



Designing a Multi-Criteria Decision-making Framework for Selecting Wards and Units in Public Hospitals: A Case of Shiraz Zeinabieh Hospital

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Abstract

Introduction: Outsourcing in healthcare services is becoming a significant and popular strategy. Paying more attention to the essential activities and poor performance of internal departments is one of the most important reasons, causing the organizations to outsource their activities. This study seeks to propose an effective outsourcing model using fuzzy MCDM methods in Zeinabieh Hospital, Shiraz, Iran.

Methods: In this research, the mixed methodology was used. In the first stage, all of the criteria affecting the outsourcing of the wards and units in the hospital were identified through a literature review and with reference to the opinions of the experts in the hospital. In the second stage, these criteria were finalized and weighted using content validity ratio (CVR) and the fuzzy best-worst method (BWM). Finally, the selected wards and units were identified and prioritized through fuzzy VIKOR method.

Results: The results showed that seven criteria constituted the final model of outsourcing in Zeinabieh Hospital wards/units: strategy, management, economic aspects, quality, security and protection of information of patients and related centers, service, and agility. The fuzzy BWM analysis showed that the “economic aspects” had the highest priority in outsourcing-related decision-making, and according to the fuzzy VIKOR analysis, among all the wards and units, the clinic showed the highest priority.

Conclusion: Making decisions about outsourcing in hospital services is a complex and multi-criteria problem. Therefore, different factors must be considered in the process of outsourcing hospital wards and units. This study proposed a model that could efficiently and effectively facilitate the process of outsourcing of hospital wards and units.

Keywords: Outsourcing, Fuzzy best-worst method, Fuzzy VIKOR, Content validity, Public hospitals

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Introduction

Inefficient financing in developing countries has caused the healthcare policymakers to consider private services as an alternative for reforming the financial dimension of the health system. The outsourcing of services is one of the types of interventions in this area (1). Proponents of this strategy believe that outsourcing improves the performance of health system services by promoting competition among suppliers and economic incentives through the link between payment and provider performance. The observations show that managers often find the outsourcing of services justifiable due to its cost reduction. However, various specifications

of this process must also be taken into account and final decisions must be made with a due consideration of all the aspects of outsourced services (2).

Outsourcing in health services is becoming growingly popular and the pioneers in this area are developed countries (3, 4). Of course, most of the successful outsourced activities have been associated with non-clinical services, as opposed to the conservative approach in clinical outsourcing (5). The reason for this is that hospital managers assume that the outsourcing of clinical services will not save much money and it may even engender risks for patients (1). Young's study showed that in Australia no clinical services, with the exception of

services in radiology and pharmacy, were entrusted to the private sector (6). Although the private sector's outsourcing of nursing services has doubled in the United States (4), in Taiwan less than 3% of the Nutrition, Pharmacy, and Nursing units have been outsourced to the private sector (7). In Iran, the management of hospitals has its own challenges, so that it can be said that in public hospitals that play a major role in the health care system, the structure of hospital management and how it is implemented has always been considered by policymakers. In fact, in order to save time and money in some wards of public hospitals, managers are forced to outsource a number of wards to contractors (outsourcing). On the other hand, hospital outsourcing is a relatively new issue in the field of health and treatment that has received much attention in the last ten years. A review of internal studies shows that few hospitals outsourced some of their units and this trend has not received much attention {Mousazadeh, 2013 #38} (8). Khalilifar et al. (2013) reported the positive effect of nutrition outsourcing in selected hospitals in Tehran (9). Ahmadizadeh et al. (2017) in their research examined the efficiency, effectiveness, and cost reduction in outsourcing the health sector and emphasized the need to pay attention to specialization in this process (10). Nazari et al. (2015) proposed a model of effective environmental factors for outsourcing services in public hospitals in Iran. They emphasized accurate assessment of the external environment of the hospitals is based on the extracted components such as the contractors' assessment, risk assessment, and contextual, developmental, political and contextual dimensions (11). Judaki et al. (2015) investigated the failure of the outsourcing policy and considered it as a result of the weakness of the public management system. In other words, it is better to think about the evolution of the government management system before outsourcing activities or simultaneously (12). Nasiripour and Parsamoein (2015) carried out a study about the outsourcing effect on the satisfaction and rights of patients referred to the radiology departments of selected hospitals in Tehran. The results showed that outsourcing in the radiology department of hospitals can increase the patients' satisfaction in terms of admission and health and welfare facilities (13).

