

# THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

## E-health Services Quality and Its Impact on User Satisfaction in Saudi Arabia

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### **Abstract:**

*Purpose – The use of information technology in the healthcare sector has resulted in many potential benefits for all stakeholders, especially healthcare managers and users. Recently, the COVID-19 outbreak has created challenges for healthcare organizations in managing and controlling this pandemic. For this, there has become an urgent need to fundamentally modify health services and work to accelerate the spread of digital medicine to reduce the epidemic's impact on society. User satisfaction is the central dimension of healthcare service evaluation through service quality dimensions that the user sees as essential in the healthcare sector. This research investigates the e-health service quality dimensions that affect user satisfaction during the Corona pandemic in Saudi Arabia.*

*Design/Methodology/Approach – A proposed model based on the 5Qs and Service Quality model of mHealth is used to support the framework of the current study. This model examines the impact of e-health services quality dimensions: information quality, process quality, system quality, and communication quality on user satisfaction. A cross-sectional study is designed to investigate the study by collecting data using an online survey of 261 users of e-health applications.*

*Findings – The findings show that respondents positively support the e-health services quality dimensions.*

*Originality/Value – Through the specific quality dimensions, this study contributes to the design of better e-health services and the development of a public policy framework to support users' satisfaction with using these services.*

**Keywords:** e-health services, user satisfaction, Saudi Arabia, COVID-19, information quality, process quality, system quality, communication quality

### **1. Introduction**

E-health constitutes one of the new systems adopted by many countries worldwide to develop and improve the services provided and prepared in the health sector. That is because of health services' great importance in developing societies and their connection with all human activity areas. It has necessitated developing a strategic framework based on information and communication technology (ICT) applications to reach health service quality (Harkat, 2020). E-health refers to various technologies facilitating health care, such as electronic communication, electronic health services systems, wireless technologies for telehealth services, and electronic health information exchange (Sousa & Lopez, 2017).

Therefore, there is significant international interest in using e-health services to improve the quality and safety and reduce the costs of health care in the community. During the twenty-first century, e-health has become a significant influence, affecting society members at various levels (Skär & Söderberg, 2018). Customer satisfaction is a person's feeling of happiness or disappointment resulting from comparing product performance or results with their expectations. Numerous studies indicate that health institutions can improve customer satisfaction by providing quality services, effective operations, and employee participation (Kasiri et al., 2017).

The Kingdom's Vision 2030, the national initiative created to reduce the Kingdom's dependence on oil, seeks to diversify the economy and improve and develop public services rendered, including health services. In recent years, several epidemics have been recognized repeatedly, the most recent being COVID-19 in 2019 (Alharbi et al., 2021). Therefore, the Ministry of Health (MOH) has implemented many qualitative initiatives. It launched the application (Tetamman) in 2019 to promote the prevention of the new Coronavirus and limit its spread (MOH, 2020a). The MOH also launched the (Sehhaty) app in 2020. The app aims to provide all health services to individuals within Saudi Arabia (MOH, 2020b). In addition, the Saudi Data and Artificial Intelligence Authority (SDAIA), in cooperation with the MOH, made it possible to implement the "Tabaud" application in 2020 to support government efforts to confront the Coronavirus (Sdaia, 2020a). The authority also announced the launch of the "Tawakkalna" application in 2020. The application shows the user's health through colored codes with the highest levels of safety and privacy (Sdaia, 2020b).

Several studies have examined the relationship between e-health uses and feedback on customer satisfaction due to many factors. However, not all of the factors affecting the use of e-health on customer satisfaction have been studied.

Therefore, a limited number of previous studies have studied the uses of e-health and their impact on user satisfaction in light of the Corona pandemic in Saudi Arabia. This study aims to clarify the factors affecting the use of e-health applications and their impact on customer satisfaction in light of the Corona pandemic in Saudi Arabia. This research aims to answer the following question: What factors affect the usage of e-health applications and their impact on customer satisfaction?

## 2. Literature Review

Surveys of previous studies measured patient satisfaction by examining the assessment of the quality of care provided to them (Astuti & Nagase, 2016). Previous studies confirmed this finding by investigating service quality dimensions that customers perceive as important in the healthcare sector (Kitsios et al., 2019). Studies by Dagger et al. (2007) confirmed that overall health service quality significantly affects users' health service satisfaction and behavioral intentions.

