

ASSESSMENT THE LEVEL OF THE HEALTH SERVICE QUALITY IN HEALTHCARE CENTER BY INTEGRATION THE SERVQUAL MODEL STEPWISE WEIGHT ASSESSMENT RATIO ANALYSIS METHOD – INVESTIGATION STUDY

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Abstract:

Service quality is a critical issue in the healthcare sector due to its vital importance and significant impact on people's lives. Therefore, organizations should continuously improve their service quality to ensure providing an optimal healthcare service as possible. In this study, healthcare service quality assessment methodology was proposed to investigate and assess the level of patient's satisfaction through analysis and measure the gap between the perception service quality and the expectation services quality from patients point view. The proposed methodology integrates Percent Point Score method and Stepwise Weight Assessment Ratio Analysis Method SWARA Method and based six SERVQUAL dimensions namely; Tangible, Responsiveness, Reliability, Assurance, Empathy and, Administrative Procedure with 42 service quality criteria. Questionnaire was developed to capture the perception and the expectation service quality from patients point view was assessed. The perception and the expectation service quality have assessed by Percent Point Score method. SWARA Method was used to identified the weight of significant of each criterion. The proposed methodology was verified in real life at a healthcare center located in Baghdad and opinion of 100 patients have obtained for two months from 1/10/2024 to 1/12/2024. Results showed that waiting time for receiving the medical service (D22) and the booking system (D53) are the weakest service quality criteria that led to patients unsatisfaction, while protecting patients' privacy, criteria (D46) achieved a high level of patient satisfaction (-0.23). The proposed methodology can help the medical center to investigate the level of quality of their various services to focus their resources in the improvement process to improve the weak services to achieve a high level of patients' satisfaction. Various dimensions of quality service can be addressed for future works; in addition, a road map of improvement for the weak dimensions can be proposed to increase patient satisfaction.

Key words: health service quality, gap analysis, percent point score method, Servqual dimensions, SWARA method

INTRODUCTION

Providing a high-quality medical service level for patients is an overarching goal of all healthcare systems in the world [1]. Health care organizations continuously pursue to improve the quality of the delivery service to achieve high patient's satisfaction. Quality can be defined as meeting customers' requirements, at first time and every time with lower cost , in health sector service it can be considered the result of the experience that patient receives at the health organization where, it is based on how the medical staff interact and handle with patients [2]. Service quality is a critical issue in the healthcare sector due to its vital importance and significant impact on people's lives. Currently, the quality of health service has been emphasized as a principal and inherent feature of the health organizations worldwide [3]. Service quality can be defined as the difference between patient

expectations and receive service or it is the gap between what is expected and perceived where it is important to measure it in order to improve healthcare service, to quickly identify shortages, and assess patients satisfaction where, the service quality is considered poor if the perceived service level is lower than patient's expected while if it is higher, it is high [4, 5].

SERVQUAL model was proposed by Zeithaml, Parasuraman and Berry to represent an important measure to assess the health service quality [6, 7]. In common, it involves five service quality dimensions namely; tangibles, reliability, responsiveness, empathy and, assurance, when patients got an appropriate service, the healthcare provided is considered to be reliable. Responsiveness dimension is fulfilled in case of the healthcare staff promptly and politely attends to a patient [8]. Assurance dimension will be rated high if patients feel confidence in the

competence and qualifications of the healthcare staff. Personalized care to patients leads to better experiences relate to empathy. Finally, the physical appearance of the equipment, aspects of cleanliness and facilities provided for disables and elderly in the healthcare facility fall under the tangibles dimension that refer to features that are visually visible [9, 10]. Health service quality can be measured by two methods [11]; Gap analysis and performance measures as shown in Figure 1.

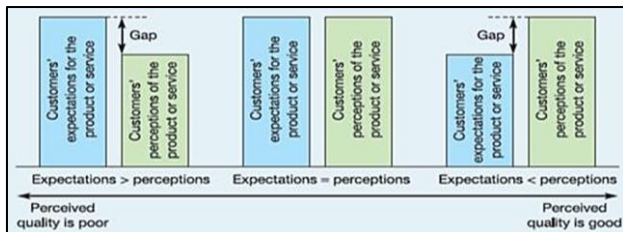


Fig. 1 Level Perceived Quality

Source: [12].

In addition, Multi criteria Decision Making (MCDM) Methods was used as an efficient tool to study the quality of health service. Measuring service quality is degree fit of the service between patient perception and expectations. The patient is satisfied when the precept service (received) is better than expect. Patient may be dissatisfied

If the service quality is low and less than expectations, while the service perceived quality is acceptable if it matches the patient expectations, Figure 2 illustrate the level of perceived quality [12].

This study was proposed a novel assessment methodology that integrate SERVQUAL model/Point Score method/SWARA method to investigate and assess the level of customer satisfaction through addressing Gap 5, which investigating and studying the difference between patient's expectations and their perception of the service received to help manager of the health center identify which service dimension and criteria required more consideration to achieve a high patient's satisfaction. Gap analysis or as commonly known Gap model is one of the best analyses to measure the service quality where, it identifies seven key gaps related to managerial perceptions of the quality of services, and activities associated with the delivery of services to patients. The six first gap (Gap 1, Gap 2 Gap 3 Gap 4 Gap 6 and Gap 7) is identified as a function related how providing of services, while Gap 5 relates to service quality thus, it is considered as the true measure of the quality of service where SERVQUAL model or dimensions is used in analysis and measure Gap5 [7].

