International Journal of Hospital Research 2018, 7(3)
http://ijhr.iums.ac.ir
Research Article

Identifying and quantifying the effect of factors affecting on the evaluation of medical faculty performance

Pejman Shadpour[1], Rouhangiz Asadi[2], Mansoureh Naderi3, Mahtaj Hashemi[2], Mohammad Mehdi sepehri[4]*

[2]Hasheminejad Kidney Center(HKC), Hospital Management Research Center (HMRC), Iran University of Medical Sciences (IUMS), Tehran, 19697, Iran

[1]Hospital Management Research Center (HMRC), Iran University of Medical Sciences (IUMS), Tehran, 19697, Iran

[3]Health care services Management, Shahid Beheshti University of Medical Sciences, and Tehran, Iran.

[4]Faculty of Engineering and systems, Tarbiat Modarres University, Hospital Hospital Management Research Center (HMRC), Iran University of Medical Sciences(IUMS), Tehran, 19697,Iran

Abstract

Background and objectives: Evaluation and assessment of hospitals Medical faculty performance plays a vital role in improving organizational performance, patient and client satisfaction, learner satisfaction and increase of the brand in hospitals. So faculty evaluation in terms of all aspects is essential in hospitals.

Methods: In this study, a multi-dimensional model from different perspectives (hospital management, research department, students and faculty) is provided for evaluation of faculty in hospitals. For this purpose, the indicators influencing assessment were identified and categorized in four dimensions: education, hospital management, research and clinical. Then, to prioritize and weight factors as well as prioritize the faculty, a multi-criteria decision-making model was developed and was solved using triangular FAHP approach.

Results The results indicate that timely and active presence in the clinic on patient bedside, sending patient to other medical centers, private and non-governmental, with no scientific reason, active cooperation with implementing quality improvement plans of health care in hospitals and etc. have the highest priority and factors such as active cooperation with the hospital committees, quality of theses, physical presence in the office hours and etc. received the lowest score.

Conclusions: he results show that all three aspects of physicians' performance are important and should be considered in their evaluation And the fuzzy hierarchical analysis method has shown this very well.

Keywords: Evaluation, faculty of medicine, fuzzy analytical hierarchy process (FAHP) approach, hospital.

Background and Objectives

For continuous improvement of a system, a tool is required to provide appropriate feedback. Evaluation is a systematic process for collecting, analyzing and interpreting information that determines achievement of the intended goals of the program and its rate. Doctors in medical universities, hospitals and medical centers are as the main members that their performance has a direct impact on the education of medical students, staff and treatment of patients, and generally has a direct impact on the quality of the implementation of the mission of hospitals.

To improve teaching and its role in the development of educational and research purposes of university, the professors may be evaluated so that they recognize their strengths and weaknesses and improve them. Evaluation also helps training centers authorities to make correct decision about hiring and promoting faculty members[1-3]. The most complex evaluation is the evaluation of faculty activities and this complexity is due to the subprime and non-precision of measuring instruments and methods used in this type of evaluation[4].

*Corresponding Author: Mohammad Mehdi Sepehri
Email: mehdi.sepehri@gmail.com

Aranutu and Panc in a study examined the factors affecting evaluation of faculty in terms of education and research[5] . The criteria introduced by the researchers are available in Table 1. Morgan and Swinney examined evaluation credit of faculty members in terms of education and the view of students from the perspective of relevant college and university management[6].

For evaluation, at first the factors affecting the evaluation should be identified. Jobs are various, each with its characteristics. Therefore, we cannot determine a set of particular indices that are general to be used to evaluate the performance of employees in each job. But in general indicators that are used to evaluate performance should have characteristics that the use of them increases the precision, accuracy and effectiveness of evaluation process. To reach this goal, past research and instructions of the Ministry of Health and Medical Education in this area were examined. A summary of the research in this area is provided in this section (Table 1). By examining the performed research it can be seen that so far the performance of the doctors has been investigated only in terms of education while doctors' performance is multi-dimensional and affects various areas including education, research, management and treatment. In this study, we examine medical faculty evaluation in these four areas and from the perspective of hospital management, hospital research department, trainees (residents and fellowship) and faculty.

Since not all criteria are equally influential in evaluation, the research uses a hierarchical analysis method to weight the criteria.