Despite the many advantages of outsourcing, it could end in failure, if not properly managed (7, 14). One of the main concerns of hospital managers is how to select a service (in wards or units) to outsource (1). Therefore, all the factors and conditions affecting outsourcing should be properly identified

and considered through the process of outsourcing services (14, 15). Because numerous factors can affect the outsourcing of a service, identifying and prioritizing the factors involved represents an essential step. To this end, multi-criteria decision making (MCDM) techniques can be helpful (16). One of the state-of-the-art MCDM techniques is called *best-worst method* (BWM). The fuzzy BWM method requires fewer pairwise comparisons and reduces the likelihood of inconsistency by producing more consistent results (17). It has been used to prioritize the effective factors in outsourcing and to construct an effective model for hospital services.

The fuzzy VIKOR method focuses on ranking a set of alternatives and on finding compromised solutions to a problem with conflicting criteria (18). There are several ways of making decisions through multi-criteria approaches; yet, given the complexity and uncertainty of multiple indicators in such processes, as well as the ambiguities in people's (e.g. experts') thinking, gaining information based on crisp values would be problematic. The fuzzy theory could propose a very useful method for dealing with this uncertainty. The aim of this study was to propose an outsourcing model for selecting the wards and units in public hospitals, Shiraz, using MADM methods.

Materials and Methods

This research was carried out using the mixed exploratory method. In the initial qualitative phase, the elements of a well-functioning MCDM process were identified. Next, quantitative data were used to finalize the criteria and prioritize the selected wards and units. In the first step, all the criteria affecting the outsourcing of the wards and units in the hospital were extracted by exploring the theoretical background and relying on the interviews in the hospital. In the second step, content validity ratio (CVR) and fuzzy BWM were used to finalize and weight all the criteria. Ultimately, the selected wards and units for outsourcing in the hospital were prioritized through fuzzy VIKOR. In this study, 5 experts in the field of hospital outsourcing were purposefully selected to participate in the interviews. These included the hospital manager, heads of various wards and units, and experts involved in evaluating hospital projects.

Phase 1

a) Literature Review

In the review of the literature, a number of databases and search engines, including Science Direct, Emerald Insight, PubMed and Springer as the international databases, were searched to find

the studies published within 2000 and 2017. The key term used in the electronic search was “hospital outsourcing.” The reason only one keyword was used in the online exploration was to specifically keep the results focused on the notion of *outsourcing* in the field under investigation. Furthermore, another search procedure was conducted on Persian databases to find the relevant published articles since 2017. The Persian databases investigated were SID and NOORMAGS. As a result of the initial search, about 4547 articles were found. 2438 articles remained after deleting the duplicates. 1208 articles were deleted after reviewing the title and screening. Then, the abstract and the original text were carefully examined, and 798 and 414 other articles were excluded, respectively. Finally, 18 relevant articles were selected, and the criteria affecting outsourcing were extracted through PRISMA and a content analysis of the selected studies.

b) Interview

In addition, the experts identified the most important criteria influencing the outsourcing of the wards and units from the perspective of the officials managing public hospitals, Shiraz. In doing so, 5 experts in the field of hospital outsourcing were interviewed.

