A fuzzy framework to evaluate service quality in the healthcare industry: An empirical case of public hospital service evaluation in Sicily

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A B S T R A C T

A novel fuzzy evaluation framework is applied in this study to evaluate service quality in the public healthcare sector. In particular, the proposed framework is based on the ServQual disconfirmation paradigm and incorporates the Analytic Hierarchy Process (AHP) method to elicit reliable estimations of service quality expectations. Moreover, degrees of uncertainty, subjectivity and vagueness on the part of stakeholders are addressed via linguistic evaluation scales parameterized by triangular fuzzy numbers. With reference to nine relevant public hospitals in the Sicilian Region (Italy), a detailed case study evaluating four core service criteria and 15 fundamental service items is conducted so as to discern dissatisfying aspects regarding the public healthcare service in the Region. Dissatisfaction reasons with the provided service are identified in the analysis as well, further demonstrating the effectiveness of the proposed approach.

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1. Introduction

Healthcare is a fundamental and relevant issue whose importance pervades all aspects of society. In fact, it has medical, social, political, ethical, business, and also financial implications.

Although the recent restructuring of the Italian healthcare system, following the model of the business enterprise, has produced new opportunities, it calls for yet more rigorous constraints. Perhaps, the most significant opportunity for healthcare organizations is a new autonomy in pursuing targeted service outcomes, whereas economic and budget issues unmistakably represent the stringent constraints. However, the gap between these two often conflicting aspects may be bridged by an element, i.e. quality, able to compensate for the distorting potential inherent in an unwary or ill-advised overemphasis merely on costs and budgets [1–4].

Healthcare quality has been defined as “the ability to achieve desirable objectives using legitimate means” whereby the desirable objective implied is “an achievable state of health” [5]. Similarly, healthcare quality may be conceived as an approach to achieve improved health outcomes for consumers [6]. Nevertheless, necessary prerequisites of quality healthcare also include appropriate technology, timely treatment, adequacy of the offer of services with regard to the demand, as well as guaranteeing acceptable standards of medical practice [7]. All the more, from a corporate viewpoint, healthcare quality constitutes a reliable means for extending the client base, so as to gain a competitive edge, thus assuring economic viability and long-term profitability [8–10].

To all intents and purposes, public healthcare quality can be viewed as a multi-dimensional entity affected by various interacting aspects and actors: institutions which organize and finance healthcare, healthcare providers and professionals in the front line of service tending to patients’ needs in terms of diagnosis, treatment and, in recent years, rehabilitation as well. Last but not least, there are the citizens experiencing the clinical outcomes, but whose bottom line also comprises a keen eye for certain aspects of the services provided, such as human relationships, hospitality and the regard for their dignity and privacy. Fig. 1 shows the three main dimensions of healthcare service quality [11].

In detail:

- **management quality**, concerns efficient and effective resource utilization and management to deliver services able to satisfy stakeholders’ needs. The evaluation of this quality dimension

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takes into consideration the managerial measures and methods adopted.

- **professional quality**, includes perspectives of healthcare experts and professionals regarding medical aspects of healthcare. This quality dimension is directly characterized by in-house medical skills and hospital facilities.

- **Stakeholder perceived quality**, consists of citizens/patients perceptions with reference to healthcare aspects involving accessibility, responsiveness, human relationships, hospitality and other service features.

This latter quality dimension is considered the most significant one since it exerts a direct influence on the perceived value of the hospital and its image and, as such, it is regarded as a key measure of the service effectiveness, as well as of the patient satisfaction [12–14]. Additionally, this quality dimension also indirectly impacts on patients' behavior in the sense that, satisfied patients do not tend to seek healthcare services elsewhere and, moreover, they more likely recommend the same hospital to other potential patients [15,16]. For such reasons, the systematic implementation of procedures and approaches to evaluate stakeholder satisfaction represents a fundamental aspect in today’s healthcare context [17].

