

# Defining Dimensions of Patient Satisfaction with Telemedicine: An Analysis of Existing Measurement Instruments

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## Abstract

*As telemedicine usage continues to grow there is a need to ensure the means are available to evaluate their success. Patient satisfaction can play a key role in determining the success of telemedicine projects. However, satisfaction remains loosely defined and there are no commonly accepted views on what it consists of. A lack of well-defined dimensions for measuring telemedicine satisfaction can make it difficult to interpret and compare results. By using a grounded theory approach for the analysis of existing patient satisfaction instruments, this research has identified several dimensions for describing patient satisfaction with telemedicine. In an effort to define these dimensions, this research examines their relationship to the existing telemedicine, information systems, and healthcare literature. In total 18 first level constructs, and 4 second order constructs were created for describing these dimensions and are defined in this research.*

## 1. Introduction

Patient satisfaction can play an important role for decision makers implementing telemedicine systems. Yet there remains a limited understanding on what exactly constitutes satisfaction and what are the dimensions that define it.

In the context of this study the term telemedicine is defined as the use of telecommunications technology to provide remote medical care and services across geographic distances [1]. Although there are some differences between medical care and health care, this study uses the terms interchangeably to mean “the maintaining and restoration of health by the treatment and prevention of disease “ [2-4].

This research also focuses on telemedicine which uses telecommunications to diagnose and treat medical issues. This is opposed to the broader term telehealth which can include surveillance and health

promotion [5]. For example both the use of web and email to provide medical consultations and the use of videoconferencing to provide assistance for direct care can be considered telemedicine and telehealth [6, 7]. However using telecommunications systems for disease surveillance [8], or the promotion of basic health literacy [9], may be considered telehealth, but not telemedicine.

There are a number of potential benefits that telemedicine can provide to medical practitioners and institutions [10, 11]. Over the next several years, reports suggest that telemedicine usage will continue to grow, creating a \$34 billion industry by 2020 [12]. Because of the growing interest in telemedicine, researchers and medical institutions are interested in learning more about the degree to which different stakeholders are satisfied with these systems.

As satisfaction remains a loosely defined term, it is important that more research be conducted into understanding the role of satisfaction in different contexts and further defining satisfaction [13, 14]. This research aims to contribute to the knowledge on satisfaction by specifically identifying different dimensions of patient satisfaction with telemedicine, and from these dimensions defining more formal constructs.

Dimensions are facets of a multidimensional construct [15]. A construct is a conceptual term used by researchers to “describe a phenomenon of theoretical interest” [16]. This study is part of an effort to develop a comprehensive instrument for measuring patient satisfaction with telemedicine. Instruments are tools used in data gathering by researchers that contain measures for constructs [16]. Using a grounded theory approach this study examines existing instruments developed for measuring patient satisfaction with telemedicine. A series of constructs are then defined and compared with the existing literature on telemedicine, healthcare, and Information Systems (IS) [17, 18].

## 2. Literature Review

Over the years many studies have looked at patient satisfaction with telemedicine [19, 20]. Many studies report high levels of patient satisfaction [13,14]. But there is often little consistency in the methodologies that are used to evaluate telemedicine satisfaction and the aspects of satisfaction explored [13]. Some of these factors can make it difficult to understand what the results of satisfaction evaluations actually measure [21]. Patient satisfaction may be high for some aspects of care. Yet satisfaction may not be high for other aspects or be enough for patients to consider telemedicine as a replacement for face to face visits [22]. Further a lack of consistency can make results difficult to compare [23].

Although there is a breadth of research on patient satisfaction with medical care [24, 25], the dependency of telemedicine systems on telecommunications technology make it unique. Telemedicine services are generally provided either through real time video conferencing, store and forward methods, or hybrid approaches [26]. Medical services via telemedicine are highly reliant on communications technology. Therefore, it is important to consider the role the entire IS plays in patient satisfaction. However often it is unclear on what aspects of telemedicine services a patient is satisfied with. It is also possible that the levels of satisfaction a patient has with a telemedicine service can be confused with satisfaction over the outcomes of medical care [13].