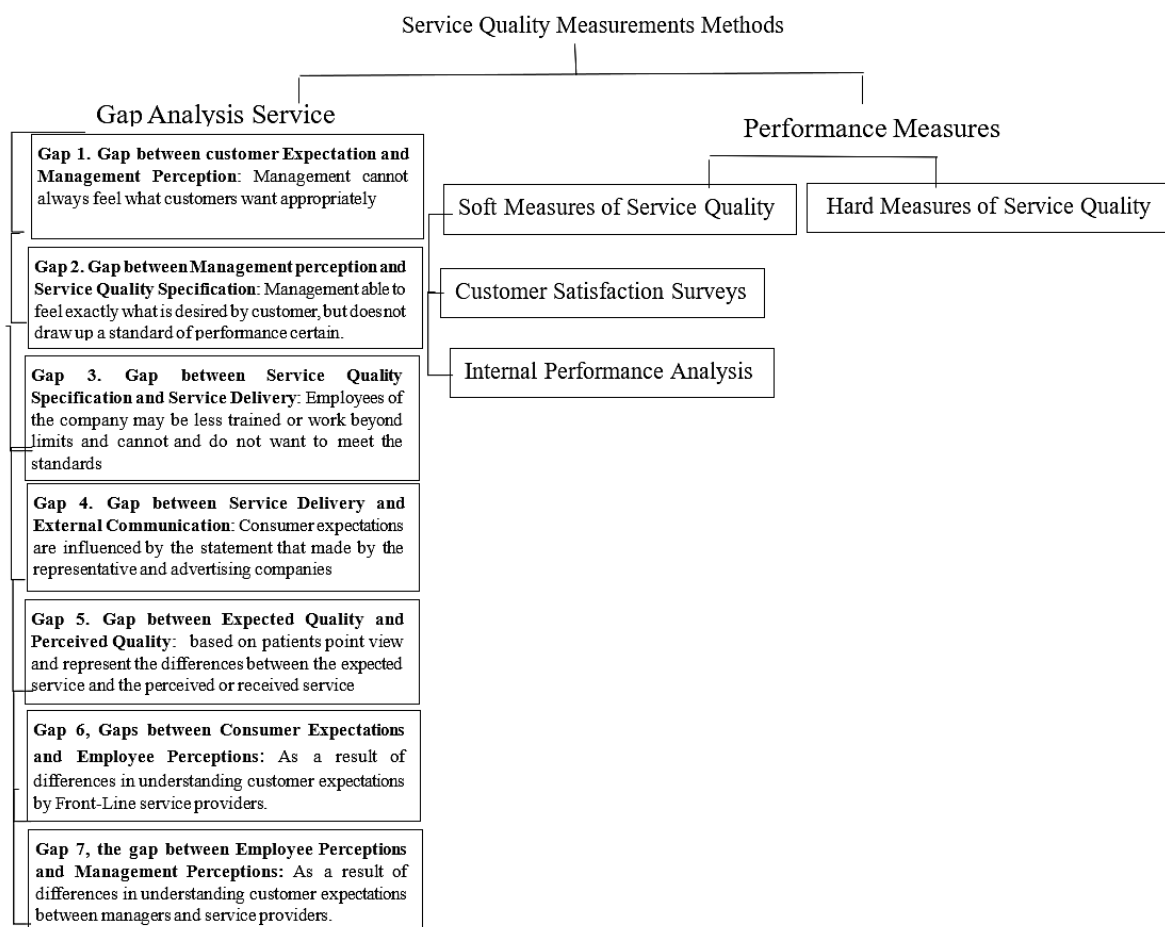


Fig. 2 Service Quality Measurements Methods: Adopted by Authors based Reference

Source: [7, 11].

LITERATURE REVIEW

MCDM techniques like Analytical Hierarchy Process (AHP), Vlsekriterijumska optimizacija I Kompromisno Rešenje (VIKOR) [19], Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) have utilized for designing and developing models that used to assess service quality criteria. T. Lupo (2015) [13] Developed a fuzzy evaluating framework based on the six ServQual dimensions namely; Tangibles, Healthcare staff, Responsiveness, Accessibility, Support services, and Relationships with 32 sub criteria and Analytic Hierarchy Process (AHP) method for evaluating service quality and assessment the service quality expectations in nine public hospitals in Italy in addition identifying the reasons of patient dissatisfaction. E.O. Oyatoye et al. (2016) [14] Developed service quality assessment model based questionnaire involve five SERVQUAL dimensions namely Tangibles, Responsiveness, Reliability, Assurance, Empathy, AHP to evaluate the service quality of four public hospitals in Nigeria. Questionnaire was performed on 400 patients who got health services from these hospitals. Data of questionnaire was analyzed using SPSS software in addition Expert choice and Microsoft Excel to identify the perception of patients towards the service quality receiving in pairwise comparison with consistent less than 10%. Results show that, the most important service quality dimension from patient's points view is reliability dimension with composite priority 0.24 or 24% followed responsiveness with 0.22 assurance 0.21, tangibility with 0.21, and least one is empathy with 0.1101. Ajwinder Singh et al. (2017) [15] Proposed an integrated methodology based on fuzzy set theory and SERVQUAL dimensions namely; Tangibles, Responsiveness, Reliability, Assurance, Empathy, and Trustworthiness with 30 sub criteria for measuring the service quality of four hospitals in India. FAHP was used to prioritize the quality dimensions and sub-dimensions of healthcare service quality attributes. These priorities were then used to rank the four hospitals based on patients' perspectives. F. Cengiz DİKMEN (2018) [16] Developed quality assessment model-based Decision-Making Trial and Evaluation Laboratory (DEMATEL), nine driven criteria related SERVQUAL dimensions namely; Appearance of service personnel, Doctors attitude towards patients, Sufficient exploratory information on the status of patients, Warm and comfortable environment, Staffs' experience level, Feeling of trust to services, Sufficiency of medical equipment, Communication skills, Advice on rational medicine usage and questionnaire. Service. Quality criteria were identified from patients point views by questionnaires using the SERVQUAL model via a field study. DEMATEL was used after determine criteria affecting service quality to identify the importance level the identified criteria in addition the causal relationships among them. Results show that patients' feeling a sense of security from the medical services provided to them is recognize as the most important criteria in determining service quality, while, dress and tidy appearance of service personnel appears is recognize as the least significant criteria.

Sudirman, Ahmad Yani et al. (2019) [17] Applied Multi-Criteria Decision-Making (MCDM) methods to evaluate the criteria impacting healthcare service quality. Four Iranian public hospitals were assessed using four hybrid MCDM methods: MDL-TOPSIS, AHP-TOPSIS, AHP-ELECTRE, and MDL-ELECTRE, based on four main criteria; environment, responsiveness, equipment and facilities, and professional capability with 16 sub-criteria, two of which had not been previously considered. The Copeland method was used to integrate the results from the four hybrid MCDM methods and determine the final hospital rankings. The results indicate that professional capability is the most important criterion. This study proposes comprehensive and novel criteria for assessing hospital quality and introduces a new hybrid MCDM approach to obtain final hospital rankings. Melih Yucesan et al. (2019) [18] Developed an evaluating model-based Pythagorean Fuzzy TOPSIS and Pythagorean FAHP to evaluate the hospital service quality using six quality dimensions namely; Hospital Equipment, Service Attribute, Pharmacy and Medical Treatment, Cleaning of Hospital Facility, Administrative Policies and Professional Competence with 32 sub service quality criteria for evaluating two public hospital and one private in Turkey. G. Tuzkaya et al. (2019) [19] Developed an evaluation methodology based on the Interval-Valued Intuitionistic Fuzzy (IVIF) set to measure patient satisfaction and the service quality of five divisions of the internal medicine department of a public hospital in Turkey and to understand their perceptions where, IVIF set is considered a suitable tool due to the vagueness and complexity of healthcare service evaluation. The IVIF-PROMETHEE method was utilized to evaluate service quality based on patients' views, and the results were compared with those obtained using the IVIF-TOPSIS method. HEALTHQUAL and SERVQUAL dimensions have used such; Interaction, Technical, Time-dependent, Physical quality with ten sub criteria. G. W. Musumba et al. (2019) [9] Developed a service quality assessment model based on the Fuzzy Analytic Hierarchy Process (FAHP) and SERVQUAL dimensions namely; Tangibles, Reliability, Responsiveness, Assurance, Empathy with 53 sub-criteria. FAHP was utilized to analyze the service quality of four hospitals in Kenya. The priority of each SERVQUAL dimension was computed and then used to rank the hospitals from the patients' perspective. P.S. Prema Kumar (2019) [20] Proposed an evaluation model based on the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) to assess the service quality of 15 private and public hospitals in India. TOPSIS was used to rank the hospitals based on six service quality dimensions namely; reliability, assurance, tangibles responsiveness, and empathy and, Safety and security with twenty-four sub-criteria, for helping patients choose hospitals that meet their expectations for quality treatment. Payam Farhadi et al. (2020) [21]. Developed quality assessment methodology that integrate SERVQUAL dimensions/Fuzzy DEMATEL/ANP techniques for identifying and prioritizing the factors impact on the quality of service from the viewpoints of all health care stakeholders in the teaching hospitals and the headquarters

