

# Improving the Quality of Clinical Dental Services using the Importance-Performance Analysis (IPA) Approach and Interpretive-Structural Modeling (ISM)

Hamed Karimi Shirazi<sup>1</sup>, Mahmoud Modiri<sup>2</sup>, Zahra Pourhabibi<sup>3</sup>, Abolfazl Rafiei Gilevae<sup>4</sup>

## ARTICLE INFO

**Article type:**  
**Original Article**

**Article history:**  
**Received: Oct 30, 2016**  
**Accepted: Mar 15, 2017**  
**Available online:**

<sup>1</sup>Young Researchers and Elite Club, Rasht Branch, Islamic Azad University, Rasht, Iran.

<sup>2</sup>Assistant Professor, Department of Industrial Management, South Tehran Branch, Islamic Azad university, Tehran, Iran.

<sup>3</sup>Statistician, Guilan University of Medical Sciences, Rasht, Iran.

<sup>4</sup>Master of Technology Management, Azad University South Tehran Branch, Tehran, Iran.

**Corresponding Author:**  
Abolfazl Rafiei Gilevae

**Address:**  
Department of Azad University South Tehran Branch, Tehran, Iran.

**E-mail:** Rafiei.kurosh@gmail.com

**Telephone:** +989368569339

## Abstract

### Introduction:

The expansion of activities and performance areas of organizations, modern management issues mean that organizations are no longer satisfied with success in only a limited number of indicators. Mathematical models thus formed and gradually are developed for the assessment of organizations and provide the right tools. This study is conducted to provide a model for improving the quality of dental services in uncertain settings.

### Materials and methods:

The study population in this study consists of two groups. The first group consisted of all the patients with at least one visit to the dental clinic of Guilan University of Medical Sciences in Rasht, 422 of whom were randomly selected through convenience sampling. These data were used for the IPA. The second group of experts consisted of 20 organizational directors and senior experts selected for the localization of the quality of services the dental clinic and the ISM. This applied descriptive-analytical study uses the Fuzzy Delphi method for selecting the components of the quality of services, the Importance-Performance Analysis (IPA) for identifying the strengths and weaknesses of these components, and the Interpretive-Structural Modeling (ISM) for improving the components of the quality of services by prioritizing the effectiveness of the factors.

### Results:

The dental clinic of Guilan University has to pay immediate attention to including providing services as promised, the delivery of services with care, timely responding, the personnel's greater efforts for solving the patients' problems, a consistent quality of services, the speed of services, in order to improve the quality of its services.

### Conclusion:

The ISM showed that there are six levels of influential factors, with the two variables of "providing services as promised" and "equipment and technology" acting as the cornerstone of the model that should be emphasized first and foremost for the system to begin functioning.

### Key words:

•Dental Clinics •Dental Health Services •Organizational Efficiency

**Copyright:** [2017] *Journal of Dentomaxillofacial Radiology, Pathology, and Surgery.*

> **Please cite this paper as:**

Karimi Shirazi H, Modiri M, Pourhabibi Z, Rafiei Gilevae A. Improving the Quality of Clinical Dental Services Using the Importance-Performance Analysis (IPA) approach and Interpretive-Structural Modeling (ISM), *3DJ* 2017;6(1):14-26.

## Introduction

The aging of societies has turned into a major global concern that affects almost every factor contributing to the quality of life, including economic growth, labor markets,

family composition, housing, pensions and health. This social transformation necessitates a system of long-term care services for providing high-quality care services to older

adults.<sup>(1)</sup> Due to the increased life expectancy and the decreased birth rates, society's aging has caused major social changes in many countries. Society's aging is additionally expected to cause many other problems, such as less productive workforce, growth in healthcare costs for older adults and worsened public finances.<sup>(2)</sup> Today, medical treatment is not the only concern of patients in the healthcare industry; rather, patients pay more attention to their own safety and comfort since they incur greater costs.<sup>(3)</sup>

Client-orientation is considered the top strategy of all organizations across the world and the quality of services is the biggest problem faced by service organizations.<sup>(4)</sup> Quality of services imply the individual's general impression about the inferiority or superiority of the organization and its services.<sup>(5)</sup> The quality of health care is a major factor in improving patient satisfaction.<sup>(6)</sup> To identify the facilitators and barriers to improving the quality of services<sup>(7)</sup> and in line with citizens' increased expectations, hospitals need to constantly provide reliable services for all and enhance their place within the health system. To achieve these goals, hospitals generally need to ensure that they provide quality services with high standards of safety and a higher productivity and that they have a competitive edge for responding to the patients' increasing demands so that they can ultimately increase their clients' satisfaction.<sup>(8)</sup> In general, healthcare services should have certain features, including effectiveness, efficiency, quality, competence, availability, accessibility, universality, comprehensiveness, fairness, timeliness and propriety so as to ensure client satisfaction.<sup>(8)</sup>

With limited resources, finding a relationship between customer satisfaction and service performance is the key to organizations' growth. It is therefore essential for organizations to understand which indicators of quality of services can enhance customer satisfaction and how their improvement priorities can contribute to better decisions.<sup>(9)</sup> Quality assessment programs are therefore required, such as the many healthcare assessment tools that work based on the type of information available. The majority of these programs involve a review of the patients' charts, clinical tests, the dental clinic and the patients' satisfaction with the dental care services received.<sup>(10)</sup> The main element in ensuring quality

is pathology and the assessment of the current level of quality in order to develop an appropriate strategy for raising the quality to the desired level. Modern decision-making techniques and the mathematical assessment of ambiguous and uncertain data such as Fuzzy data can help reduce ambiguities and increase accuracy.<sup>(11)</sup>

The problem is that, in the past years, there have been many problems in providing quality dental services at the dental clinic of Guilan University of Medical Sciences and the clinic has witnessed a failure in providing proper dental services and achieving client satisfaction and the patients' judgment of the quality of the dental services offered at this center has been compromised. The present study first uses IPA to analyze and examine the components from the perspective of the clients and then uses ISM to form a hierarchy of the components required for improving the quality of the services provided.