The complexity of satisfaction makes it a difficult construct to define [14]. Satisfaction has historically been used as a means of measuring IS effectiveness and success [27, 28]. However satisfaction can also be viewed as a factor contributing to the usability of a system that is based in part on the user experience [29]. The latter view is common in the Human Computer Interaction (HCI) literature while the former is common in the IS literature. This is an important distinction to make as the subjectiveness of the term satisfaction can allow for meanings that extend beyond disciplines. For example, a patient asked to rate their overall satisfaction with telemedicine could possibly consider the ability of the service to meet their goals. However, they may also consider the enjoyment derived from affective aspects of the system, or something entirely different.

While research into satisfaction is still relatively young in the HCI literature, satisfaction remains a major part of IS research [27, 30, 31]. Even within the IS literature there is no consensus on how to define satisfaction or what it consists of. In a

historical review of the IS literature [27] classified studies based on the authors' approach towards defining satisfaction. One approach is described as a process oriented approach. This approach is used to describe the process by which satisfaction develops. The second approach is an outcome oriented approach. The outcome oriented approach views satisfaction as an "outcome of a consumption process" [27]. In this approach researchers focus on defining related constructs that either influence or are influenced by satisfaction.

Although many studies examine patient satisfaction with telemedicine there remains a need to identify the contributing attributes or dimensions of patient satisfaction. There are many studies that use satisfaction as a measure of the successful outcomes of telemedicine [23, 32]. However satisfaction is often undefined in telemedicine research [23]. Broad questions such as those that ask a patient to rate their overall satisfaction with telemedicine, are common. Yet these questions are difficult to interpret. The resulting responses do not lead to an understanding of what satisfied means or what aspects of a system a patient is satisfied with. Further researchers that focus on specific aspects of a telemedicine service often use custom instruments that make generalizing results difficult [19, 21].

Several studies have identified unique dimensions that may be a part of patient satisfaction with telemedicine. Patient perspectives on dimensions such as appointment scheduling, travel time, accessibility, waiting time, cost savings and medical outcomes can play a role in satisfaction [13, 33].

Patients' views can also be shaped not only on their own comfort, but how they perceive the system as affecting their medical providers [34]. The most commonly examined dimensions of satisfaction are professional-patient interaction, patients' feelings about the consultation, and technical aspects of the service [19]. Yet some of these dimensions of patient satisfaction are not often examined and seldom examined collectively. Contributing dimensions of patient satisfaction with telemedicine are often only studied in relationship to instrument development [35, 36]. However even among instruments developed specifically for evaluating telemedicine satisfaction, there is a lack of consistency in the dimensions of satisfaction examined.

## 3. Methodologies

This research attempts to define constructs that contribute to patient satisfaction with telemedicine. Similar to other research on satisfaction this research uses an outcome oriented approach towards defining

satisfaction. Satisfaction is seen as an outcome of the usage of telemedicine by patients. This research focuses on developing constructs from existing instruments used to measure telemedicine satisfaction. By examining the instruments used to measure satisfaction, researchers can separate some of the subjectivity in measurement instruments while identifying the different dimensions explored. Examining the individual items being measured in an instrument can allow them to be evaluated separately from what researchers intended to measure overall with the instrument.

As part of the overarching goal of this project is to eventually develop a comprehensive instrument for measuring satisfaction, the methods used were based on guidelines for instrument design. This research adopts the methods described by [18] for developing measurement instruments based on the framework outlined by [17]. These procedures were followed to enable the development of constructs from the telemedicine satisfaction literature that could eventually be validated and further developed into a measurement instrument.

Unlike the research conducted by [18] there are no single set of comprehensive guidelines for examining telemedicine satisfaction. Researchers decided that the best avenue for collecting data to define measures of telemedicine satisfaction would be to evaluate existing instruments used to measure telemedicine satisfaction. To accomplish this a team led by the lead author first surveyed the literature to identify instruments used in measuring telemedicine using the instrument described by [19]. The team consisted of three graduate students and two visiting undergraduate students. Papers were extracted based on a survey of the literature conducted by searching the National Center for Biotechnology Information's PubMed database. The database was searched for the terms telemedicine satisfaction. The survey included only papers that specifically described empirical measures of telemedicine satisfaction. Of these the current study examined 167 papers. From these results only papers that evaluated patient satisfaction with telemedicine and used instruments the authors claimed had been previously validated were selected. This was done to decrease the likelihood that measures were dependent on other contextual factors within a specific study. In total 22 instruments were examined.

