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Analyzing Hospital Services Quality Using a Hybrid Approach: Evidence from Information Technology

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Abstract

Hospitals are the most important part of the healthcare system. Statistics show that a significant portion of health budgets are allocated to hospitals. The continuous impact of information technology on hospitals' performance has led to perfect competition. Accordingly, this study aimed to evaluate the quality indicators of hospital services considering information technology using a hybrid approach of the Kano model, Analytical Hierarchy Process (AHP), and Quality Function Deployment (QFD). In this regard, based on related studies, a total of 18 needs were recognized to evaluate the service quality of a hospital. The statistical population of the study consisted of patients of the hospital and due to the difficulty of access to the patient, a limited sample of 50 patients was selected. After collecting data, the identified needs were classified into three categories called basic, functional, and motivational using the Kano model, and 7 needs were set as basic needs. Then, using the AHP technique, the importance of the basic needs was calculated and considered as the input of the QFD model in the next phase. After providing some solutions based on the literature to meet these 7 needs, solutions were ranked and prioritized using the QFD model. Since the organization had limited resources, the Pareto technique was used to respond to 20% of these strategies and achieve 80% satisfaction. The results of the study

showed that the hospitals can achieve 80% satisfaction by implementing the strategies of "holding ethics training courses online" and "creating team spirit and using health information technology in the hospital", respectively.

Keywords: Health Information Technology, Patient Satisfaction, Kano Model, AHP Technique, QFD Model.

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Introduction

The rapid spread of information technology (IT) has revolutionized every facet of life over the past few decades (Ahmed et al., 2021). During the Coronavirus pandemic (COVID-19 pandemic), the role of IT has become more prominent. Since the COVID-19 pandemic has greatly affected the service sector (Xiang et al., 2021), services that use IT in their operations can be more successful. It can be helpful in different operations such as training employees (Elhazzam, 2015), financial issues (Alshubiri et al., 2019), customers (Shahzad et al., 2020), etc.

The service sector is a rapidly growing area of the global economy, and in the COVID-19 pandemic situation, healthcare organizations play an essential role in this growth. With the development and expansion of information technology (IT) the healthcare market has become a competitive environment, and the number of hospitals in Iran has increased (Doshmangir et al., 2019). To survive in competitive environments, organizations should consider customer satisfaction, which is the most fundamental issue for them.

In today's world, the issue of quality has challenged organizations' management, and its acceptance in the service sector has increased. Service quality is an essential factor for the growth, success, and viability of the organization, and as an effective and comprehensive strategy, it is on the agenda of top management. Traditional attitudes have defined quality based on product or service characteristics (Kim-Soon et al., 2014; Kumar & Palmieri, 2010), while new practices and perspectives define quality as customers' needs (Bedane & Mohammed, 2021). Therefore, successful organizations seek to meet their customers' wants and needs.

Health as a complete physical, psychological, and social well-being is intricately linked to other political, social, economic, cultural, and technological fields. Due to the increasing

complexity of various aspects of development and the Covid-19 pandemic, the provision, maintenance, and promotion of health have become the central concern and challenge of policymakers, decision-makers, and the public in countries. If the countries' health is enhanced, their development will undoubtedly be improved and sustained. In 2016, the United States spent 17.8% of its Gross domestic product (GDP) on health care; however, only about 19% were satisfied with healthcare quality (Papanicolas et al., 2018). Statistics also show that 40 to 70% of health budgets are allocated to hospitals (Fakhri & Aslipoor, 2015).

As one of the large and complex service organizations and an essential service provider in the health system, the role of hospitals is very prominent. Due to the high risk of the hospital's services, the services provided must be of superior quality. Also, due to the fierce competition and complexities of the business environment, service providers must provide quality services to maintain their survival and profitability and achieve sustainable competitive advantage (Adel et al., 2011). Hospitals are responsible for supporting primary care services in the health system, without which the health system would not be complete in providing quality and effective care. Hospitals' primary mission is to provide quality care for patients and meet their needs and expectations. Achieving this mission requires the institutionalization of quality in hospitals.

Patient satisfaction with hospital service is one of the leading indicators of the efficiency and effectiveness of services provided by different hospital wards. A satisfied patienttheis a key to any hospital's success. It is noteworthy that knowing the client's expectations is the first step in improving the health service quality. Quality is the customer's desire, and their perceived expectations determine the quality (Aghamolaei et al., 2014; Bedane & Mohammed, 2021; Sharma & Gadenne, 2001).

Employee activities in service organizations are a determinant factor in developing effective customer relationships. Therefore, employees' skills, attitudes, and behaviors are critical in this area because medical staff are responsible for providing quality services that meet customer expectations (Suleiman Awwad & Mohammad Agti, 2011). Due to the competitive environment in service organizations and increasing customer awareness of the services provided by these organizations, customer expectations are ever-increasing. Therefore, service organizations need to provide customers with quality services to retain them.

Satisfaction is essential in health care systems because the disease experience and the need to follow the treatment and care process increase patients' vulnerability and intensify their need for comprehensive support. However, in recent years, changing social conditions and increasing public awareness have also raised patients' expectations of receiving services (Sadeghi et al., 2021).

Patient relationship management (PRM), in addition to customer relationship management (CRM), can create a long-term two-way relationship between patient and hospital. Having skilled staff to deal with the patients can lead to customer loyalty and improved health. Implementing a PRM system enables patient retention and profit, and reputation promotes community health (Meskarpour-Amiri et al., 2021).

A growing number of healthcare centers are equipped with IT have increased competition for patient admissions, and as a result, hospitals have implemented models to improve patient satisfaction. Today, hospitals need to develop close relationships and PRM and provide optimal service and care environments through innovative technologies for enhancing patient satisfaction (Poku et al., 2017). Combining the Kano model and quality function deployment (QFD) helps organizations design services or products according to customers' desires and wants, thereby providing the highest customer satisfaction. The main philosophy of the QFD technique is to apply customer demands in product or service development. Therefore, all product/service design specifications are obtained according to the consumer's point of view. It is noteworthy that the role of experts in the design of a new product and service is nothing more than a translator. These translators use QFD to convert customer demands into quantitative specifications (Koleini Mamaghani & Barzin, 2019).

To the best of our knowledge, previous research has not conducted a detailed study of significant factors for hospital service quality considering IT. Therefore, for responding effectively to customers and their maximum satisfaction, which is the main factor for gaining a competitive advantage, this study first tried to identify the determinants (needs) of hospital service quality using experts' opinions and relevant literature review, and then categorize these needs using the Kano model. After sorting the needs into three categories named "Basic", "Functional", and "Motivational", the basic needs' relative importance was computed using the AHP method. Next, some solutions were provided for basic needs that seemed to play a significant role in increasing customer satisfaction and loyalty.

Literature Review

In the traditional approach, objective criteria such as mortality rate and disease prevalence were used to assess health service quality. However, these criteria are now primary tools to evaluate clinical service quality. Today, subjective measurements are more common. As a result, healthcare service providers are trying to use customer-centric assessment tools, since the role of patients in defining service quality is becoming more apparent. Also, patients' needs change over time. Hence healthcare service providers should be aware of patients' needs and satisfy them. In the COVID-19 pandemic situation, effective use of IT can help healthcare systems to attain better service quality. Service quality is recognized as a critical determinant of organizational success in today's competitive environment, and it is worrying

when customer satisfaction declines because of poor service quality (Zaim et al., 2010). For a better understanding of the concepts in this paper, the following definitions are presented:

IT: The term "Information Technology" refers to any technology that assists humans in creating, altering, storing, or transmitting information. Computers, telephones, televisions, cell-phones, and other electronic devices are examples of information technology. (Sihombing et al., 2020).

