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E-service Evaluation: User Satisfaction Measurement and Implications in Health Sector

Abstract

E-appointment systems are useful for patients to plan and organize their medical appointments online. Managing appointments in healthcare organizations and ambulatory care settings is a difficult process and one frequent challenge that several healthcare professionals have to overcome is related to non-attendance. Findings from previous surveys indicate that many physicians are willing to use these systems and patients would be probably to book an online appointment with their health care provider, if the e-appointment system was available. There is a lack of empirical studies that have examined the adoption, user acceptance, and effectiveness of e-appointment systems in private care services. The purpose of this article was the application of the MUSA (MULTicriteria Satisfaction Analysis) method to measure the extent of users' satisfaction of an e-appointment system of a Greek state hospital in Thessaloniki and to provide useful data to the administrators in order to be able to make better decisions and determine which characteristics of the service need to be improved.

Keywords

e-service, e-appointment, user satisfaction, e-health, health care sector

1. Introduction

Healthcare organizations broadly use Information & Communication Technology (ICT) which supports healthcare professionals to enhance the efficiency and effectiveness of services. Many hospitals use health Information Systems which can record and locate significant information quickly. Recently, researchers examined new issues and challenges regarding the use of ICT in order to provide better healthcare services. ICT can help healthcare managers to better understanding the dimensions and services that can increase service quality. ICT initiatives in a hospital, named e-health, provide several benefits such as reduction of cost and patients' empowerment [1, 10, 42-46].

The increased use of the Internet and web-based systems has provided many advantages because they support the connection between service/product providers with their customers. The use of ICT has become a new challenge in many industries and in the healthcare sector managers are aware of planning and implementing web-based information systems. Decreasing the work load of staff along with enhancing efficiency and service quality should be a top priority in every healthcare organization and using the ICT and the Internet could be of great help. Hospitals are planning and implementing web-based e-hospital systems which will reduce operation cost, increase clinical service quality, enhance the efficiency of hospital management and support patient loyalty in order to accomplish strategic goals and to gain competitive advantage. Several e-services are included in e-hospital systems, such as clinical information collection and processing, remote monitoring of patients, and web-based appointment systems [6, 43-45].

The appointment scheduling system is a service provided by hospitals which increases efficiency, productivity, and profitability in healthcare services. Managing appointments in healthcare organizations and ambulatory care settings is a difficult process and one frequent

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challenge that several healthcare professionals have to overcome is related to non-attendance. Previous surveys indicate that missed appointments represent approximately 10% of all medical appointments. Therefore, there are several issues related to missed appointments which concern the providers, staff, and the patients themselves [23].

On patient's planning and organizing their medical appointments online appointments systems are proved to be useful as they have been developed. In such a way that they can make management of booking appointments in medical practices and healthcare settings as efficient as possible. Findings from previous surveys indicate that many physicians in Canada, United States and Europe are willing to use these systems and patients would be probably to book an online appointment with their health care provider, if the e-appointment system was available. According to the results of previous surveys, respondents ranked e-booking system in one of the most useful online consumer health services [23].

Therefore, in modern care settings researchers pay attention to a common practice which has been given to the patients' opinion regarding to the service quality as well as their satisfaction level that derives from them. The quality and measurement of the satisfaction levels in relation to the offered healthcare are significant tools of evaluating these specific services. Despite the physicians and professionals, patients, who are the end users of healthcare services, provide significant data when they participate in surveys regarding the improvement of these services. Specifically, the combination of patients' opinions on healthcare services with the findings from previous surveys can provide solid conclusions for the implementation of operations of different hospitals and levels of healthcare [11]. Patients are conscious of alternatives on offer but of the quality of the service they experience as well, as rising service quality levels have expanded their expectations. Service quality is used as a strategic differentiation tool by managers so as to develop such an advantage that their competitors would have difficulty in copying it [1, 7]. These perceptions are important and that this paper will focus on those which are important, especially for private healthcare where competition has a big impact.

Limited surveys provide findings regarding to the use of ICT and Information Systems which make more efficient the management of appointment process and enhance attendance in primary care and outpatient settings. Empirical studies have examined the adoption, user acceptance, and effectiveness of e-appointment platforms in private care services [6, 23]. Previous most studies in the field are focused in analyzing the adoption of e-health systems instead of evaluating perceived patient satisfaction. Thus, these studies are not able to provide a real customer benchmarking framework.

Therefore, this paper attempts to fill this gap. Therefore, it is an important challenge for healthcare professionals to investigate the acceptance of e-appointment system from the patient's viewpoints. Thus, The purpose of this article was the application of the MUSA (Multicriteria Satisfaction Analysis) method to measure the extent of users' satisfaction of an e-appointment service of a Greek state hospital in Thessaloniki and to provide useful data to the administrators in order to be able to make better decisions and determine which characteristics of the service need to be improved.

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The rest of the paper is organized as follows: Section 2 presents the theoretical framework regarding the satisfaction of e-health services. Section 3 presents the methodology used for the paper. Section 4 provides the results of data analysis. Finally, conclusion recommendations for future research are provided in the last section of the paper.

2. Theoretical Background

2.1 Electronic Service quality in healthcare sector

Parasuraman et al., (1988) [21] developed the SERVQUAL model by combining the results of empirical studies in many industry sectors, including the healthcare industry. This model is a widely known multiple-item instrument which helps professionals to measure customers' global (as opposed to transaction-specific) evaluation of an organization's service quality. Service quality measurement is based on five dimensions: reliability, responsiveness, assurance, empathy, and tangibility [21, 22].

According to previous studies in the field of service quality measurement in the healthcare sector, seven main aspects characterize the service quality. The first one refers to security which describes the level of trust that has a customer on a service system. The second aspect concerns consistency. According to this aspect the quality of service should not distinct from different service staff, time or place. Next, the third aspect refers to attitude which represents the extent of the hospitality provided by the service staff. The completeness of the facilities that provide services is another aspect as well as conditions which can be used to describe the environment and the overall atmosphere in which the services are offered. The sixth aspect concerns transportation availability as well as the extent of usage of trading environment as a whole. The last aspect describes the comparison between the time that is required in order to complete service and the customer's expected time [6].

On the other hand, there are ten indicators that can be used in order to measure service quality in the healthcare sector. The first indicator refers to the reliability. Professionals who offer services to customers aim to provide reliable and consistent service according to their promises to the customer. The next aspect is the responsiveness, a term referring to the swiftness of response of the staff to the customer. Competence is also an indicator which is used to describe all the skills and knowledge the service staff is required to have. Another equally important indicator which is used to measure the quality of services is the extent of accessibility of specific services to the customers. That is to say shorter waiting time, service locations and engagement of the customer. Communication is also another factor which indicates the quality of the services measuring the capability of the staff to offer services in accordance with the customers' special cultural characteristics as well as their language. This capability refers to listening the customers, and therefore offering service to customers that meet their expectations. Furthermore, credibility measures customers' trust to the organization. Security is defined as the capability to reduce the customers' risk, danger and uncertainty. Another indicator refers to the understanding of the need of the customers and as well as to the capability to offer customized services. Finally, the last indicator refers to tangibility, which is a characteristic of services that describes the capability of the organization which provide services to develop the apparel of the service staff, a physical service environment, tools and facilities [6].