affiliated to Shiraz University of Medical Sciences. Rupal Khambhat et al. (2021) [5] Proposed a performance evaluation model based on the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) to evaluate and compare the healthcare service quality of three urban public healthcare organizations, as well as to validate the 25 service quality dimensions. Two questionnaires were developed: one to collect data from patients and the other to gather feedback from experts within these organizations. Patients' responses were divided into two random samples for the construction and validation of the Urban Public Healthcare Service Quality (UrbPubHCServQual) scale. Six dimensions was derived from the 25 and implemented to design the second questionnaire namely Medical Service, Service Responsiveness, Discharge, Admission, Hygiene, and Visual Facility, which was then used to compare the performance and rank the three healthcare organizations using Fuzzy TOPSIS. M. Al Awadh (2022) [22] Proposed an evaluation model based on the Analytical Hierarchy Process (AHP) to identify criteria for improving perceived healthcare quality in both public and private hospitals in Saudi Arabia. Six SERVQUAL dimensions namely; Tangibles, Responsiveness, Reliability, Assurance, Empathy, Constancy, and Security with 31 sub-criteria, were used to evaluate the service quality performance of three hospitals: one private and two public. The results indicate that hospitals should prioritize tangibles, reliability, and security, while placing less emphasis on consistency. Among the 31 sub-criteria, infection prevention and hygiene emerged as the most critical areas for improvement. The private hospital achieved the highest

quality performance. Mehrdad ESTIRI et al. (2023) [23]. Proposed an evaluation model that integrates the SERVQUAL model/multi-attribute decision-making (MADM) methods using interval-valued triangular fuzzy numbers (IVTFN) step-wise weight assessment ratio analysis (SWARA)/Additive Ratio Assessment (ARAS) method. for measuring, evaluating, and ranking the quality of health care services of different health centers. A. Karki (2024) [2] Proposed quality assessment model based Analytical Hierarchy Process (AHP) and the five SERVQUAL dimensions namely; Tangibles, Responsiveness, Reliability, Assurance, Empathy for comparing and assessing the perceived service quality for eleven private hospitals in Nepal classify into four groups; Public hospitals, Public Teaching Hospital, Private Teaching Hospital and, Private hospitals. AHP was used through using Expert Choice software to rank hospitals where, Private Teaching Hospitals has got the highest perceived service quality from patients point view, then the Public Teaching Hospitals and patients value tangibility rather than other service dimensions. The common five SERVQUAL dimensions namely Tangible, Responsiveness, Reliability, Assurance and, Empathy have used in most paper to assess the quality of health service in addition using other an important dimension as shown in Table 1.

In this study, SWARA method was applied to identify the significance weight of the decision criteria from patients point view. It is one of MCDM method that developed by Kersulienel at (2010).

Table 1
Survey the SERVQUAL Dimensions

References	SERVQUAL Dimensions					
	Tangible	Responsiveness	Reliability	Assurance	Empathy	Other
M. Ali, A. Hamid et al. (2015) [24]	√	√	√	√	√	Access and Comfort
T. Lupo (2015) [13]	√	√				Healthcare staff, Accessibility Support services, and Relationships
E.O. Oyatoye et al. (2016) [14]	√	√	√	√	√	
Ajwinder Singh et al. (2017) [15]	√	√	√	√	√	Trustworthiness
Md Rajib Rahman et al. (2018) [25]	√	√	√	√	√	Communication, Process features, Cost, Access, Billing services, Treatment outcome.
Sudirman, Ahmad Yani et al. (2019) [17]		√				Environment, equipment and facilities, and professional capability.
G.W. Musumba et al. (2019) [9]	√	√	√	√	√	
P.S. Prema Kumar (2019) [20]	√	√	√	√	√	Safety and security
Zainab Al-Baldawi et al. (2020)	√	√	√	√	√	
P. Ghimire et al. (2020) [26] [12]	√	√	√	√	√	
Tahereh Sharifi et al. (2021) [6]	√	√	√	√	√	HEALTHQUAL dimensions; Environment, Efficiency, Effectiveness.
M. Al Awadh (2022) [22]	√	√	√	√	√	Constancy, and Security
Rayan Sharka et al. (2024) [27]	√	√	√	√	√	Cost effectiveness, Staff-related factors, Revisit intention
Current Research	√	√	√	√	√	Administrative Procedure

Stepwise Weight Assessment Ratio Analysis (SWARA) Method

The general procedure of Stepwise Weight Assessment Ratio Analysis (SWARA) method for identifying of the relative weights of criteria can be summarized through the following steps [28]:

Step 1: criteria have ranked in a descending order based their expected significant from patients point view where, the least important one is in the last position and the most important one is in the first position, while the criteria between have ranked significance.

Step 2: identifying the Comparative Importance of the Average Value (s_{ij}), beginning from the second ranked criterion by evaluates how much criteria (D_{ij}) is more important than criterion (D_{ij+1}).

D_{ij} Criteria j of dimensions D_i ,

where:

$i = 1, 2, \dots, 6$,

$j = 1, 2, \dots, n$,

n = No. of criteria of each SERVQUAL Dimension.

Step 3. Calculating the coefficient k_{ij} by Eq 1 as follow:

$$k_{ij} = \begin{cases} 1 & j = 1 \\ s_{ij} + 1 & j > 1 \end{cases} \quad (1)$$

Step 4. Calculating the recalculating weight q_{ij} by Eq 2 as follow:

$$q_{ij} = \begin{cases} 1 & j = 1 \\ \frac{q_{ij-1}}{k_{ij}} & j > 1 \end{cases} \quad (2)$$

Step 5. Identifying the importance weights of the criteria D_{ij} for dimension D_i by Eq 3 as follow:

$$w_{ij} = \frac{q_{ij}}{\sum_{k=1}^n q_k} \quad (3)$$

where:

w_{ij} are the relative weights of the service quality criteria D_{ij}

HEALTH SERVICE QUALITY ASSESSMENT METHODOLOGY

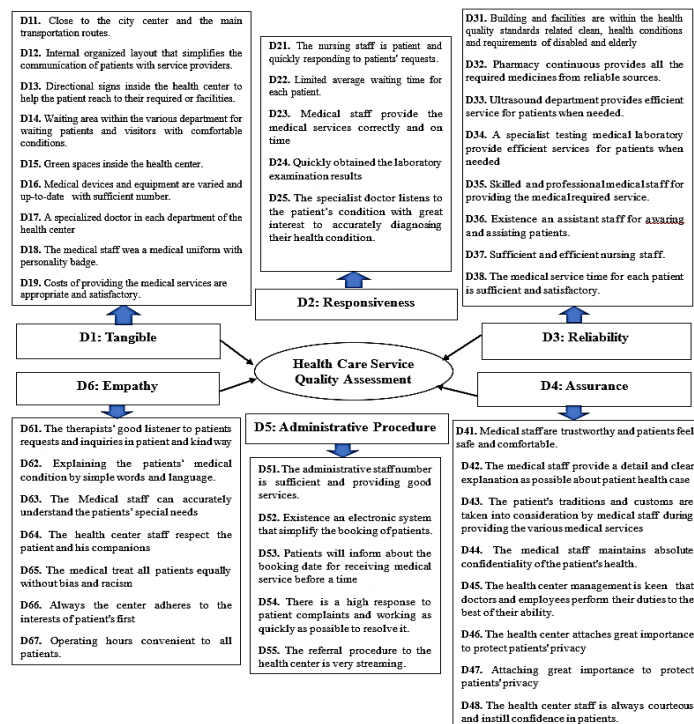


Fig. 5 Health Care Service Quality Dimensions and Sub Sub-Dimensions

Health Service Quality Assessment Methodology was proposed to identify the level of health service quality by integration SERVQUAL Dimensions/Percent Point Score method SWARE Method Gap analysis in addition investigate the level of patient's satisfaction related the expectations of service and perception of service. The general structure of the proposed methodology was illustrated by IDFE0 diagram as shown in Figure 3 and the detailed of the proposed methodology is illustrate by Figure 4