For this purpose, semi-structured face-to-face interviews were used. According to the objective of the study and in order to collect the views of experts, the research experts consisted of hospital managers who had a scientific or executive background; 5 individuals were selected as a sample based on the goal-oriented or purposive sampling and Snow Balling method. Thus, at first, all managers who had at least three years of scientific or executive experience in the field of hospital services outsourcing and agreed to participate in the study were purposefully selected; in the next stage, according to the introduction of these people, in the next stage, redundant other people who could help to advance the goals of the study by expressing their views were identified. The exit conditions of the participants were also willingness to participate in the study. Sampling was continued until theoretical data saturation was achieved.

According to the respondents, the questions were interviewed by two faculty members who were not among the selected interviewees, and according to their views and, if necessary, the corrections were made to complete it. The interview guide included warm-up questions, main questions, sub-questions, and probing questions. The time of the interview sessions was predetermined and coordinated

with the interviewees by phone or in person. In addition, during this coordination, while providing the necessary explanations about the purpose of the interviews, individuals were assured that the confidentiality of the data and the anonymity of the interviewees were fully maintained. Meanwhile, the participants were allowed to cancel the interview at any time they wished, despite the initial agreement.

In the next step, all individuals who were fully informed and willing to cooperate completed and signed a written consent form. In order to increase the issues related to the accuracy, precision and confidentiality of the content of the interviews, we tried to do the interview as much as possible at a quiet place away from the hustle and bustle of the people, and we ensured that the entry and exit of the client and phone ringing would not disturb the meeting. In addition, the duration of each interview was between 40 and 55 minutes, depending on the interest and tolerance of the interviewees; also, in order to avoid possible problems, we recorded the interview through two electronic devices all the time in the sessions.

Phase 2

a) Content Validity Ratio (CVR)

Content validity was used to identify and select the most important criteria for the process of outsourcing in hospital wards and units. For this purpose, a questionnaire including 34 extracted criteria was designed and the experts were asked to determine the importance of each of the criteria using a 3-point scale (“Necessary”, “Effective but not necessary”, and “Not effective”). Then, the CVR value was calculated according to the following formula:

$$CVR = \frac{n_E - \frac{N}{2}}{\frac{N}{2}}$$

where n_E was the number of experts who selected “Necessary” choices, and N was the total number of the experts involved. Because the number of the specialists was 12, the criteria with a CVR greater than 0.5 were accepted (13).

b) Fuzzy Best-Worst Method (Fuzzy BWM)

After the most important criteria associated with the outsourcing of the hospital wards and units were screened and identified, the fuzzy BWM method was used to weight the criteria. A second questionnaire was designed and completed by 10 experts in the field of hospital outsourcing to determine the weights of the criteria under study. The steps of conducting the

fuzzy BWM to weight the criteria are as follows:

Step 1. A set of decision criteria was determined as $\{C_1, C_2, C_3, \dots, C_n\}$.

Step 2. The best and the worst criteria were identified by the experts. At this stage, the best and worst criteria were generally determined by the decision-makers. The best and worst criteria were represented by C_b and C_w , respectively.

Step 3. The preference of the best criterion over all the other criteria was determined through a 5-point scale (ranging from 1 to 5), which yielded the best-to-others vector as:

$$A_B = (a_{B1}, a_{B2}, a_{B3}, \dots, a_{Bn})$$

where a_{Bj} indicates the preference of the best criterion B over the criterion j ; as a result, the following relation would be evident:

$$a_{BB} = (1, 1, 1)$$

Step 4. The preference of all the other criteria over the worst criterion was determined through a 5-point scale (ranging from 1 to 5), which helped to construct the others-to-worst vector as:

$$A_W = (a_{1W}, a_{2W}, a_{3W}, \dots, a_{nW})$$

where a_{jW} is the preference of the criterion j over the worst criterion W ; given these statements, the following relation would be evident:

$$a_{WW} = (1, 1, 1)$$

Step 5. The optimal weights $(w_1^*, w_2^*, \dots, w_n^*)$ had to be found.

