p>1. Availability of the related medical information 2. The registration and admission process (quick) 3. Waiting time to get the medicine 4. Waiting time to see doctor 5. Reservation process for consultation 6. Visitors' time and duration 7. The facilities for families and visitors 8. The hospital's ability to understand and satisfy the requests of patients 9. Acceptance of the special requests of patients 10. Care given to the requests of families and visitors</p>	18

signing the study.

The data was collected by Hamed Rahimi, Zahra Kavosi, and Mohammad Khammar nia; and was analyzed and interpreted jointly by Hamed Rahimi and Mohammad Khammar nia. Hamed Rahimi, Zahra Kavosi and Marzieh Eslahi contributed equally to writing the manuscript, and all authors had an equal share in revising the manuscripts. All authors read and approved the final manuscript.

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Table 2 Methodology and indicators of articles, continued

No of articles	Indicators Methodology	No of articles	
Balanced scorecard	clinical	1. Readmission rate 2. Percentage of caesarian sections 3. Hospital acquisition infection rate 4. Patient safety culture 5. Sentinel event rate 6. Mortality rate	21
	patient	1. Patient satisfaction 2. Rate of Patient complaints 3. Mean waiting time in emergency department	
	process	1. Length of stay 2. Outpatient per doctor 3. Cancelled operations 4. Big surgery percent 5. Inpatients per doctors 6. Employee productivity 7. Bed occupancy	
	finance	1. Income per inpatient 2. Income per outpatient 3. Cost coverage 4. Preventive maintenance (PM) cost of total budget 5. Current cost per bed	
	employee growth	1. Training expenditures per capita 2. Sickness absence rate 3. Employee satisfaction 4. Percutaneous injuries 5. Training expenditures 6. Information technology (IT) efficiency	
Balanced scorecard	Efficiency	1. Relative stay index (RSI) 2. Standardized day surgery rate	22
	Effectiveness	1. Unplanned readmissions 2. 30-day mortality	
	Equity	1. Ethnic equity 2. Socio-economic equity	
DEA and Pabon lasso	1. Number of active beds, 2. Number of active bed-days, 3. Number of occupied bed-days, 4. Number of discharges, 5. Bed occupancy rate (BOR), 6. Bed turnover (BTO) 7. average length of stay (ALS)	23	

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