Many researchers have measured the quality of e-service in health care using e-service quality dimensions. These dimensions relate to site quality, usability, and components such as site design, among others. In addition, perceived usefulness is a standard dimension of evaluating e-service quality in the health care sector and ease of use (Davis, 1989; Szajna, 1996; Yoo & Donthu, 2001). Moreover, information privacy and security are essential and fundamental dimensions of e-health service quality assessment. This dimension does not refer only to patient information that is shared across the web (Barnes & Vidgen, 2002; Zeithaml et al., 2002). Recent studies have mainly focused on other dimensions, such as information processing and online problem management, to promote user intent and satisfaction with e-health systems (Handan, 2016).

In his literature review, Endeshaw (2020) discussed five models employed to measure the health services qualities that have been developed under various dimensions. These models included the Donabedian model, SERVQUAL, HEALTHQUAL, PubHosQual, and HospQual.

Endeshaw (2020) concluded that all models were developed to measure healthcare service quality under various dimensions, but they had some technical limitations. Also, no consensus in determining the quality of service in health care is reached. Endeshaw also found through his literature review that some authors used only generic models such as SERVQUAL. Evidence suggests that many researchers have adapted and developed public service quality models according to the context of their health care services. Furthermore, Fatima et al. (2019) argued that service quality dimensions might differ and vary from one country to another, whether in developed or developing countries. In these countries, the most used, as well as the most minor dimensions of health service quality perceptions, are identified.

According to Zineldin and Zineldin (2014), the 5Qs model had some common and standardized dimensions. Its application was carried out in many ways in different industries with varying results. Furthermore, the authors found that this model can be used to identify deficiencies in health organizations. They also found that this model may help develop better preventive strategies and evaluate the impact of improvement initiatives undertaken by service providers (Verma et al., 2021).

Zineldin et al. (2011) conducted comprehensive studies on the crucial factors affecting patient satisfaction in Kazakhstan, Egypt, Jordan, and India. They found the 5Qs model to be an appropriate tool for monitoring and evaluating the quality of health services and identifying deficiencies in the model. In their study, Verma et al. (2020) found that "interaction quality, hospital ambience quality, and object quality" are essential dimensions of customer satisfaction with e-health services.

The results of the studies by Akter et al. (2013a) and Meigounpoory et al. (2014) showed that Service Quality for mHealth is a multidimensional hierarchical model consisting of three primary dimensions: interaction quality, system quality, and information quality. The results also confirmed that the Service Quality for mHealth model could better predict satisfaction and continuity.

Recently, this powerful model for measuring and predicting mHealth service quality has been developed specifically for a developing economy by Akter et al. (2013b). Akter used a guiding model for general theories in marketing, information systems and health management. Further, this model assesses the quality of any services based on a mobile platform. Several authors cited and acknowledged Akter et al. (2013b) for the service Quality model for mHealth (Oppong et al., 2021).

Most of the previous studies focused on investigating user satisfaction with e-health services. Researchers have adopted many models to measure user satisfaction with e-health services quality, such as the 5Qs model reported by Ajarmah et al. (2017) and Verma et al. (2020) and the Service Quality model for mHealth by Oppong et al. (2021). In contrast, many researchers used different models (Kitsios et al., 2019; Sakka & Qarashay, 2020; Bhuvana & Vasantha, 2020) to measure the relationship between user satisfaction and e-health services quality.

Furthermore, Ajarmah et al. (2017) investigated the dimensions of service quality that affect patient satisfaction in Jordanian military hospitals using the 5Q model. However, the results found that the hospital atmosphere significantly influenced patient satisfaction and was critical to overall service quality. At the same time, process quality had the most negligible impact on user satisfaction.

On the other hand, in mHealth services, Oppong et al. (2021) and Kitsios et al. (2019) assessed the main factors affecting user satisfaction with mobile health services utilizing different models. The study results showed that only interaction quality was essential in user satisfaction. At the same time, information quality and system quality were found to have a positive impact on the continuous use of mHealth. The results also indicated that user satisfaction varies in terms of perceived usefulness, user experience, willingness to use site quality, and service quality. However, they agreed that its ease of use was a competitive advantage.