In order to meet all these conditions for all the j values, a solution had to be found through which it was possible to minimize the maximum absolute differences $\left| \frac{w_B}{w_j} - a_{Bj} \right|$ and $\left| \frac{w_j}{w_W} - a_{jW} \right|$ for all j values. The optimal weights were obtained by considering the non-negativity and sum constraint of the weights, by solving the following problem:

It should be noted that W_B , W_j and W_W are triangular fuzzy numbers, and in some cases, it is preferred to use $W_j = (l_j^w, m_j^w, u_j^w)$; the total weights could be formulated as follows:

$$\{\min \max \left| \frac{w_B}{w_j} - a_{Bj} \right|, \left| \frac{w_j}{w_W} - a_{jW} \right|\}$$

$$\sum_{j=1}^n R(W_j) = 1$$

$$\begin{aligned} l_j^m &\leq m_j^w \leq u_j^w \\ l_j^w &\geq 0 \\ j &= 1, 2, n \end{aligned}$$

By solving the model, the optimal values $(W_1^*, W_2^*, \dots, W_n^*)$ were processed and obtained in LINGO software.

c) Fuzzy VIKOR

After the most important criteria of outsourcing were weighted, the outsourceable wards and units, including the seven para-clinics in public Hospitals, Shiraz (Clinic, Radiology, Emergency, Infertility, Pharmacy, Laboratory and Audiometry) had to be identified. All these paraclinical wards were introduced and selected by the management of Zeinabieh hospital. The third questionnaire was designed to prioritize the selected outsourceable wards and units. This questionnaire was completed based on the fuzzy VIKOR method by 10 experts specialized in hospital outsourcing. These experts had the necessary and sufficient experience and expertise in the field of outsourcing clinical and non-clinical hospital services.

The steps of the fuzzy VIKOR method for ranking the alternatives are as follows:

Step 1. Identify and define linguistic terms and relevant membership functions.

Step 2. Construct a decision matrix.

Step 3. Weight all the criteria.

Step 4. Calculate the overall performance evaluation.

Step 5. Determine the best value (f_i^*) and the worst one (f_i^-) for each criterion.

Step 6. Calculate S_i , R_i and Q_i

Step 7. Prioritize the alternatives by ascending S , R , and Q values.

Step 8. Determine the optimum alternative based on minimum Q and the related conditions

Results

After the literature was reviewed, 18 studies contributing to the purpose of this research were identified. Based on these studies 21 criteria concerned with outsourcing were extracted. Furthermore, 13 criteria were identified through the interviews with the experts. The content validity of these criteria was then assessed. Based on the viewpoints of the experts in the interview, 20 criteria were approved, and 14 criteria were rejected. Consequently, seven dimensions including strategy, management, economic dimensions, quality, security, and security and protection of information of patients and related centers, service and agility were selected which totally encompassed 20 criteria as the constituents of the final model of outsourcing at public hospitals in Shiraz (See Table 1). It should be noted that all the criteria were inherently positive.