In the literature, a number of methods have been proposed to assess stakeholder satisfaction in the healthcare field. Basically, they can be classified into three fundamental groups: Stated Importance Methods (SIMs), Derived Importance Methods (DIMs) and the Multi-Criteria Decision-Making (MCDM)-based approaches. As regards SIMs [18–20], stakeholders are asked to fill out a detailed questionnaire related to both expectations and perceptions on fundamental service quality aspects. On the contrary, DIMs [21,22] require a significantly simplified questionnaire given that stakeholders are asked to assess only perceptions on service quality aspects and to provide their overall satisfaction degree as synthesis of the perceived service quality. Quality expectations are statistically derived in a second phase, after the survey, on the basis of relations among the collected perceptions and the overall satisfaction degree. Finally, MCDM approaches are based on the general principle that the attitude of customers toward a given service is based on their assessment of service aspects on the basis of the importance assigned to them [23]. With this recognition, MCDM methodologies such as the Analytic Hierarchy Process (AHP) method [24], the Vísekriterjumska optimizacija I Kompromisno Resenje (VIKOR) method [25], the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method [26] and so on, constitute a solid underpinning on which to draw so as to favor the development of approaches able to comparatively evaluate and/or select service alternatives. Several recent applications of such approaches in the healthcare sector are described in [27–29].

Nevertheless, results obtained by the above mentioned methods can be imprecise or even unreliable for various reasons. For example, lengthy questionnaires typical of SIMs often bore respondents, consequently lessening the reliability of the data collected [30]. In addition, since users tend to attribute a greater importance to all service aspects especially when they are asked upon to directly rate them, quality expectations may be overestimated and also characterized by a lower discriminatory power. Moreover, quality preferences garnered by such methods can be flawed by uncertainty, subjectivity and vagueness inherent in the use of linguistic variables to assess service quality aspects [31,32].

In the light of the previous considerations, a novel evaluation framework is herein developed to overcome the known weaknesses of the aforementioned methods, with the aim of assessing the healthcare service quality. Specifically, such a framework is based on the ServQual disconfirmation paradigm [33] and incorporates the AHP method to point out reliable estimates of quality expectations [34,35].

ServQual is the most commonly used conceptual model for studying and analyzing the quality of services [36]. The large employment of its paradigm is widely witnessed by the large amount of scientific literature produced over the years in different service fields, such as car rental industry [37], financial services [38], transportation [39], higher education [40], quality certification [41], hotel services [42-43], online business [44-46]. On the contrary, AHP is one of the most established MCDM methods for facing a wide variety of decision situations, in fields such as government, business, industry, healthcare, shipbuilding and education [47]. This fact is probably due to some aspects characterizing such method, such as: possibility to integrate both quantitative and qualitative and also conflicting criteria, opportunity to conduct sensitivity analysis on obtained results and, moreover, it is well supported by user-friendly computer software. Furthermore, the advantageous mathematical structure characterizing AHP and its easiness in acquiring the required data allow to overcome many critical issues, namely the well-documented respondents tendency to select the central category of the evaluation scale to express their judgments [48], the influence in the evaluation process of the categories number of the evaluation scale, the form and the type of related linguistic variables [49, 50].

Finally, a fuzzy evaluation environment is considered to deal with the inherent uncertainty, subjectivity and vagueness characterizing stakeholders in expressing their own judgments on service quality [51–53]. The fuzzy set theory has been successfully applied in many fields of the management science as decision-making [54], service performance evaluation [55,56], information retrieval [57,58], and so on. In the field of healthcare service quality evaluation, several recent applications are described in [59–61]. Fig. 2 summarizes the architecture of the evaluation framework developed.

The framework herein proposed seeks to support healthcare decision makers and managers in their choice of effective and efficient strategies aimed at service quality improvements. For example, it can facilitate the rational prioritization of interventions, such as allotting additional resources for those service aspects that prove to be inadequate, in order to achieve improved levels of performance.

The remainder of the present paper is organized as follows. Section 2 contains a detailed description of the framework. Section 3 illustrates the strategic service quality analysis focusing on the public healthcare service of Sicily (Italy). Finally, conclusions section
comprises a summary, suggestions for service quality improvements and directions for future research.

2. The novel fuzzy evaluation framework

As mentioned before, the devised evaluation framework includes fuzzy service quality evaluation and analysis modules. In Sections below such modules are in detail described.

2.1. Fuzzy service-quality evaluation module

Service quality perceptions and expectations are assessed under a fuzzy evaluation environment, taking into account the service aspects of the service quality structure (Fig. 3).