In addition, the Bhuvana and Vasantha (2020) study examined the satisfaction of rural citizens with accessing e-health services during the COVID-19 pandemic. The result of the study argued that citizens' satisfaction with e-health

services was the result of electronic interaction, public trust, and system quality. In addition, the general public's trust played an essential role in contributing to the satisfaction of rural citizens with access to e-health services.

Sakka and Qarashay (2020) also examined how e-health affects the doctor-patient relationship in Amman (Jordan) private hospitals. This study revealed that the majority of patients had a significant positive perception of the relationship between e-health and the patient.

### 3. Research Methodology

#### 3.1. Research Construct & Hypotheses Formulation

The current study attempts to verify user satisfaction with e-health services during the COVID-19 pandemic in Saudi Arabia from a quality perspective. Through previous studies, this study adopts the dimensions of e-health service quality (information quality, process quality, system quality, communication quality) and user satisfaction with the quality of these services. Therefore, the study integrates the 5Qs model and the Service Quality Model for mHealth. Each construction and proposed hypothesis is explained in detail in the following subsections.

##### 3.1.1. Information Quality

Information quality refers to the extent to which a service is useful in completing a given task (Motamarri et al., 2014).

##### 3.1.2. Process Quality

Process quality determines functional quality in how e-healthcare services are delivered (the technical) and their practical applications (Verma et al., 2020).

##### 3.1.3. System Quality

DeLone and McLean (2003) defined system quality as the quality that appears in system performance and is valued by users' perceptions of the technical level of communication.

##### 3.1.4. Communication Quality

Communication quality refers to the interaction, which means the methods and time spent communicating between service consumers and healthcare providers (Verma et al., 2020).

Therefore, this study found that each of the four dimensions of e-health service quality plays an essential role in enhancing user satisfaction. Hence, based on the above arguments, this study assumes the following hypotheses:

- H1: Information quality has a positive effect on the quality of e-health services.
- H2: Process quality has a positive effect on the quality of e-health services.
- H3: System quality has a positive effect on the quality of e-health services.
- H4: Communication quality has a positive effect on the quality of e-health services.
- H5: E-health service quality has a positive effect on user satisfaction.

#### 3.2. Research Model

Consequently, with the analysis of the previous studies and theories, this study adopts a conceptual model by integrating the 5Qs model and the Service Quality model for mHealth as a theoretical model. That is, it is in order to investigate the impact of the quality of e-health services on user satisfaction during the COVID-19 pandemic in Saudi Arabia.

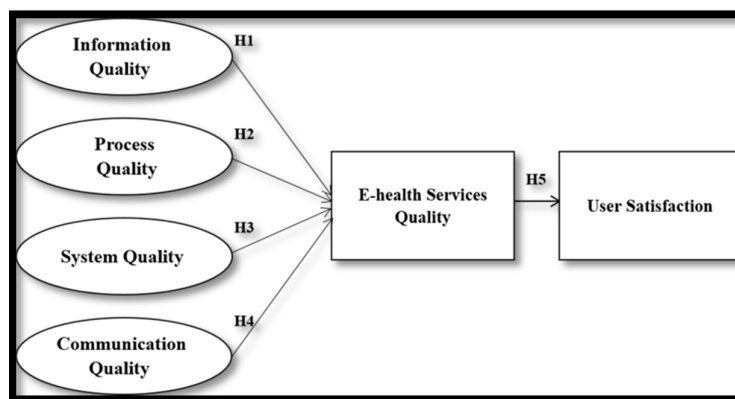


Figure 1: Research Conceptual Model

As shown in figure 1, the model proposes dimensions of e-health service quality: information quality, process quality, system quality, and communication quality. These independent factors affect the quality of e-health services, which affects user satisfaction (dependent factor). Independent factors (information quality, system quality) are extracted from the Service Quality model for mHealth. In contrast, the independent factor (process quality) is extracted from the 5Qs model.

The independent factor (communication quality) is extracted from the 5Qs model and the Service Quality model for mHealth. The relationship between the information quality and the e-health services quality declares the first hypothesis. At the same time, the second hypothesis is indicated by the connection line between process quality and e-health services quality. Moreover, the relationship between system quality and e-health services quality clarifies the third hypothesis. The fourth hypothesis refers to the relationship between the communication quality and the e-health services quality through the line connecting them. The fifth and final hypothesis indicates the relationship between the quality of e-health services and user satisfaction.