Table 1: The outsourcing model for the hospital

Dimensions	Criteria	Description	Code
A Strategy	Affecting the achievement of organizational goals	Goals that are important for management	AA1
	Helping to accomplish hospital strategic and operational plans	A realistic view of employees, production, services and other resources consistent with values and realities to achieve the best results	AA2
B Management	Improving management and control of the wards and units	Management stability, executive managers' authority and commitment of managers at different levels	BA1
	Reducing the administrative burden of the hospital	Reduce the burden of executive affairs to focus more on key activities and needs in the organization	BA2
	Having a structure suitable for supervision	Control and focus on important and vital activities of the organization	BA3
	Supporting domestic products	Use of accessories that are domestically produced (province and country)	BA4
	Improving performance and the use of resources	Proper use of resources and increase in revenue in the units that have been outsourced due to the resources belonging to them	BA5
	Improving administrative ethics and reducing corruption	reducing corruption due to the resources belonging to them	BA6
C Economic aspects	Improving hospital cash flow	Turning the units is facing the problem of lack of liquidity Due to delays in payment of insurance companies	CA1
	Reducing costs	It means changing the costs of human groups, buying medicine and supplies and other current and operational prices	CA2
	Fitting to the resilient economic pattern	According to the model of the resistance economy, what units should be outsourced and changed to increase income	CA3
	Increasing hospital efficiency	The least time or energy consumed for most of the work done	CA4
	Improving hospital productivity	Productivity in HR, production, services and other resources with value to achieve the best result	CA5
D Quality	Fostering customer satisfaction	Achieving and improving customer satisfaction	DA1
E Security and archiving patients' records	Providing security and archiving information and related services	Security and protection of information records of patients	EA1
F Services	Developing the hospital service capacity by relying on contractor facilities	Use of knowledge, technology and capabilities of the private sector in service delivery	FA1
	Solving supply problems of the section	By delegating responsibilities in the outsourcing process	FA2
	Reducing work processing time	Reduce redundant activities and time of work processes	FA3
	Providing facilities and easier access for patients	Easy and permanent access to health care services for all members of the community	FA4
G Agility	Enhancing responsiveness to stakeholders' needs	Minimize and streamline, reduce managers' tenure and create opportunities for managerial tasks to respond to stakeholder satisfaction	GA1

Weighting the Criteria for the Process of Outsourcing Wards and Units Through the Fuzzy BWM

At this stage, the data were initially converted into triangular fuzzy numbers. In doing so, the expert opinions were incorporated into a generic matrix. The numbers of each of the matrix cells was calculated as follows: the minimum value of the experts' opinions was regarded as the smallest likely value, the mean of the experts' opinions was seen as the most probable value, and the maximum of value the experts' opinions of was seen as the greatest possible value (see Table 2).

Prioritizing Wards and Units of Public Hospitals Through Fuzzy VIKOR

After identifying the importance of the criteria affecting decision-making about outsourcing, the outsourceable wards and units in the hospital were identified based on the experts' opinions so that all of the para-clinical wards and units were included (Clinic, Radiology, Emergency, Infertility, Pharmacy, Laboratory and Audiometry). The outsourceable wards and units were then prioritized. To prioritize the wards and units, the type of criteria (more - better or less - better) had to be specified. All the criteria

Table 2: Final weight of criteria on outsourcing decision making

No	Criteria	Final Weight
1	Security and protection of information of patients and related centers	(0.035, 0.06, 0.087)
2	Customer satisfaction	(0.026, 0.033, 0.089)
3	Enhancing the responsiveness to change of stakeholder needs	(0.012, 0.014, 0.028)
4	Influence on the attaining hospital strategic and operational plans	(0.013, 0.015, 0.033)
5	Influence on the achievement of organizational goals	(0.016, 0.024, 0.025)
6	Improving hospital cash flow	(0.011, 0.014, 0.026)
7	Providing facilities and easier access for patients	(0.02, 0.021, 0.036)
8	Cost reduction	(0.013, 0.017, 0.027)
9	Development of hospital service capacity with the help of contractor facilities	(0.016, 0.019, 0.063)
10	Decreasing working process time	(0.004, 0.006, 0.064)
11	Fitting to resilience economy pattern	(0.006, 0.009, 0.048)
12	Increasing hospital efficiency	(0.006, 0.01, 0.046)
13	Solving supply problems of that section	(0.005, 0.006, 0.039)
14	Improving hospital productivity	(0.026, 0.097, 0.153)
15	Decreasing the administrative burden of hospitals	(0.075, 0.109, 0.146)
16	Possibility of supervision	(0.01, 0.015, 0.06)
17	Improving performance and suitable usage of resources	(0.014, 0.019, 0.035)
18	Improving administrative health and reducing corruption	(0.013, 0.024, 0.051)
19	Improving management and control of that section	(0.01, 0.018, 0.062)
20	Supporting of domestic products	(0.056, 0.075, 0.146)