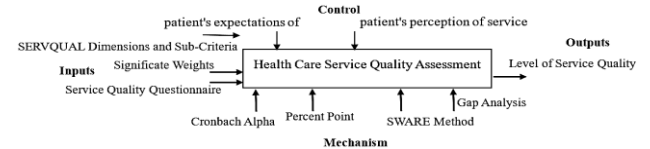


Fig. 3 IDFE0 the Proposed Methodology

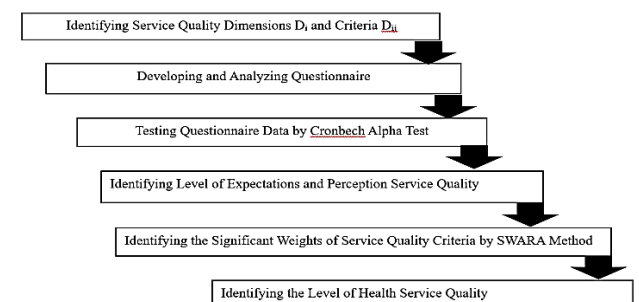


Fig. 4 Structure of the Proposed Methodology

Step 1. Identifying Service Quality Dimensions D_i and Criteria D_{ij}

Six quality service dimensions, comprising 45 quality service criteria, were used to study and assess the level of health service quality in a healthcare center using the proposed methodology as shown in Figure 5.

The SERVQUAL model, which involves five quality service dimensions, was applied, with the administrative procedure considered as an additional important dimension.

Step 2. Developing and Analyzing Questionnaire

A health service quality questionnaire was developed using a three-point Likert scale to investigate and capture expectations and perceptions of service quality from the patients' point of view. The questionnaire consists of two sections: the first focuses on general information about the patients who participated in the survey, as shown in Table 2.

Table 2
Data of Section Two of Questionnaire

Age	12-20	21-35	36-49	More than 50 years
Gender	Male		Female	
Education Level	Reads and Writes	Illiterate	Graduate	Postgraduate Degree
Number of times visit the health center	First Time	2-5	5-10	More than 10

The second section consists of 42 questions related to 42 health service quality criteria belonging to six SERVQUAL dimensions. Scale 1, labeled as 'Disagree,' indicates that the quality of the expected and received service does not satisfy patients. Scale 2 refers to the quality of the expected and received service is somewhat satisfactory for patients. Scale 3 indicates that the quality of the expected and received service is very good and satisfies patients, as shown in Table 3.

Table 3
The Health Service Quality Dimensions and Criteria

Service Quality Dimensions	Criteria	Weight of Significance (1-5)	Likert Scale of the Expected Service			Likert Scale of Receiving Service		
			1 (Disagree)	2 (Somewhat)	3 (Agree)	1 (Disagree)	2 (Somewhat)	3 (Agree)
D ₁	D ₁₁							
								
								
	D _{1j}							
D _i	D _{i1}							
	D _{ij}							
D ₆	D ₆₁							
	D _{6j}							

Additionally, patients were asked to rank the criteria of each dimension based on their significance to them using a five-point Likert scale. The scale is as follows: 1 – Not significant, 2 – Somewhat significant, 3 – Significant, 4 –

Highly significant, and 5 – Critically important, meaning the quality of this criterion must be high due to its critical importance to patients.

Step 3. Testing Questionnaire Data by Cronbech Alpha Test

The collected data of questionnaire was tested by the Cronbach's alpha(α) test to measure reliability and the internal consistency of questionnaire responses. Cronbach's Alpha (α) is a simple statistical analysis that implemented to test the internal consistency and reliability of questionnaire by measuring the extent the correlation responses of questionnaire questions with each other by estimating the variance in a set of questionnaire responses. its ranges between 0 and 1 where, the acceptance ranges must be more than 0.7 A higher alpha value indicates a strong correlation among the criteria being tested [29], as shown in Table 4. The acceptance ranges must be more than 0.7 where, the high alpha value indicate that the criteria in the test are highly correlated. The developed questionnaire comprises 42 questions related 45 health service quality criteria belong to six SERVQUAL Dimensions.

Table 4
Cronbach's Value Interpretation

Internal consistency	Cronbach's value (α)
Excellent	$\alpha \geq 0.9$
Good	$0.9 > \alpha \geq 0.8$
Acceptable	$0.8 > \alpha \geq 0.7$
Questionable	$0.7 > \alpha \geq 0.6$
Poor	$0.6 > \alpha \geq 0.5$
Unacceptable	$0.5 > \alpha$

Source: [29].

Step 4. Identifying Level of the Expectations and the Perception Service Quality

The reliable questionnaire data was analyzed by Percent point score method to calculate the level of expectations and perception service quality based on three Likert scale. Quality of the Expected Service:

$$(E) = \frac{TPS_E}{n \times 3}, \quad (4)$$

$$\text{Percent Point Score: } (TPS_E) = \sum N_{ij} \times S_{ij} = AA \times 1 + B \times 2 + C \times 3. \quad (5)$$

Quality of the Perceived or Received Service:

$$(P) = \frac{TPS_P}{n \times 3}, \quad (6)$$

$$\text{Percent Point Score } (TPS_P) = \sum N_{ij} \times S_{ij} = A \times 1 + B \times 2 + C \times 3, \quad (7)$$

where:

N_i Number of patients responses,

S_i Likert scale where 3 is represented the Likert Scales used,

i = service quality dimensions,

j = service quality criteria.

Step 5. Identifying the Significant Weights of Service Quality Criteria by SWARA Method SWARA method as MCDM method was used to identify the weight of service quality criteria as follow:

1. Ranking the service quality criteria in a descending order as illustrated in section 3 SWARA method Step 1.
2. Identifying the Comparative Importance of the Average Value (s_{ij}) as mention in section 3 SWARA method step 2.
3. Calculating the coefficient k_{ij} by Eq 1.
4. Calculating the recalculating weight q_{ij} by Eq 2.
5. Identifying the importance weights w_{ij} of the service quality criteria D_{ij} for each SERVQUAL dimension D_i by Eq 3, where w_{ij} are the relative weights of the service quality criteria D_{ij} .

Step 6. Identifying the Level of Health Care Service Quality.