It can be argued that quality is considered a strategic tool by organizations.<sup>(12)</sup> Quality is a vast concept to which all organizational departments are committed and which prevents the emergence of quality-reducing factors; the ultimate goal of quality is full compliance with clients' required specifications with the minimum costs imposed on the organization and maximum client satisfaction.<sup>(13)</sup> With the transformation of lifestyles and the mechanization of industrial production over the past decade, the majority of the workforce in industrial countries has now joined service organizations, so that more than 75% of the workforce in the United States works in the service sector.<sup>(14)</sup> Accordingly, management theories related to industrial settings have undergone modifications in order to also apply to service organizations. The most important features of high-quality services are:

1. Clarifying the waiting time for the clients and providing services as promised
2. Being complete and containing all the components of the service
3. Being respectful and delivered with a happy face
4. Being delivered consistently at different times
5. Being easily accessible
6. Being delivered as initially defined
7. Being delivered with a sense of responsibility at times of unforeseen events<sup>(15)</sup>

The healthcare sector, especially the organiza-

tional sector such as hospitals, is no exception to this rule if it wants to ensure the best quality of care.<sup>(16)</sup> In addition, hospitals are key units of any health system that play a key role in providing healthcare services.<sup>(17)</sup> Several factors therefore affect the successful provision of quality dental services. Both individually and in combination,

these factors are considered important prerequisites to the efforts made for the successful provision of quality dental services, since they affect the internal environment of the organization. Table 1 presents the factors and sub-factors that affect the successful provision of quality dental services.

**Table 1.** The key indicators and sub-indicators of the successful provision of quality dental services

Row	Indicator	Sub-Indicator	Researchers (year)
1	Tangibles	Warm and comfortable hospital environment, personnel's tidy appearance, advanced medical equipment, properly sign-posted hospital, offering meals to patients	Shieh et al.(2010) <sup>18</sup> , Parasuraman A, et al. (1988) <sup>15</sup> , Agha mollaei T,et al. (2007) <sup>19</sup> .
2	Responsiveness	Proper outpatient location used by the service personnel, service personnel with good communication and rapid problem-solving skills, pharmacists' advice for medication use, pharmacists' compliance with physician's recommendations.	Shieh et al.(2010) <sup>18</sup> , Parasuraman A, et al. (1988) <sup>15</sup> , Dewi et al. (2011) <sup>20</sup> .
3	Assurance	Feeling assured about the medical services provided, trusting the competence of the medical personnel, professionally-competent personnel.	Shieh et al.(2010) <sup>18</sup> , Parasuraman A, et al. (1988) <sup>15</sup> , Mohamadnia M, et al.(2010) <sup>4</sup> , Dewi et al. (2011) <sup>20</sup> .
4	Reliability	Easy to use hospital services system, outpatient waiting time, operational methods in the emergency room, process of admission.	Shieh et al.(2010) <sup>18</sup> , Parasuraman A, et al. (1988) <sup>15</sup> .
5	Empathy	Detailed patient history taken by the physician, friendly attitude of the service personnel, medical teams' concern about the patients' personal needs, medical personnel's caring attitude.	Shieh et al.(2010) <sup>18</sup> , Parasuraman A, et al. (1988) <sup>15</sup> , Boshoff C, Gray B., (2004) <sup>21</sup> .
6	Support Services	Consistent quality of services, broad choice of services, reasonable support policy, provision of the necessary equipment, access to service centers, place for registering complaints, responding to patients' complaints, time taken to resolve complaints, providing services as promised, access to public services, means of contacting public services, understanding patients' needs, patient management, providing professional services, technical competence in providing services, improved interpersonal conduct in providing services, quality and accessibility of technical guidelines or service documents, access to information and counseling at the service center, consistent quality of services.	Seth, et al. (2006) <sup>22</sup> , Pakdil, et al. (2012) <sup>23</sup> , Murali et al. (2016) <sup>24</sup> , Saccani, et al.(2014) <sup>25</sup> , Zeithaml, et al.(2006) <sup>26</sup> , Söderlund and Rosengren (2010) <sup>27</sup> .

## Materials and Methods

In terms of objective, the present study is an applied study, and in terms of data collection, it is descriptive and analytical. The study population was Guilan University of Medical Sciences, the Faculty of Dentistry. The statistical population consisted of two groups. The first group consisted of all the patients with at least one visit to the dental clinic of Guilan University of Medical Sciences, 422 of whom were randomly selected through convenience sampling in account of the unlimited size of the population and according to the initial questionnaire distribution and the calculation of its variance. These data were used for the IPA. The second group of experts consisted of 20 organizational directors

and senior experts with high levels of education and work experience in managerial positions selected for the localization of the components of the quality of services provided by the university's dental clinic and the ISM. Data were collected through a review of literature and interviews held with the experts for identifying the required factors. Two questionnaires were also used in the course of the study, including an Importance-Performance Analysis questionnaire and another questionnaire for prioritizing factors using Interpretive-Structural Modeling. The items were researcher-made and their validity was confirmed by five university professors and five experts and their reliability was controlled

through visual distribution to the respondents.

**Data Analysis**

The components of quality of services were identified in this study through a review of literature, and then, based on the proposed models, SERVQUAL was chosen to examine the problem. Importance-Performance Analysis (IPA) was then used in line with the objective of the study, i.e. the assessment of the quality of services. Figure 1 shows the structure of an IPA matrix.<sup>(28)</sup>

High Importance	Q <sub>1</sub>	Q <sub>1</sub>
Low Importance	Q <sub>3</sub>	Q <sub>4</sub>
LOW Performance		HIGH Performance

**Figure 1.** The Importance-Performance matrix

The four quadrants of this matrix are explained below:

1. Quadrant one: Concentrate here

The respondents rate the indicators as highly important, but the performance of the organization in these indicators is rather low. Efforts for improvement and development should thus be concentrated in this area<sup>(28)</sup>

2. Quadrant two: Keep up the good work

The respondents rate the indicators as highly important and the organization has a very good performance with regard to these indicators. Past performance should therefore be kept up in this area.