Table 1 summarizes the electronic service quality dimensions which have been used by previous researchers. Several researchers have measured electronic service quality in healthcare using dimensions related to site's quality, ease of use, and components such as website design. This finding supports that the quality of e-health services can be measured using these dimensions. Perceived usefulness is a common dimension in electronic service quality evaluation in the healthcare sector as well as ease of use [8, 26, 29]. Another dimension which has frequently been used in the existing literature of health systems is site's quality which involves variables such as design, speed and security [3, 19, 29, 30]. Privacy and security of information is an important dimension in e-health service quality assessment which does not only refer to patients' information which are shared through the web [26, 27]. Recent studies have mainly focused on dimensions such as handling information and managing capability of online registration problems in order to increase the intention and satisfaction of users for e-health systems [6, 14, 23].

Electronic Service quality dimensions	References
Perceived usefulness Ease of use	Davis (1989) and Szajna (1996) [8]
Site's quality (trust, usability, information, design and empathy)	Barnes and Vidgen (2002) [3]
Site quality (ease of use, aesthetic design, processing speed, and security)	Yoo and Donthu (2001) [29]
Product offerings Site design Financial security	Szymanski and Hise (2000) [27]
Privacy/security Website design Reliability/fulfillment Customer service	Wolfinbarger and Gilly (2003) [28]
Access Reliability Ease of navigation Responsiveness Flexibility Efficiency Assurance/trust Customization/personalization Price knowledge Security/privacy Site aesthetics	Zeithaml et al. (2002) [30]
Website quality (web site presentation system security, response time, efficiency, speed of providing services, and effectiveness)	Loiacono et al. (2002) [19]
Handling information Managing capability of online registration problems	Chang et al., (2015) [6], Handan, (2016) [14] and Paré et al., (2014) [23]

Table 1. Electronic Service quality dimensions

It is obvious that e-health may increase the quality of healthcare services in many ways. For example it allows comparisons between different providers, and it involves customers as

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additional power for quality assurance. Furthermore, it provides guidelines to patient streams to the best quality providers [12]. Many indicators that were used in order to measure the service quality in healthcare sector are different from those that are used in electronic services. These indicators concern the completeness of the facilities that provide services, the skills and knowledge the service staff, and the waiting time and the location where the service is provided. The indicators which measure electronic service quality are different because the service is provided through the Web.

2.2 Patient Satisfaction in healthcare sector

Executives in healthcare organizations need to be aware of customers' expectations in order to manage customers. Therefore, managers have to detect their expectations and to examine reasons of their dissatisfactions. Customers' satisfaction is a central dimension for service evaluation. In other words, managers aim to improve customers' satisfaction which should be derived from business strategy. Furthermore, offering premium quality of services has become a significant competitive advantage for healthcare organizations. Thus, organizations have already involved customers in healthcare processes in order to increase the impact of outcomes. As a business entity, a healthcare organization has to implement the same practices and standards of customer service with other sectors or business organizations [1].

Nowadays, patients are actively collecting and sharing health information and using it to make decisions about their health. Customers' expectations in healthcare are increasing and healthcare organizations face a significant challenge because they have to fulfill these expectations as well as to make exceptional impression on every patient. In another case, if customers are not satisfied with the service, they will switch healthcare providers due to many reasons such as lower quality of care, inefficiency, and higher cost [1].

As a result, the implementation of a beneficial relationship between patients and healthcare providers is based on the understanding of how expectations are developed. Reducing the gap between patients' expectations and their actual experiences is the aim of an organization when they manage expectations. This is a crucial process as patients can access the service provider to express their opinion on the quality of the service [2].

The evaluation of patient satisfaction refers to several distinct functions. Previous surveys measured patient satisfaction examining the evaluation of service care quality, the effectiveness of educational level of nurses and patients, the assessment of the effectiveness of an organizational intervention, and the assessment of the performance of a type of nurse practitioner [4].

Customers make comparison between their expectations and perceived performance of healthcare services and they are satisfied if their expectations are aligned with service performance. Doctors who interact with their patients and they support that patient physician relationships are as significant as partnerships increase the level of satisfaction among their patients. According to the results of a multivariate analysis, spending more time with patients is an important factor which has significantly increased patient satisfaction. Asking the patient immediately after the visit to the doctor about the doctor-patient communication was proved to be a factor that increases satisfaction. The type of treatment provider negatively affects patient satisfaction and provider switching. Therefore, if the patient has expectations that have

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not been satisfied, then he/she may change healthcare provider [2]. Previous studies in healthcare confirm this finding because many surveys contain variables such as the kindness and helpfulness of nursing staff [4].

Customer service is required in healthcare in order to increase service quality as well as it can be used as a competitive advantage for business organization. As patients can make decisions on the location in which they receive healthcare based on their service experiences, healthcare professionals can be informed so as to create an institution able not only to perceive but also to react empathetically to their customers' expectations. Nowadays these choices are increased for patients who interact with doctors and healthcare providers. If the customer service is valuable for patients the healthcare system will be improved. In addition, the knowledge regarding the development and management of healthcare systems and the factors according to the quality of healthcare services, their outcomes, and patient satisfaction, have been important. For this purpose, the investigation of service quality dimensions that customers perceive as significant in the healthcare sector is required [1].

2.3 E- appointment systems for hospitals

Nowadays, customers including people at all ages, such as children and elders, frequently collect information on the Internet. It is essential that businesses use new technologies to support effective self services, as handling customers transactions effectively can reduce costs and make the most of using staff's time though, so far its implementation does not satisfy either the staff or the patients, so improvements have to be made. Fulfilling customers' expectations is considered as an important challenge on how a healthcare organization interacts with their customers effectively. Moreover, customers' demands have changed because customers search for information, collect a large amount of information and share it [1, 5, 14, 15].

Although groups of users are determined by conventional usability testing profiles and targets, it is observed that in the health industry ICT challenges are an outcome of larger possible number and classes of users in this field, such as physicians, pharmacists and nurses. Each class is essential to separate into subclasses of users, such as emergency physicians, attending physicians, residents, and surgeons. Furthermore, despite for normal demographic differences, such as age, sex, and computer literacy, specialty, and nature of treatment for instance chronic, episodic, acute vary not only in healthcare but also in clinical practice in local, regional level and national boundaries. Having an increase of failed systems in healthcare when they are distributed in complex environments, it is certainly clear that varied contexts of systems which are used during the design and development phase should be considered, in particular when different types of users analyze complex tasks that are performed in the field of healthcare. This requires the integration of users, tasks and contexts [18].