In order to compute linguistic variables used to represent stakeholders’ perceptions and expectations, several methods are available in the literature. The method hereafter described is commonly adopted in the service quality evaluation field for its ease of use and effectiveness [62–64] and, thus, employed in this study. In particular, quality perceptions are assessed using a five-point linguistic scale parameterized by Triangular Fuzzy Numbers (TFNs) [65,66]. In detail, the membership function of a TFN $\hat{B}$ is $\mu_{\hat{B}}(x)$: $k \rightarrow [0,1]$ and it can be represented by the set of Eq. (1), where $l_B < m_B < u_B$. The parameter $m_B$ corresponds to the maximum value of $\mu_{\hat{B}}(x)$, whereas $l_B$ and $u_B$ are the lower and upper limits of the definition interval, respectively [67].

\[
\mu_{\hat{B}}(x) = \begin{cases} 
\frac{x - l_B}{m_B - l_B} & \text{for } l_B \leq x \leq m_B, \\
\frac{u_B - x}{u_B - m_B} & \text{for } m_B \leq x \leq u_B, \\
0 & \text{otherwise}
\end{cases}
\] (1)

Fig. 3. Service quality structure.

Fig. 4. Five-point fuzzy perceptions scale.

Fig. 4 shows the five-point fuzzy-linguistic scale utilized herein to assess perceptions.

Quality perceptions of stakeholders are evaluated by the procedure reported below.

Considering the generic $k$th service criterion ($k = 1, 2, \ldots, n$), let $P_{i,k} = (l_{i,k}, m_{i,k}, u_{i,k})$ denote the TFN which measures the aggregate perception characterizing its $i$th service item ($i = 1, 2, \ldots, C_k$) obtained via the arithmetic mean, as reported below:

\[
l_{i,k} = \frac{1}{j} \sum_{j=1}^{l} (l_{i,k,j}) \text{; } m_{i,k} = \frac{1}{j} \sum_{j=1}^{l} (m_{i,k,j}) \text{; } u_{i,k} = \frac{1}{j} \sum_{j=1}^{l} (u_{i,k,j})
\] (2)

where $(l_{i,k,j}, m_{i,k,j}, u_{i,k,j})$ denotes the TFN measuring the perception of the $j$th evaluator ($j = 1, 2, \ldots, f$).

Finally, the relative crisp perception can be obtained with reference to the confidence level $\alpha$ ($\alpha$-cut) [66], which includes evaluators’ uncertainty over their judgments, and the optimism degree $\rho$ on fuzzy results [68], by the following relationship:

\[
p_{\alpha}^{\rho} = \rho \cdot u_{\alpha}^{\rho} + (1 - \rho) \cdot l_{\alpha}^{\rho}
\] (3)

\[
\forall \rho \in [0, 1] \text{; } k = 1, 2, \ldots, n \text{; } i = 1, 2, \ldots, C_k
\]

in which,

\[
\begin{align*}
& u_{\alpha}^{\rho} = u_{i,k} - (u_{i,k} - m_{i,k}) \cdot \alpha \\
& l_{\alpha}^{\rho} = (m_{i,k} - l_{i,k}) \cdot \alpha + l_{i,k}
\end{align*}
\] (4)

\[
\alpha \in [0, 1]
\]
where the generic term $\tilde{a}_{k,w} = (l_{k,w}, m_{k,w}, u_{k,w})$ denotes the TFN measuring the relative importance of the $k$th vs the $w$th service criterion. Particularly, $l_{k,w}, m_{k,w}, u_{k,w}$ are the minimum value, most plausible value and maximum value, respectively, obtained by aggregating evaluators’ assessments via the geometric mean [70]:

$$l_{k,w} = \left( \prod_{j=1}^{n} l_{k,w,j} \right)^{\frac{1}{n}}, m_{k,w} = \left( \prod_{j=1}^{n} m_{k,w,j} \right)^{\frac{1}{n}},$$

$$u_{k,w} = \left( \prod_{j=1}^{n} u_{k,w,j} \right)^{\frac{1}{n}} \quad (6)$$

where $(l_{j,k,w,j}, m_{j,k,w,j}, u_{j,k,w,j})$ indicates the TFN measuring the assessment expressed by the $j$th evaluator $(j = 1, 2, \ldots, J)$. ii) From the fuzzy comparison matrix $\tilde{A}$, fuzzy expectations are computed via the logarithm least-squares method [71], which is selected herein for its effectiveness. In particular, the expectation level expressed in fuzzy form for the $k$th service criterion $\tilde{E}_k$ can be obtained as follows:

$$\tilde{E}_k = (l_{E_k}, m_{E_k}, u_{E_k}) \quad k = 1, 2, \ldots, n \quad (7)$$

in which:

$$s_{Ek} = \left( \prod_{k=1}^{n} s_{k,w} \right)^{\frac{1}{n}} \quad s \in \{ l, m, u \} \quad (8)$$

iv) The related crisp expectation can be obtained with referring to the confidence level $\alpha$ and the optimism degree $\rho$ by the following relationship:

$$E_k^c = \rho \cdot u_{E_k} + (1 - \rho) \cdot l_{E_k} \quad (9)$$

in which,

$$\begin{cases} u_{E_k} = u_{E_k} - m_{E_k} \cdot \alpha \\ l_{E_k} = (m_{E_k} - l_{E_k}) \cdot \alpha + l_{E_k} \end{cases} \quad (10)$$

Also in this case, the $\alpha$ index reflects the degree of uncertainty in choosing a crisp value, on the part of the evaluators, to represent their judgments and the $\rho$ index is considered to reflect evaluators’ attitudes toward risk on fuzzy assessment results.

Finally, by following such a procedure, expectations of service items are obtained by multiplying their importance weights, which can be obtained via the above described procedure, by the expectation level of the related service criterion.

### 2.2. Service quality analysis module

As before said, the healthcare service quality is herein analyzed by means of the ServQual paradigm. The latter is based on the expectations disconfirmation approach, also defined as disconfirmation paradigm, to identify dissatisfying service aspects and reasons of such dissatisfactions. In particular, with reference to the

Fig. 5. Fuzzy importance scale (a) and relative reciprocal values (b)

A larger $\alpha$ value is considered when evaluators are confident in choosing a crisp value to represent their judgments, whereas $\rho$: $K \rightarrow [0, 1]$ reflects evaluators’ attitudes toward risk on fuzzy assessment results [69]. Evaluators are inclined to prefer higher or lower crisp values, derived from fuzzy assessments, according to whether they are optimistic or pessimistic, respectively.

Conversely, AHP is considered to assess expectations of stakeholders on the healthcare service quality. The employed procedure is comprised by the following fundamental steps: (i) pairwise comparison of service aspects, (ii) structuring of the fuzzy comparison matrix, (iii) computing of fuzzy expectations and, finally, (iv) calculating crisp expectations. Such steps are described below.

i) Terms used to express the relative importance of each pair of service aspects, at the same level of the service quality structure (Fig. 3), are quantified by TFNs. Fig. 5 shows the fuzzy-linguistic importance scale adopted comprising TFNs (Fig. 5a) and their reciprocal values (Fig. 5b).

ii) Considering the service criteria $1, 2, \ldots, n$, of the service quality structure, the fuzzy comparison matrix $\tilde{A}$ is defined as:

$$\tilde{A} = \begin{bmatrix} 1 & \tilde{a}_{1,2} & \ldots & \tilde{a}_{1,n} \\ \tilde{a}_{2,1} & 1 & \ldots & \tilde{a}_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_{n,1} & \ldots & \ldots & 1 \end{bmatrix} \quad (5)$$
generic ith service aspect, seven fundamental service discrepancies (i.e., gaps) are defined:

- **Gap 1:** represents the discrepancy between what customers actually want and what managers perceive customers to want;
- **Gap 2:** denotes the discrepancy occurring when managers fail to design service standards that meet customers’ expectations;
- **Gap 3:** occurs when the service delivery system, that is employees, technology and processes, fails to deliver according to specified standards;
- **Gap 4:** occurs when the communication to customers is misleading, promising service quality levels unfulfilled by employees, technology and processes;
- **Gap 5:** represents the discrepancy between customers’ perception \( P_i \) and their expectation \( E_i \); indicates the difference between what customers actually want and what employees assume customers to want;
- **Gap 6:** expresses the divergence between what employees assume customers to want and what managers think they want.