Service: Service is a process involving a series of intangible activities that occur naturally in customer-employee interactions to provide solutions to customer problems (Kasim et al., 2018).

Quality: Quality is a measure of excellence. Quality has no meaning but what the customer wants. In other words, a product or service is of high quality when it meets customers' wants and needs (Bedane & Mohammed, 2021; Madu & Madu, 2002).

Service quality: Service quality consistently complies with customer expectations and knowledge of a particular service. Therefore, it can be acknowledged that service quality is a judgment that customers make based on their perception after a service delivery process (Büyüközkan et al., 2011; Stefano et al., 2015).

What differentiates quality in the healthcare sector from other sectors is that patients and medical staff do not think of quality in the same way. As mentioned, the medical staff defines quality as doing the right thing at the right time and doing it right from the first time. Patients judge quality differently. Studies have shown that patients measure quality based on their values. Health service quality consists of technical quality (outcome quality) and functional quality (process quality). Technical quality focuses on the accuracy of physician procedures and diagnoses, and functional quality refers to how healthcare service is provided to patients. Since most patients lack the knowledge needed to evaluate the technical quality of services, their quality assessment is based on the medical care process (Lam, 1997; Lin et al., 2004; Zarei et al., 2012). The medical care process includes five essential steps: collecting subjective and objective information about the patient; gathering and evaluating data to identify problems and set priorities; designing an evidence-based and cost-effective care plan; implementing the care plan, and monitoring the patient during follow-up encounter to evaluate the plan's effectiveness and modify it as necessary (Haines et al., 2017).

Using health information technology, these steps can be performed in higher quality and consequently satisfy patients. Information technology in hospitals can aid in training employees, maintaining records, managing data, and making informed decisions (Pezaro & Lilley, 2015).

Several studies have been conducted on hospital service quality due to the growing importance of services in advancing organizational goals and increasing customer satisfaction with services. Purcărea et al., (2013) sent a SERVQUAL questionnaire to 1,000 Romanian women's e-mail and concluded that because most healthcare clients lack the necessary know-how, they try to measure services in terms of tangibles such as environment and price.

In their study "Survey on Nursing Service Quality by SERVQUAL at Tehran Social Security Organization Hospitals," Mohammadnia et al., (2010) reported the service quality of the selected hospitals at a reasonable level. This study showed that reliability, assurance, and empathy had the highest quality, and responsiveness had the lowest quality.

A case study by Ozturkcan et al., (2009) confirmed the effect of hospital service quality at Marmara University on customer satisfaction and loyalty. A study in Egyptian hospitals showed that patients' expectations of hospital service quality affected their satisfaction with services and hospital type (private or public) selection (Mostafa, 2005). Another study showed the relationship between healthcare providers' communication skills and patient satisfaction (Boissy et al., 2016).

A study in Canada examined the relationship between hospital health information technology and patient satisfaction. The study showed that full implementation of health information technology in hospitals can lead to significant improvement in patient satisfaction (Roham et al., 2012).

Materla et al., (2019) used the Kano model-based questionnaire over 138 patients to identify diverse patient needs and aims to eliminate the gaps identified in prior research. Singh & Prasher, (2019) integrated fuzzy set theory into SERVQUAL, and AHP to measure the service quality of four hospitals in India and ranked them based on patients' perspectives. Sinha et al., (2013) combined SERVQUAL and QFD to identify the success factors to improve the quality of the healthcare industry. They found that better behavior and attitude of staff results in a higher quality of the hospital. They also find a strong relationship between the behavior and attitude of staff and having enough modern technology.

To the best of the authors' knowledge, there is not any study that applies AHP, QFD, and the Kano model to identify patients' needs and provide solutions considering information technology to meet their expectations. Therefore, in this paper, the researchers addressed this issue.

Kano model

In 1984, Professor Noriaki Kano et al. introduced the Kano customer satisfaction model, distinguishing between three types of product needs affecting customer satisfaction in diverse ways. The Kano model divides each product's quality needs and characteristics into three

categories, each representing a specific customer need to be expected to exist in the product. These three types of requirements are:

Basic requirements: The first category of qualitative characteristics are the basic needs that exist implicitly. In other words, they are compliant with standards, i.e., minimums, which prevent customer dissatisfaction. In the other words, customer dissatisfaction will be high if they are absent or perform poorly (Materla, Cudney, & Antony, 2019).

Functional requirements: The second category of quality characteristics are the functional needs of the product/service. The customer clearly expresses these needs, and their fulfillment leads to satisfaction, and their failure leads to dissatisfaction. For example, a car's warranty and reasonable price fall into the functional requirements (Paraschivescu & COTÎRLEȚ, 2012; Sauerwein et al., 1996).

Motivational requirements: These needs are product features that significantly impact how a customer is satisfied after receiving the product. These needs are never explicitly stated by the customer or expected. Fully meeting these needs will further enhance customer satisfaction. If the customer does not receive them, they will not feel dissatisfied. Observing these features makes the company a market leader (Azizi & Aikhuele, 2015). The Kano model is shown in Figure 1.

The Kano questionnaire is a tool for categorizing customer requirements in the Kano model, and the items in this questionnaire are designed as two-dimensional items for each feature. Kano uses a simple method of positive and negative items to understand and identify customers' quality needs. The first item (positive aspect) is a person's reaction to a feature in a product or service. The second item (negative aspect) also indicates the person's response to not considering the same feature in the product or service (Sauerwein et al., 1996; Witell et al., 2013). The product or service features can be classified by collecting two-item answers in the evaluation table. Table 1 shows how customer needs are assessed and ranked based on this questionnaire.

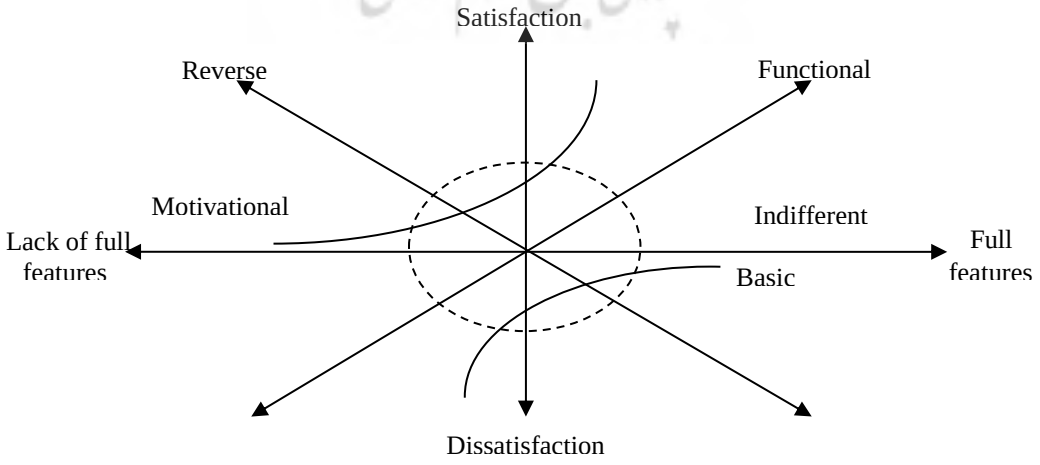

Figure 1. Kano model

Analytic Hierarchy Process method

Analytic hierarchy process (AHP) presented by (Saaty, 1988), is a multiple-criteria decision-making method and one of the most extensively used and powerful methods to solve complex decision problems. AHP is a very significant approach to MCDM (Solangi et al., 2019). In the AHP method, the pairwise comparison is operated in a matrix used to evaluate and prioritize the basic needs of patients. The AHP process can be elaborated as follow:

Table 1. Needs' logic classification

Needs		Undesirable				
		I like this feature	This feature is basic	It is indifferent to me	I can handle it	It can be removed
Desirable	I like this feature	Q	M	M	M	F
	This feature is basic	B	I	I	I	R
	It is indifferent to me	B	I	I	I	R
	I can handle it	B	I	I	I	R
	It can be removed	Q	R	R	R	R
Q: Questionable, B: Basic, I: Indifferent, M: Motivational, R: Reverse, F: Functional						

The experts' consolidated opinions are taken in terms of pairwise comparisons of the selected needs. The pairwise comparisons are done using Likert's five-point scale (1, 2, 3, 4, and 5 points in the scale represent Equally-, Moderately-, Strongly-, Very strongly-, and Extremely-important). The AHP method allows some small inconsistencies in opinions because humans' opinions are not always consistent. The ratio scales are derived from the principal Eigenvectors and the consistency index is derived from the principal Eigenvalue. We construct a pairwise comparison matrix using Likert's five-point scale. Considering n needs, the pairwise comparison of need i with need j yields a square matrix A where a_{ij} denotes the comparative importance of need i with respect to need for j. In the matrix, $a_{ij} = 1$, when $i = j$ and $a_{ji} = 1/a_{ij}$.

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix} \quad (1)$$

For this case, a group of 50 patients involved in the collecting data process were asked to give their opinions on the relative importance of the needs, and the highest frequency of opinions were considered for evaluation. Their opinion/relative importance grading was used to form the square matrix (A).

We calculate the normalized matrix A_n by summation of each column and then dividing each element by the respective column total, where element C_{ij} is the:

$$\text{Normalized element, } C_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \text{ and } A_n = \begin{bmatrix} c_{11} & \cdots & c_{1n} \\ \vdots & \ddots & \vdots \\ c_{n1} & \cdots & c_{nn} \end{bmatrix} \quad (2)$$

Next, we calculate the mean of each row to obtain the normalized principal Eigen vector i.e., $\begin{bmatrix} \frac{1}{n}\sum^{C_1 j} \\ \vdots \\ \frac{1}{n}\sum^{C_1 n} \end{bmatrix}$ or $j = 1,2,\ldots,n$. Here, several iterations are done by squaring the normalized matrix till the difference in principal Eigenvectors in previous and iterated matrix becomes almost zero or negative. This final iterated matrix gives the principal Eigenvector (or priority vector), which is the weight of each need. The principal Eigenvalue of the matrix A must be calculated, and it is called λ_{max}. It is calculated by multiplying the column sums of matrix A with the principal Eigen:

$$\text{vector (e) i.e., } \lambda_{max} = \left[\sum_{i=1}^{n} a_{i1} \ldots \sum_{i=1}^{n} a_{in}\right] \times \begin{bmatrix} e_1 \\ \vdots \\ e_n \end{bmatrix} \quad (3)$$

Quality function deployment model

The QFD model falls into the category of quality management models and proposes a linear and structured strategy to return customer needs to the features of new products or services. The model involves the development of four matrices or the so-called House of Quality (HoQ) (Bevilacqua et al., 2006; Ramírez et al., 2017).

The measurable objectives of applying the QFD model can be summarized as follows: lower cost design, elimination of frequent technical changes, preliminary identification of critical production locations, determination of processes ahead for production, significant reduction of product development time, more efficient resource allocation, adjustment of design quality and planned quality, analysis of market quality information, reduction of development costs, and increased market share (Han et al., 2001; Mohanraj et al., 2011; Vinodh & Rathod, 2010).

The HoQ has helpful content that can be the endpoint of many QFD projects if accurately prepared and adjusted while providing valuable information about the product or service. Straightforwardly and tangibly, the HoQ can be considered as a matrix of customer needs (WHATs) and technical or engineering specifications (HOWs) (Wang & Chin, 2011). Each HoQ has six sections: customer requirements, planning matrix, technical requirements (HoQ's roof), relationship matrix, balanced matrix, and targets.

This study identified 18 needs to measure hospital service quality indicators based on experts' opinions. These needs are shown in Figure 2

Methodology

This is a descriptive survey. In this regard, based on the experts' opinions and related works, a total of 18 key performance indicators (KPIs) were identified and determined to evaluate the quality KPIs of hospital services. These components were determined based on similar studies and interviews with academic and hospital experts. The components list is shown in Figure 2. In this study, to identify the basic, functional, and motivational needs, the Kano model was used, in which, 18 KPIs were presented once as desirable and once as unfavorable, resulting in a questionnaire containing 36 questions. After the Kano model and KPIs classification (7 needs), which are a crucial factor in gaining a competitive advantage for companies and organizations, their relative importance was determined using the AHP technique. These needs were then considered as input to the QFD model. Finally, after analyzing the QFD model due to the organization's limitations in solving all of them, the Pareto model was used to solve 20% of the organization's problems, creating 80% satisfaction, which was calculated using Minitab software.

The framework for conducting the present study is shown in Figure 3. In the first step, KPIs (needs) related to the quality of hospital services were identified. In the second step, using the Kano model, the identified needs were divided into three categories: Basic, functional, and motivational needs. In the third step, using the AHP technique, the significance of the basic needs categorized in the previous step was calculated. In the fourth step, the basic needs were considered as the input of the QFD model, the solutions to meet the required needs were identified using experts' opinions and the final weight of each solution was calculated. Since the organization's resources are limited and there are many ways to meet these needs, the Pareto technique was used to meet 20% of the needs and obtain 80% satisfaction. The statistical population of the study included all patients of the Hospital and Medical Center. To determine the statistical sample, since difficult access to patients, a limited number of 50 patients were randomly selected to collect the required data.

The data required for this study were collected for the Kano model using a questionnaire. The questionnaire included 6 dimensions and 35 items related to service quality. Since the questionnaire was identified based on the quality of the services and provided from the experts' perspective, and the final version of the questionnaire was approved by several experts, the content validity was confirmed. Frequency of data collected is shown in TABLE 2. Confirmatory factor analysis was used to evaluate the construct validity of the research variables measurement tool. The results confirmed the construct validity of the model for measuring the quality of patient relationship management services. Furthermore, Cronbach's alpha method was used to calculate the reliability. Using SPSS software, the reliability of this questionnaire was estimated to be 0.902. It is worth noting that since the Cronbach's alpha was greater than 70 %, the reliability of the distributed questionnaire was approved.