Existing literature presents many strategies that can be used in order to reduce missed appointments. Overbooking which is a common strategic approach is used in order to book more appointments than this practice can actually accommodate. Although this strategy may be efficient from the standpoint of use of staff time, both patients and staff are not satisfied with its implementation. Sending reminders is another strategy which includes text messages

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or e-mails or even, automated or not, telephone calls. These practices aim to deal with no-shows as many patients forget their appointments. Many surveys have been conducted to compare the efficiency of these reminders. It was indicated that there has been a decrease in the risk of patients forgetting their appointments when reminders were sent to patients a few days before their appointment date. It has also been concluded that text reminders are as effective as any other type of reminders [23].

Another strategy is advanced access scheduling. Rather than book appointment slots months in advance this method means receiving appointment slots for some day appointment. Physicians who use this strategy have generally reduce prescheduled visits. The combination between prescheduled and open appointments is frequently identified by the medical practice's unique balance of demand and supply for appointments. Previous studies have explained that advanced access scheduling can provide many advantages, such as fewer missed appointments, increased satisfaction for patients, providers, and staff, and increased productivity among the healthcare professionals [23].

A large amount of information can be obtained by customers who wish not to physically visit a hospital or a medical center by using online registration services. They can have access to personal information or clinical records by using an account number and a password to connect to a hospital database. They can even make appointment reservations taking into account the doctors' available time which is stated on a web-based appointment system. The web-based appointment system provides various benefits to patients as well as to doctors and healthcare professionals. In this way, patients can be informed of the current physicians on duty, so it is only when patients receive clinical treatment that they go to the hospital for an initial appointment, thus the clinical cost is reduced. However the medical management cost can be decreased as well as healthcare professionals can automatically acquire a patient's personal clinical info records using the registration system which is connected to the medical database [6].

Despite the benefits that provide registration systems there are some challenges which face many patients. While patients benefit from online registration services, elderly patients face many difficulties due to their lack of computer-use experience. Elderly patients have limited knowledge regarding new technologies and as a result they are not aware of using them and taking advantage of new, web-based appointment systems [6].

Previous researches stated that scheduled visits are twice fulfilled by web based referral system, as well as that web-based system is linked with greater scheduling of appointments among patients. This is related to a lack of understanding of the e-appointment process. Especially, Chang et al., (2015) [6] have observed that the total number of the patients who maintained scheduled appointment using registration system was increased as 83%. Kim-Hwang et al., (2010) [17] provided significant results concerning the use of e-health systems by physicians and surgeons. Responders indicated that they had the intention to use e-health systems for medical and surgical visits and they did not face difficulties. Furthermore, healthcare professionals indicated that follow-up visits were not avoidable for medical and surgical patients who used e-health system.

However, there are several challenges for physicians who use e-appointment or web-based appointment systems. Also it is due to limited technological infrastructure that would make communication easier. Technical infrastructure makes easier communication among distributed software components, organizational structures which do not support the e-appointment process as well as organizational conditions and requirement for ICT support which do not reduce the economy of scale [6].

Investments in ICT are increasing and healthcare organizations use new technologies to develop a more efficient and effective healthcare services. Medical staffs use the web technology in order to monitor their patients remotely and to share information according to health education or promotion programs with their patients. Many benefits stem from the use of the web for healthcare, which often provides advanced e-health services to patients and doctors. These advantages concern availability, fast response and convenience [1].

3. Methodology

3.1 Research Framework

Executives in healthcare organizations need to be aware of customers' expectations in order to manage customers. Therefore, managers have to detect their expectations and to examine reasons of their dissatisfactions. Customers' satisfaction is a central dimension for service evaluation. In other words, managers aim to improve customers' satisfaction which should be derived from business strategy. Furthermore, offering premium quality of services has become a significant competitive advantage for healthcare organizations. Thus, organizations have already involved customers in healthcare processes in order to increase the impact of outcomes [1].

The suggested framework presents the dimensions of e-health service quality that affect patients' satisfaction who use e-appointment systems (Figure 1). These dimensions were obtained in Table 2. According to previous studies, perceived usefulness is a common dimension in service quality evaluation as well as ease of use [8, 29]. Another dimension which has frequently used in the existing literature is site's quality which involves variables such as design, speed and security [3, 19, 29, 30]. Privacy and security of information is an important dimension in service quality assessment which does not only refer to patients information which are shared through the web [27, 28].

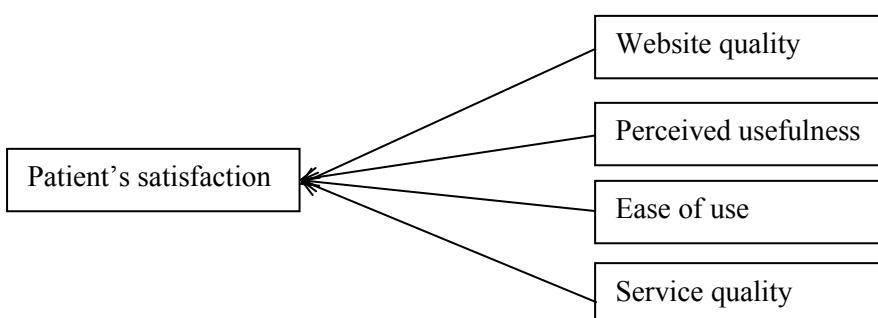


Figure 1. Research Framework

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3.2 Questionnaire design and Data collection

A field survey for users of the platform was developed. The instrument used seven-point Likert-scales to operationalize seven constructs: perceived ease of use, perceived usefulness, user experience, willingness to use, website quality, service quality and satisfaction. The perceived ease of use construct measured the extent to which user easily uses the functions of online registration, and the extent to which user easily learns and with clear operation description. Another indicator is the perceived usefulness construct which measures how useful the user online registration is considered to be by the users. The user experience construct measures the patients experience of computers use, and how this can have an influence on their intention of reusing it in the future. Characteristics such as website presentation efficiency, response time, speed of providing services and system security and effectiveness are measured as well. Service quality is evaluated by the users perspective on handling information and managing capability of online registration problems. The items were derived from Chang et al., (2015) [6], Handan, (2016) [14], Loiacono et al., (2002) [19], Paré et al., (2014) [23], Stefanakakis & Kitsios, (2016) [25] and Stefanakakis et al., (2017) [24]. Satisfaction construct measured the extent to which user is satisfied with each one of the previous constructs [9, 23]. A 5point Likert ordinal satisfaction scale was used. Table 1 summarizes the definitions of constructs and variables used in this paper. Appendix A displays the items and scales as they appeared in the survey.