### 3.3. Research Design

#### 3.3.1. Research Approach

This research depends on the deductive approach, focusing on a quantitative strategy to emphasize quantification and determine the relationship between the variables within the sample. The deductive approach is suitable for the current research and is based on descriptive and quantitative statistical methods. The reason for this is that the recent study falls under social research, and the appropriate approach for this type of research is the deductive one.

This research is based on descriptive and analytical design. This type of design depends on collecting quantitative data to understand the relationships between dependent and independent variables. Descriptive design helps to study scientific phenomena or problems through the scientific description and then arrive at logical explanations with evidence and proof that help develop specific frameworks for the problem used to define research results.

The data for this research are primary and secondary. The primary data for the research is collected through a questionnaire distributed to the respondents. At the same time, secondary data is collected and used for research after investigating and reviewing several relevant previous studies on e-health service quality and user satisfaction. This research follows a quantitative analysis using the Statistical Package for Social Sciences (SPSS v.24), which helps investigate and study the relationships between variables.

#### 3.3.2. Research Instrument

The questionnaire is the most suitable tool for the deductive approach in social research. Therefore, the questionnaire is used in this research. The closed-question method is used to collect data in this questionnaire. The questionnaire consists of three sections: a cover sheet, a general information section, and a section including five scale questions. The cover sheet explains the purpose of the research. It also assures the participants of the confidentiality of their responses. In the end, there is a yes/no question about desiring to participate in the study. Section II collects general information about the participant through four questions related to demographic information: age, gender, nationality, and educational level. In addition, three general questions about the use of e-health applications. Section III includes five parts under an ordinal scale adapted from previously validated studies. It contains five information quality questions, five process quality questions, four system quality questions, four communication quality questions, and eight user satisfaction questions. All statements are formulated positively regarding the relationship between factors and data. To verify the respondents' opinion on the topic of this research, all items are measured using a 5-point Likert scale (1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = completely agree). The Likert scale was chosen because most of the literature on user satisfaction with the quality of e-health services used a 5- or 7-point Likert scale to measure their questions. In addition, it is easy for respondents to read all the options using this scale.

## 4. Research Result

### 4.1. Research Reliability and Validity

A pilot test is conducted to pre-test the questionnaire to ensure its reliability and validity and confirm the measurement's appropriateness for the study.

Dimension	Cronbach's Alpha for N=30		Person Correlation Coefficients Between Dimension and Total Score of the Questionnaire	
	Cronbach's Alpha	Internal Consistency	Person C.C.	Significant Level
Information Quality	0.68	Questionable	0.84*	0.00
Process Quality	0.86	Good	0.91*	0.00
System Quality	0.66	Questionable	0.68*	0.00
Communication Quality	0.9	Excellent	0.85*	0.00
User satisfaction	0.91	Excellent	0.95*	0.00
Overall reliability	0.95	Excellent		

Table 1: Research Reliability and Validity  
\*Statistically Significant at Level ( $A=0.01$ )

Table 1 reveals that the overall reliability is (0.95), which is sufficient to guarantee a reliable internal consistency of the questionnaire. The table also shows that the "User satisfaction" dimension has the highest Cronbach's Alpha value at (0.91), but the "System Quality" dimension has the lowest Cronbach's Alpha value at (0.66). The values in the table prove

that the study tool is reliable. It shows that all the Person's correlations are statistically significant at the level ( $\alpha = 0.01$ ) and that all dimensions are related to the total scores of the questionnaire. Person correlation coefficients ranged between (0.68 - 0.95) with a high degree of validity, determining the desired measurement objectives. The results in the table show that the validity of the tool is met in this research.

#### 4.2. Population and Sampling

In the current study, users of e-health services in Saudi Arabia are selected as the study population. In this study, a simple random sample is chosen to represent the population of the study. The study sample is determined using a statistical equation to calculate the sample size that reduces the standard error, as the sample size for this study is (261) participants.

#### 4.3. Data Collection

Google Forms was used to conduct a survey. The survey was distributed on 3 October 2021 by sharing the link to the participants through the web and social media applications and sending it via e-mail. After four weeks of data collection, the responses totaled 261. These responses were used in the analysis process.