The level of service quality across the health center was assessed using Eq. 8 [30] by analyzing the gap between the Expected Service (E) and the Perceived or Received Service (P) for each criteria using the Gap Analysis Method, specifically Gap 5, as illustrated in Figure 1, while also considering the calculated weight of criteria importance w_{ij} identified using the SWARA method:

$$\text{Service Quality of the Medical Center (HQSij)} \\ \text{or the Level of Satisfaction} = w_{ij}(E - P) \quad (8)$$

RESULTS AND DECISION

The health service assessment methodology was applied in medical center located in Baghdad that providing various medical service. It is a public health center under the Iraqi Ministry of Health, established in 2010. It provides various primary medical services during its six-hour work-days, five days a week. A team of specialist medical staff offers periodic examinations for disease diagnosis and treatment at reasonable fees compared to private medical centers. Additionally, the center provides specialized care services for heart diseases, diabetes, elderly care, child care, and rehabilitation. It also offers medical laboratory services, X-ray imaging, and ultrasound diagnostics. A health service quality questionnaire was developed using a three-point Likert scale to assess *patients* expected and perceived quality of health services. Additionally, a five-point Likert scale was used to evaluate the importance of each criterion from the patients' perspective. The questionnaire was conducted over two months, from October 1 to December 1, 2024. On average, 30 patients visit the health center daily. Patients were asked during the specific date to participate in filling out the questionnaire, but only 100 agreed to do so. Data was collected through interviewing patients face-to-face. The first section of the questionnaire focused on general information about the respondents. The most common age group among visiting patients was between 36 and 49 years old, as shown in Table 5, and the majority of the participants were male.

The second section involves six SERVQUAL dimensions, namely Tangible, Responsiveness, Reliability, Assurance, Empathy, and Administrative Procedure, with 42 service quality criteria. Questionnaire data was analyzed by the Cronbach Alpha test to check the consistency and reliability of patients' answers. The (α) values for all service

quality dimensions are acceptable and above 70, indicating consistent and reliable data, as illustrated in Table 5.

Table 5
Information of the Respondents of the Questionnaire

1. Age	12-20	21-35	36-49	More than 50 years
Frequency	18	21	42	19
2. Gender	Male		Female	
Frequency	61		39	
3. Education Level	Reads and Writes	Illiterate	Under graduate	Post graduate
Frequency	33	12	51	4
4. Number of Visiting	First Time Visit	2-5	5-10	Several Visits
Frequency	11	37	29	23

SWARA method was used as weighting method to identify the weights of service quality sub-criteria as shown in Table 6 where costs of providing the medical services are appropriate and satisfactory (D19) is consider the most important criteria of tangible dimension with weight 0.16.

Table 6
Cronbach's Value (α)

Quality Service Dimensions	Description	Sub-Criteria	Cronbach's Value (α)
D1: Tangible	This dimension involves building layout, the available infrastructure, various physical facilities, hygiene, green Space, and the available up-to-date equipment.	D19	0.75
		D14	
		D11	
		D13	
		D17	
		D16	
		D18	
		D12	
D2: Responsiveness	This dimension involves quickly responding to patients' requests with providing medical services correctly and on time by the medical staff with a limited average waiting time for each patient.	D24	0.73
		D21	
		D25	
		D23	
		D22	
D3: Reliability	This dimension involves existence of buildings and facilities within the healthy quality standards, with the existence of a pharmacy, medical laboratory and ultrasound department providing fast and reliable service with sufficient time by Skilled and professional medical staff.	D32	0.72
		D34	
		D33	
		D35	
		D36	
		D31	
		D38	
D4: Assurance	This dimension involves providing a detailed and clear explanation about the patient's health case while maintaining absolute confidentiality of the patient's health. Medical staff are courteous and instill confidence in patients and consider traditions and customs when providing the various medical services.	D43	0.80
		D44	
		D41	
		D46	
		D48	
		D45	
		D42	
		D47	

cont. table 6

D5: Administrative	This dimension involves how to simplify the administrative procedures related to referrals and using technology to simplify work like booking and responding to patient complaints.	D55	0.74
		D53	
		D51	
		D54	
D6: Empathy	This dimension includes explaining the patients' medical condition in simple words with accurately understand the patients' special needs, respecting the patient and his companions without bias and racism and the Operating hours convenient to all patients.	D52	0.71
		D67	
		D65	
		D64	
		D63	
		D66	
		D61	
		D62	

While, quickly obtained the laboratory examination results (24) is consider essential criteria in responsiveness dimension with weight 0.26 also, pharmacy continuous provides all the required medicines from reliable sources (D32) is the most important criteria for reliability dimension with weight 0.20. The patient's traditions and customs are taken into consideration by medical staff during providing the various medical services (D43) is the most important criteria of assurance dimension with weight 0.20 while the referral procedure to the health center is very streaming (D55) is considered the most important criteria of administrative procedure with weight 0.27, finally Operating hours convenient to all patients (D67) is

considered the most important criteria of Empathy dimension with weight 0.24 as shown in Figure 6.

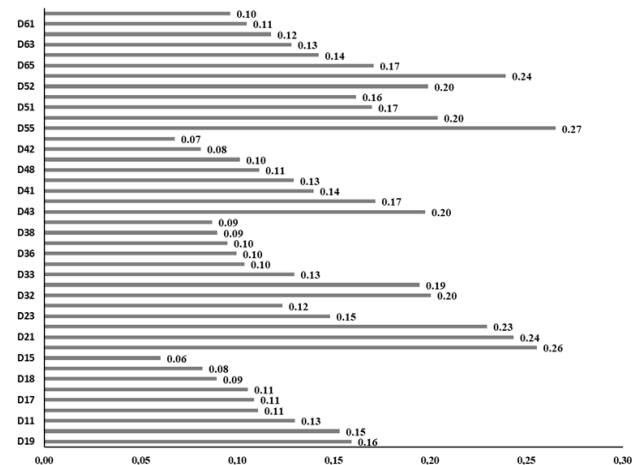


Fig. 3 Weights of Service Quality Criteria

Level of quality the Expected service and the perceived service have assessed by analysis Questionnaire data that represent Patients point of view using Percent Point Score method. Quality of the Expected Service (E) was assessed as shown in Table 6 by Eq. 4 and Eq. 5 while Quality of the Perceived or Received Service (P) was determined using Eq 6 and Eq 7 as illustrate in Table 7.

Table 7
Sub-Criteria Weights Calculation by SWARA Method

Quality Service Dimensions	Sub-Criteria Symbol	Importance Ranking Based Patient's Judgments	Importance Based Patient's Judgments			S_{ij}	k_{ij}	Recalculating Weight q_{ij}	Normalized Weights
D1: Tangible	D19	1	D19 is	4%	More important than D14		1	1.00	0.16
	D14	2	D14 is	18%	More important than D11	0.04	1.04	0.96	0.15
	D11	3	D11 is	17%	More important than D13	0.18	1.18	0.81	0.13
	D13	4	D13 is	2%	More important than D17	0.17	1.17	0.70	0.11
	D17	5	D17 is	3%	More important than D16	0.02	1.02	0.68	0.11
	D16	6	D16 is	18%	More important than D18	0.03	1.03	0.66	0.11
	D18	7	D18 is	9%	More important than D12	0.18	1.18	0.56	0.09
	D12	8	D12 is	36%	More important than D15	0.09	1.09	0.52	0.08
D2: Responsiveness	D15	9				0.36	1.36	0.38	0.06
	D24	1	D24 is	5%	More important than D21		1	1.00	0.26
	D21	2	D21 is	6%	More important than D25	0.05	1.05	0.95	0.24
	D25	3	D25 is	55%	More important than D23	0.06	1.06	0.90	0.23
	D23	4	D23 is	20%	More important than D22	0.55	1.55	0.58	0.15
D3: Reliability	D22	5				0.20	1.20	0.48	0.12
	D32	1	D32 is	3%	More important than D34		1	1.00	0.20
	D34	2	D34 is	50%	More important than D33	0.03	1.03	0.97	0.19
	D33	3	D33 is	25%	More important than D35	0.50	1.50	0.65	0.13
	D35	4	D35 is	4%	More important than D36	0.25	1.25	0.52	0.10
	D36	5	D36 is	5%	More important than D31	0.04	1.04	0.50	0.10
	D31	6	D31 is	6%	More important than D38	0.05	1.05	0.47	0.10
	D38	7	D38 is	3%	More important than D37	0.06	1.06	0.45	0.09
	D37	8				0.03	1.03	0.43	0.09