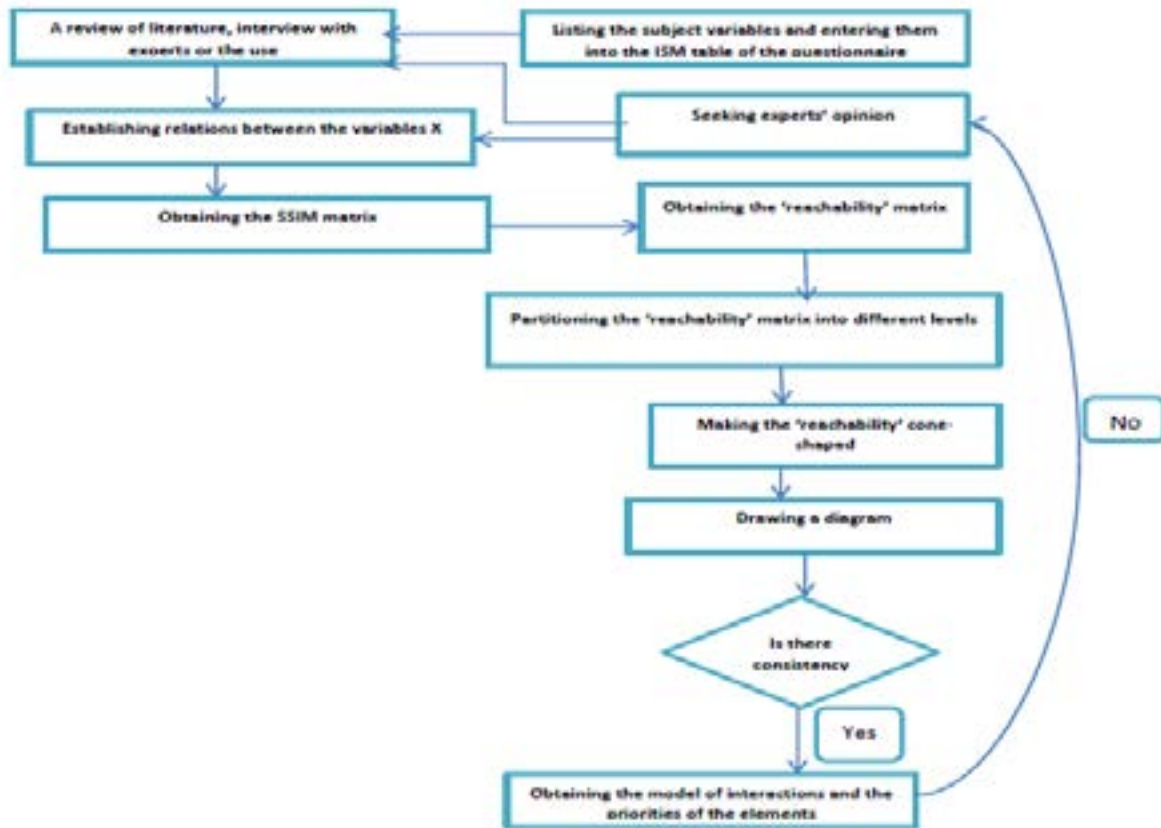
3. Quadrant three: Low priority

The indicators have a low importance and a low performance and limited resources should be allocated to this area by the organization.

4. Quadrant four: Possible overkill

In view of the respondents, the indicators in this quadrant are not very important, but enjoy a relatively high performance. The respondents are happy with the organization’s high performance in these indicators, but the managers should dramatically reduce their current efforts with regard to these indicators<sup>(29)</sup>

Next, Interpretive-Structural Modeling (ISM) is used to find the priorities and levels of effectiveness and the interaction between the components in a system for developing a graphic model. Figure 2 shows the stages of implementing Interpretive-Structural Modeling (ISM)



**Figure 2.** T Stages of ISM

Downloaded from 3djj.gums.ac.ir at 23:00 IRST on Friday January 19th 2018

•Obtaining the Structural Self-Interaction Matrix (SSIM)

The dimensions of this matrix consist of the variables inserted into its first row and column in order. The pairwise relationships between the variables are then identified by symbols. Experts' views can be used to determine the type of the relationships. These experts may be directors and professionals in the industry under study. The general form of this matrix is shown in figure 3. To determine the type of the relationship, the following symbols can be used:

- V ----- helps variable I reach variable j (column)
- A ----- helps variable J reach variable I (column)
- X ----- helps I and J reach each other (reciprocal relationship)
- O ---- I and J are not related to each other

•Obtaining the reachability matrix

The reachability matrix can be obtained by converting the relationship symbols of the SSIM matrix into zero and one according to the following rules:

- If the relationship is such as in V, then  $(i, j)=1$  and so  $(j, i)=0$
- If the relationship is such as in A, then  $(i, j)=0$  and so  $(j, i)=1$
- If the relationship is such as in X, then  $(i, j)=(j, i)=1$
- If the relationship is such as in O, then  $(i, j)=(i, j)=0$

•Making the reachability matrix consistent

Once the initial reachability matrix is obtained, an internal consistency has to be established in it. For example, if variable 1 leads to variable 2, and variable 2 leads to variable 3, then, variable 1 must also lead to variable 3, and if this relationship does not hold in the reachability matrix, then the matrix should be modified and

the missing relationships should be replaced. The consistency of the reachability matrix is established using mathematical rules, so that the reachability matrix is raised to the power of  $K+1$ , where  $K \geq 1$ . The exponentiation of the matrix should be 1 according to the Boolean rule, according to which  $1+1=1$  and  $1 \times 1=1$ .