AHP in healthcare

Various researchers have used the hierarchical analysis approach for various purposes such as risk assessment(7, 8), quality of service assessment[7-10], Evaluation of hospital web services[11], assessment of health management information systems efficiency[12], Performance analysis of hospital managers[13], Waste management[14], selection and assessment of hospital outsourcing services and select of supplier[15-17] and so on.

Method

Due to the high number of factors in evaluation of the medical faculty and that each of the factors is not equally effective in the evaluation, we should select the more effective factors from identified factors. So in order to select the effective factors, we should use the selection methods and have a systematic process. There are many methods and models used in this selection. In this study, FAHP approach was used.

FAHP

FAHP was considered for the first time in the studies of van Laarhoven and Pedriz. Then some other researchers provided several FAHP methods in various fields. Development analysis is one of the easiest and most common methods of fuzzy multi-criteria analysis based on using triangular fuzzy numbers and paired comparison that was developed by Chang.

Step 1: Draw a hierarchical graph

In this study, 38 factors that affect the outsourcing were extracted from the investigation of performed studies as well as experts in this field. FAHP technique was used for prioritization and selection of effective factors. In the beginning, the 38 factors were classified in four areas of 1. Education 2. Clinical (treatment) 3. Research 4. Hospital management that you can see in Table 1. Then paired matrices were designed based on AHP model for the factors that will be shown in the figure 2 .

Step 2: Defining fuzzy numbers for paired comparison

Then paired matrices were designed based on criteria and hierarchical model and were given to 15 hospital experts, managers and officials in Tehran.

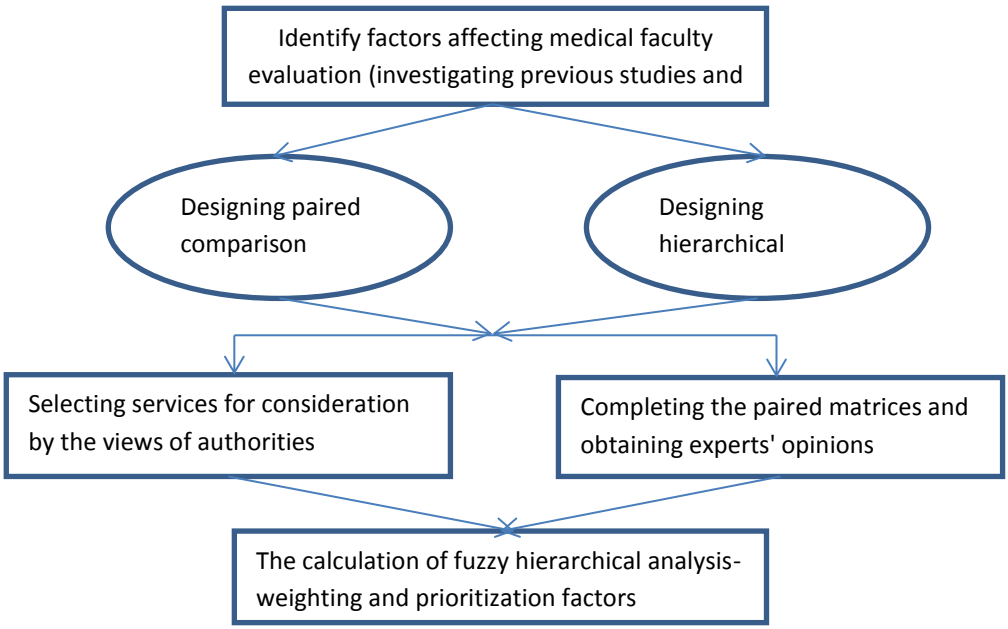


Figure 1. The stages of research

Table 1- Summary of studies[1-26]