#### 4.4. Statistical Techniques for Data Analysis

A statistician is performing all statistical analyses using SPSS v.24 to enter the collected data to answer research questions and test hypotheses. Statistical methods used to analyze data include both descriptive and inferential statistical methods.

The following descriptive and inferential statistics are used to test hypotheses:

*Means and standard deviation:* It is used to verify the extent to which the sample members responded to the study dimensions and also, the extent to which they answered the questionnaire statements, in addition, to verify the existence of positive traits that correlate with the objectives of the study.

*Cronbach's Alpha test to measure reliability:* This test is used to verify the reliability of the questionnaire in its draft. It has no errors that respondents may cause, and that the questionnaire can be distributed to the study sample in a final revolution.

- *Pearson's correlation coefficient* to measure the relationship between independent and dependent variables: This test is used to check the availability of relationships between variables, the type of relationship, and whether it is positive or negative, in addition to being a measure of the strength of the relationship between those variables.
- *Simple linear regression:* The simple regression equation is used to verify the existence of a linear relationship between two scale variables. Also, to measure the strength of the influence of the independent variable on the dependent variable. Moreover, to form an equation through which we can predict the values of the dependent variable in the presence of future values of the independent variable.
- *Analysis of variance (ANOVA):* One-way analysis of variance (ANOVA) is used to verify the existence of a statistically significant effect of the independent variable on the dependent variable by using the amount of error ( $\alpha$ ).
- *Multi-analysis of variance (MANOVA):* Multiple analyses of variance are used to verify the existence of a statistically significant effect of the independent variables on a set of dependent variables by using the amount of error ( $\alpha$ ). It is used to verify the effect of demographic variables on the dependent variable in the study.
- *N-Way ANOVA:* N-way analysis of variance is used to verify the existence of a statistically significant effect of the independent variables on the dependent variable by using the amount of error ( $\alpha$ ). This test is used to check the relation between all factors that together influence user satisfaction.

#### 4.5. Demographic Characteristics Analysis

Descriptive statistics describe the (261) respondents' answers to questionnaire questions. The sample characteristics show that the age category (26-35) has the highest percentage (30.7%). In addition, females have the highest percentage in the sample size (56.3%). Also, it shows that the Saudi category has the highest percentage in the sample size (69%). Moreover, (The Graduate) category has the highest percentage in the sample size (56.7%). Furthermore, 91.6% of the participants search the internet for health-related information. Also, 91.2% of the respondents use Tawakkalna App as an e-health app and website. Again, this shows that 64.4% of the participants did not use e-health applications before the Corona pandemic.

#### 4.6. Overall Questionnaire Dimensions Analysis

Pearson correlation analysis is used to test the relations between the independent variables and the dependent variable. Table 2 shows Pearson correlation analysis between independent and dependent variables.

		INFO	PROQ	SYSQ	COMQ	E-health Services Quality
E-health Services Quality	Pearson Correlation	0.897**	0.914**	0.857**	0.858**	
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	N (Sample Size)	261	261	261	261	
User Satisfaction	Pearson Correlation	0.761**	0.758**	0.757**	0.799**	0.868**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N (Sample Size)	261	261	261	261	261

Table 2: Pearson Correlations Analysis

\*\*Correlation Is Significant at the 0.01 level (2-tailed)

Table 2 shows a statistically positive correlation between all independent variables and the dependent variable. Pearson correlation coefficients (r) range (0.757–0.914).

Model		Sum of Squares	df	Mean Square	F	P-value
1	Regression	79.013	4	19.753	214.096	.000 <sup>b</sup>
	Residual	23.619	256	.092		
	Total	102.632	260			

Table 3: Anova<sup>a</sup> for (User Satisfaction) with the Independent Variable (E-Health Services Quality)

a. Dependent Variable: User Satisfaction.

b. Predictors: (Constant), Communication Quality, System Quality, Information Quality, Process Quality

From table 3, since the p-value is (0.000), which is less than the significant level ( $\alpha = 0.05$ ), then there is a statistically significant influence for e-health services quality with four factors (Information Quality, Process Quality, System Quality, and Communication Quality) (predictors) on (User satisfaction). To construct the simple linear regression equation,

#### 4.7. Testing Research Hypothesis

Table 2 shows a meaningful positive correlation between information quality and e-health services quality since ( $r=0.897$ ). In addition, it shows a meaningful positive correlation between process quality and e-health services quality since ( $r=0.914$ ). In addition, it shows a meaningful positive correlation between system quality and e-health services quality since ( $r=0.857$ ). It also offers a significant positive correlation between communication quality and e-health services quality since ( $r=0.858$ ). Therefore, it is proved that information quality, process quality, system quality, and communication quality positively affect the quality of e-health services. Additionally, table 3 confirmed a statistically significant influence of e-health services quality (predictors) on user satisfaction. Therefore, it has been proved that the quality of e-health services positively affects user satisfaction.