•Determining the level and priority of the variables

The higher is the effect of one factor on the others, the lower is its place in ISM, and the more one factor is affected by others, the higher will be its place in ISM. Effectiveness occurs from low to high in ISM.

To determine the level and priorities of the variables, the Antecedent Set and the Intersection Set are determined for each variable. The antecedent set for a variable includes variables that can be reached through this variable, and the intersection set includes variables through which this variable can be reached. This step is performed using the reachability matrix. Once the antecedent and intersection sets are determined for each variable, the common elements in these sets are identified for each variable. The result is a table such as the following. Once the antecedent and intersection sets and common elements are determined, it is time to determine the variables' (elements') level. In the first table, the variable with perfectly similar antecedent and intersection sets has the highest level. After determining this/these variable(s), they are eliminated from the table, and the next table is formed by the remaining variables. The level-two variable is identified in the second table just as in the first table, and the process is continued until all the variables are assigned levels.

Variable	N	.....	6	5	4	3	2
1	.....	.....	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....	.....
3	.....	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	.....	.....	.....
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
m-1	.....	.....	.....	.....	.....	.....	.....

Figure 3. The SSIM matrix



### •Plotting the diagram

When the variable levels are determined, the diagram of the relationships and levels of the variables is plotted. First, the variables are plotted as a circle from top to bottom according to the priorities obtained and their levels, and then, based on the consistent reachability matrix, the relationships between the variables are identified with arrows.

### •MICMAC analysis

The purpose of MICMAC analysis is to determine and analyze the driving power and dependence of the variables. In this analysis, variables are divided into four groups based on their driving power and dependence. Group one

consists of “independent variables” that have a poor driving power and dependence. These variables have almost no link to the system and have poor relations with the system. The second group consists of “dependent variables” that have a poor driving power, but a high dependence. The third group consists of “linkage variables” that have a high driving power and dependence. These variables are non-static, since any change in them can affect the system, and the system’s feedback can in turn change the variables once again. The fourth group consists of “independent variables” that have a high driving power but a low dependence.<sup>(30)</sup>

Element	Antecedent set	Intersection set	Common elements	Level
1	.....	.....	.....	.....
2	.....	.....	.....	.....
3	.....	.....	.....	.....
n	.....	.....	.....	.....

Figure 4. Determining the variables’ level

## Results

First, through a review of literature, the components of the quality of services were identified based on the SERVQUAL model. Then, for the purpose of localization (screening), a 28-item qualitative questionnaire was developed based on a 5-point scale (from ‘extremely important’ to ‘unimportant’). This questionnaire was distributed among 20 people in the first sample group and screening began using the Fuzzy Delphi method, and eventually, 20 components affecting the quality of dental services at Guilan University dental clinic were chosen (Table 1).

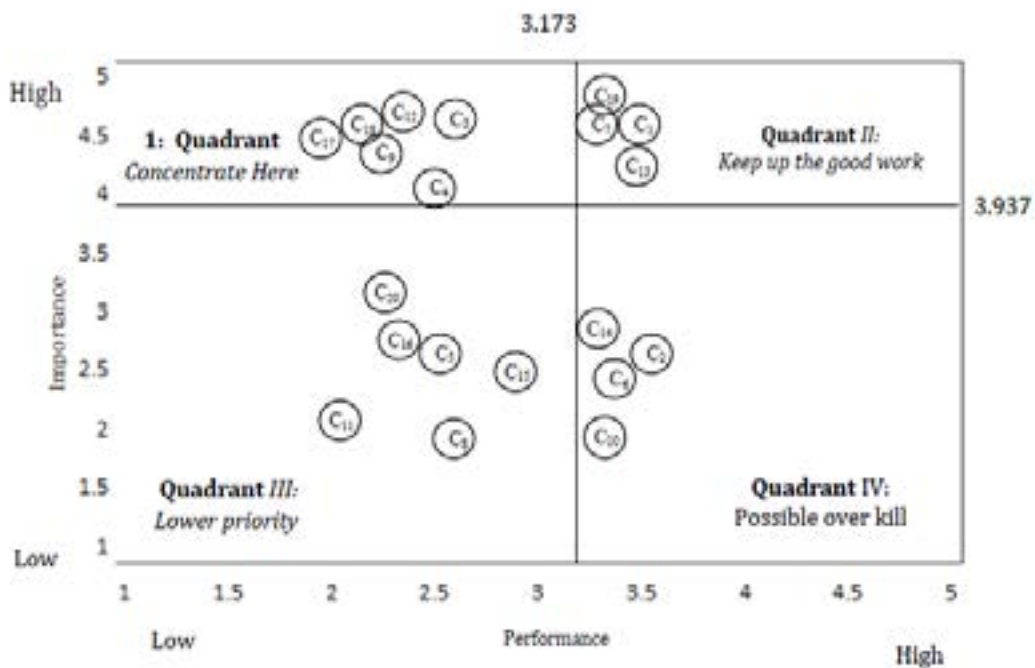
To determine the degree of importance-performance of the indicators based on the 5-point Likert scale, the views expressed by 422 customers were integrated (aggregated) and the importance-performance value of the components affecting the quality of dental services was obtained (Table 2). The IPA matrix was then drawn (Figure 5). According to the results presented in Table 2, with the weight of 0.13, the component of “consistent quality of services” was ranked

first and had the poorest performance and the patients were least satisfied with this indicator. As shown in the IPA matrix (Figure 2), the key factors involved in the improvement of the quality of dental services can be categorized as follows:

- Quadrant I (“Concentrate here”) contains the indicators C3, C4, C9, C12, C17 and C18. The organization should concentrate on where the importance is high and the performance low and pay immediate attention to these indicators in order to improve customer satisfaction with the quality of services.
- Quadrant II (“Keep up the good work”) contains the indicators C1, C7, C13 and C19, which indicate the organization’s main area of strength and recommend that it keeps up that quality.
- Quadrant III (“Lower priority”) contains the indicators C5, C8, C11, C15, C16 and C20. The managers should not pay too much attention to this area and should spend only limited resources on it.
- Quadrant IV (“Possible overkill”) contains the indicators C2, C6, C10 and C14. Concentration on this area is a waste of resources.