cont. table 7

D4: Assurance	D43	1	D34 is	15%	more important than D44		1	1.00	0.20
	D44	2	D44 is	23%	more important than D41	0.15	1.15	0.87	0.17
	D41	3	D41 is	8%	more important than D46	0.23	1.23	0.71	0.14
	D46	4	D46 is	16%	more important than D48	0.08	1.08	0.65	0.13
	D48	5	D48 is	10%	more important than D45	0.16	1.16	0.56	0.11
	D45	6	D45 is	25%	more important than D42	0.10	1.10	0.51	0.10
	D42	7	D42 is	20%	more important than D46	0.25	1.25	0.41	0.08
D5: Administrative Procedure	D47	8				0.20	1.20	0.34	0.07
	D55	1	D55 is	30%	more important than D53		1	1.00	0.27
	D53	2	D53 is	20%	more important than D51	0.30	1.30	0.77	0.20
	D51	3	D51 is	5%	more important than D54	0.20	1.20	0.64	0.17
	D54	4	D54 is	28%	more important than D52	0.05	1.05	0.61	0.16
D6: Empathy	D52	5				0.28	1.28	0.75	0.20
	D67	1	D67 is	40%	more important than D65		1	1.00	0.24
	D65	2	D56 is	20%	more important than D64	0.40	1.40	0.71	0.17
	D64	3	D64 is	11%	more important than D63	0.20	1.20	0.60	0.14
	D63	4	D63 is	9%	more important than D66	0.11	1.11	0.54	0.13
	D66	5	D66 is	12%	more important than D61	0.09	1.09	0.49	0.12
	D61	6	D61 is	9%	more important than D62	0.12	1.12	0.44	0.11
	D62	7				0.09	1.09	0.40	0.10

Available of Green spaces inside the health center (D15) for tangible dimension, quickly obtained the laboratory examination results (D24) for responsiveness dimension, achieve high patients satisfy for responsiveness dimension (D33), for reliability dimension, the medical staff maintains absolute confidentiality of the patient's health (D44) for assurance dimension, the administrative staff number is sufficient and providing good services (D51) for administrative procedure dimension and the health

center staff respect the patient and his companions (64) have achieved high patients satisfaction due to most patients agree by their responses by questionnaire the quality of the received service for these sub-criteria is high and satisfy them. The quality expectation of D11 is higher than that perceived and received as shown in Table 8 and Table 9, and the same for D21, D34, D44, and D55, while the expected quality of D64 is in the same quality that the patients received.

Table 8
Calculation of the Expected Service (E)

Quality Service Dimensions	Criteria	Number of Responses Ni for each Likert Scale Si			TPS = (Ni·Si)	The Expected Service (E) = (Ni·Si)/(n·3)	Ranking
		1	2	3			
		A	B	C			
D1: Tangible	D11	13	39	48	235	0.78	1
	D12	25	44	31	206	0.69	8
	D13	39	24	37	198	0.66	9
	D14	16	49	35	219	0.73	5
	D15	22	32	46	224	0.75	3
	D16	17	35	48	231	0.77	2
	D17	20	37	43	223	0.74	4
	D18	25	33	42	217	0.72	6
	D19	25	36	39	214	0.71	7
D2: Responsiveness	D21	17	34	49	232	0.77	1
	D22	22	33	45	223	0.74	2
	D23	40	39	21	181	0.60	4
	D24	55	23	22	167	0.56	5
	D25	34	33	33	199	0.66	3
D3: Reliability	D31	34	36	30	196	0.65	6
	D32	34	38	28	194	0.65	7
	D33	32	32	36	204	0.68	4
	D34	17	36	47	230	0.77	1
	D35	37	36	27	190	0.63	8
	D36	30	30	40	210	0.70	3
	D37	13	50	37	224	0.75	2
	D38	22	57	21	199	0.66	5

cont. table 8

D4: Assurance	D41	17	34	49	232	0.77	2
	D42	22	33	45	223	0.74	3
	D43	36	34	30	194	0.65	6
	D44	13	39	48	235	0.78	1
	D45	29	45	26	197	0.66	5
	D46	46	38	16	170	0.57	7
	D47	27	38	35	208	0.70	4
	D48	37	35	28	191	0.64	4
D5: Administrative Procedure	D51	24	39	37	213	0.71	2
	D52	53	33	14	161	0.54	6
	D53	41	38	21	180	0.60	5
	D54	33	33	34	201	0.67	3
	D55	22	37	41	219	0.73	1
D6: Empathy	D61	27	32	41	214	0.71	2
	D62	29	28	43	214	0.71	3
	D63	42	48	10	168	0.56	7
	D64	18	38	44	226	0.75	1
	D65	28	33	39	211	0.70	4
	D66	51	19	30	179	0.60	6
	D67	42	34	24	182	0.61	5

Table 9

Calculation of the Perceived or Received Service (P)

Quality Service Dimensions	Criteria	Number of Responses Ni for each Likert Scale Si			TPS = (Ni·Si)	Perceived Service (P) = (Ni·Si)/(n·5)	Ranking
		1	2	3			
		A	B	C			
D1: Tangible	D11	28	24	48	220	0.73	8
	D12	15	34	51	236	0.79	5
	D13	12	22	66	254	0.85	3
	D14	20	33	47	227	0.76	7
	D15	11	14	75	264	0.88	1
	D16	16	35	49	233	0.78	6
	D17	20	42	38	218	0.73	9
	D18	11	33	56	245	0.82	4
	D19	11	18	71	260	0.87	2
D2: Responsiveness	D21	33	35	32	199	0.66	4
	D22	49	44	7	158	0.53	5
	D23	31	38	31	200	0.67	3
	D24	19	34	47	228	0.76	1
	D25	15	46	39	224	0.75	2
D3: Reliability	D31	47	33	20	173	0.58	6
	D32	25	44	31	206	0.69	4
	D33	19	39	42	223	0.74	1
	D34	37	45	18	181	0.60	5
	D35	51	38	11	160	0.53	7
	D36	62	23	15	153	0.51	8
	D37	30	31	39	209	0.70	3
	D38	19	44	37	218	0.73	2
D4: Assurance	D41	26	39	35	209	0.70	6
	D42	27	29	44	217	0.72	5
	D43	25	45	30	205	0.68	7
	D44	10	28	62	252	0.84	1
	D45	22	39	39	217	0.72	4
	D46	19	22	59	240	0.80	2
	D47	39	24	37	198	0.66	8
	D48	17	41	42	225	0.75	3
D5: Administrative Pro- cedure	D51	28	33	39	211	0.70	1
	D52	73	16	11	138	0.46	4
	D53	88	11	1	113	0.38	5
	D54	40	36	24	184	0.61	2
	D55	41	49	10	169	0.56	3

cont. table 9

D6: Empathy	D61	17	36	47	230	0.77	2
	D62	19	53	28	209	0.70	5
	D63	21	38	41	220	0.73	4
	D64	15	18	67	252	0.84	1
	D65	36	48	16	180	0.60	7
	D66	26	25	49	223	0.74	3
	D67	29	36	35	206	0.69	6