According to the ServQual paradigm, the **Gap 5** value represents a direct measure of customers’ satisfaction (CSi), that is:

\[
CS_i = P_i - E_i
\]

(11)

Thus, a positive CSi value indicates satisfaction with the ith service aspect, whereas customers’ dissatisfaction for this aspect exhibits a negative discrepancy value. Moreover, customers’ satisfaction is related to values assumed by the other six service discrepancies, as expressed below:

\[
CS_i = f(Gap_1, Gap_2, Gap_3, Gap_4, Gap_6, Gap_7)
\]

(12)

However, as recent literature indicates [72], customers’ satisfaction proves to be tightly correlated to only two service discrepancies: **Gaps 1 and 6**, that is:

\[
CS_i = f(Gap_1, Gap_6)
\]

(13)

with only limited effects resulting from the others. Therefore, the relationship (13) is used, as reported below, to discern reasons underlying stakeholders’ dissatisfaction with regard to healthcare services, whereas relationship (11) is considered to evaluate stakeholder satisfaction concerning the established service items, on the basis of the data collected by way of the survey.

### 3. Preliminary aspects of healthcare quality in Sicily

Healthcare in Sicily, as in the rest of the Country, is overburdened with ever increasing state expenditures with a consequently expanding deficit. Paradoxically, while spending for healthcare has been rising, patient satisfaction seems not to have followed suit. In fact, in many cases there seems to be a negative correlation between total expenditures and the level of satisfaction of patients and other stakeholders, as well. This situation may, at least in part, be attributable to an ineffective and inefficient use of resources [73].

Hence, in recent years in Sicily, evaluation, as strategic tool for triggering systems of actions and reactions aimed at improving efficiency and effectiveness of organizations, has assumed a focal role in monitoring healthcare effectiveness. This increased importance attributed to evaluation processes also arises from the following reasons:

- an increased awareness on the part of the citizenry, whose pursuit of elevated health standards and psychological well-being implies a demand for state-of-the-art healthcare, reflected in their expectations of personalized, high quality services;
- healthcare federalism policies have raised the issue of guaranteeing equality, while establishing minimum service standards for all. As a consequence, assessing the healthcare levels actually offered in Italy has become a virtual necessity.

In response to the above context, three types of evaluations are currently performed in the Sicilian healthcare system:

- evaluations of technical and scientific quality, performed by professionals and academics as dictated by “evidence-based medicine”;
- evaluations of organizational quality, mainly performed by consultants, concerning voluntary accreditation and certification procedures;
- evaluations of perceived healthcare quality, according to a variety of techniques (customers’ satisfaction, focus groups, civic audits, etc.).

With reference to the latter, nowadays in Sicily stakeholder perspectives on healthcare quality are considered a necessary and indispensable dimension to evaluate healthcare effectiveness. Currently, surveys on perceived healthcare quality comprise the most numerous and significant means of evaluation.

Given the premises above, an empirical evaluation study of service quality in the public healthcare sector in Sicily has been undertaken. In particular, the investigation has been focused on 9 relevant public hospitals, covering the entire Sicilian territory and over 30% of the healthcare demand, namely St. Giovanni di Dio (Agrigento), St. Elia (Caltanissetta), Cannizzaro (Catania), Enna Hospital (Enna), St. Martino (Messina), Di Cristina e Benfratelli (Palermo), Ragusa Hospital (Ragusa), Umberto I, (Syracuse) and St. Antonio Abate (Trapani).

These hospitals are comparable and highly specialized structures which, thanks to their set of advanced technologies and facilities, professional skills, productive capacity and the variety of services provided, represent reference points not only for Sicilians, but for non-residents from the other Italian regions as well. The evaluation results obtained may effectively map out stakeholder needs for hospital managers, thus assisting their endeavor to deliver quality healthcare.

### 3.1. Structure of healthcare service quality

The quality structure of the healthcare service has been described on the basis of a comprehensive review of the relevant literature in the field [74–77], after a wide consultation involving several healthcare managers and experts, physicians and a representative body of both in-patients and out-patients. Particularly, the overall healthcare service quality structure is subdivided into six service criteria and 32 service items as shown in Fig. 6.

Subsequently, in order to simplify the questionnaire to be adopted in the survey, this comprehensive list of service quality aspects has been narrowed down to a set of fundamental healthcare aspects of services delivered in Sicily. In particular, the latter have been derived by using the Critical Cases method [78] after a consultation involving several healthcare service experts (healthcare service managers, medical staff and nurses), academics and a limited number of stakeholders (in-patients, out-patients and...
their families). The resulting fundamental healthcare service quality structure is shown in Fig. 7.