Interviews with hospital management experts	Interview with research experts	Doctors' retention plan in disadvantaged areas	Arnautu & Panc. 2015(5)	Shakoornia et al(3).	Mahdavi et al(25).	Zare Bidaki et al(24).	Moshaverinia et al(23).	Bastani rt al.(22)	Gorii and Siami(21)	Hussein Abdullahi (20)	Mahmoudi Sahebi et al.(19)	Aliasgharpour et al.(18)	Rafiei et al.(2)	Researcher / Factors affecting faculty evaluation
		*						*					*	Quality of theory classes
													*	Training during patient examination / surgery
		*		*		*			*			*	*	Respectful behavior with students
		*			*	*	*	*	*	*		*	*	Hours, teaching methods and lesson delivery method
				*	*	*		*	*		*		*	Efficient use of classroom time (timely presence, etc.)
						*		*	*	*		*	*	Access to professor outside of class
		*				*		*	*	*	*	*	*	Academic ability, knowledge and skills
		*				*		*	*	*		*	*	To-date information, knowledge and application of new methods in education
								*	*			*	*	Being example (patience, modesty and professional ethics)
	*	*												Quality of articles (ISI, scientific research, conference journals)
	*	*												Quality of theses (Guidance, consultation and arbitration)
	*													Writing a book or translation
	*													Holding seminars, symposia, workshops, hospital conferences etc.
	*													Implementing research projects
													*	Patient management and treatment process
													*	Good and emergency consultations
													*	Cooperation on call time
												*	*	How to deal with patients and considering patients' rights
		*												Timely and active presence in the clinic on patient bedside
		*												Proper information about the treatment process to the patient / patient companion
		*												Inter-department and multi-team interaction
		*												Receiving money out of the fund routine of hospital
		*												Send patient / his companion for the preparation of medicines, equipment and supplies to
		*												Sending patient to other medical centers, private and non-governmental, with no scientific
		*												Innovation and use of new technologies for the treatment

Interviews with hospital management experts	Interview with research experts	Doctors' retention plan in disadvantaged areas	Arnautu & Panc. 2015(5)	Shakoornia et al(3).	Mahdavi et al(25).	Zare Bidaki et al(24).	Moshaverinia et al(23).	Bastani rt al.(22)	Gorii and Siami(21)	Hussein Abdullahi (20)	Mahmoudi Sahebi et al.(19)	Aliasgharnour et al.(18)	Rafiei et al.(2)	Researcher / Factors affecting faculty evaluation
*														Inter-department and multi-team interaction
*														Active cooperation with the center to provide health care (on call, etc.)
*		*												Physical presence during office hours at the center
*		*												Determining emergency patients' situation in the shortest time possible
*		*												Timely presence in the operating room and doing emergency procedures
*														Observing the hospitalization indications of patients in clinical and special departments
*														Active cooperation with hospital committees
*														Active cooperation with implementation of plans to improve quality of treatment services in
*														Considering instructions and clinical guidelines for diagnosis and treatment of disease
*														Recording all documentation of patient's file (related to doctor) and trying to reduce insurance

