IDENTIFYING KEY FACTORS OF PATIENT SATISFACTION BASED ON SERVQUAL AND DEMATEL

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ABSTRACT

Today, the competition between hospitals is very cruel. So the hospital must retain as many patients as possible by increasing satisfaction of the patients. In order to find the key factors of influencing patient satisfaction, this study first designed 27 criteria of the hospital service and constructed the questionnaire based on SERVQUAL model for the patients or their families. Then six major criteria were selected based on the analysis of the returned questionnaire. The second survey developed based on decision-making trial and evaluation laboratory (DEMATEL) method to evaluate the importance of the six major criteria. The results show that highly skilled medical staff is the most essential criterion, and effectiveness in handling patient complaint, detailed description of the patient's condition, and staff with good communication skills, are also important criterions. Therefore, the hospital should invest more in training the professional competence, communication skills and problem-solving abilities of the medical staff rather than buying more machines.

Keywords: *Patient Satisfaction, SERVQUAL Model, DEMATEL Method*

1. INTRODUCTION

After 30 years of economic development, China has shifted its policy priority from purely chasing economic growth to establishing a harmonious society. Under this policy target, the current administration has initiated a series reform to improve social equity and health care is one of those reforms. The recent plan on health system reform approved by the State Council on March 17 of 2009 is a road map toward a more equitable health system [1]. Building a community-based health system to provide essential health care for every resident is a major action in the reform plan. To achieve the objectives raised in the reform plan, the current administration has decided to allocate 850 billion Yuan in the following 3 years. With the increasing investment of government, a large number of hospitals were established. Today, there are more than 20000 hospitals in China and the competition between hospitals is very cruel. The citizens are more aware of high-quality medical care than ever. They pay much attention to medical treatment safety, instructions from physicians, and the overall service quality performed by the hospital. To manage a hospital successfully, the important goals are to attract and then retain as many patients as possible. In order to meet potential demands of the various kinds of the patients, each medical organization focuses on not only purchasing advanced medical equipment but also developing and implementing marketing strategies. As a result, the hardware equipment might not be the only factor to attract the patients. In contrast, patients' satisfaction to the overall medical care quality becomes the more important indicator. Under such circumstances, the hospital needs to understand the patients' needs regularly and then provide the needed medical care services to retain the patients.

Numerous studies were developed to assess healthcare service quality. Patient satisfaction is extensively used to evaluate healthcare service quality. The SERVQUAL model, or the so-called gap model, which was developed to assess the service quality of general businesses and is commonly used to examine healthcare service quality, is useful for calculating the gap between customer/patient expectations and perceptions [2-5]. However, the healthcare significantly differs from general business services, and patient assessments of healthcare quality are more complex than those for other services. Donabedian thus developed a systematic framework, namely the structure-process-outcome model, to evaluate healthcare service quality. The Donabedian framework is also widely adopted to assess healthcare service quality [6, 7].

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In the study, a comprehensive set of service criteria was designed based on the framework of Donabedian and the suggestions from doctors, then the first questionnaire was constructed based on SERVQUAL model for the patients or their families to find the major criteria, and then the second survey developed based on DEMATEL method to evaluate the importance of the major criteria to identify the key factors of patient satisfaction with hospital services, and to promote service quality of the hospital.

2. MATERIALS AND METHODS

The case illustrated in this study is Henan Provincial People's Hospital in Zhengzhou City. In fact, the medical services in Zhengzhou City are very competitive. Therefore, there is a need for the hospital to evaluate the patient satisfaction with its medical service and identify the key factors of influencing patient satisfaction, and then the hospital can increase patient satisfaction by improving the key factors.

2.1 Identification of Service Quality Criteria

Based on the framework of Donabedian, the service quality criteria were classified in terms of three aspects, structure, process, and outcome. Then, 27 criteria, shown in Table 1-3, were identified based on the literature and suggestions from doctors at the studied hospital [6-8]. The structure aspect includes 7 criteria, the process aspect has 17 criteria and the outcome aspect includes 3 criteria.

Table 1: The Criteria Of Structure Aspect

Number of criterion	Criterion
1	well-equipped medical equipment
2	clean and hygienic appearance
3	sterilization of instruments
4	convenient arrival
5	well dressed staff
6	sufficient medical staff
7	highly skilled medical staff

Table 2: The Criteria Of Process Aspect

Number of criterion	Criterion
1	services right the first time
2	sense of security during treatment
3	subside pain during treatment
4	reliable health instructions
5	detailed description of the patient's condition
6	explain diagnosis and treatment intimately
7	concern with patient's questions and worries
8	sympathetic attitude with patient's problems
9	prompt patient service
10	effectiveness in handling patient complaints
11	staff with good communication skills
12	short duration of hospital stay
13	meet patient on time
14	soliciting of patient opinions
15	accurate patient records
16	easily making appointment
17	clearly stated item charge list

Table 3: The Criteria Of Outcome Aspect

Number of criterion	Criterion
1	pain relief after treatment
2	more confidence after treatment
3	acceptable fees for service

2.2 Questionnaire Design and Criteria Selection

The questionnaire with 27 criteria was designed based on the SERVQUAL model and consultation of management team of Henan Provincial People's Hospital in order to evaluate the importance of criteria from patients' viewpoints at Henan Provincial People's Hospital.