**Table 2.** The key indicators of success and importance-performance value of the components of improving the quality of dental services

Rank	Weight	Performance	Importance	Key Indicator	Component
8	0.06	3.359	4.544	C1	Professional personnel
12	0.028	3.609	2.672	C2	Providing services as per the appointments
9	0.057	3.431	4.544	C3	Providing services as promised
5	0.071	2.482	4.054	C4	Providing services with care
19	0.004	2.502	2.627	C5	Confidentiality
14	0.026	3.431	2.521	C6	Responding to clients' complaints
7	0.062	3.327	4.544	C7	Personnel's willingness to respond to the patients
15	0.013	2.611	2.034	C8	Guiding the clients according to their needs (by the personnel)
3	0.111	2.359	4.544	C9	Timely and rapid responding
13	0.027	3.266	2.119	C10	Personal attention to the patients
20	0.003	2.087	2.192	C11	Friendly communication
2	0.12	2.414	4.691	C12	Personnel's effort to solve the clients' problems
10	0.044	3.51	4.401	C13	Equipment and technology
18	0.008	3.193	2.95	C14	Attractiveness of the facilities and physical equipment
16	0.011	2.956	2.564	C15	Personnel with good appearance
17	0.011	2.482	2.831	C16	Visually clean and tidy environment
1	0.13	1.984	4.544	C17	Consistent quality of services
4	0.111	2.359	4.544	C18	Speed of services
6	0.069	3.386	4.691	C19	Support services
11	0.033	2.359	3.257	C20	Easy access to services



**Figure 5.** The results of the IPA model of quality of services in the dental clinic

The next step after identifying the factors that have a weak role in improving the quality of services in the dental clinic is to improve on them. The organization should improve the indicators placed in quadrant one in order to achieve customer satisfaction. This study used Interpretive Structural Modeling (ISM) for achieving this improvement. ISM identifies the relationships and partitioning between the variables for solving the problem and achieving improvement. The variables in quadrant II are therefore used to help improve the variables in quadrant I (continue) that require improvement. As a result, ISM starts with the components in quadrants I and II. But first, the Structural Self-Interaction Matrix (SSIM) of the variables should be developed. The dimensions of the SSIM consist of factors that are inserted into the matrix's first row and column, in order. The pairwise relationships between the factors are then identified. The following scale can be used in determining these relationships. A row factor can lead to a column factor. The views of 20 experts with full knowledge of the study subject were then used and the results thus obtained were summarized in the SSIM. The reachability matrix was obtained by determining the relationships as 0 and 1 from the SSIM with a threshold of 50. In Table 4, numbers higher than 50 are placed as 1 and numbers less than 50 placed as 0. After the addition of the identity matrix, the reachability matrix will be as shown in Table 5. Once the initial reachability matrix is obtained, its internal consistency should be established.

Boolean rules were used for this purpose.

Table 6 shows the consistency matrix. The level and priority of the variables are determined by the sum of the row (driving power=D) and column (dependence =R) in the consistency matrix. Table 6 shows the results. After determining the relationships and variable levels, they can be drawn as a model. To this end, the variables are first drawn from high to low according to their levels. In the present study, the components affecting the quality of clinical dental services were placed in six levels. Figure 6 shows the interpretive structural model for partitioning the key factors for improving the quality of clinical dental services.

The variable of “providing services as promised” and “equipment and technology” are at the lowest level of this model and act as its cornerstone, and the improvement of the quality of services begins with these variables and spreads to the other variables. These variables are inter-related. The components “professional employees” and “providing services with care” are at level five. In addition, the low-level (sixth-level) variable affects the fifth-level variable.

**Table 3.** The verbal options and Fuzzy numbers for measuring the intensity of the effects (Jeng and Tzeng, 2012)

Row	Verbal Statement	Affectability Score
1	No effects	0
2	Low effect	1
3	Moderate effect	2
4	High effect	3
5	Very high effect	4

**Table 4.** The SSIM

	C1	C3	C4	C7	C9	C12	C13	C17	C18	C19	C21
C1	0	43	70	59	53	64	49	68	72	63	71
C3	63	0	62	72	39	59	61	47	64	54	59
C4	65	37	0	68	59	71	36	72	57	70	42
C7	25	42	35	0	74	65	43	59	60	67	63
C9	32	46	45	47	0	37	25	61	73	53	68
C12	43	27	32	63	68	0	41	70	54	59	49
C13	49	69	54	68	59	64	0	72	63	71	55
C17	32	35	28	37	34	38	37	0	41	63	61
C18	29	42	32	45	71	47	28	63	0	57	59
C19	28	39	39	23	27	40	46	59	39	0	57
C21	44	24	46	27	44	37	25	37	47	38	0