Variable	Definition
Perceived ease of use of the e-appointment system	Measuring the extent to which a registered user easily uses the functions of online registration, and the extent to which user easily learns and with clear operation description
Perceived usefulness of the e-appointment system	Measuring the extent of user's perceived usefulness online registration
User experience	Measuring the extent of user experience of using computers as well as its extent of influence on using intention in the future
Willingness to use the e-appointment system	Measuring user's intention of the use of online registration functions in the future
Website quality	Measuring characteristics such as web site presentation efficiency, response time, speed of providing services, and system security and effectiveness
Service quality of the e-appointment system	Measuring service quality of the e-appointment system from user's view, such as handling information, managing capability of online registration problems
Satisfaction	Measuring the extent to which user is satisfied with each one of the previous constructs of the e-appointment system

Table 2. Construct definitions

Table 2 summarizes the criteria that were described previously and they are used in this study in order to measure user's satisfaction. These criteria are related to perceived ease of use,

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perceived usefulness, website quality, and service quality and they were derived from Chang et al., (2015) [6], Handan, (2016) [14], Loiacono et al., (2002) [19] and Paré et al., (2014) [23].

Healthcare professionals in the Greek hospital have developed the e-appointment system in order to improve appointment reservations and reduce missed appointments as many patients forget their appointments. Fulfilling customers' expectations is considered as an important challenge for healthcare executives in the hospital. Patients who use the system can even make appointment reservations taking into account the doctors' available time which is stated on a web-based appointment system. The web-based appointment system provides various benefits to patients as well as to doctors and healthcare professionals. In this way, patients can be informed of the current physicians on duty, so it is only when patients receive clinical treatment that they go to the hospital for an initial appointment, thus the clinical cost is reduced. However the medical management cost can be decreased as well as healthcare professionals can automatically acquire a patient's personal clinical info records using the registration system which is connected to the medical database.

Health decision makers aim to evaluate the developed e-appointment system which was used by patients. Thus, the survey was sent to registered users. Ten users were asked to participate in a pre-test. Each one completed the survey and commented on the contents, length, and overall appearance of the instrument. The survey was sent to 35.500 users. A total of 157 users returned the survey. Fifteen sent only demographic data and they had not participated in the survey; thus, the analysis used 142 questionnaires. The response rate was 0.4%.

3.3 Data analysis

Multicriteria user satisfaction analysis was used in order to measure the satisfaction and to provide the weak and strong points of satisfaction. This method was selected among other Operational Research methods such as goal programming, multi-steps linear programming, integer programming, or dynamic programming because it will indicate the satisfaction indices of each criterion as well as the weights that patients evaluates for each criterion. Furthermore, the purpose of this methodology is that the health policy maker can use the action and improvement diagrams which are produced, in order to be aware of the weak and strong points of satisfaction. In addition, the improvement diagrams give to healthcare professionals a clearer view of the actions that have to be improved [20, 31-41].

The MUSA method is a multicriteria methodology which aims to measure and analyze customer satisfaction. This method is used for the evaluation of a set of marginal satisfaction functions. The global satisfaction functions stems from the results of the marginal satisfaction functions which are the results of consumer's reviews. Therefore, the most important goal of the method is the aggregation of individual judgments into a collective value function [13].

The MUSA approach evaluates global and partial satisfaction functions Y^* and X_i^* respectively, given consumers' ordinal judgments Y and X_i (for the i -th criterion). The hypothesis of an added utility model is the basic axis of the method, and it is represented by the following ordinal regression analysis equation:

$$\tilde{Y}^* = \sum_{i=1}^n b_i X_i^* - \sigma^+ + \sigma^-$$

where \tilde{Y}^* is the estimation of the global value function Y^* , n is the number of criteria, b_i is a positive weight of the i -th criterion, σ^+ and σ^- are the overestimation and the underestimation errors, respectively, and the value functions Y^* and X_i^* are normalized in the interval [0, 100] [13].

Many types of results are produced by MUSA methodology. The final result is calculated using the average of the near optimal solutions of linear programming, which increase the weights of the n satisfaction criteria. A significant solution concerns the criteria weights b_i , which present the relative significance of the evaluated satisfaction criteria (value trade-offs among the criteria). Many normalized indices are included in the MUSA methodology. These indices may support the in-depth analysis of the satisfaction measurement problem. These indices involve a series of other types of indices [13]. These average indices named; satisfaction indices are ranged between [0, 1] which represents the level of customer global or criteria satisfaction. These indices can be identified as the basic average performance indicators (globally or per criteria) for the business organization. The normalized indices named; demanding indices are ranged between [-1, 1] and they are calculated according to the set of estimated added value curves. Furthermore, these indices represent customers' demanding level (globally and per criteria) and they are identified as an indicator for the extent efforts that an organization aims to improve. The normalized average improvement indices are ranged between [0, 1] and these indices represent the improvement margins on a specific criterion. The significance of the satisfaction dimensions defines the result of the improvement efforts and their contribution to dissatisfaction as well.

Furthermore, the results can be visualized using two types of diagrams. These diagrams named action and improvement diagrams are developed based on the aforementioned results [13]. The first type of diagrams are developed using a combination of criteria weights and satisfaction indices (Figure 2). These diagrams are similar to SWOT analysis and they can illustrate the strong and weak points of the organization, in order to help practitioners to identify which satisfaction dimensions should be improved.

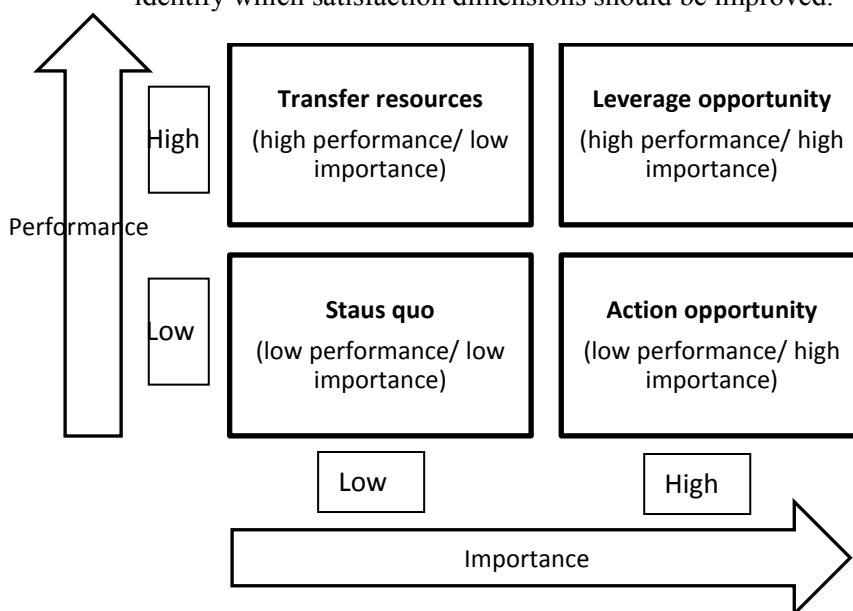


Figure 2. Action diagram

Adapted from: Grigoroudis and Siskos (2002)

Action diagrams are divided into four quadrants and the satisfaction dimensions are represented into two actions according to performance and importance. The improvement actions for each satisfaction dimension could be implemented according to the quadrant in which the dimension is illustrated. Status quo quadrant is characterized by low performance and low importance. Therefore, no action is required because customers do not consider that these satisfaction dimensions are significant. Leverage opportunity quadrant is characterized by high performance and high importance. The dimensions that are included in this area can be considered as advantage against competition. In several cases, these dimensions are explained the reasons why customers have purchased the product/service under study. Then, transfer resources quadrant is characterized by high performance and low importance. These resources may be better used elsewhere. For example company's resources can be used in order to improve the satisfaction dimensions located in the action opportunity quadrant. Finally, action opportunity quadrant is characterized by low performance and high importance. These criteria that need attention and therefore improvement actions should be focused on these in order to increase the global customer satisfaction level.