Table 3: Weighed decision matrix

	Fuzzy number for wards and units						
	Clinic	Emergency	Laboratory	Radiology	Pharmacy	Audiometry	Infertility
AA1	(0.14, 0.74, 1)	(0.14, 0.57, 1)	(0.14, 0.61, 1)	(0.14, 0.64, 1)	(0.14, 0.61, 1)	(0.14, 0.66, 1)	(0.14, 0.47, 1)
AA2	(0.14, 0.76, 1)	(0.14, 0.6, 1)	(0.14, 0.64, 1)	(0.14, 0.67, 1)	(0.14, 0.66, 1)	(0.14, 0.7, 1)	(0.14, 0.5, 1)
BA1	(0.21, 0.71, 1)	(0.21, 0.66, 1)	(0.21, 0.6, 1)	(0.21, 0.63, 1)	(0.14, 0.63, 1)	(0.14, 0.64, 1)	(0.14, 0.5, 1)
BA2	(0.14, 0.83, 1)	(0.21, 0.61, 1)	(0.14, 0.6, 1)	(0.14, 0.66, 1)	(0.14, 0.73, 1)	(0.14, 0.6, 1)	(0.14, 0.64, 1)
BA3	(0.14, 0.73, 1)	(0.14, 0.58, 1)	(0.14, 0.56, 1)	(0.14, 0.56, 1)	(0.14, 0.57, 1)	(0.14, 0.5, 1)	(0.14, 0.48, 1)
BA4	(0.14, 0.41, 0.78)	(0.14, 0.46, 0.78)	(0.14, 0.48, 0.93)	(0.14, 0.41, 0.78)	(0.14, 0.6, 0.93)	(0.14, 0.4, 1)	(0.14, 0.51, 1)
BA5	(0.14, 0.61, 1)	(0.14, 0.54, 1)	(0.14, 0.56, 1)	(0.14, 0.56, 1)	(0.14, 0.6, 1)	(0.14, 0.57, 1)	(0.14, 0.61, 1)
BA6	(0.14, 0.57, 0.93)	(0.14, 0.51, 0.93)	(0.14, 0.54, 1)	(0.14, 0.54, 1)	(0.14, 0.44, 1)	(0.14, 0.48, 1)	(0.14, 0.61, 1)
CA1	(0.14, 0.55, 0.93)	(0.14, 0.58, 1)	(0.14, 0.64, 1)	(0.14, 0.64, 1)	(0.14, 0.76, 1)	(0.14, 0.61, 1)	(0.14, 0.74, 1)
CA2	(0.14, 0.64, 1)	(0.14, 0.63, 1)	(0.14, 0.63, 1)	(0.14, 0.63, 1)	(0.14, 0.77, 1)	(0.14, 0.6, 1)	(0.14, 0.67, 1)
CA3	(0.14, 0.43, 0.93)	(0.14, 0.41, 0.78)	(0.14, 0.53, 1)	(0.14, 0.53, 1)	(0.14, 0.64, 1)	(0.14, 0.4, 0.93)	(0.14, 0.6, 1)
CA4	(0.14, 0.71, 1)	(0.14, 0.61, 1)	(0.14, 0.6, 1)	(0.14, 0.6, 1)	(0.14, 0.64, 1)	(0.14, 0.58, 1)	(0.14, 0.7, 1)
CA5	(0.14, 0.7, 1)	(0.14, 0.58, 0.93)	(0.14, 0.58, 0.93)	(0.14, 0.58, 0.93)	(0.14, 0.57, 0.93)	(0.14, 0.5, 0.93)	(0.14, 0.64, 0.93)
DA1	(0.14, 0.67, 1)	(0.14, 0.51, 1)	(0.14, 0.46, 0.93)	(0.14, 0.47, 0.93)	(0.14, 0.47, 0.93)	(0.46, 0.14, 1)	(0.14, 0.6, 1)
EA1	(0.14, 0.7, 1)	(0.14, 0.61, 1)	(0.14, 0.56, 1)	(0.14, 0.57, 1)	(0.14, 0.57, 1)	(0.14, 0.53, 1)	(0.14, 0.68, 1)
FA1	(0.14, 0.66, 1)	(0.14, 0.51, 0.78)	(0.14, 0.47, 0.78)	(0.14, 0.48, 0.93)	(0.14, 0.48, 0.93)	(0.14, 0.44, 0.78)	(0.14, 0.63, 0.93)
FA2	(0.14, 0.63, 1)	(0.14, 0.54, 1)	(0.14, 0.58, 1)	(0.14, 0.54, 1)	(0.14, 0.54, 1)	(0.14, 0.5, 1)	(0.14, 0.6, 1)
FA3	(0.14, 0.68, 1)	(0.14, 0.64, 1)	(0.14, 0.56, 0.93)	(0.14, 0.54, 0.93)	(0.14, 0.53, 0.93)	(0.14, 0.5, 0.93)	(0.14, 0.57, 1)
FA4	(0.14, 0.77, 1)	(0.14, 0.63, 1)	(0.14, 0.67, 1)	(0.14, 0.61, 1)	(0.14, 0.61, 1)	(0.14, 0.54, 1)	(0.14, 0.66, 1)
GA1	(0.14, 0.8, 1)	(0.14, 0.68, 1)	(0.14, 0.7, 1)	(0.14, 0.67, 1)	(0.14, 0.67, 1)	(0.14, 0.58, 1)	(0.14, 0.63, 1)