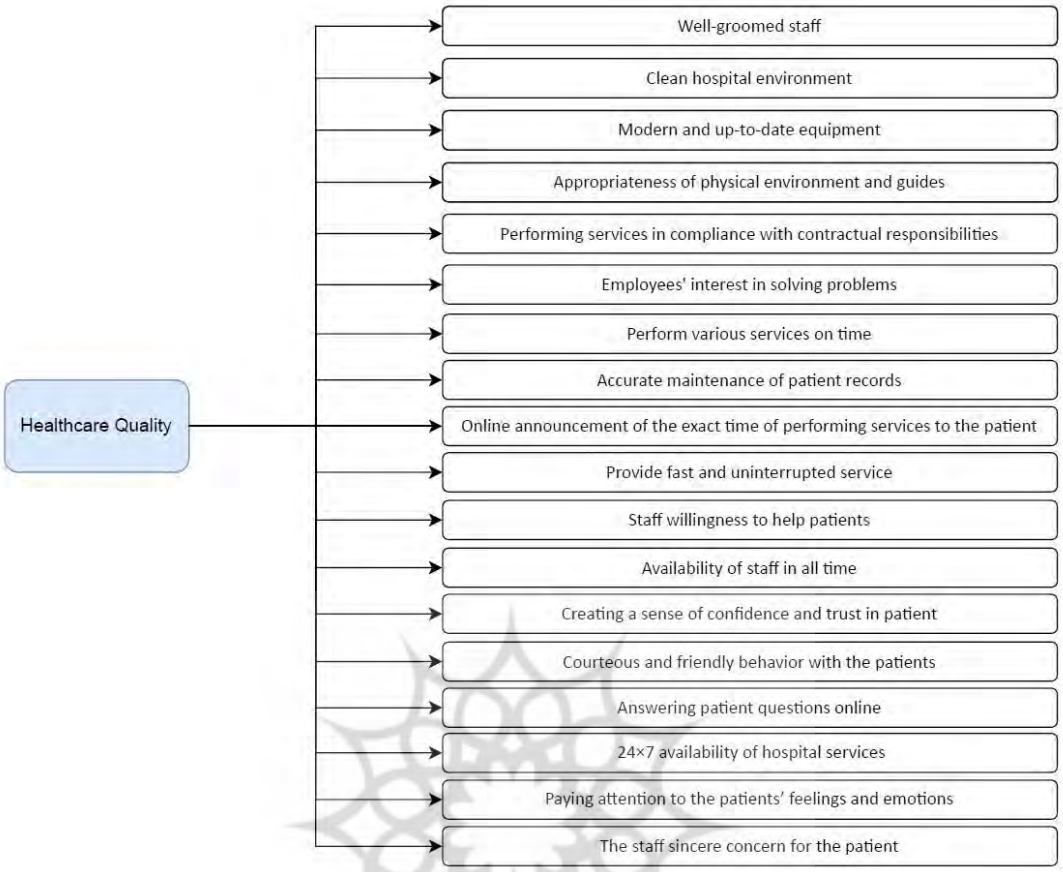

Figure 2. Healthcare quality criteria

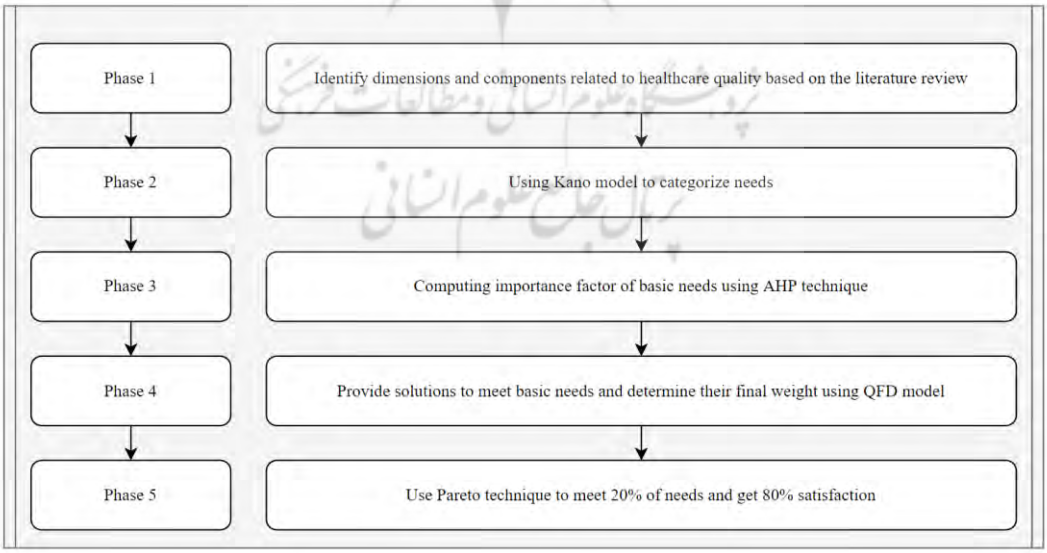

Figure 3. General Research framework

Results and Discussion

The collected data were first analyzed based on the Kano model using Excel software, for which the weighted mean frequency method was used. In this method, the frequency of three basic, functional, and motivational needs was computed. In this method, the basic needs got degree 1, functional needs recived degree 2, and degree 3 went to the motivational needs. Then the weighted average of each need was calculated based on Equation 2.

$$\text{Score} = [(1 \times n_1) + (2 \times n_2) + (3 \times n_3)] \div N \quad (4)$$

n1: Number of required answers

n2: Number of one-dimensional answers

n3: Number of motivational answers

N: Total number of answers

Table 2. Frequency of data collected

Code	Needs	B	F	M	I	R	Q	Sum
N1	Well-groomed staff	13	9	9	15	2	2	50
N2	Clean hospital environment	12	13	9	16	0	0	50
N3	Modern and up-to-date equipment	10	8	11	5	9	7	50
N4	Appropriateness of physical environment and guides	10	12	10	15	1	2	50
N5	Performing services in compliance with contractual responsibilities	11	12	12	5	5	5	50
N6	Employees 'interest in solving problems	12	10	9	15	3	1	50
N7	Perform various services on time	13	14	7	13	1	2	50
N8	Accurate maintenance of patient records	13	9	8	11	5	4	50
N9	Online announcement of the exact time of performing services to the patient	12	11	16	7	2	2	50
N10	Provide fast and uninterrupted service	13	11	10	14	1	1	50
N11	Staff willingness to help patients	15	13	9	11	1	1	50
N12	Availability of staff in all time	12	13	10	12	0	1	50
N13	Creating a sense of confidence and trust in patient	13	9	11	14	1	2	50
N14	Courteous and friendly behavior with the patients	12	10	14	10	2	2	50
N15	Answering patient questions online	14	14	11	11	0	0	50
N16	24×7 availability of hospital services	12	15	13	9	0	1	50
N17	Paying attention to the patients' feelings and emotions	18	13	9	10	0	0	50
N18	The staff sincere concern for the patient	17	11	11	7	2	2	50

As mentioned earlier, the alphabet B indicates basic needs, alphabet F indicates functional needs, and M indicates motivational needs. The alphabet I (Indifferent) stands for times when the customer is almost discouraged by the presence or absence of a need in the product. Q (Questionable) indicates when the customer did not understand the question, or the information was incomplete. R (Reverse) occurs when the observance of a feature is

expressed in a desirable way and its non-observance is expressed in an undesirable way. Table 3 shows the weighted average of needs identified.