Figure 2-Analytic Hierarchy Chart

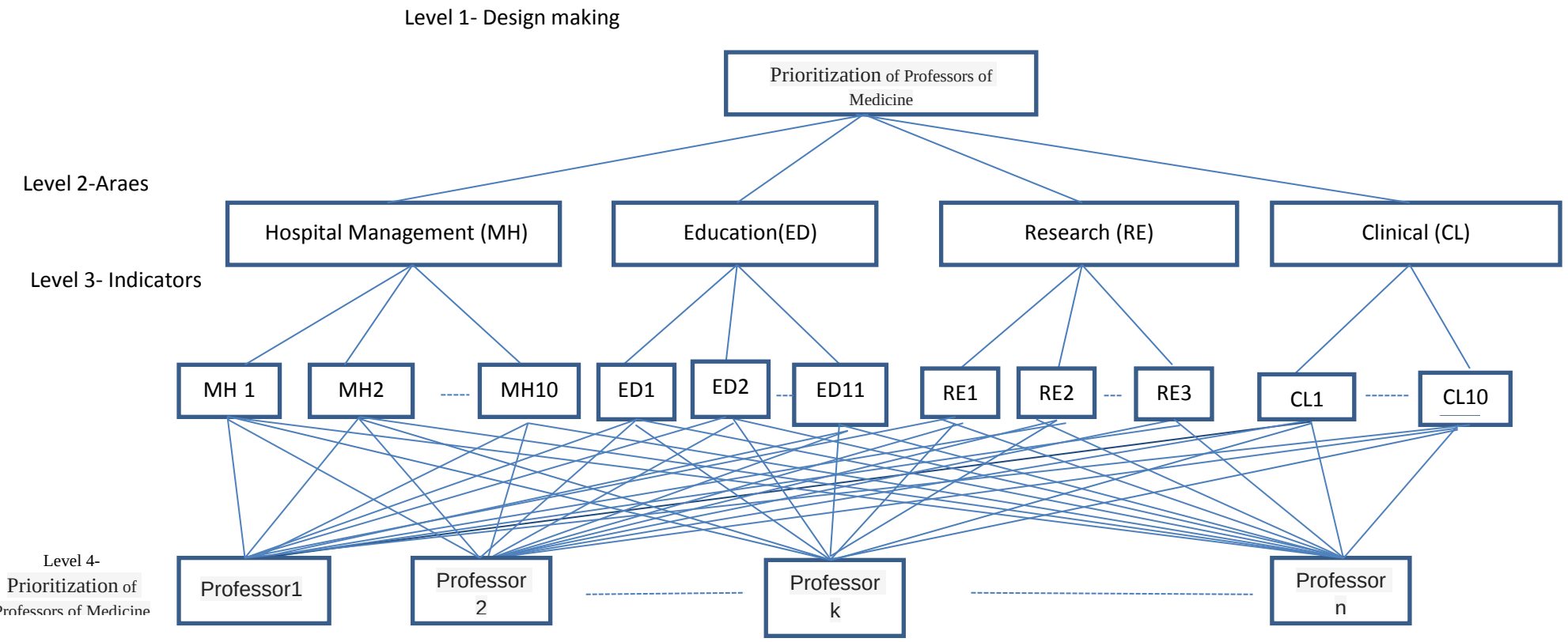


Figure 1 - Analytical Hierarchy model of factors affecting faculty evaluation in health centers

Step 3: Formation of paired matrix using fuzzy numbers

Designing the pairwise comparison and the decision matrices

The most important step in selection and evaluation of suppliers is to identify the appropriate evaluation criteria; thus based on the previous studies as well as the hospital experts 19 criteria are determined for the selection and evaluation of hospital outsourcing service suppliers[26] based on the balanced scorecard.

Defining fuzzy numbers for paired comparison

Fuzzy numbers used in this study are shown in the following table.

Table 2: Fuzzy numbers used in this study are shown in the following table.

Fuzzy number	9̃	7̃	5̃	3̃	1̃	1
Definition	Absolute importance	Very strong importance	Strong importance	Low importance	Equal important	Exactly equal importance
Triangular fuzzy scale	(7,9,9)	(5,7,9)	(3,5,7)	(13,5)	(1,1,3)	(1,1,1)

Then paired matrices were designed based on criteria and hierarchical model and were given to 15 hospital experts, managers and officials in Tehran

Step 4: FAHP Calculations

Step 1: The fuzzy composition value of (s_i)̃ is calculated than i criteria using equation 1.

$$\widetilde{s_\iota} = \sum_{j=1}^{m} M_{gi}^{j} \otimes \left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]^{-1},\ i = 1,2,3,\dots.,n \qquad (1)$$

In which ⊗ means wide multiplying of two fuzzy numbers and each of fuzzy numbers obtained represents a relative weight of a criterion (or option) to other criterion.

Step 2. If $(\widetilde{M_1}, \widetilde{M_2})̃$ are two triangular fuzzy numbers, greatness degree of of $\widetilde{M_2} = (l_2, m_2, u_2) \geq (l_1, m_1, u_1)$ is defined using the following equation .

$$\mu(d) = \begin{cases} 1 & m_2 \geq m_1 \\ \dfrac{u_1 - l_2}{(u_1 - m_1) - (m_2 - l_2)} & otherwise \\ 0 & l_1 \geq u_2 \end{cases} \qquad (2)$$

In the above equation, $\mu(d) = v(\widetilde{M_2} \geq \widetilde{M_1}), \widetilde{M_1} = (l_1, m_1, u_1), \widetilde{M_2} = (l_2, m_2, u_2)$