Gap values that represent the level of medical service quality that achieves satisfied or unsatisfied of patients were calculated using Eq 8 and then ranked. Smaller gaps indicate higher patient satisfaction, as patients receive services that meet or exceed their expectations, whereas larger gaps result in dissatisfaction and increased negative

feedback. The criterion ranked 1 is the weakest quality one. Identifying gaps in service quality helps health center management focus their efforts and resources on improving weaker criteria. The gray-colored criteria (positive values), as shown in Table 10, represent medical center services that patients expect to be provided at a high level of quality but have actually received at a lower level.

Table 10
Calculation the Service Quality of the Medical Center

Quality Service Dimensions	Symbol	Criteria	Weights	Expected Service (E)	Perceived Service (P)	Gap	Ranking
D1: Tangible	D11	Close to the city center and the main transportation routes	0.13	0.78	0.73	0.05	1
	D12	Internal organized layout that simplifies the communication of patients with service providers	0.08	0.69	0.79	-0.1	6
	D13	Directional signs inside the health center to help the patient reach to their required or facilities.	0.11	0.66	0.85	-0.19	9
	D14	Waiting area within the various department for waiting patients and visitors with comfortable conditions	0.15	0.73	0.76	-0.03	5
	D15	Green spaces inside the health center	0.06	0.75	0.88	-0.13	7
	D16	Medical devices and equipment are varied and up-to-date with sufficient number	0.11	0.77	0.78	-0.01	4
	D17	A specialized doctor in each department of the health center	0.11	0.74	0.73	0.02	4
	D18	The medical staff wear a medical uniform with personality badge	0.09	0.72	0.82	-0.09	7
	D19	Costs of providing the medical services are appropriate and satisfactory	0.16	0.71	0.87	-0.15	8
D2: Responsiveness	D21	The nursing staff is patient and quickly responding to patients' requests	0.24	0.77	0.66	0.11	2
	D22	Limited average waiting time for each patient	0.12	0.74	0.53	0.22	1
	D23	Medical staff provide the medical services correctly and on time	0.15	0.60	0.67	-0.06	3
	D24	Quickly obtained the laboratory examination results	0.26	0.56	0.76	-0.20	5
	D25	The specialist doctor listens to the patient's condition with great interest to accurately diagnosing their health condition.	0.23	0.66	0.75	-0.08	5
D3: Reliability	D31	Building and facilities are within the health quality standards related clean, health conditions and requirements of disabled and elderly	0.10	0.65	0.58	0.07	4
	D32	Pharmacy continuously provides all the required medicines from reliable sources	0.20	0.65	0.69	-0.04	6
	D33	Ultrasound department provides efficient service for patients when needed.	0.13	0.68	0.74	-0.06	7
	D34	A specialist testing medical laboratory provide efficient services for patients when needed	0.19	0.77	0.60	0.16	2
	D35	Skilled and professional medical staff for providing the medical required service.	0.10	0.63	0.53	0.10	2
	D36	Existence an assistant staff for awaring and assisting patients.	0.10	0.70	0.51	0.19	1
	D37	Sufficient and efficient nursing staff	0.09	0.75	0.70	0.05	2
	D38	The medical service time for each patient is sufficient and satisfactory	0.09	0.66	0.73	-0.06	6

cont. table 10

D4: Assurance	D41	Medical staff are trustworthy and patients feel safe and comfortable.	0.14	0.77	0.70	0.07	1
	D42	The medical staff provide a detail and clear explanation as possible about patient health case	0.08	0.74	0.72	0.02	2
	D43	The patient's traditions and customs are taken into consideration by medical staff during providing the various medical services	0.20	0.65	0.68	-0.03	4
	D44	The medical staff maintains absolute confidentiality of the patient's health.	0.17	0.78	0.84	-0.06	5
	D45	The health center management is keen that doctors and employees perform their duties to the best of their ability	0.10	0.66	0.72	-0.06	6
	D46	The health center attaches great importance to protect patients' privacy	0.13	0.57	0.80	-0.23	8
	D47	Attaching great importance to protect patients' privacy	0.07	0.70	0.66	0.04	5
	D48	The health center staff is always courteous and instill confidence in patients.	0.11	0.64	0.75	-0.11	8
D5: Administrative Procedure	D51	The administrative staff number is sufficient and providing good services.	0.17	0.71	0.70	0.01	5
	D52	Existence an electronic system that simplify the booking of patients.	0.20	0.54	0.46	0.08	3
	D53	Patients will inform about the booking date for receiving medical service before a time	0.20	0.60	0.38	0.22	1
	D54	There is a high response to patient complaints and working as quickly as possible to resolve it.	0.16	0.67	0.61	0.06	2
	D55	The referral procedure to the health center is very streaming.	0.27	0.73	0.56	0.17	1
D6: Empathy	D61	The therapists' good listener to patients requests and inquiries in patient and kind way	0.11	0.71	0.77	-0.06	3
	D62	Explaining the patients' medical condition by simple words and language.	0.10	0.71	0.70	0.01	2
	D63	The Medical staff can accurately understand the patients' special needs	0.13	0.56	0.73	-0.17	5
	D64	The health center staff respect the patient and his companions	0.14	0.75	0.84	-0.09	3
	D65	The medical treat all patients equally without bias and racism	0.17	0.70	0.60	0.10	1
	D66	Always the center adheres to the interests of patient's first	0.12	0.60	0.74	-0.14	2
	D67	Operating hours convenient to all patients.	0.24	0.61	0.69	-0.08	1

A radar map was used as a visual tool to illustrate the level of patient satisfaction for each quality dimension. The closer a criterion is to the center, the higher the satisfaction level, while satisfaction decreases as it moves toward the outer radius of the map. For the Tangibles dimension, the most satisfying criterion from the patients' perspective is the health center's proximity to main transportation routes, with a satisfaction level of (-0.19). The least satisfying criterion is the cost of medical services (0.05), as shown in Figure 7.

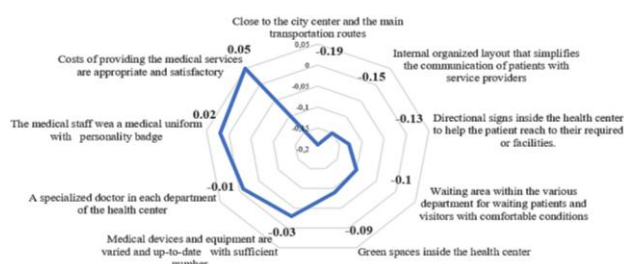


Fig. 4 Level of Patients Satisfaction for the Quality of Criteria of the Tangible Dimension

In the Responsiveness dimension, the most satisfying criterion is the quick availability of laboratory tests (-0.20), while the least satisfying is the waiting time for services, as shown in Figure 8.