Table 3. Weighted average of needs

Need	Frequency of basic answers (B)	Frequency of functional answers (F)	Frequency of motivational answers (M)	Weighted average
N9	12	11	16	1.64
N16	12	15	13	1.62
N15	14	14	11	1.5
N14	12	10	14	1.48
N18	17	11	11	1.44
N17	18	13	9	1.42
N5	11	12	12	1.42
N11	15	13	9	1.36
N12	12	13	10	1.36
N2	12	13	9	1.3
N10	13	11	10	1.3
N4	10	12	10	1.28
N13	13	9	11	1.28
N7	13	14	7	1.24
N3	10	8	11	1.18
N6	12	10	9	1.18
N1	13	9	9	1.16
N8	13	9	8	1.1

Figure 4. shows the categorized needs. The classification of needs, in this figure, was done based on the following logic: Needs that gained more than 1.4 were considered as the basic needs. Needs that scored between 1.2 and 1.4 were identified as the functional ones. Needs that scored less than 1.2 were regared as the motivational needs. Based on the results of Figure 4 the basic needs include:

- Online announcement of the exact time of performing services to the patient,
- 24×7 availability of hospital services,
- Answering patient questions online,
- Courteous and friendly behavior with the patients,
- The staff sincere concern for the patient,
- Paying attention to the patients' feelings and emotions,
- Performing services in compliance with contractual responsibilities.

These needs were the primary concern of patients. Interestingly, given the prevalence of the coronavirus, answering patient questions online was considered a basic need.

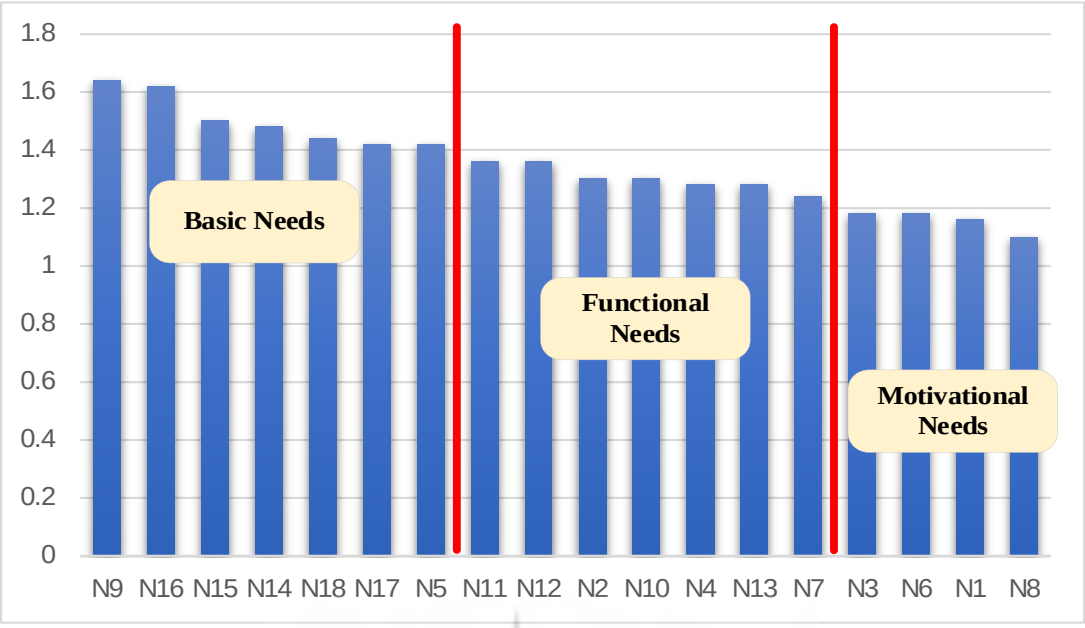

Figure 4. Needs classification based on Kano model

By identifying the basic needs, the relative importance of these needs to enter the QFD model was calculated based on the AHP technique using Expert Choice software. The significance coefficient of these needs is shown in Figure 5. AHP is a prime approach as it enhances decision-making learning using the consistency measure (Olson, 1988). AHP method is an approach of MCDM, which analyzes the problem displayed in different levels of hierarchy. This technique has the strength to determine quantitative and qualitative factors using a pairwise comparison matrix (Solangi et al., 2021). After weighing and determining the importance of basic needs using the AHP method, solutions to improve and meet these needs were provided using experts' opinions and literature review. These solutions are as follows:

- Creating team spirit and using health information technology in the hospital (S1)
- Identifying problems and improving service quality (S2)
- Planning for online training courses (S3)
- Increasing the level of efficiency and effectiveness of services (S4)
- Using IT equipment (S5)
- Hiring skilled personnel (S6)
- Establishment of the outpatient clinic (S7)
- Holding ethics training courses online (S8)

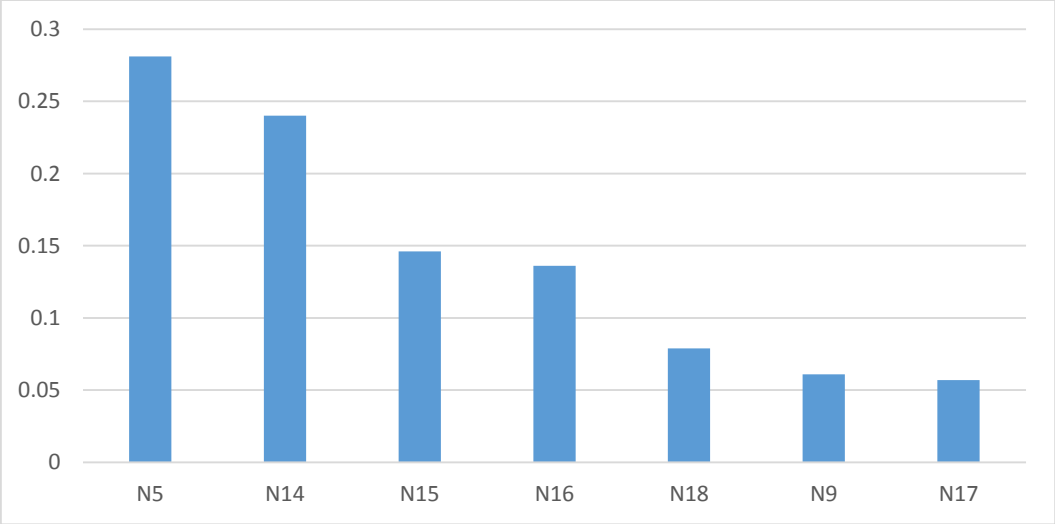

Figure 5. Relative importance of basic needs

Table 4. Results of QFD model

		Technical requirements of each solution (How)								AHP weight
		S1	S2	S3	S4	S5	S6	S7	S8	
Customer needs (What)	N9	1	3	9		3	9		9	0.061
	N16	9	9	9	9	9		9	3	0.136
	N15	9	3	9	3	1		1	1	0.146
	N14	3				3			9	0.240
	N18	9				3			9	0.079
	N17					3			9	0.057
	N5	9	9	9	9	9			9	0.281
W		6.559	4.374	5.616	4.191	5.21	0.549	1.37	7.016	34.89
w		0.188	0.125	0.161	0.12	0.149	0.016	0.039	0.201	1
Relations: Strong: 9 – Moderate: 3 and Weak: 1										

The QFD model can be drawn and analyzed in several ways. In this research, only the quality house matrix is created by QFD 2000 software, and its analysis is summarized in Table 4. As can be seen in Table 4, customer demands are the same as the basic needs of the Kano model; but the technical requirements are how to meet the 7 needs requested by the customer. Because the organization's resources are limited and the ways to meet these needs are numerous, the Pareto technique has been used. Pareto law considers 80% of disabilities to be due to 20% of causes. According to this principle, paying attention to this 20% can have the greatest impact or improvement in 80% of the satisfaction. In this regard, this step was done using Minitab software and the results are shown in Figure 6.