Step 3: the possibility degree of a convex fuzzy number is greater than the possibility

degree k of convex fuzzy number$(\widetilde{M}_i (i = 1,2, \dots, k)$

$$V(\widetilde{M} \geq \widetilde{M}_1, \widetilde{M}_2, \dots., \widetilde{M}_k) = V(\widetilde{M} \geq \widetilde{M}_1) \; and \; V(\widetilde{M} \geq \widetilde{M}_2) \; and \; \dots . and \; V(\widetilde{M} \geq \widetilde{M}_k) = \min V(\widetilde{M} \geq \widetilde{M}_k), i = 1,2, \dots, k \quad (3)$$

Step 4: Following normalization of W´ normalized weight vector is calculated according to the following formula in which W is a non-fuzzy number.

$$W = \left(d(A_1), d(A_2), \dots . d(A_n)\right)^T \quad (4)$$

determined. 10 of the 38 identified factors were classified in the field of education that following the assessment and prioritization by FAHP we found out that factors such as management of theory courses, respectful behavior with students, hours, teaching methods and lesson delivery, up to date information, knowledge and application of new methods and efficient use of class time are prioritized first to sixth in this area. Results are shown in the following diagram. Inconsistencies of Pairwise comparisons matrix were performed by the Expert choice 11software that presented in the chart of each comparison.

Compatibility of paired comparison matrices in AHP is one of the most important issues that should always be considered in the decision process. If the incompatibility is less than 0.1 judgments are acceptable. In this study, to check the compatibility of judgments, at first, inconsistency of all Paired Comparison Matrices was calculated in Expert choice software .

Results

In this study, factors affecting faculty evaluation in health centers were identified and classified in 4 areas and were prioritized using fuzzy hierarchical analysis and the effect of each of these factors on the faculty evaluation was

Table 1. Structural model of the first order to the second-order path

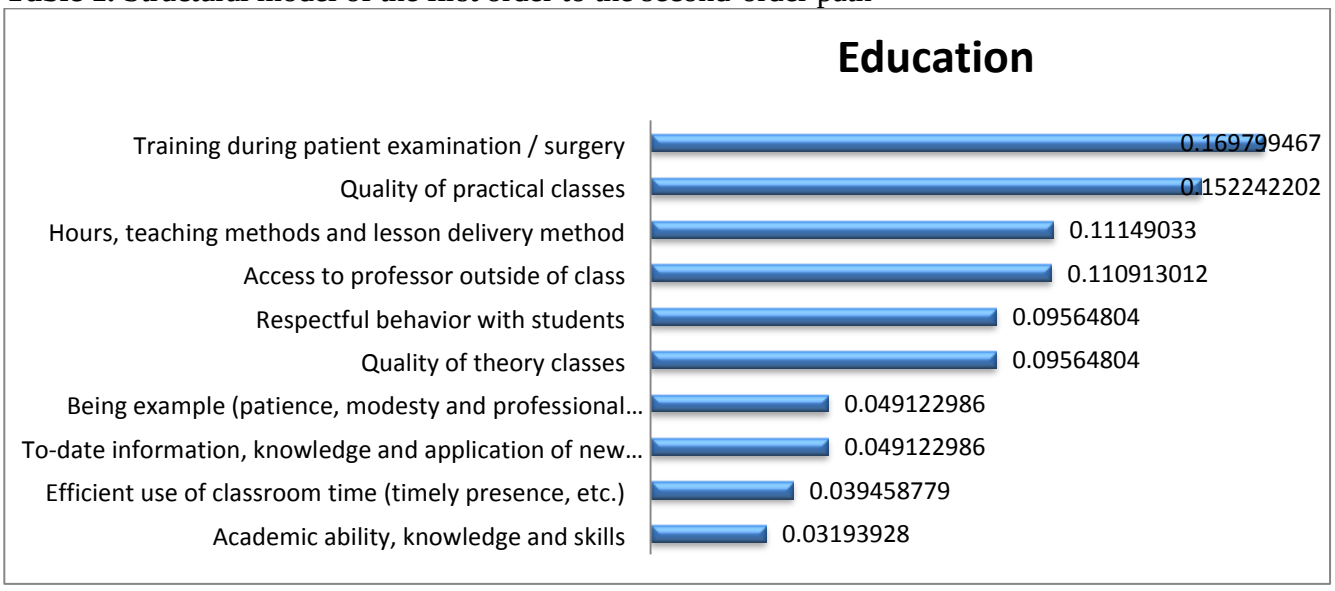


Figure 2. The results of prioritizing the factors affecting faculty evaluation in the field of education

Results of prioritizing two factors in the clinical field (treatment) are shown in the following figure.