Such a fundamental structure was considered to perform the analysis reported below.

3.2. Healthcare service quality evaluation

The survey was conducted over a five-month period, between January and May of 2014. For each considered hospital, about 60 respondents between in-patients and out-patients, as well about 20 among managers, doctors and nurses were interviewed via internet by the questionnaire form reported in Appendix A. Totally, 680 questionnaires were selected for their completeness from about 730 returned forms. Moreover, for both alpha and rho indices a value of 0.5 was assumed. Quality perceptions and expectations for each established core service item were calculated by relationships (3) and (9), respectively. Fig. 8 summarizes the obtained results.

More in detail, for all the established service items, quality perceptions varied only slightly within a narrow range (0.054; 0.083), whereas for quality expectations the degree of variation was significantly broader (0.036; 0.121), as shown in Fig. 8. In particular, service items with high expectation levels were $S_{1,1}$, $S_{1,2}$, $S_{1,3}$, $S_{2,1}$, and $S_{2,2}$. Instead, the service items $S_{3,2}$, $S_{3,3}$, $S_{3,4}$, $S_{4,1}$, $S_{4,2}$ and $S_{4,3}$ proved to be less important.

3.3. Healthcare service quality analysis

As previously mentioned, the ServQual paradigm was herein adopted to analyze the healthcare quality. To this aim, stakeholder satisfaction ($CS_i$) for any core service item was evaluated via the corresponding relationship (11) obtaining the results shown in Fig. 9.

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As one can observe, service items which points representative of their CS fall within the red area represent the dissatisfying service aspects. Thus, SI1, SI1, SI3, and SI2,1 represent those healthcare aspects with which respondents were strongly dissatisfied. On the contrary SI2,4, SI3,2, SI3,3, SI4,1, SI4,2, and SI4,3 were considered very satisfying healthcare aspects.

Finally, perceptions of stakeholders’ needs were also collected from healthcare managers and staff viewpoints via questionnaire to elicit the reasons underlying stakeholder dissatisfaction and, thus, the Gaps 1 and 6 were evaluated. In detail, positive values of such discrepancies indicate an underestimation of the related service aspects by healthcare managers and staff respectively, whereas service aspects characterized by negative values of such discrepancies are overestimated. Fig. 10 shows the obtained values.

The results reveal that managers’ perspectives on healthcare quality tend to overestimate service aspects of the criterion C2 and underestimate those of the service criteria C1 and C3. On the contrary, importance of service aspects of the criterion C4 are correctly understood by managers since they are characterized by almost zero Gap 1 values. Finally, according to staff viewpoints, very important service aspects are those relating to the criterion C1, service aspects of the criterion C4 are underestimated, whereas the criteria C2 and C3 are correctly perceived.
4. Conclusions and suggestions

In the present paper, the public healthcare sector of the Sicily Region (Italy) was analyzed via a suitable framework based on the ServQual paradigm. In particular, a fuzzy environment was considered to deal with the uncertainty of stakeholders in expressing their own judgments on service quality, whereas AHP was employed to obtain reliable estimations of service quality expectations. From the results analysis, key factors for healthcare quality emerge and, thus, a rational strategy for the service quality improvement can be identified. In particular, in the light of the obtained $C_5$ values, strategic efforts toward the service quality improvement should concern the following service criteria: Healthcare staff and Responsiveness and, particularly: Staff capacity to work as a team, Ability of doctors to understand patient needs, Staff reliability and Swiftness of registration and admission procedures. Conversely, the obtained discrepancies characterizing managers’ viewpoints on service quality highlight that the importance of the service criteria Responsiveness, Healthcare staff and Relationships is not correctly perceived by them. Thus, actions should be primarily focused on improvements in marketing researches, direct interactions between managers and stakeholders and bottom-up internal communications to correctly understand what stakeholders actually want. Furthermore, effective internal communications of achievements in service quality should reduce the discrepancies between stakeholders’ needs and how staff perceive those needs. Future research development will regard the improvement of the herein adopted assessment framework by considering MCDM procedures to comparatively evaluate the quality of healthcare service alternatives.