Improvement diagrams are developed using a combination of improvement and demanding indices (Figure 3). In contrast to action diagrams which can only present which satisfaction dimensions should be improved, these diagrams can evaluate improvement priorities and predict the output or the extent of improvement efforts.

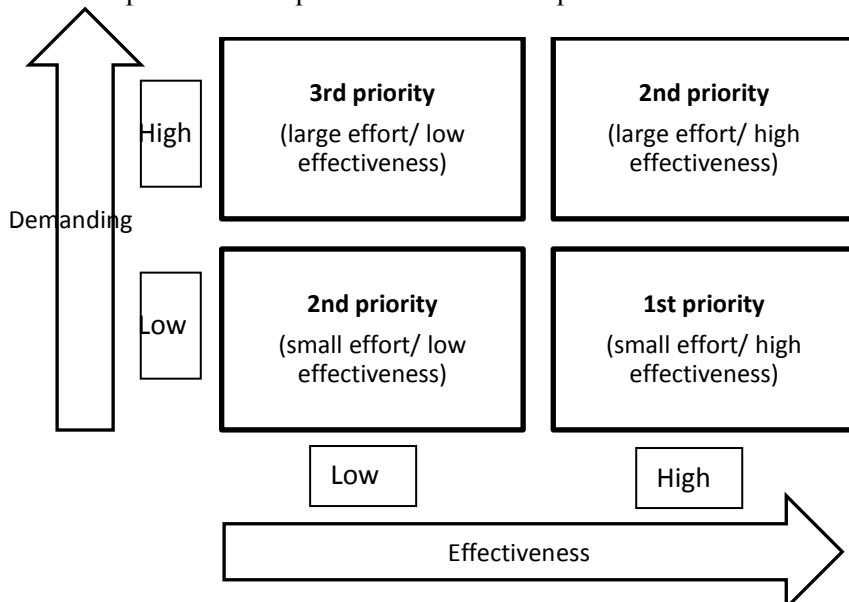


Figure 3. Improvement diagram

Adapted from: Grigoroudis and Siskos (2002)

Improvement diagrams can be considered as dynamic because they can present only the current situation of customer behavior. These diagrams are divided into four quadrants and the satisfaction dimensions are represented into two actions according to demanding and effectiveness. The improvement priorities for each satisfaction dimension could be evaluated

according to the quadrant in which the dimension is illustrated. 1st priority area recommends direct improvement actions because these satisfaction dimensions are effective and customers are not demanding. Then, 2nd priority area contains satisfaction dimensions that have either a low demanding index or a high improvement index. Finally, third priority area includes satisfaction dimensions that have small improvement margin and need improvement actions [13].

4. Results

Respondents were 36-55 years old, well-educated, and experienced. The majority of them are willing to use the application in the future. Table 3 shows further respondent breakdown by age, education, experience, and user's intention to use the application in the future.

Variables	Categories (scale)	Total sample (n=142)
Age	18-25	1.40%
	26-35	18.30%
	36-45	27.46%
	46-55	33.80%
	56-65	18.30%
	>65	11.26%
Education	Some college	30.98%
	2 year college graduate	18.30%
	4 year college graduate	45.77%
	Post graduate degree	10.56%
	PhD degree	2.11%
	Other	2.81%
Experience	No extent (1)	11.26%
	Small extent (2)	6.33%
	Some extent (3)	24.64%
	Moderate extent (4)	31.69%
	Great extent (5)	45.07%
User's intention	No extent (1)	2.81%
	Small extent (2)	0%
	Some extent (3)	4.22%
	Moderate extent (4)	12.67%
	Great extent (5)	90.84%

Table 3. Percentage distribution of the samples' characteristics

As noted in the previous section of the paper MUSA method was used in order to analyze the data. This method can identify the level of patients' satisfaction. The analysis of the general patients' satisfaction indicates that the average satisfaction index is significant (89.5). It is obvious that the users of the e-appointment system are relatively satisfied regarding the website quality, the perceived usefulness, the ease of use and the service quality of the system. In particular, the patients appear to take more into consideration satisfaction criteria such as perceived usefulness and ease of use. On the other hand, the patients are not satisfied with the service quality and the website quality. The values of satisfaction indices for each criteria are presented in Table 4.

Criteria	Weights (%)	Satisfaction Indices (%)
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Website quality	11,163	85,785
Perceived usefulness	49,448	96,906
Ease of use	18,738	93,013
Service quality	20,652	77,137
Global		89,473

Table 4. Criteria Weights and Satisfaction Indices

As presented in the previous section of this paper, using this method a series of actions diagrams are developed in order to further analyze the patients' satisfaction and prioritize actions which are required to make improvements. The results of the action diagram indicate that the strong point of the e-appointment system of this hospital against the competition refers to the ease of use. This dimension was considered crucial by the patients while it may be of a relatively higher significance. This is the main reason which influences patients' decision about using the e-appointment system and thus the future efforts should be focused on supporting this high performance. The most significant characteristic contributing to the dissatisfaction is service quality. Patients are not satisfied with the decency of customer service representatives, the resolving of problems by customer service representatives, the availability of channels for asking questions, the completion of correct operation procedures by customer service representatives and the hospital which does not adopt their suggestions. Another important dimension which does not contribute to patients' satisfaction is website quality. Patients are not satisfied with the information quality, the extent to which the website meets their needs, the time to get a response after a request or an interaction with the website, the online completion of their transaction and the response they get to inquiries, comments, and feedback. In this area, the patients indicated their low level of satisfaction. It is obvious that the e-appointment system of the hospital is an emerging platform which was developed few years ago. Healthcare professionals have not evaluated the system yet. Furthermore, the majority of employees are nurses and doctors who do not have the necessary technical skills to help users with the system. However, the significance of these dimensions is also relatively low. It is important to mention that there is no gap in the action diagram, i.e., patients are more satisfied from the most important criteria, and less satisfied from the least important criteria. Figure4 presents the relative action diagram.