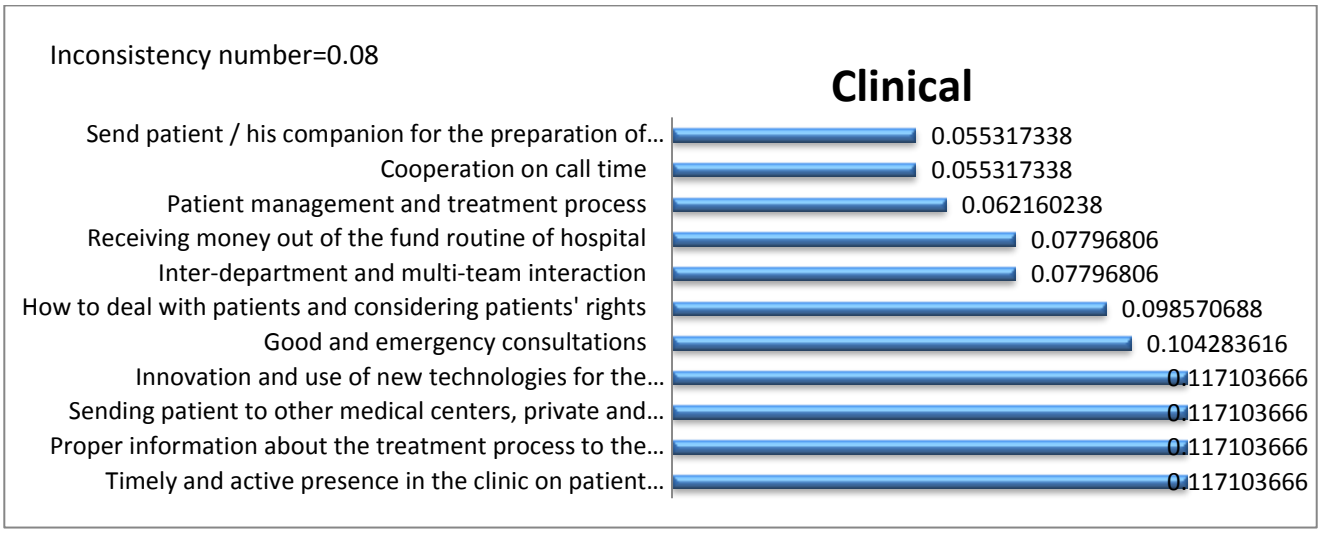


Figure 3. The prioritization results of the factors affecting the faculty evaluation in clinical area.

5 factors that influence the faculty evaluation in research area were examined using fuzzy hierarchical analysis and the results showed that 4 factors: implementation of research projects, quality of articles, writing books or translation and holding seminars etc. have the highest rating with almost the same weight. The results of prioritizing and weighting factors in this area are shown in the following figure.

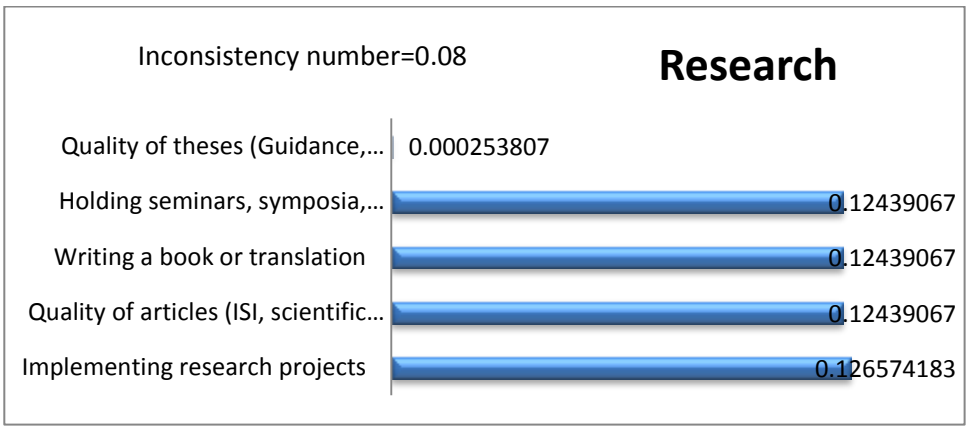


Figure 3. The prioritization results of the factors affecting the faculty evaluation in research area.