The instruments were reviewed and coded using a grounded theory approach adapted from [18]. This method was selected because of its potential to derive dimensions in the creation of an instrument for measuring user perceptions. Grounded theory is an inductive approach to analyzing and creating

categories from data that lead to the development of theory [37]. Grounded theory provides researchers with an inductive approach towards analyzing qualitative data through the use of open and axial coding. Open coding is the process of examining text line by line, identifying concepts and coding the results. Axial coding can be performed on the resulting categories to identify connections between categories.

Each instrument was reviewed independently by the lead author and open coding was performed using line by line analysis. The following questions were used to guide the open coding process:

- What is the main criteria explored with each item?
- What are the keywords associated with each item?
- How do the keywords relate to the main criteria?

The questions were also reviewed to identify patterns in the data that could lead to the formation of salient categories [17]. The open codes were then grouped into subcategories based on conceptual similarity. Axial coding was then performed to group the categories and subcategories into conceptual units. Following the initial round of axial coding the results were reviewed by a second researcher and also a medical professional. Both helped revise descriptions that were unclear and further refined the results of grouping.

The results of first order constructs were compared to existing dimensions identified in the IS, healthcare, and telemedicine literature. A third reviewer served as a judge to resolve conflicts and help ensure the clarity of definitions. Finally a second round of review was performed on the identified constructs to derive second or third order constructs using the process described by [18]. A literature review was conducted to define these constructs. The definitions for constructs were matched to questions using a matrix as described by [18, 38]. Four raters with expertise in information systems used the matrix to compare the constructs to the questions used to create the constructs. Two rounds of reviews and revisions were conducted based on the results. The identified constructs and definitions will be discussed in the discussion section.

## 4. Results

The results of the initial axial coding and the comparison led to the creation of 18 first order

constructs. Figure 1 lists the first order constructs initially identified. From the evaluation of the first order constructs and comparison with the literature, four second order constructs were identified. The second order constructs include health care, perceived information quality, perceived system quality and perceived net benefits.

Constructs identified for patient satisfaction with telemedicine

- Cost
- Information Availability
- Scheduling
- Duration
- Provider Benefits
- Support
- Usefulness
- Ease of Use
- Privacy
- Technology Reliability
- Environment
- Intention to Reuse
- Treatment
- Quality of Service
- Interaction with Provider
- Outcome
- Relationship with provider
- Quality of Care

Figure 1: Initial first order constructs identified for patient satisfaction with telemedicine

Based on an examination of the second order constructs relationships were determined. All of the first order constructs were initially grouped into higher level categories. Concepts such as cost, provider benefits, scheduling, environment, duration and usefulness were grouped into a category initially called benefits and convenience but changed to net benefits based on the literature review. Treatment, quality of service, interaction with provider, relationship with provider, and medical outcomes are grouped into healthcare. Support, ease of use, and reliability are grouped into system quality. Information completeness and privacy were grouped into information quality. Two constructs were not grouped into any additional category. The final results are shown in figure 2.

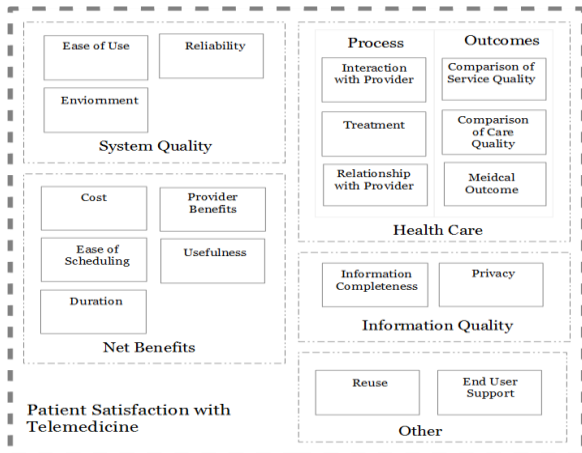


Figure 2: Proposed constructs for defining patient satisfaction with telemedicine