The results of the Figure 6 show that the hospital can achieve the highest satisfaction with the least action by implementing the 8th and 1st solutions (Holding ethics training courses online and Creating team spirit and using health information technology in the hospital).

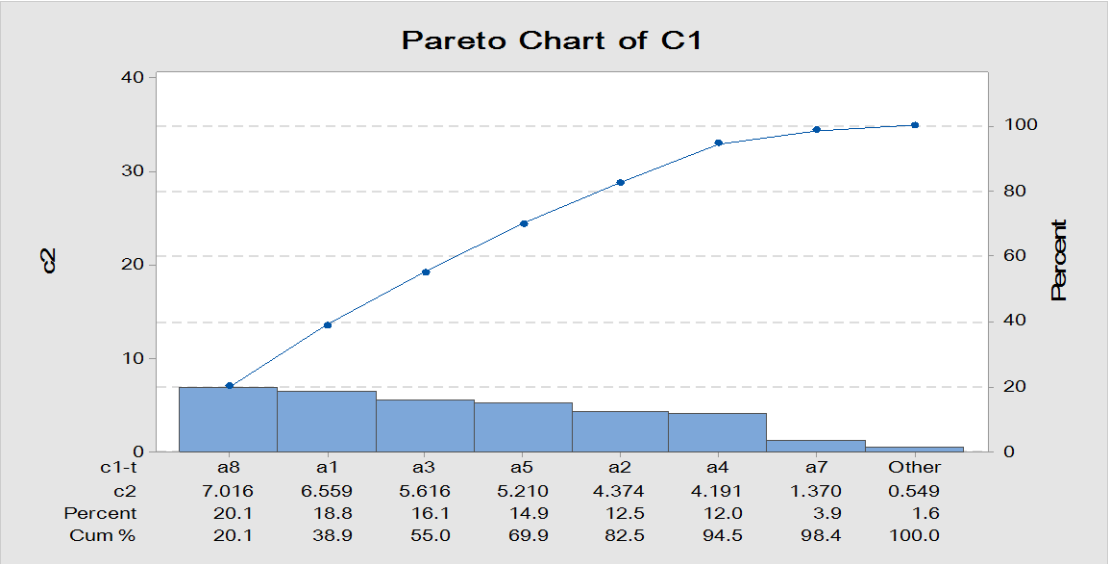

Figure 6. Pareto results related to proposed solutions

Conclusion

The hospitals' role as one of the most important service providers for people who seek healthcare and medical services is very prominent (Hussain et al., 2019). Hospitals should consider their service quality to overcome patients' needs and boost patients' satisfaction; since their satisfaction is tied to service quality (Zaman et al., 2021). The continuous revolutionary effect of information technology on services has changed the importance of these needs. Therefore, hospitals should take specific actions to improve their performance and provide high-quality services considering the effect of health information technology on their outcomes (Pai et al., 2022) and the intensity of competition among them.

According to the purpose of the research and to present a novel approach in service quality studies, Kano, AHP, QFD, and Pareto techniques were used in combination. The method used in this research can offer the hospitals' administrations better insights to improve their services. In the first step, the most important and vital needs (basic needs) were identified using the Kano model, which are as follows: online announcement of the exact time of performing services to the patient, 24×7 availability of hospital services, answering patient questions online, courteous and friendly behavior with the patients, the staff sincere concern for the patient, paying attention to the patients' feelings and emotions, and performing services in compliance with contractual responsibilities. The importance of indicators in the model was weighted based on the AHP method. As part of this step, experts presented solutions (strategies) to meet these needs.

These solutions were ranked using QFD 2000 software. Since hospitals are not able to meet all these needs, the Pareto technique was used to create 80% satisfaction by satisfying 20% of the leading solutions. Finally, the strategies of "holding ethics training courses online"

and “creating team spirit and using health information technology in the hospital” were selected. The obtained results of the current study were previously approved by other pieces of research such as the studies conduted by Camgöz-Akdağ, H., Tarım, M., Lonial, S. and Yatkın in 2013, the one by Meesala & Paul in 2018, and that of Roham et al. in 2012. For instance, Camgöz-Akdağ et al., (2013) concluded that employee conduct and attitude have the greatest effect on hospitals’ performance which improves their quality by about 25 percent. Holding online ethics training courses for staff members, especially during the pandemic when remote working was popular among employees, improved their attitude and behavior toward the patients. Roham et al., (2012) found that the complete deployment of health information technology in hospitals enhances patient satisfaction i.e. it can improve the quality of hospital services. Reliability and responsiveness, which are pertinent to creating team spirit and using health information technology in the hospital, can enhance patient satisfaction (Meesala & Paul, 2018).

Despite all contributions mentioned in this work, some suggestions for future research are presented below:

Given the limited access to patients, according to which a limited number of 50 patients were selected as a statistical sample, it is suggested that future researchers increase the volume of the statistical sample to achieve more comprehensive results.

Since the house of quality was divided into 6 main parts and the driving force of the whole QFD process is patients' needs, and due to the increasing needs, it is recommended that the needs be grouped by statistical techniques such as factor analysis and cluster analysis and then the finalized groups enter the quality house matrix. This will make the research results more complete. Given that the Kano model only shows the importance of needs, it is suggested that in future research, the desired results be achieved using the importance-performance matrix.

Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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References

Adel, A., Abbas, R. P., & Navid, J. (2011). *Evaluate Service Quality In Public Sector For Fuzzy Data* (Vol. 10, Issue 240, pp. 13–38). *Journal of Executive Management*. https://www.sid.ir/en/Journal/ViewPaper.aspx?ID=196533

Aghamolaei, T., Eftekhaari, T. E., Rafati, S., Kahnouji, K., Ahangari, S., Shahrzad, M. E., Kahnouji, A., & Hoseini, S. H. (2014). Service quality assessment of a referral hospital in Southern Iran with SERVQUAL technique: Patients' perspective. *BMC Health Services Research*, *14*(1), 1–5. https://doi.org/10.1186/1472-6963-14-322/TABLES/2

Ahmed, Z., Nathaniel, S. P., & Shahbaz, M. (2021). The criticality of information and communication technology and human capital in environmental sustainability: Evidence from Latin American and Caribbean countries. *Journal of Cleaner Production*, *286*, 125529. https://doi.org/10.1016/j.jclepro.2020.125529

Alshubiri, F., Jamil, S. A., & Elheddad, M. (2019). The impact of ICT on financial development: Empirical evidence from the Gulf Cooperation Council countries. *International Journal of Engineering Business Management*, *11*. https://doi.org/10.1177/1847979019870670

Azizi, A., & Aikhuele, D. O. (2015). *An integrated model of Kano and quality function deployment for evaluation of lean production tools in assembly environment*. 1–6. https://doi.org/10.1109/ieom.2015.7228097

Bedane, B. I., & Mohammed, M. A. (2021). *Contemporary Quality Management Approach*. *21*(1). https://www.engineeringresearch.org/index.php/GJRE/article/view/2158