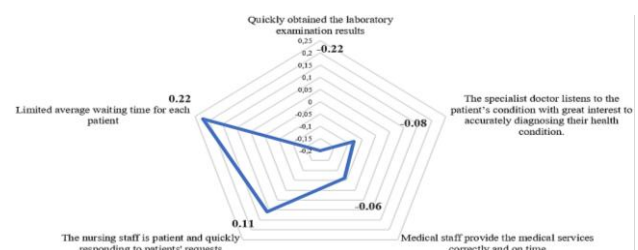


Fig. 5 Level of Patients Satisfaction for the Quality of Criteria of the Responsiveness Dimension

For the Reliability dimension, the most satisfying criteria, as illustrated in Fig. 9, are the provision of efficient ultrasound services and sufficient medical service time for each patient (-0.06), whereas the least satisfying is the lack of assistant staff (0.19).

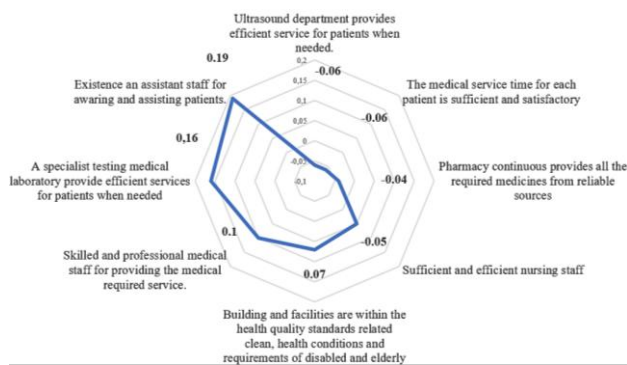


Fig. 9 Level of Patients Satisfaction for the Quality of Criteria of the Reliability Dimension

In the Assurance, Administrative, and Empathy dimensions, the most satisfying criteria are patient privacy protection, a sufficient number of administrative staff, and an understanding of patients' needs, respectively, as shown in Figures 10, 11, and 12.

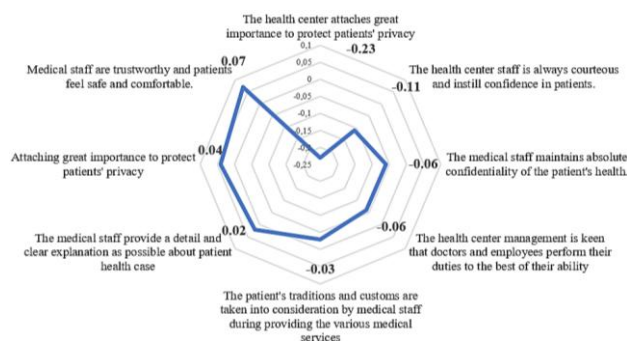


Fig. 10 Level of Patients Satisfaction for the Quality of Criteria of the Assurance Dimension

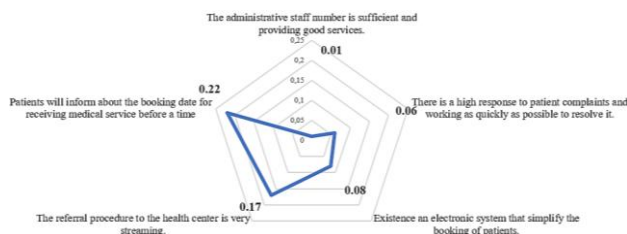


Fig. 6 Level of Patients Satisfaction for the Quality of Criteria of the Adminstrative Dimension

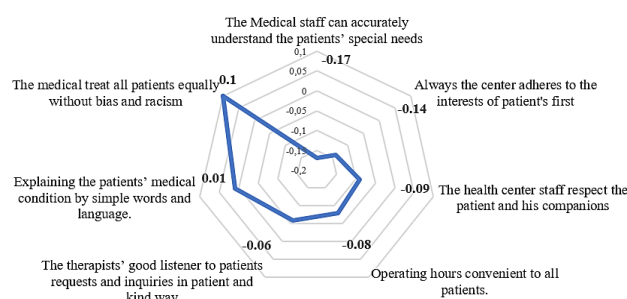


Fig. 7 Level of Patients Satisfaction for the Quality of Criteria of the Empathy Dimension

Waiting time for receiving the medical service (D22) and the booking system (D53) are the weakest service quality criteria, as shown in Figure 13 that they led to patients unsatisfaction, so the management of the medical center must take high attention and work to improve it to satisfy

patients through finding a way to reduce the waiting time and dealing with the booking date problem by establishing an efficient and accurate booking system as possible. protect patients' privacy D46, as shown in Figure 13, is providing in medical center with high level of patient satisfaction (-0.23).

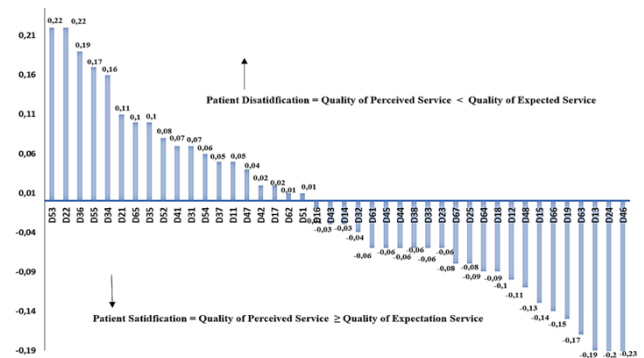


Fig. 8 Level of Patients Satisfaction Related the Quality of Medical Center Services

Gap analysis is important for medical center to investigate the level of quality of their various services to focus their resources in improvement process to improve the weak services to achieve high level of patients' satisfaction.

CONCLUSION

Investigation and assessing the level of medical service quality is quite important for improving the received health service due to its relation and impact on people's lives, so most health organizations continuously pursue to improve their service quality to achieve a high level of patient's satisfaction. Service quality is determined by the differences between patients' expectations and the actual received service. Thus, the association between service quality and patient satisfaction is emerged as a significant concern topic. Health service assessment methodology was proposed that integrates the SERVQUAL model Percent Point Score method MCDM SWARA method for investigating and assessing the level of quality of medical services providing for patients. Questionnaire was developed to capture data related quality of the expectation and perception service that involve 42 questions related 42 criteria of service quality. SWARA method was used to weight 42 service quality criteria from patients point view. Gaps in the quality of services that the medical center provided for their patients were analyzed and calculated to identify the weak services that the management of the medical center should be taking their attention to improve it to achieve high levels of quality and patient satisfaction. Results showed that waiting time for receiving the medical service (D22) and the booking system (D53) are the weakest service quality criteria that led to patients unsatisfaction, while protecting patients' privacy, criteria (D46) achieved a high level of patient satisfaction (-0.23). The findings can help health center management study the causes of weak service delivery in certain areas, leading to patient dissatisfaction, and focus their efforts and resources on improving these criteria. The proposed methodology can serve as a guide and roadmap for health

organization management in their improvement journey. Additionally, future work could consider more service quality dimensions and include a benchmarking study across multiple public health centers to assess and compare the quality-of-service delivery. The low participation of patients in filling out the questions of the questionnaire was one of the challenges that faced this study. During two months, the visiting patients were asked to participate in filling questionnaire, but only 100 agreed to do so.

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