The survey was taken among 200 patients or their families at Henan Provincial People's in Zhengzhou City from March 6, 2012 to May 19, 2012 by asking the importance of each criterion with a five-point scale, where 1 and 5 represent very unimportant and very important, respectively. The number of valid questionnaire is 278. The demographic information of these 278 respondents is summarized in Table 4.

The cronbach's α is 0.916, which represents the internal consistency reliability is excellent. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy provides an index (between 0 and 1) of the proportion of variance among the variables that might be common variance (i.e., that might be indicative of underlying or latent common factors). In our study, the KMO value was found to be 0.9036, which is far better than the suggested 0.6 value, it was understood that factor analysis could be applicable to the data. We also found that the importance values of 27 criteria fall in the range of 4.11 and 4.63. On account of that it is unrealistic to improve all of the criteria simultaneously with limited resources, thus 6 major criteria were determined to be in higher priority after the discussions with the management team of Hospital, including (1) well-equipped medical equipment, (2) highly skilled medical staff, (3) staff with good communication skills, (4) detailed description of the patient's condition, (5) effectiveness in handling patient complaints, and (6) reliable health instructions.

Table 4: Distribution Of Study Group

Parameters	Frequency (Percentage)
Gender	
Male	87 (43.5)
Female	113(56.5)
Age group	
18-25	35 (17.5)
26-40	77 (38.5)
41-60	62 (31.0)
61 and above	26 (13.0)
Profession	
Worker	39 (19.5)
Farmer	27 (13.5)
Doctor and nurse	34 (17.0)
Student	11 (5.5)
Teacher	16 (8.0)
Financial staff	12 (6.0)
Other	61 (30.5)
Education level	
High school below	35 (17.5)
High school	66 (33.0)
Technological school	41 (20.5)
University	52 (26.0)
Graduate	6(3.0)

2.3 DEMATEL Method

DEMATEL method was originally developed by the Science and Human Affairs Program of the Battelle Memorial Institute of Geneva between 1972 and 1976 to study and resolve the complicated and intertwined problem group [9]-[13]. This method can identify the interdependence among the elements of a system.

The procedure of DEMATEL method can be divided into 5 steps:

Step 1: Construct the respondent matrix

Every respondent must evaluate the direct influence between any two factors by an integer score ranging from 0, 1, 2, and 3, representing "no influence", "low influence", "medium influence", and "high influence", respectively.

In this paper, the notations of M, N and x_{ij} represents the number of respondent, the number of factor, and the degree of factor i affects factor j which given by the respondent, respectively.

For each respondent, a $n \times n$ non-negative matrix $X^k = [x^k_{ij}]$ can be established, where k is the number of the respondent, and if $i = j$ then $x_{ij} = 0$.

Step 2: Compute the average matrix

The matrix $A = [a_{ij}]$ represents the average of all the M respondents, and a_{ij} can be expressed as Eq. (1).

$$a_{ij} = \frac{1}{M} \sum_{k=1}^{M} x^k_{ij} \qquad (1)$$

Step 3: Calculate the normalized matrix

The normalized matrix can be expressed as Eq. (2).

$$S = A \times \frac{1}{\max\limits_{1 \le i \le n} \sum\limits_{j=1}^{n} a_{ij}} \qquad (2)$$

Step 4: Calculate the total relation matrix

The total relation matrix $T = [t_{ij}]$ can be calculated by Eq. (3).

$$T = S(I - S)^{-1} \qquad (3)$$

The notation of I is the identity matrix.

Step 5: Calculate the total effects given and received of every factor.