Bevilacqua, M., Ciarapica, F. E., & Giacchetta, G. (2006). A fuzzy-QFD approach to supplier selection. *Journal of Purchasing and Supply Management*, *12*(1), 14–27. https://doi.org/10.1016/j.pursup.2006.02.001

Boissy, A., Windover, A. K., Bokar, D., Karafa, M., Neuendorf, K., Frankel, R. M., Merlino, J., & Rothberg, M. B. (2016). Communication Skills Training for Physicians Improves Patient Satisfaction. *Journal of General Internal Medicine*, *31*(7), 755–761. https://doi.org/10.1007/S11606-016-3597-2/TABLES/4

Büyüközkan, G., Çifçi, G., & Güleryüz, S. (2011). Strategic analysis of healthcare service quality using fuzzy AHP methodology. *Expert Systems with Applications*, *38*(8), 9407–9424. https://doi.org/10.1016/j.eswa.2011.01.103

Camgöz-Akdağ, H., Tarım, M., Lonial, S. and Yatkın, A. (2013). QFD application using SERVQUAL for private hospitals: a case study. *Leadership in Health Services*, *26*(3), 175–183. https://doi.org/10.1108/LHS-02-2013-0007

Doshmangir, L., Bazyar, M., Majdzadeh, R., & Takian, A. (2019). So Near, So Far: Four Decades of Health Policy Reforms in Iran, Achievements and Challenges. In *Archives of Iranian medicine* (Vol. 22, Issue 10, pp. 592–605). www.aimjournal.ir

Elhazzam, M. (2015). The Effect of ICT on Human Resources Management Practices Case of Number of Organizations in Southwest Algeria (Bechar City). *The Effect of ICT on Human Resources Management Practices Case of Number of Organizations in Southwest Algeria (Bechar City)*, *2*(3), 35–38.

Fakhri, M. K., & Aslipoor, A. (2015). The Burnout on Nurses in ICU, Emergency and Surgery at Teaching Hospital Mazandaran University of Medical Sciences and Relationship with Perceived Stress. *Tolooebehdasht*, *14*(1), 138–150.

Haines, S. T., Kliethermes, M. A., & Sorensen, T. D. (2017). The Patient Care Process. In J. T. DiPiro, R. L. Talbert, G. C. Yee, G. R. Matzke, B. G. Wells, & L. M. Posey (Eds.), *Pharmacotherapy:*

A Pathophysiologic Approach, 10e. McGraw-Hill Education. http://accesspharmacy.mhmedical.com/content.aspx?aid=1148276498

Han, S. B., Chen, S. K., Ebrahimpour, M., & Sodhi, M. S. (2001). A conceptual QFD planning model. *International Journal of Quality and Reliability Management*, *18*(8), 796–812. https://doi.org/10.1108/02656710110401187

Hussain, A., Sial, M. S., Usman, S. M., Hwang, J., Jiang, Y., & Shafiq, A. (2019). What Factors Affect Patient Satisfaction in Public Sector Hospitals: Evidence from an Emerging Economy. *International Journal of Environmental Research and Public Health 2019, Vol. 16, Page 994*, *16*(6), 994. https://doi.org/10.3390/IJERPH16060994

Kasim, R., Umar, M. A., & Juanil, D. M. D. (2018). Service Quality versus Service Excellence: A Paradigm Shift. *Advanced Science Letters*, *24*(6), 4679–4683. https://doi.org/10.1166/asl.2018.11680

Kim-Soon, N., Rahman, A., & Visvalingam, L. (2014). SERVQUAL: Can it be used to differentiate guest's perception of service quality of 3 star from a 4 star hotel. *International Business Research*, *7*(7), 37–47. https://doi.org/10.5539/ibr.v7n7p37

Koleini Mamaghani, N., & Barzin, E. (2019). Application of Quality Function Deployment (QFD) to improve product design quality in school furniture. *Int. J. Architect. Eng. Urban Plan*, *29*(2), 277–287. https://doi.org/10.22068/ijaup.29.2.277

Kumar, R., & Palmieri, M. J. (2010). Points to consider when establishing drug product specifications for parenteral microspheres. In *AAPS Journal* (Vol. 12, Issue 1, pp. 27–32). Springer. https://doi.org/10.1208/s12248-009-9156-6

Lam, S. S. K. (1997). SERVQUAL: A tool for measuring patients' opinions of hospital service quality in Hong Kong. *Total Quality Management*, *8*(4), 145–152. https://doi.org/10.1080/0954412979587

Lin, H. C., Xirasagar, S., & Laditka, J. N. (2004). Patient perceptions of service quality in group versus solo practice clinics. *International Journal for Quality in Health Care*, *16*(6), 437–445. https://doi.org/10.1093/intqhc/mzh072

Madu, C. N., & Madu, A. A. (2002). Dimensions of e-quality. *International Journal of Quality and Reliability Management*, *19*(3), 246–258. https://doi.org/10.1108/02656710210415668/FULL/XML

Materla, T., Cudney, E. A., & Antony, J. (2019). The application of Kano model in the healthcare industry: a systematic literature review. In *Total Quality Management and Business Excellence* (Vol. 30, Issues 5–6, pp. 660–681). Routledge. https://doi.org/10.1080/14783363.2017.1328980

Materla, T., Cudney, E. A., & Hopen, D. (2019). Evaluating factors affecting patient satisfaction using the Kano model. *International Journal of Health Care Quality Assurance*, *32*(1), 137–151. https://doi.org/10.1108/IJHCQA-02-2018-0056/FULL/XML

Meesala, A., & Paul, J. (2018). Service quality, consumer satisfaction and loyalty in hospitals: Thinking for the future. *Journal of Retailing and Consumer Services*, *40*, 261–269. https://doi.org/10.1016/j.jretconser.2016.10.011

Meskarpour-Amiri, M., Bahadori, M., Rahmati, F., Ravangard, R., & Yaghoubi, M. (2021). Designing a model for patient relationship management in the general hospitals using the combination of analytic hierarchy process and interpretive structural modeling. *Journal of Education and Health Promotion*, *10*(1). https://doi.org/10.4103/JEHP.JEHP_1040_20

Mohammadnia, M., Delgoshaei, B., Tofighi, S. H., Riahi, L., & Omrani, A. (2010). Survey on nursing service quality by SERVQUAL at Tehran social security organization hospitals. *Journal of*

Hospital, *8*(3), 68–73.

Mohanraj, R., Sakthivel, M., & Vinodh, S. (2011). QFD integrated value stream mapping: An enabler of lean manufacturing. *International Journal of Productivity and Quality Management*, *7*(4), 501–522. https://doi.org/10.1504/IJPQM.2011.040546

Mostafa, M. M. (2005). An empirical study of patients' expectations and satisfactions in Egyptian hospitals. *International Journal of Health Care Quality Assurance*, *18*(7), 516–532. https://doi.org/10.1108/09526860510627201

Olson, D. L. (1988). Opportunities and limitations of AHP in multiobjective programming. *Mathematical and Computer Modelling*, *11*(C), 206–209. https://doi.org/10.1016/0895-7177(88)90481-5

Ozturkcan, S., Aydin, S., Ates, M., & Tansel Cetin, A. (2009). Effects of Service Quality on Customer Satisfaction and Customer Loyalty: Example of Marmara University Hospital. *SSRN Electronic Journal*. https://doi.org/10.2139/SSRN.1362601

Pai, D. R., Rajan, B., & Chakraborty, S. (2022). Do EHR and HIE deliver on their promise? Analysis of Pennsylvania acute care hospitals. *International Journal of Production Economics*, *245*. https://doi.org/10.1016/j.ijpe.2021.108398

Papanicolas, I., Woskie, L. R., & Jha, A. K. (2018). Health care spending in the United States and other high-income countries. In *JAMA - Journal of the American Medical Association* (Vol. 319, Issue 10, pp. 1024–1039). American Medical Association. https://doi.org/10.1001/jama.2018.1150

Paraschivescu, A. O., & COTÎRLEŢ, A. (2012). Kano Model. *Economy Transdisciplinarity Cognition*, *15*(2).