Acknowledgements

The Author thanks the two anonymous referees for their remarks which helped to significantly improve the paper.

Appendix A. Appendix A

See Tables A1 and A2.

### Table A1

<table>
<thead>
<tr>
<th>Questionnaire form to collect perceptions of healthcare service.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
</tr>
<tr>
<td>Healthcare staff ($C_1$)</td>
</tr>
<tr>
<td>Ability of doctors to understand patient needs</td>
</tr>
<tr>
<td>Capacity to work as a team</td>
</tr>
<tr>
<td>Staff reliability</td>
</tr>
<tr>
<td>Staff availability</td>
</tr>
<tr>
<td>Responsiveness ($C_2$)</td>
</tr>
<tr>
<td>Swiftness of registration and admission procedures</td>
</tr>
<tr>
<td>Administrative quality</td>
</tr>
<tr>
<td>Waiting time for tests results</td>
</tr>
<tr>
<td>Waiting time for medical records</td>
</tr>
<tr>
<td>Relationships ($C_3$)</td>
</tr>
<tr>
<td>Confidentiality between doctor and patient</td>
</tr>
<tr>
<td>Confidentiality between all healthcare staff</td>
</tr>
<tr>
<td>Cooperation and helpfulness of administrative staff</td>
</tr>
<tr>
<td>Humanization of relationships</td>
</tr>
<tr>
<td>Support services ($C_4$)</td>
</tr>
<tr>
<td>Quality of food &amp; beverage for patients</td>
</tr>
<tr>
<td>Security within hospital</td>
</tr>
<tr>
<td>Cleanliness of facilities and premises</td>
</tr>
</tbody>
</table>

Please mark in the questionnaire form reported below the letters related to your judgments:

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### Table A2

Questionnaire form to collect expectations of healthcare service.

<table>
<thead>
<tr>
<th>How important is:</th>
<th>Healthcare staff</th>
<th>Responsiveness</th>
<th>Relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Support services</strong></td>
<td>A B = a b</td>
<td>A B = a b</td>
<td>A B = a b</td>
</tr>
<tr>
<td>C D = c d</td>
<td>C D = c d</td>
<td>C D = c d</td>
<td></td>
</tr>
<tr>
<td><strong>Relationships</strong></td>
<td>A B = a b</td>
<td>A B = a b</td>
<td>A B = a b</td>
</tr>
<tr>
<td>C D = c d</td>
<td>C D = c d</td>
<td>C D = c d</td>
<td></td>
</tr>
<tr>
<td><strong>Responsiveness</strong></td>
<td>A B = a b</td>
<td>A B = a b</td>
<td>A B = a b</td>
</tr>
<tr>
<td>C D = c d</td>
<td>C D = c d</td>
<td>C D = c d</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How important is:</th>
<th>Ability of doctors to understand patient needs</th>
<th>Capacity to work as a team</th>
<th>Staff reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staff availability</strong></td>
<td>A B = a b</td>
<td>A B = a b</td>
<td>A B = a b</td>
</tr>
<tr>
<td>C D = c d</td>
<td>C D = c d</td>
<td>C D = c d</td>
<td></td>
</tr>
<tr>
<td><strong>Staff reliability</strong></td>
<td>A B = a b</td>
<td>A B = a b</td>
<td>A B = a b</td>
</tr>
<tr>
<td>C D = c d</td>
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<tr>
<td><strong>Capacity to work as a team</strong></td>
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<tr>
<th>How important is:</th>
<th>Swiftness of registration and admission procedures</th>
<th>Administrative quality</th>
<th>Waiting time for tests results</th>
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<thead>
<tr>
<th>How important is:</th>
<th>Confidentiality between doctor and patient</th>
<th>Confidentiality between all healthcare staff</th>
<th>Cooperation and helpfulness of administrative staff</th>
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<tr>
<td><strong>Humanization of Relationships</strong></td>
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<th>Quality of food &amp; beverage for patients</th>
<th>Security within hospital</th>
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<td><strong>Cleanliness of facilities and premises</strong></td>
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<td><strong>Security within hospital</strong></td>
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D: Extremely more important  
C: Very strongly important  
B: Strongly important  
A: Moderately important  
#: Equally important  
a: Moderately less important  
b: Strongly less important  
c: Very strongly less important  
d: Extremely less important

### References


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