10 factors that influence the evaluation in hospital management area were prioritized using fuzzy hierarchical analysis and the results showed that active cooperation with implementing quality improvement plans, timely presence in the operating room and doing emergency procedures have a higher priority than other factors. Results are shown in the following figure.

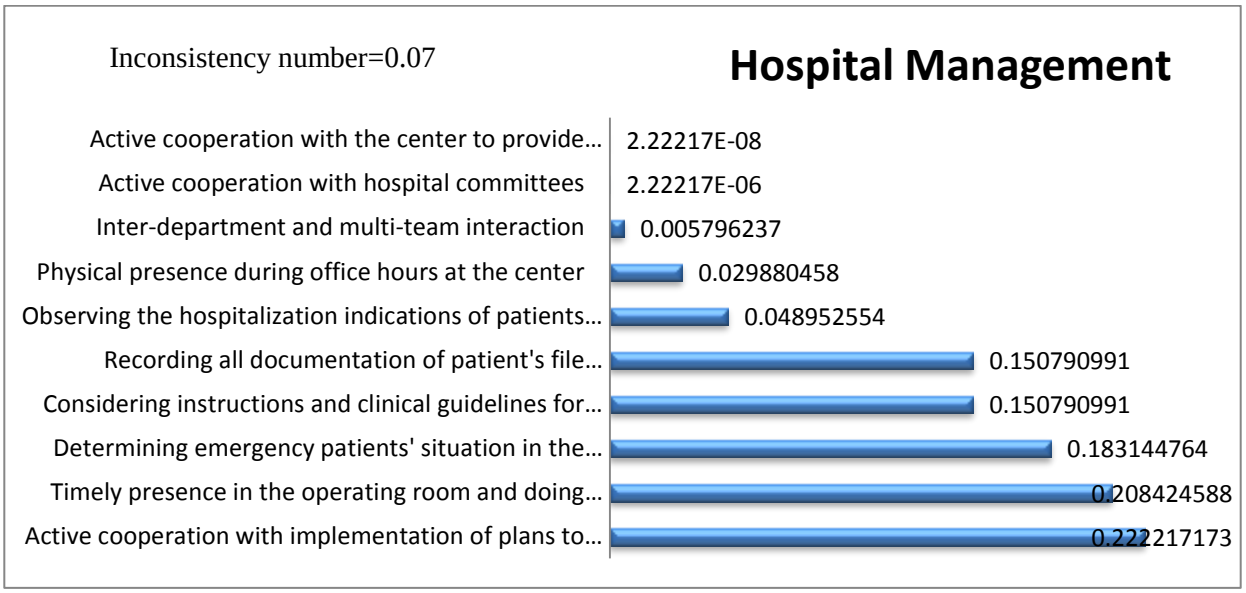
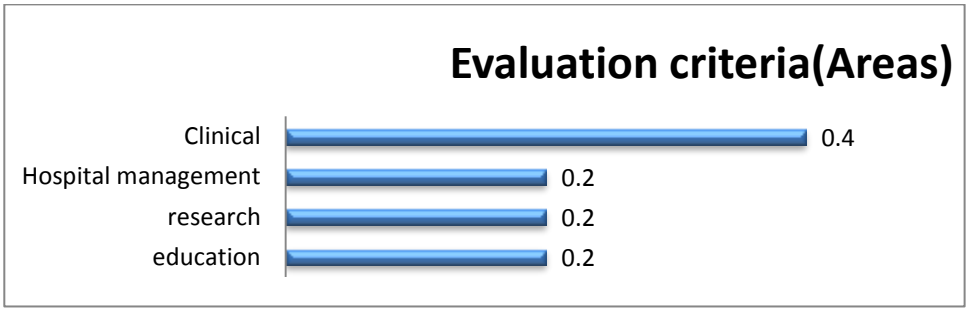


Figure 4. The result prioritizing the factors affecting faculty evaluation in the hospital management area.

In the end, 4 areas evaluated with each other and the results are shown in the following diagram.