To check if there is an effect of all factors together on user satisfaction and which of these factors has a high influence on user satisfaction, N-Way ANOVA is used; see the results in table 4.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	242.552	1	242.552	1367.567	.000	.958
Information quality	3.153	12	.263	3.039	.001	.148
Process quality	1.314	14	.094	1.085	.037	.067
System quality	3.726	12	.311	3.592	.000	.170
Communication Quality	5.269	10	.527	6.095	.000	.225

Table 4: N-Way ANOVA for Variable User Satisfaction (Tests of Between-Subjects Effects)

From table 4, there exists a statistically significant effect of four factors on user satisfaction at a significant level ( $\alpha=0.05$ ) since (Sig.) is less than (0.05) for all factors. Eta represents the power of influence since the (Communication quality) factor has a larger Eta value (0.23). It is the most influential factor on user satisfaction, and the factor (Process quality) has the least influence on user satisfaction.

In summary, it could be concluded that all four factors of the independent variable (E-health services quality) significantly influence a dependent variable (User satisfaction). A summary of the testing of the hypotheses is shown in table 5:

Hypothesis No.	Hypothesis Statement	Result
H1	Information quality has a positive effect on the quality of e-health services.	Supported
H2	Process quality has a positive effect on the quality of e-health services.	Supported
H3	System quality has a positive effect on the quality of e-health services.	Supported
H4	Communication quality has a positive effect on the quality of e-health services.	Supported
H5	E-health service quality has a positive effect on user satisfaction.	Supported

Table 5: Summary of Hypotheses Testing Results

## 5. Conclusion

E-health plays a vital role in supporting business needs and patient care as the basis for all e-health strategies. Several previous studies indicated the positive impact of the e-health approach in improving health service delivery, reducing operational costs, increasing process efficiency, and, most importantly, managing health information. User satisfaction with e-health services is a commonly researched topic. However, a literature review indicated that most researchers used the quality services scale. In addition, healthcare providers often judge the quality of the services provided by user satisfaction. The recent outbreak of COVID-19 has created challenges for many countries and their healthcare organizations in managing and controlling the pandemic. For instance, in Saudi Arabia, the MOH, based on Vision 2030, has developed a telehealth application strategy to screen suspected cases, provide long-term care, and track COVID-19 patients. Therefore, the MOH has implemented many qualitative initiatives. It launched the (Tetamman) application in addition to the (Sehhaty) application. In addition, SDAIA, in cooperation with the MOH, enabled the implementation of several applications such as "Tabaud" and "Tawakkalna" applications. However, previous studies lacked an examination of all the factors that influence the use of e-health in user satisfaction. Therefore, a limited number of previous studies have studied the uses of e-health in light of the Corona pandemic in Saudi Arabia and its impact on user satisfaction. Therefore, the current study sheds light on the factors that affect the use of e-health applications and their impact on user satisfaction during the Corona pandemic in Saudi Arabia. Thus, the study successfully proposed an integrated model for the quality dimensions of e-health services: information quality, process quality, system quality, and communication quality. Several tests were conducted to obtain the results that showed that the quality of e-health services positively affects user satisfaction. Nevertheless, the study results showed that communication quality is supported to have a more significant positive impact on user satisfaction. In contrast, process quality has a low positive impact on user satisfaction. Moreover, e-health services are supported as a strong determinant of user satisfaction. This study also indicates that demographic characteristics do not affect user satisfaction regarding e-health services. Besides, the study finds that the e-health services quality dimensions confirm the hypotheses developed in their impact on user satisfaction with e-health services. Finally, all the proposed research hypotheses showed a positive and confirmed result. The results of this study can prove the importance of these dimensions in building user satisfaction.

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