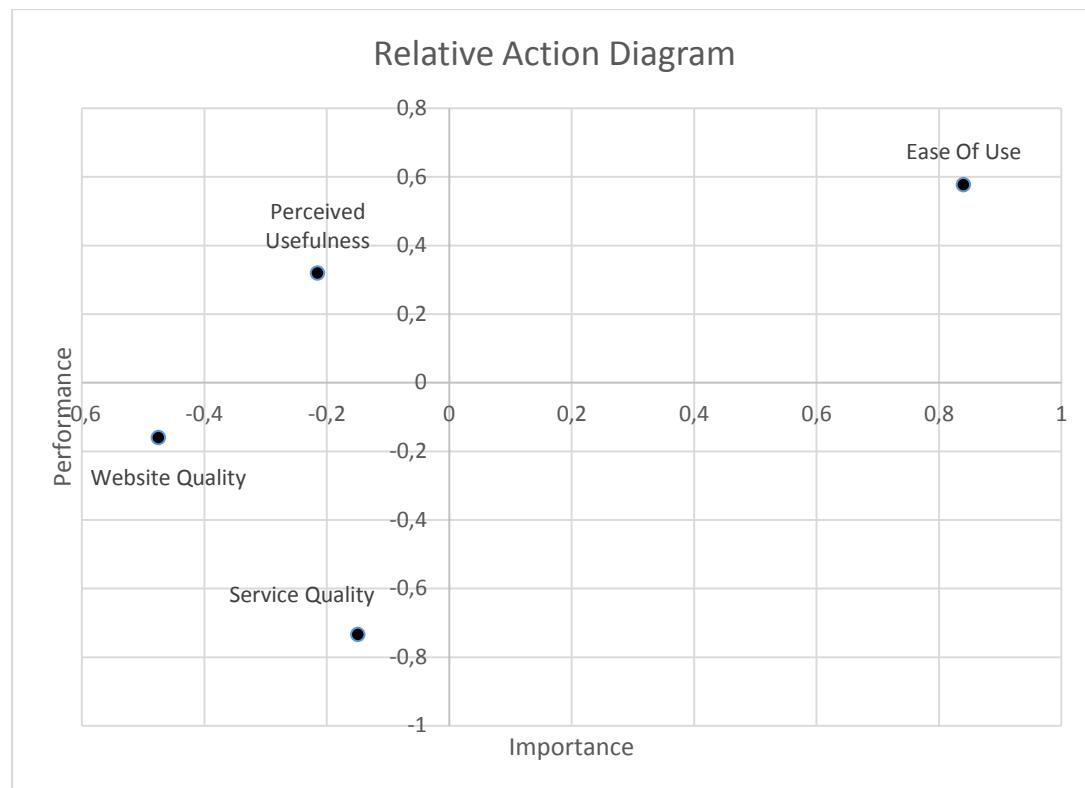


Figure 4. Relative Action Diagram

MUSA method also produces improvement diagrams which help decision makers to make decisions on which characteristics of satisfaction should be enhanced. Healthcare professionals should focus on the dimension of service quality where the data gathered recommend that the satisfaction is low. In other words, the patients are quite demanding and with important improvement actions the satisfaction will be increased. Other criteria such as ease of use and website quality are of secondary importance for the patients. Patients are not demanding for these criteria but they have small improvement margins. Finally, healthcare providers have to pay attention to the improvement of perceived usefulness. Managers have to educate employees in the department of customer services in order to improve their technical skills and help patients with the e-appointment system. Furthermore, developers have to redesign the system and improve its technical infrastructure in order to be more friendly to users. These results are presented in Figure 5.

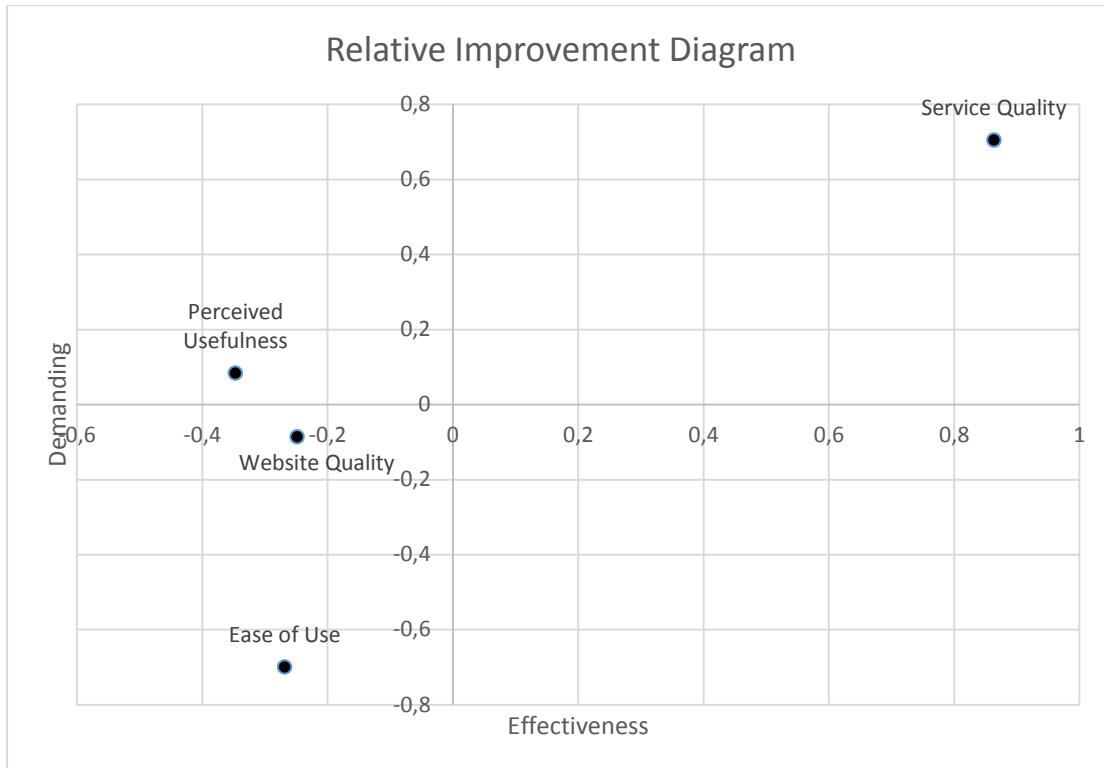


Figure 5. Relative Improvement diagram

First, healthcare professionals should improve the decency of customer service representatives, the resolving of problems by customer service representatives, and the completion of correct operation procedures by customer service representatives. Furthermore, they have to increase the available channels which are used by patients in order to ask questions.