The effects given by the factor i can be calculated by Eq. (4).

$$f_i = \sum_{j=1}^{n} t_{ij} \quad (i = 1, 2, \dots, n) \qquad (4)$$

The effects received by the factor i can be calculated by Eq. (5).

$$e_i = \sum_{j=1}^{n} t_{ji} \quad (i = 1, 2, \dots, n) \qquad (5)$$

Then, the total effects given of factor i can be calculated by Eq. (6).

$$m_i = f_i + e_i \quad (i = 1, 2, \dots, n) \qquad (6)$$

The total effects received by factor i can be calculated by Eq. (7).

$$n_i = f_i - e_i \quad (i = 1, 2, \dots, n) \qquad (7)$$

That is, m_i indicates the degree of importance that factor i plays in the entire system. On the contrary, n_i depicts the net effect that factor i contributes to the system

2.4 Experiment and Analysis

Base on the six selected criteria, we designed the second questionnaire to twelve managerial personnel of Henan Provincial People's Hospital, including Director of Management Department, Director of Nursing Department, Director of Surgical Department, and Head Nurse of inpatient department. Ten valid questionnaires have been received. Therefore, the computation of using DEMATEL method is based upon these ten experts' opinions.

To follow the procedure of DEMATEL method, first constructs a 6×6 matrix for each respondent, including:

$$X^1 = \begin{bmatrix} 0 & 2 & 2 & 2 & 2 & 2 \\ 2 & 0 & 1 & 2 & 2 & 2 \\ 2 & 2 & 0 & 2 & 2 & 2 \\ 2 & 2 & 2 & 0 & 2 & 2 \\ 2 & 2 & 2 & 2 & 0 & 2 \\ 1 & 2 & 1 & 1 & 2 & 0 \end{bmatrix}, X^2 = \begin{bmatrix} 0 & 2 & 1 & 1 & 1 & 2 \\ 1 & 0 & 1 & 1 & 2 & 2 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 2 & 1 & 2 & 0 & 1 & 1 \\ 1 & 2 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 2 & 0 \end{bmatrix},$$

$$X^3 = \begin{bmatrix} 0 & 3 & 2 & 2 & 3 & 2 \\ 2 & 0 & 2 & 2 & 3 & 2 \\ 2 & 2 & 0 & 2 & 3 & 2 \\ 0 & 2 & 2 & 0 & 3 & 2 \\ 0 & 2 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}, X^4 = \begin{bmatrix} 0 & 2 & 1 & 2 & 3 & 1 \\ 2 & 0 & 2 & 2 & 3 & 2 \\ 2 & 2 & 0 & 2 & 2 & 1 \\ 1 & 2 & 1 & 0 & 2 & 1 \\ 3 & 3 & 2 & 2 & 0 & 1 \\ 1 & 2 & 2 & 1 & 2 & 0 \end{bmatrix},$$

$$X^5 = \begin{bmatrix} 0 & 2 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 \\ 2 & 1 & 0 & 2 & 1 & 1 \\ 1 & 1 & 3 & 0 & 1 & 1 \\ 1 & 2 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \end{bmatrix}, X^6 = \begin{bmatrix} 0 & 2 & 1 & 2 & 3 & 1 \\ 2 & 0 & 2 & 2 & 3 & 2 \\ 2 & 2 & 0 & 2 & 2 & 1 \\ 1 & 2 & 1 & 0 & 2 & 1 \\ 3 & 3 & 2 & 2 & 0 & 1 \\ 1 & 2 & 2 & 1 & 2 & 0 \end{bmatrix},$$

$$X^7 = \begin{bmatrix} 0 & 3 & 2 & 3 & 3 & 2 \\ 2 & 0 & 3 & 3 & 3 & 3 \\ 0 & 3 & 0 & 3 & 3 & 1 \\ 1 & 2 & 2 & 0 & 2 & 2 \\ 1 & 2 & 2 & 1 & 0 & 1 \\ 1 & 3 & 2 & 2 & 0 & 0 \end{bmatrix}, X^8 = \begin{bmatrix} 0 & 2 & 2 & 2 & 2 & 2 \\ 1 & 0 & 2 & 2 & 2 & 2 \\ 0 & 2 & 0 & 2 & 2 & 1 \\ 1 & 2 & 2 & 0 & 2 & 2 \\ 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 \end{bmatrix},$$

$$X^9 = \begin{bmatrix} 0 & 1 & 2 & 3 & 3 & 1 \\ 2 & 0 & 2 & 2 & 2 & 2 \\ 2 & 1 & 0 & 3 & 3 & 1 \\ 2 & 1 & 3 & 0 & 2 & 2 \\ 3 & 1 & 3 & 2 & 0 & 2 \\ 1 & 2 & 2 & 2 & 1 & 0 \end{bmatrix}, X^{10} = \begin{bmatrix} 0 & 3 & 1 & 3 & 2 & 2 \\ 3 & 0 & 3 & 3 & 3 & 3 \\ 2 & 3 & 0 & 3 & 3 & 3 \\ 2 & 3 & 3 & 0 & 3 & 2 \\ 1 & 3 & 3 & 2 & 0 & 2 \\ 1 & 3 & 3 & 2 & 2 & 0 \end{bmatrix}.$$

Then, the average matrix $A = [a_{ij}]$ can be constructed based on Eq. (1).