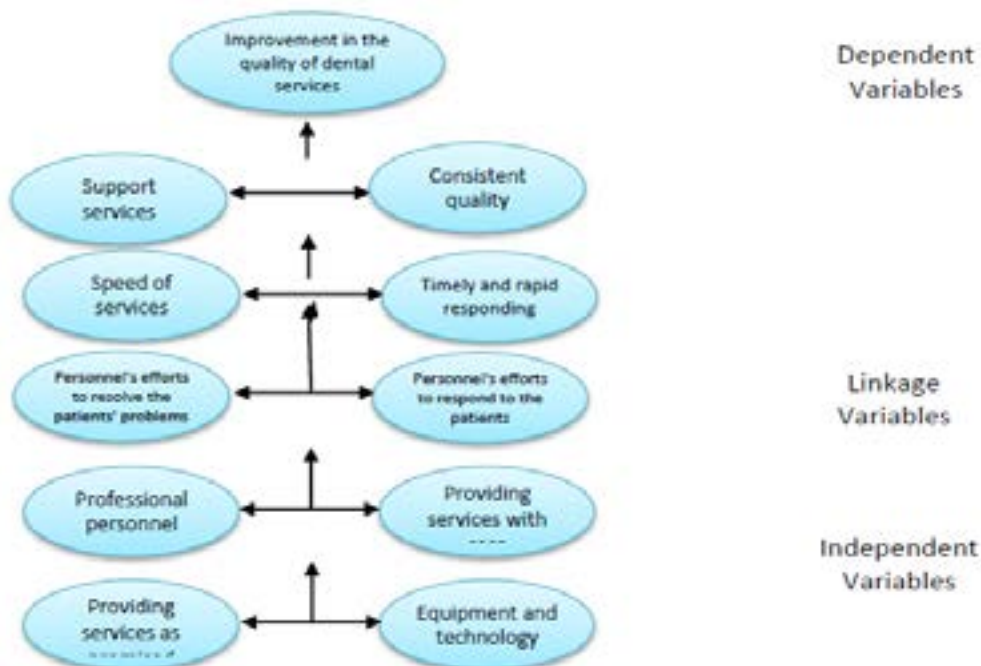
**Table 5.** The reachability matrix

	C1	C3	C4	C7	C9	C12	C13	C17	C18	C19	C21
C1	1	0	1	1	1	1	0	1	1	1	1
C3	1	1	1	1	0	1	1	0	1	1	1
C4	1	0	1	1	1	1	0	1	1	1	0
C7	0	0	0	1	1	1	0	1	1	1	1
C9	0	0	0	0	1	0	0	1	1	1	1
C12	0	0	0	1	1	1	0	1	1	1	0
C13	0	1	1	1	1	1	1	1	1	1	1
C17	0	0	0	0	0	0	0	1	0	1	1
C18	0	0	0	0	1	0	0	1	1	1	1
C19	0	0	0	0	0	0	0	1	0	1	1
C21	0	0	0	0	0	0	0	0	0	0	1

**Table 6.** The final reachability matrix

	C1	C3	C4	C7	C9	C12	C13	C17	C18	C19	C21	D	D-R
C1	1	0	1	1	1	1	0	1	1	1	1	9	5
C3	1	1	1	1	*1	1	1	*1	1	1	1	11	9
C4	1	0	1	1	1	1	0	1	1	1	*1	9	5
C7	0	0	0	1	1	1	0	1	1	1	1	7	1
C9	0	0	0	0	1	0	0	1	1	1	1	5	-3
C12	0	0	0	1	1	1	0	1	1	1	*1	7	1
C13	*1	1	1	1	1	1	1	1	1	1	1	11	9
C17	0	0	0	0	0	0	0	1	0	1	1	3	-7
C18	0	0	0	0	1	0	0	1	1	1	1	5	-3
C19	0	0	0	0	0	0	0	1	0	1	1	3	-7
C21	0	0	0	0	0	0	0	0	0	0	1	1	-10
R	4	2	4	6	8	6	2	10	8	10	11		

Note: 1\* entries are included to incorporate transitivity



**Figure 6.** The Interpretive-Structural model for improving the quality of clinical dental services

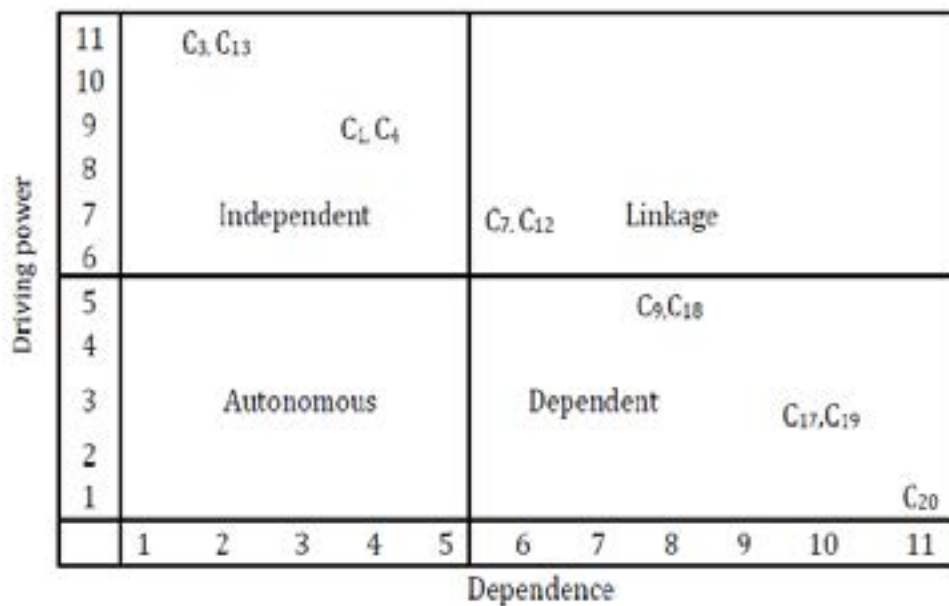
The variables “employees’ willingness to respond to the patients” and “employees’ efforts to resolve the patients’ problems” are at the fourth level, and all the variables in the previous levels affect this variable. The variables “timely and rapid responding” and “speed of services” are at the third level. These variables are affected by the variables in the previous level and affect the variables in level two, i.e. “consistent quality of services” and “support services”, and ultimately improve the quality of clinical dental services by improving the variables in the previous levels.