Pezaro, S., & Lilley, L. (2015). Digital voice recorders - A conceptual intervention to facilitate contemporaneous record keeping in midwifery practice. In *Women and Birth* (Vol. 28, Issue 4, pp. e171–e176). Elsevier. https://doi.org/10.1016/j.wombi.2015.04.008

Poku, M. K., Behkami, N. A., & Bates, D. W. (2017). Patient Relationship Management: What the U.S. Healthcare System Can Learn from Other Industries. *Journal of General Internal Medicine*, *32*(1), 101–104. https://doi.org/10.1007/s11606-016-3836-6

Purcărea, V. L., Gheorghe, I. R., & Petrescu, C. M. (2013). The Assessment of Perceived Service Quality of Public Health Care Services in Romania Using the SERVQUAL Scale. *Procedia Economics and Finance*, *6*, 573–585. https://doi.org/10.1016/s2212-5671(13)00175-5

Ramírez, Y., Cisternas, L. A., & Kraslawski, A. (2017). Application of House of Quality in assessment of seawater pretreatment technologies. *Journal of Cleaner Production*, *148*, 223–232. https://doi.org/10.1016/j.jclepro.2017.01.163

Roham, M., Gabrielyan, A. R., & Archer, N. P. (2012). Predicting the impact of hospital health information technology adoption on patient satisfaction. *Artificial Intelligence in Medicine*, *56*(2), 123–135. https://doi.org/10.1016/j.artmed.2012.08.001

Saaty, T. L. (1988). What is the Analytic Hierarchy Process? In *Mathematical Models for Decision Support* (pp. 109–121). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-83555-1_5

Sadeghi, M., Rahimi, M., Poornoroz, N., & Jahromi, F. F. (2021). *Patient satisfaction with hospital services after the implementation of the health system*. *12*(1), 31–36.

Sauerwein, E., Bailom, F., Matzler, K., & Hinterhuber, H. H. (1996). The Kano model: How to delight your customers. *International Working Seminar on Production Economics*, *1*(4), 313–327.

Shahzad, A., Hassan, R., Abdullah, N. I., Hussain, A., & Fareed, M. (2020). Covid-19 Impact on E-Commerce Usage: an Empirical Evidence From Malaysian Healthcare Industry. *Humanities & Social Sciences Reviews*, *8*(3), 599–609. https://doi.org/10.18510/hssr.2020.8364

Sharma, B., & Gadenne, D. (2001). An investigation of the perceived importance and effectiveness of quality management approaches. *TQM Magazine*, *13*(6), 433–443. https://doi.org/10.1108/EUM0000000006180

Sihombing, G. L. A., Situmeang, L. M., & Sormin, R. M. B. (2020). Information Technology In A New Normal Era. *Proceeding of International Conference of Education in the New Normal Era*, *1*(1), 45–50. https://doi.org/10.31098/iceiakn.v1i1.238

Singh, A., & Prasher, A. (2019). Measuring healthcare service quality from patients' perspective: using Fuzzy AHP application. *Total Quality Management and Business Excellence*, *30*(3–4), 284–300. https://doi.org/10.1080/14783363.2017.1302794

Sinha, M., Camgöz-Akdağ, H., Tarım, M., Lonial, S., & Yatkın, A. (2013). QFD application using SERVQUAL for private hospitals: a case study. *Leadership in Health Services*, *26*(3), 175–183. https://doi.org/10.1108/LHS-02-2013-0007

Solangi, Y. A., Longsheng, C., & Shah, S. A. A. (2021). Assessing and overcoming the renewable energy barriers for sustainable development in Pakistan: An integrated AHP and fuzzy TOPSIS approach. *Renewable Energy*, *173*, 209–222. https://doi.org/10.1016/j.renene.2021.03.141

Solangi, Y. A., Shah, S. A. A., Zameer, H., Ikram, M., & Saracoglu, B. O. (2019). Assessing the solar PV power project site selection in Pakistan: based on AHP-fuzzy VIKOR approach. *Environmental Science and Pollution Research*, *26*(29), 30286–30302. https://doi.org/10.1007/s11356-019-06172-0

Stefano, N. M., Casarotto Filho, N., Barichello, R., & Sohn, A. P. (2015). A fuzzy SERVQUAL based method for evaluated of service quality in the hotel industry. *Procedia CIRP*, *30*, 433–438. https://doi.org/10.1016/j.procir.2015.02.140

Suleiman Awwad, M., & Mohammad Agti, D. A. (2011). The impact of internal marketing on commercial banks' market orientation. *International Journal of Bank Marketing*, *29*(4), 308–332. https://doi.org/10.1108/02652321111145943

Vinodh, S., & Rathod, G. (2010). Application of QFD for enabling environmentally conscious design in an Indian rotary switch manufacturing organisation. *International Journal of Sustainable Engineering*, *3*(2), 95–105. https://doi.org/10.1080/19397030903494837

Wang, Y. M., & Chin, K. S. (2011). Technical importance ratings in fuzzy QFD by integrating fuzzy normalization and fuzzy weighted average. *Computers and Mathematics with Applications*, *62*(11), 4207–4221. https://doi.org/10.1016/j.camwa.2011.10.005

Witell, L., Löfgren, M., & Dahlgaard, J. J. (2013). Theory of attractive quality and the Kano methodology - the past, the present, and the future. *Total Quality Management and Business Excellence*, *24*(11–12), 1241–1252. https://doi.org/10.1080/14783363.2013.791117

Xiang, S., Rasool, S., Hang, Y., Javid, K., Javed, T., & Artene, A. E. (2021). The Effect of COVID-19 Pandemic on Service Sector Sustainability and Growth. In *Frontiers in Psychology* 12. Frontiers Media SA. https://doi.org/10.3389/fpsyg.2021.633597

Zaim, H., Bayyurt, N., & Zaim, S. (2010). Service Quality And Determinants Of Customer Satisfaction In Hospitals: Turkish Experience. *International Business & Economics Research Journal (IBER)*, *9*(5), 51. https://doi.org/10.19030/IBER.V9I5.8145

Zaman, N., Goldberg, D. M., Abrahams, A. S., & Essig, R. A. (2021). Facebook Hospital Reviews: Automated Service Quality Detection and Relationships with Patient Satisfaction. *Decision*

Sciences, *52*(6), 1403–1431. https://doi.org/10.1111/DECI.12479

Zarei, A., Arab, M., Froushani, A. R., Rashidian, A., & Tabatabaei, S. M. G. (2012). Service quality of private hospitals: The Iranian Patients' perspective. *BMC Health Services Research*, *12*(1), 1–7. https://doi.org/10.1186/1472-6963-12-31/TABLES/2

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