$$A = \begin{bmatrix} 0.0 & 2.2 & 1.4 & 2.1 & 2.2 & 1.5 \\ 1.8 & 0.0 & 1.8 & 2.0 & 2.4 & 2.1 \\ 1.4 & 1.9 & 0.0 & 2.2 & 2.1 & 1.4 \\ 1.3 & 1.8 & 2.1 & 0.0 & 2.0 & 1.6 \\ 1.6 & 2.1 & 1.7 & 1.4 & 0.0 & 1.2 \\ 0.7 & 1.8 & 1.4 & 1.2 & 1.4 & 0.0 \end{bmatrix}$$

Step 3 is to calculate the normalized matrix based on Eq. (2).

$$S = \begin{bmatrix} 0.0000 & 0.1719 & 0.1094 & 0.1641 & 0.1719 & 0.1172 \\ 0.1406 & 0.0000 & 0.1406 & 0.1562 & 0.1875 & 0.1641 \\ 0.1094 & 0.1484 & 0.0000 & 0.1719 & 0.1641 & 0.1094 \\ 0.1016 & 0.1406 & 0.1641 & 0.0000 & 0.1562 & 0.1250 \\ 0.1250 & 0.1641 & 0.1328 & 0.1094 & 0.0000 & 0.0938 \\ 0.0547 & 0.1406 & 0.1094 & 0.0938 & 0.1094 & 0.0000 \end{bmatrix}$$

Then the total relation matrix can be constructed based on Eq. (3).

$$T = \begin{bmatrix} 0.2210 & 0.4465 & 0.3636 & 0.4155 & 0.4566 & 0.3509 \\ 0.3539 & 0.3151 & 0.4008 & 0.4227 & 0.4829 & 0.3993 \\ 0.3106 & 0.4163 & 0.2547 & 0.4110 & 0.4381 & 0.3345 \\ 0.2988 & 0.4036 & 0.3895 & 0.2575 & 0.4247 & 0.3409 \\ 0.3045 & 0.4027 & 0.3475 & 0.3399 & 0.2709 & 0.3015 \\ 0.2119 & 0.3368 & 0.2881 & 0.2823 & 0.3197 & 0.1769 \end{bmatrix}$$

The total effects given and received of these six criteria can be calculated based on Eq. (6) and Eq. (7), and the result is depicted in Table 5.

Table 5: Effect Given And Received Of The Criteria

Number of criterion	$m_i = f_i + e_i$	$n_i = f_i - e_i$
1	3.9549	0.5533
2	4.6956	0.0537
3	4.2093	0.1212
4	4.2437	-0.0139
5	4.3599	-0.4259
6	3.5194	-0.2884

Analysis of the result, we can find that the six selected criteria can be prioritized as $(2) > (5) > (4) > (3) > (1) > (6)$ based on the ($m_i = f_i + e_i$) value. It means that highly skilled medical staff is the most import criterion, while reliable health instructions is the least important criterion.

In contrast to the importance, (1), (2) and (3) are net causes, whereas (4), (5) and (6) are net receivers based on the ($n_i = f_i - e_i$) value.

Through the above analysis, we may find that Henan Provincial People's Hospital should pay much attention to three causes (1), (2), (3) rather

than receivers (4), (5), and (6). Well-equipped medical equipment is a key criterion since it is not only a cause but also not affected by the other criterion.

However, the importance of well-equipped medical equipment ranks only fifth. In contrast, (2) highly skilled medical staff is the most important criterion, (5) effectiveness in handling patient complaint, (4) detailed description of the patient's condition, and (3) staff with good communication skills, are also important criterions. Therefore, trainings on communication skills and problem-solving abilities would result in positive interaction for patients.

3. CONCLUSION

There is a need for the hospitals to understand the weaknesses, opportunities, and threats associated with healthcare services for their patients and then enhance their ability of healthcare to attract patients which is a very important factor for the hospital to win in the fierce competition.

This study first designed 27 criteria of the hospital service based on Donabedian framework, and then constructed the questionnaire with the 27 criteria based on SERVQUAL model. Finally, six major criteria were selected from the 27 criteria based on the patients' or their families' viewpoints.

The second survey developed for applying DEMATEL method was issued to the management of Henan Provincial People's Hospital. By applying DEMATEL method, the importance of six criteria can be determined. The results show that highly skilled medical staff is the most essential criterion, and effectiveness in handling patient complaint, detailed description of the patient's condition, and staff with good communication skills, are also important criterions. But well-equipped medical equipment is not a necessity which is out of the hospital managers' expectation. Therefore, in order to increase the patient satisfaction, hospital should invest more in training the professional competence, communication skills and problem-solving abilities of the medical staff rather than buying more machines.

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