Figure 7 shows the driving power and dependence of the components affecting improvement in the quality of clinical dental services.

The first group includes the autonomous variables, which have a poor driving power and dependence. These criteria are relatively unattached to the system and have a poor connection to it. None of the criteria are classified in this group, which shows the correlation between the components affecting the quality of clinical

dental services. The second group is composed of the dependent variables, which have a poor driving power but a high dependence. The indicators C9, C17, C18, C19 and C20 are in this group. These variables are mainly the result of the satisfaction indicators, which engage many variables for being achieved, and they are less able to pave the way for the other variables. The third group consists of the linkage variables, which have a high driving power and a high dependence. These variables are non-static, since any change in them can affect the system, and the system feedback can in turn change these variables once again. The criteria C12 and C7 are classified in this group. The fourth group consists of the independent variables, which have a high driving power, but a low dependence. This group acts as the cornerstone of the model and the system’s emphasis should be on them in order to function. The indicators C1, C3, C4 and C13 are classified in this group.

Figure 7. The driving power-dependence diagram



## Discussion

According to Lee et al., the main indicators for improving the quality of medical services include the medical team, expert pharmacists, professional nurses and the speed and quality of providing medical services.<sup>(3)</sup> Gürdal et al., argued that effective dentist-patient communication, the regular provision of services and the personnel’s scientific knowledge are the most

important factors contributing to patient satisfaction while lengthy waiting periods, irregular provision of services and a slow radiography department are the most important causes of patient dissatisfaction.<sup>(31)</sup> Davis et al., also confirmed the importance of quality assessment in a competitive health care setting.<sup>(32)</sup> So in this study the primary objective of this study was to

identify the key factors affecting improvement in the quality of clinical dental services. Based on the results of previous studies on the subject, 20 important factors were identified, which are mainly concerned with the criteria of reliability, responsiveness, empathy, tangibles and assurance. These results answer the primary objective of the study.

The second objective of the study was to determine the importance of each of the key factors in improving the quality of clinical dental services. For this purpose, Importance-Performance Analysis (IPA) was used, which led to the following results:

The indicators “providing services as promised”, “providing services with care”, “timely and rapid responding”, “employees’ efforts to resolve the patients’ problems”, “consistent quality of services” and “speed of services” require greater attention, as they are important to the patients and are performed poorly.

These components require immediate attention in order for the quality of clinical dental services to be improved. These results indicate that improving the quality of clinical dental services at Guilan Faculty of Dentistry is dependent on “providing services as promised” and “providing services with care”. These indicators can be effective in improving the quality of clinical dental services. A clinic that intends to enhance its quality of services and productivity but fails to provide services as promised and with care will definitely not be able to accomplish these objectives.

The third objective of the study was to determine the variable levels and their effectiveness in improving the quality of clinical dental services. ISM was used to achieve this objective and the classification made is analyzed as follows:

The results showed that the components affecting the quality of clinical dental services are placed in six levels, with the variables “providing services as promised” and “equipment and technology” at the lowest level of the model and acting as its cornerstone, where improvement in the quality of services begins and spreads to the other variables.

These variables are interrelated. Having the right quality of clinical dental services requires meeting these criteria, and improving the quality of clinical dental services at Guilan Faculty of

Dentistry begins with these components.

It can be concluded that these two components are the foundation and basically the main factors required for improving the quality of clinical dental services at Guilan Faculty of Dentistry.

## Conclusion

According to the results, the components “professional employees”, “employees’ willingness to respond to the patients”, “equipment and technology” and “support services” indicate the dental clinic’s concentration, since they construe the main strength of the dental clinic of Guilan School of Dentistry in improving the quality of clinical services. The directors and managers of the dental clinic of Guilan School of Dentistry should therefore concentrate on these factors in order to improve their performance.

Based on the IPA results, dental clinics and schools of dentistry are recommended to pay greater attention to providing services as promised, providing services with care, ensuring timely and rapid responding to the patients, ensuring employees’ efforts to resolve the patients’ problems and ensuring a consistent quality of services and an adequate speed of services. Based on the ISM results, the key factors involved in improving the quality of clinical dental services are to provide services as promised and to use advanced equipment and technology. Since making improvements based on merely one criterion is always very risky, it is recommended that several criteria be used simultaneously for improving the quality of clinical dental services. Every clinic should emphasize factors that are more compatible with the level of services it provides.

## Conflict of Interest

Authors declare no conflicts of interest.

## Acknowledgement

The authors would like to thank Dr. Modabbernia for help in this research.