Inconsistency number=0.08

Figure 5. Comparison of the 4 studied areas

Conclusion

This paper presents a model of fuzzy multi-criteria decision-based to prioritize the factors affecting hospital faculty evaluation. For this purpose, 38 factors

were identified and extracted from the previous studies and by views of hospital experts; the selected factors were classified in 4 areas of education, clinical, research and hospital management. Hierarchical model of the identified factors was designed in the form of AHP and then according to it paired comparison matrices were designed and completed by 15 experts and managers and officials of the hospital. The collected information was analyzed and evaluated fuzzy hierarchical analysis and weight and the effect of each of the influencing factors were determined and are shown in the following table

Table 3: The prioritization results of all criteria compared to each other

Subcriteria	Final Score	Areas
Timely and active presence in the clinic on patient bedside	0.046841466	Clinical
Proper information about the treatment process to the patient / patient companion	0.046841466	Clinical
Sending patient to other medical centers, private and non-governmental, with no scientific reason	0.046841466	Clinical
Innovation and use of new technologies for the treatment	0.046841466	Clinical
Active cooperation with implementation of plans to improve quality of treatment services in hospital	0.044443435	Hospital management
Good and emergency consultations	0.041713446	Clinical
Timely presence in the operating room and doing emergency procedures	0.041684918	Hospital management
How to deal with patients and considering patients' rights	0.039428275	Clinical
Determining emergency patients' situation in the shortest time possible	0.036628953	Hospital management
Training during patient examination / surgery	0.033959893	Education
Inter-department and multi-team interaction	0.031187224	Clinical
Receiving money out of the fund routine of hospital	0.031187224	Clinical
Quality of practical classes	0.03044844	Education
Considering instructions and clinical guidelines for diagnosis and treatment of disease	0.030158198	Hospital management
Recording all documentation of patient's file (related to doctor) and trying to reduce insurance deductions	0.030158198	Hospital management
Implementing research projects	0.025314837	Research
Quality of articles (ISI, scientific research, conference journals)	0.024878134	Research
Writing a book or translation	0.024878134	Research
Holding seminars, symposia, workshops, hospital conferences etc.	0.024878134	Research
Patient management and treatment process	0.024864095	Clinical
Hours, teaching methods and lesson delivery method	0.022298066	Education
Access to professor outside of class	0.022182602	Education
Cooperation on call time	0.022126935	Clinical
Send patient / his companion for the preparation of medicines, equipment and supplies to outside of the hospital	0.022126935	Clinical
Quality of theory classes	0.019129608	Education
Respectful behavior with students	0.019129608	Education
To-date information, knowledge and application of new methods in education	0.009824597	Education
Being example (patience, modesty and professional ethics)	0.009824597	Education
Observing the hospitalization indications of patients in clinical and special departments	0.009790511	Hospital management
Efficient use of classroom time (timely presence, etc.)	0.007891756	Education
Academic ability, knowledge and skills	0.006387856	Education
Physical presence during office hours at the center	0.005976092	Hospital management
Inter-department and multi-team interaction	0.001159247	Hospital management
Quality of theses (Guidance, consultation and arbitration)	5.07613E-05	Research
Active cooperation with hospital committees	4.44434E-07	Hospital management

Subcriteria	Final Score	Areas
Active cooperation with the center to provide health care (on call, etc.)	4.44434E-09	Hospital management

As it can be seen in the table above, timely and active presence in the clinic on patient bedside, sending patient to other medical centers, private and non-governmental, with no scientific reason, active cooperation with implementing quality improvement plans of health care in hospitals and etc. have the highest priority and factors such as active cooperation with the hospital committees, quality of theses, physical presence in the office hours and etc. received the lowest score.

As can be seen in Table 3, clinical and management factors are of greater importance than other factors, so it is recommended that hospital authorities and decision makers consider more rigorous arrangements for monitoring and monitoring this part of physicians' activities. The factors presented in this study are comprehensive factors that have been collectively provided by experts, so hospital managers can use these factors to evaluate and monitor physicians.

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Please cite this article as:

Rouhangiz Asadi1, Pejman Shadpour2, , Mansoureh Naderi3, Mohammad Mehdi sepehri. Identifying and quantifying the effect of factors affecting on the evaluation of medical faculty performance. Int J Hosp Res. 2018;7 (3).