confirmed for outsourcing in the public hospitals in Shiraz were rated as “More-Better.” Next, the data were analyzed in the form of triangular fuzzy numbers. In accordance with the first step of the fuzzy VIKOR method, after the questionnaires were collected, the expert opinions were integrated (U-matrix). In the next step, the final weighted matrix

was calculated by multiplying the final fuzzy weights of the criteria in the U-matrix (see Table 3).

The next step was to calculate the *positive ideal* and the *negative ideal* values for each criterion to find the fuzzy VIKOR S and R values for each alternative. Finally, the value of Qi was calculated. It should be noted that the value of V was 0.5. Table 4 shows the rankings of the

Table 4: Prioritizing wards and units by S, R, Q

No	Wards/units	S	Rank	R	Rank	Q	Rank
1	Clinic	0.2001	1	0.1129	1	0.1506	1
2	Radiology	0.6085	3	0.1064	2	0.5	2
3	Emergency	0.4908	2	0.1175	3	0.6135	3
4	Infertility	0.5426	4	0.1149	4	0.6167	4
5	Pharmacy	0.53	5	0.1221	5	0.7675	5
6	Laboratory	0.5026	6	0.128	6	0.8715	6
7	Audiometry	0.6084	7	0.1225	7	0.8723	7

wards and units for outsourcing based on S, R, and Q.

It was found that both conditions specified by the VIKOR method were met. The first condition was approved (see below). The second condition also states that the Q-rated alternatives must have at least one of the values of S and R assigned to the same rating; this condition was approved as well.

$$Q^{(2)} - Q^{(1)} \geq \frac{1}{j-1} \quad 0.5 - 0.1506 = 0.3494$$

$$\frac{1}{j-1} = \frac{1}{7-1} = 0.1666 \quad 0.3494 > 0.1666$$

Discussion

The results of the study showed that decision-making about outsourcing hospital wards and units was a multidimensional and complex decision problem. The study drew on the findings of other articles dealing with the topic by reviewing the literature and interviewing some experts concerned with outsourcing in hospitals. These investigations revealed seven dimensions affecting outsourcing in this area: strategy, management, economic aspects, quality, security, and protection of information of patients and related centers, services, and agility. Economic, services, and management aspects were, respectively, the most important dimensions of decision-making for outsourcing. The results further revealed that the “economic aspects” had the highest degree of priority in outsourcing-related decision-making. Most studies identified cost savings as the main reason for outsourcing-related decision-making. Organizations need a competitive strategy to achieve cost savings which can be realized through effective outsourcing (19-23). Although organizations may outsource their business for economic reasons, there is no guarantee that the expected savings will occur. There is much evidence that the estimated cost savings have not been realized (24). For example, the findings of Ferdosi et al. (2013) indicated that after outsourcing, the cost of each hospital bed was increased, and ultimately the total cost was raised (25). Moreover, some indirect costs, such as contract costs, contract control, ethics, absenteeism, and inefficiency may rise through outsourcing