## References

1. Jang SH, Kim RH, Won Lee Ch. Effect of u-healthcare service quality on usage intention in a healthcare service. *Technological Forecasting and Social Change*. 2016; 113(B): 396-403. Available from: <http://www.sciencedirect.com/science/article/pii/S0040162516301871>.
2. Fried LP. What are the roles of public health in an aging society. *Public Health for an Aging Society*. USA: John Hopkins University Press; 2012.
3. Lee CKM, Ru CTY, Yeung CL, Choy KL, IP WH. Analyze the healthcare service requirement using fuzzy QFD. *Computers in Industry*. 2015; 74:1-15.
4. Mohammadnia M, Delgoshaei B, Tofighi S, Riahi L, Omrani A. Survey on Nursing Service Quality by SERVQUAL at Tehran Social Security Organization Hospitals. *j Hosp*. 2010; 8(3,4):68-73. Persian.
5. Bitner MJ, Booms BH, Mohr LA. Critical service encounters: the employee viewpoint. *Journal of Marketing*. 1994; 58: 95-106.
6. Sharma k. Managing quality in health care, WHO South-East Asia Journal of Public Health: Publisher: Rawat Publications, Jaipur (India), 2012; 1(1):119-120.
7. Nair M, Baltag V, Bose K, Boschi-Pinto C, Lambrechts T, Mathai M. Improving the Quality of Health Care Services for Adolescents, Globally: A Standards Driven Approach. *J Adolesc Health*. 2015; 57(3):288-98. doi: 10.1016/j.jadohealth.2015.05.011.
8. Becker C. Patient satisfaction is in the details. 6 N.Y. HMOs will give enrollees specific explanations when treatment is denied. *Mod Healthc*. 2001 Oct 22; 31(43):34.
9. Meng Q, Jiang X, Bian L. A Decision-Making Method for Improving Logistics Services Quality by Integrating Fuzzy Kano Model with Importance-Performance Analysis. *Journal of Service Science and Management*. 2015; 8: 322-31.
10. Butters JM, Willis DO. A comparison of patient satisfaction among current and former dental school patients. *J Dent Educ*. 2000; 64(6): 409-15.
11. Zhou Q, Huang W, Zhang Y. Identifying critical success factors in emergency management using a fuzzy DEMATEL method. *Safety Science*. 2011; 49:243-252.
12. Lee J H, Kim HD, Jae K Y, Sagas M. The influence of service quality on satisfaction and intention :A gender segmentation strategy. *sport management review*. 2011; 14 : 54-63.
13. Donnelly M, Rimmer R, Shiu EM. Assessing the quality of police services using SERVQUAL Policing: an International. *Journal of Police Strategies and Management*. 2006; 29(1): 92-105.
14. Dean JW, Ewans JR. Total quality management, organization and strategy. USA: West Publishing Co; 1994. p. 7-9.
15. Parasuraman A, zeithaml VA, Berry LL. SERVQUAL: A multiple item scale for measuring consumer perception of service Quality. *Journal of Retailing*. 1998; 64(1): 12-40.
16. Arab M, Eskandari Z, Rahimi A, Purreza A, Dargahi H. Causes of readmission for patients in hospitals of Tehran. *Journal of Hospital*. 2010; 9(1,2): 43-55. Persian.
17. Arab M, Zareei A, Rahimi A, Rezayian F, Akbari F. Analysis of factors affecting the duration of stay of patients in state hospitals in Lorestan. *Hakim*. 2009; 12(4): 27-31. Persian.
18. Shieh a, Jiunn-I. Hsin-Hung Wub, Kuan-Kai Huang. A DEMATEL method in identifying key success factors of hospital service quality. *Knowledge-Based Systems*, 2010; 23: pp; 277-82.
19. Agha mollaei T, Zare SH, Pudat A, Kebriaei A. Expectations and perception recipients perceived quality of primary health care services in healthcenters Bndrabas. *Medical Journal of Hormozgan*. 2007; 11(3): 173-9. Persian.
20. Dewi FD, Sudjana G, Oesman YM. Patient satisfaction analysis on service quality of dental health care based on empathy and responsiveness. *Dent Res J (Isfahan)*. 2011 Oct; 8(4):172-7. doi: 10.4103/1735-3327.86032.
21. Boshoff C, Gray B. The relationship between service quality, customer satisfaction and buying intentions in the private hospital industry. *South African Business Management*. 2004; 35(4):27-37.
22. Seth NSG, Deshmuk H, Vrat P. SSQSC: A Tool to Measure Supplier Service Quality in Supply Chain. *Production Planning & Control*. 2006; 17 (5): 448-63.
23. Pakdil F, Isin FB, Genc H. A Quality Function Deployment Application Using Qualitative and Quantitative Analysis in after Sales Services. *Total Quality Management & Business Excellence*. 2012; 23 (11-12): 1397-1411.
24. Murali, S. Pugazhendhi, S. Muralidharan, C. Integration of IPA and QFD to assess the service quality and to identify after sales service strategies to improve customer satisfaction – a case study, *Production Planning & Control: The Management of Operations*, 2016; ISSN:0953-7287 (Print) 1366-5871 (Online) Journal homepage: <http://www.tandfonline.com/loi/tpc20>.
25. Saccani N, Visintin F, Rapaccini M. Investigating the Linkages between Service Types and Supplier Relationships in Servitized Environments. *International Journal of Production Economics*. 2014; 149 (3): 226-38.
26. Zeithaml V A, Bitner MJ, Gremler DD. *Service Marketing: Integrating Customer Focus across the Firm*. 4th Ed. New York: McGraw-Hill; 2006.
27. Söderlund M, Rosengren S. The Happy versus Unhappy Service Worker in the Service Encounter: Assessing the Impact on Customer Satisfaction. *Journal of Retailing and Consumer Services*. 2010; 17 (2): 161-69.
28. Tzeng, GH, Chang HF. Applying Importance-Performance Analysis as a Service Quality Measure in Food Service Industry. *Journal of Technology Management & Innovation*. 2011; 6(3):pp:106\_15.
29. Raymond KSC, Choi T. An importance-performance analysis of hotel selection factors in the Hong Kong hotel industry: a comparison of business and leisure travelers.

Tourism Management. 2000; 21 (4): 363-77.

30. Kannana G, Pokharel SH, Sasi Kumarc P. A hybrid approach using ISM and fuzzy TOPSIS for the selection of reverse logistics provider. Resources, Conservation and Recycling. 2009; 54: 28–36.

31. Gürdal P, Cankaya H, Onem E, Dinçer S, Yilmaz T. Factors of patient satisfaction/dissatisfaction in a dental faculty outpatient clinic in Turkey. Community Dent Oral Epidemiol. 2000; 28(6):461-9.

32. Davis BA, Kiesel CK, McFarland J, Collard A, Coston K, Keeton A. Evaluating instruments for quality: testing convergent validity of the consumer emergency care satisfaction scale. J Nurs Care Qual. 2005;20(4):364-8.