Patients are not demanding for ease of use and website quality but healthcare providers can improve the use of application, the learning of application, and they can improve the flexibility of communication between providers and patients. Additionally, healthcare professionals can take actions to improve the information quality, the time to get a patient a response after a request or an interaction with the website and the implementation of an online transaction. The last priority for healthcare professionals is to improve the perceived usefulness. They can improve the quick completion of patients' reservation, the reservation efficacy as well as the usefulness of application.

4.1 Reliability Evaluation

The reliability evaluation of the results is mainly focused on presenting the fitting level to the patient satisfaction data, and the stability of the post-optimality analysis results. Some quantitative measures for the evaluation of the results (e.g. Average Fitting Index, Average Stability Index) provided by the MUSA method are presented in Tables 5-7. Furthermore, the post optimality analysis is presented in Table 8. $AFI = 1 - (\frac{F^*}{100M}) = 0,9496$ (1)

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The variance diagram shows the range values that the customers give for each level of the ordinal scale. Table 5 presents the max and min added values for each level of the ordinal satisfaction scale.

Scale	Max Added Value	Min Added Value
1	87	0
2	90,68	47,75
3	94,7	65,19
4	100	79,35
5	100	88,5

Table 5. Max and min added values for each level of the ordinal satisfaction scale

Criterion	Weight	Max	Min
Perceived Ease of Use	11,163	26,650	6
Perceived Usefulness	49,448	78,792	33,7
Website Quality	18,738	41,8	6
Service Quality	20,652	36,4	9,208

Table 6. Criteria weights variance

Average	Max	Min
89,5	98,7	78,6

Table 7. Global satisfaction variance

The calculation of Average Stability Index is based on the formula presented by Grigoroudis and Siskos (2002) [39] and it is 70.02%.

	W11	W12	W13	W14	W21	W22	W23	W24	W31	W32	W33	W34	W41	W42	W43	W44	Z1
Maxb1	22,15	1,5	1,5	1,5	26,7	4	1,5	1,5	16,65	1,5	1,5	1,5	1,5	10	1,5	5,5	48,85
Maxb2	1,5	1,5	1,5	1,5	68,5	6,5	1,5	2,292	1,5	1,5	1,5	1,5	1,5	1,51	1,5	4,708	70
Maxb3	1,5	1,5	1,5	1,5	26,7	4	1,5	1,5	1,5	37,3	1,5	1,5	1,5	10	1,5	5,5	33,7
Maxb4	1,5	1,5	1,5	1,5	44,6	4	1,5	1,5	1,5	1,5	1,5	1,5	1,5	27,9	1,5	5,5	51,6
Average	6,663	1,5	1,5	1,5	41,625	4,625	1,5	1,698	5,288	10,45	1,5	1,5	1,5	12,35	1,5	5,302	51,038
additive	6,663	8,163	9,663	11,163	41,625	46,25	47,75	49,448	5,288	15,738	17,238	18,738	1,5	13,85	15,35	20,652	51,038

Table 8. Post optimality analysis

The variance diagram depends on the estimated satisfaction values and the optimal values of the error variables. In order to develop this diagram, the maximum and minimum satisfaction curves are calculated for each level of the ordinal satisfaction curve [39]. Figure 6 presents the variance diagram of the additive value curve.

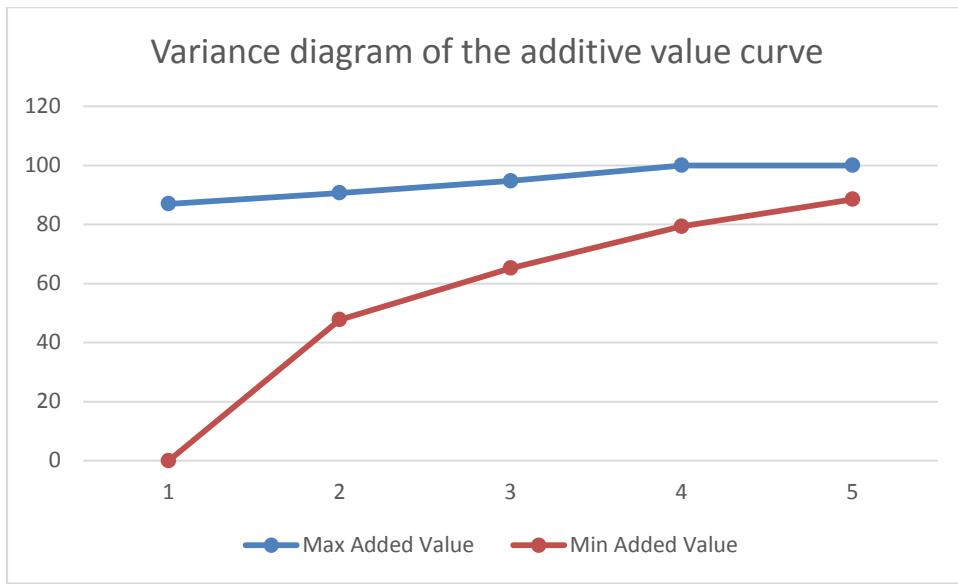


Figure 6. Variance diagram of the additive value curve

5. Conclusion

The purpose of this article was the application of the MUSA method to measure the extent of users' satisfaction of an e-appointment service of a Greek state hospital in Thessaloniki and to provide useful data to the administrators in order to be able to make better decisions and determine which characteristics of the service need to be improved. Furthermore, the use of the MUSA method identified the areas in which the e-appointment service of the Greek hospital is close to meeting users' expectations and areas in which the e-health service falls far short of expectations. Using this method the Greek hospital can enhance the level of quality and the effectiveness of the e-appointment service.

An analysis of the findings clearly shows that the dimension of ease of use can be used as a competitive advantage for the e-appointment service. However, it was found that ease of use and website quality are of secondary importance for the patients. Patients are not demanding for these criteria but they have small improvement margins. Previous researchers claimed that ease of use and perceived usefulness positively influence patients' satisfaction as well as the use of e-appointment systems [14, 24, 25].

The great majority of patients said that the most significant characteristic contributing to the dissatisfaction is service quality. Patients are not satisfied with the decency of customer service representatives, the resolving of problems by customer service representatives, the availability of channels for asking questions, the completion of correct operation procedures by customer service representatives and the hospital which does not adopt their suggestions. The same dimensions were identified by Kim-Hwang et al., (2010) [17] when they measured the satisfaction of an e-referral system in a hospital. Another important dimension which does not contribute to patients' satisfaction is website quality. Patients are not satisfied with the information quality, the extent to which the website meets their needs, the time to get a response after a request or an interaction with the website, the online completion of their

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transaction and the response they get to inquiries, comments, and feedback. In this area, the patients indicated their low level of satisfaction.

However, improving service quality requires the enhancement of decency of customer service representatives, the resolving of problems by customer service representatives, and the completion of correct operation procedures by customer service representatives. Furthermore, healthcare professionals have to increase the available channels which are used by patients in order to ask questions. In contrast, previous surveys regarding the satisfaction of patients who have used e-appointment systems have mentioned that service quality is a significant dimension [6, 24, 25].