(24). “Services” was the second most important dimension, which includes developing the hospital service capacity by relying on contractor facilities, solving supply problems of the section, reducing work processing time and providing facilities and easier access for patients. One of the important reasons and goals of organizations which outsource their services is to develop and improve service provision. Therefore, by outsourcing, senior managers can outsource minor activities and focus more on the core activities of the organization (26). Hassanain et al. (2015) believe that outsourcing can reduce workload and energy consumption of hospital activities (15). “Management” was the third factor in terms of importance among the dimensions. “Management” factors can influence the performance and service management. In this study, the dimension of “management” encompassed 6 criteria affecting the process of outsourcing hospital wards and units. These criteria included “improving management and control of the section”, “reducing the administrative burden of the hospital”, “having a structure suitable for supervision”, “supporting domestic products”, “improving performance and the use of resources”, “improving administrative ethics”, and “reducing corruption.”

The results of the research in the case of prioritizing the selected wards and units of the hospital through fuzzy VIKOR showed that the clinic had the highest degree of priority for outsourcing, followed by Radiology and Emergency. As mentioned earlier, few studies in Iran have focused on outsourcing hospital wards. Nasiripour and Parsa Moin (2015) mentioned the radiology department as a successful example of outsourcing (13). Khalilifar et al. (2013) also mentioned the positive effect of nutrition unit outsourcing in their research (9). However, researchers such as Nazari et al. (2015), Ahmadizadeh et al. (2015) and Judaki et al. (2015) addressed structural issues in the field of outsourcing and tried to provide a framework for its proper implementation (10-12).

Conclusion

This study has been conducted to support outsourcing

decision making in Zeinabieh Hospital in Shiraz and shows that the decision to outsource hospital services is a complex and multi-criteria decision, and the hospital officials should consider various factors to outsource hospital wards and units. The outsourcing decision-making framework presented in this study and its findings can help to make appropriate decisions for outsourcing hospital wards and units. The dimensions of this research may be presented in previous models, but the difference between this research and previous studies is the concentration of indicators in the specialized units under study; however, in other models, outsourcing indicators were generally considered. In addition, in terms of analysis method, the results of this research have been done in a fuzzy environment to consider the uncertainty of experts in providing opinions. Also, using the FBWM method to measure and prioritize research indicators caused less pairwise comparisons and decision makers to have minimal inconsistency. In addition, FVIKOR is used to prioritize hospital wards in this study, which can help decision makers reach a final decision. However, this research also had some limitations. Although the results of this study are very useful for many public hospitals, it should be noted that the generalization of the results to other hospitals, especially in the private sector, should be done with caution due to the limited number of experts. Therefore, it is suggested that the model designed in this study should be tested in other hospitals, and other decision-making techniques in fuzzy or gray space should be used to analyze the results. This study was an attempt to contribute to the process of outsourcing-related decision-making in hospital wards and units and identify the factors affecting outsourcing. Therefore, it is suggested that the authorities in Shiraz Zeinabieh hospital should use this framework to make outsourcing-specific decisions, while considering different criteria in their decisions.

Ethical Approval

This study was approved by Abadan University of Medical Sciences ethics committee with the approval number of IR.ABADANUMS.REC.1400.018.

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Authors Contribution

M. R and P.Sh Conception and design, J.B and M.R acquisition of data, analysis and interpretation of data, K.A drafting of the manuscript, critical revision of the manuscript for important intellectual content, P.SH and J.B data analysis administrative, technical, or material support, K.A and P.SH supervision and approving final draft.

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