Last, in line with prior findings, patients are not demanding for ease of use and website quality but healthcare providers can improve the use of application, the learning of application, and they can improve the flexibility of communication between providers and patients. Paré et al., (2014) [23] also concluded to the same findings. In their survey, patients who used the e-appointment system were not aware of system user friendliness and security. Additionally, healthcare professionals can take actions to improve the information quality, the time to get a patient a response after a request or an interaction with the website and the implementation of an online transaction. This dimension is very important for e-patients who use e-appointment systems and search for medical information [16, 24, 25]. The last priority for healthcare professionals is to improve the perceived usefulness. They can improve the quick completion of patients' reservation, the reservation efficacy as well as the usefulness of application.

As the findings indicate that the ease of use dimension is the most significant for patients, healthcare professionals should take into consideration the following variables; technical skills, expected successful completion and error rates and experience in order to improve the e-health system [14, 18]. Patients can also be encouraged to make appointments online, view their medical records, and consult online with medical staffs. Authorized access has many advantages both for patients and healthcare organizations. From patient perspective, users can improve their health literacy and acquire better knowledge of their own health status. On the other hand, healthcare organizations require having long lasting relationship with patients since they always in need to access the service. Additionally, empowering patients and physicians will give them flexible time when and where they want to implement their health related activities [1].

As the majority of users were satisfied with the system and intended to use it in the future, it is revealed that the use of e-appointment system can significantly decrease no-shows or missed appointments. Almunawar et al., (2012) [1] and Paré et al., (2014) [23] concluded that the users of the e-booking system claimed to be very satisfied and they are willing to manage their own medical appointments in the future. In general, the findings of this survey demonstrate that patients who use e-health systems need a strong cooperation with the physicians for participating him/her in their e-health experience [9].

5.1 Implications and Future Research

Despite the positive results presented above, few patients were still hesitant to manage appointments electronically. One reason may be the fact that there are several types of

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medical appointments, such as prenatal check-ups, surgical follow-up, routine annual examinations which vary in length. The development of pop-up menus can be an effective strategy which can help patients through structured questions to select the right type of appointment [23]. Another effective strategic action could be the encouragement of patients by physicians to use the e-booking system in order to reduce the rate of missed appointments. Physicians should emphasize to the benefits of e-appointment system and specifically the flexibility in making appointments, the automated reminders, the time saved, as well as the system's features, such as user-friendliness, reliability and security. Given that, reminders, as it has already been mentioned above, are a successful tool. They could also be used to remind the users of the e-appointment system [23]. Future research could be done in order to examine the effectiveness of each strategy and combine these actions with the efforts that should be done in order to improve patients' satisfaction. It would be helpful to identify the required action which is necessary for each service quality dimension that has to be improved based on the results of the MUSA method.

Through this survey decision makers in the hospital can examine how the patients evaluate the hospital and which dimensions of satisfaction have to be improved. The MUSA method indicated the strong and weak points of patients' satisfaction. The action and improvement diagrams are important tools for managers in order to make decisions for the improvement of the e-appointment system. Future researchers could examine if there is a difference in satisfaction taking into account factors such as the type of incidence, sex and the economic status of the patients.

The implementation of in-depth interviews on both patient and physicians who use the e-appointment system so as to acquire a deeper understanding of the data gathered through survey questionnaires should be taken into consideration for future research. Also this survey could be replicated and extended in other primary settings, as well, in order to evaluate the generalizability of the results.

In general, the satisfaction for the e-appointment platform is effective for orientating patients towards a health-related information source. The results of this survey indicate that patients should be encouraged by physicians to involve them in their e-health experience. This survey has pinpointed the significance of the mutual participation along with the shared decision making process in the digital era, too. This paper has advanced the knowledge on e-health satisfaction, combined with paradigms regarding the improvement of e-health service quality. Future research should be implemented, according to other organizational backgrounds. Furthermore, other patient behaviors can be examined, which could result from e-health experiences, so as to understand how e-appointment system influences the dynamics of healthcare organizations.

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Appendix A: Questionnaire

Please mark the number to indicate the extent to which you are satisfied with each of the following criteria related to user's satisfaction during the use of the e-appointment application	
1. Ease of use	Very dissatisfied (1)-Very satisfied (5)
How satisfied are you with the use of application?	
How satisfied are you with the learning of application?	
How satisfied are you with the capability to be quickly familiar with using the application?	
How satisfied are you with the capability to understand the application?	
How satisfied are you with the flexibility of communication?	
How satisfied are you with the capability to use the application in order to make a reservation?	
How satisfied are you with the ease of use of the application?	
2. Perceived usefulness	Very dissatisfied (1)-Very satisfied (5)
How satisfied are you with the quick completion of your reservation?	
How satisfied are you with the improvement of reservation efficacy?	
How satisfied are you with the capability to make easy a reservation?	
How satisfied are you with the confirmation of the completion of reservation transaction?	
How satisfied are you with the usefulness of application?	
How satisfied are you with the perceived usefulness of use of the application?	
3. Website quality	Very dissatisfied (1)-Very satisfied (5)
How satisfied are you with the information quality?	
How satisfied are you with the extent to which the website meets your needs?	
How satisfied are you with the time to get a response after a request or an interaction with the website?	
How satisfied are you with the online completion of your transaction?	
How satisfied are you with the response to your inquiries, comments, and feedback?	
How satisfied are you with the website quality of the application?	
4. Service quality	Very dissatisfied (1)-Very satisfied (5)
How satisfied are you with the decency of customer service representatives?	
How satisfied are you with the resolving of problems by customer service representatives?	
How satisfied are you with the available channels to ask questions?	

This is the pre-print version. The final version is available at: Kitsios, F., Stefanakakis, S., Kamariotou, M. and Dermentzoglou, L. (2019). E-service Evaluation: User Satisfaction Measurement and Implications in Health Sector, *Computer Standards & Interfaces Journal*, 63, pp. 16-26. [see: <https://www.sciencedirect.com/science/article/abs/pii/S0920548918302022>]

How satisfied are you with the completion of correct operation procedures by customer service representatives?	
How satisfied are you with the hospital which adopts your suggestion?	
How satisfied are you with the service quality?	
5. Global satisfaction	Very dissatisfied (1)-Very satisfied (5)
How satisfied are you with the application?	
 Please mark the number to indicate the extent to which you agree with each of the following statements related to user's satisfaction during the use of the e-appointment application	
6. User's experience	Strongly disagree (1)-Strongly agree (5)
I am used to use word processing software	
I am used to use numeric calculating software	
I am used to use presentation software	
I am used to use email	
I can quickly find needed information online	
I am used to read news online	
7. Willingness of use	Strongly disagree (1)-Strongly agree (5)
I would preferably choose the application to make a reservation	
I would recommend the application to others	
I have strong intention to use the application	