## 5. Discussion

The discussion will start off by describing the results in relationship to concepts identified in the literature. These concepts were used to re-examine some of the initial constructs described in the results. Some of these were renamed for clarity. Section 6 defines all of the constructs identified based on a review of the literature. The constructs are also described in terms of their relationships to higher level constructs and satisfaction. As the goal of this research is to identify dimensions of satisfaction and not provide a model on how satisfaction occurs, only the fact that a relationship exists between constructs is considered and not the type of relationship.

Based on the results of the instrument evaluations a number of first order and second order constructs were identified. Many of these constructs are similar to concepts described in the previous literature. Four second order dimensions were identified. There is support in both the medical and IS literature for the separation of these components.

The DeLone and McLean model of IS Success matches with some of the second order constructs identified and their relationship to satisfaction [28]. The model shows that information quality, system quality, service quality and net benefits can impact user satisfaction. Three of the second-order constructs identified in this study could be matched to these measures. System quality is similar to the construct termed system aspects in the initial proposed model. Net benefits are similar to the benefits and convenience construct. However, it is not clear whether the health care aspects can be considered part of service quality, information quality or an entirely different construct.

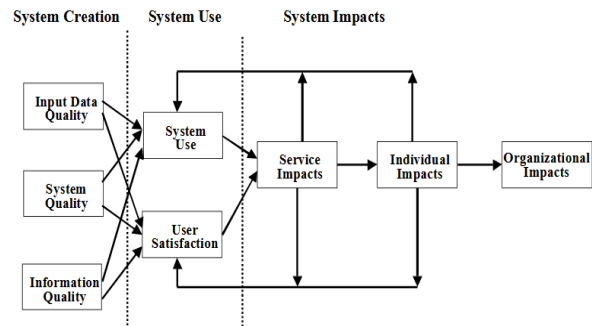


Figure 3: Model of telemedicine systems success [39]

This was examined in the model presented by [40] which considered the influence of “services”. Services are described as the extent to which the IS is used to provide services that support a core product

or service transaction to help users reach their goals [40]. The idea of service impact is also supported by a model designed by [39] for the success of telemedicine. In this model service impacts are viewed as resulting and informing satisfaction.

The separation of system components from services can also be seen in the literature on medical care. [41] discusses three categories under which quality of care can be examined: structure, processes and outcomes. Structures are considered attributes of material, human and organizational resources. Processes are considered what is done by both patient and provider, in giving and receiving care. Outcomes are the overall effects of care on the patient's health status. This supports the notion that system components can be viewed separately by patients from other aspects of healthcare.

The goal and technical designs of telemedicine systems can vary but are centered around providing some form of medical care service. Further, the relationship between the patient and telemedicine system is different than the traditional client server models in which other IS are typically based on. Through the telemedicine system, querying the patient is as important as allowing the patient to use the system to query the provider; creating a more peer-to-peer dynamic. This dynamic was used in the model by [39] which separated input data quality from information quality. These constructs will be defined based on the existing literature in the next section. Second order constructs will be defined in different sections along with a brief description of related first order constructs identified in this study.

## **6. Second-Order Construct: Health Care**

Health care is defined as the extent to which patients perceive the aspects of care which contribute directly to the maintenance, treatment, restoration and prevention of health related conditions [2]. The term health care is being used to eliminate possible confusion with the use of the term medical care, as medical care may have a narrower meaning in the medical field [3, 4].

Researchers have noted that studies on telemedicine often do not distinguish between a patient's satisfaction with the results of medical care and satisfaction with the telemedicine service itself [20]. Yet, the quality of a service provided can impact the perspectives of users [40]. [40] discusses how service quality can impact user attitudes such as enjoyment that play a role in their satisfaction. [40] define service quality as the overall evaluations and judgements concerning the service provisions delivered by and through a system. Although, their

focus was on e-services, the similar dependence on computer mediation can apply to telemedicine. In the case of telemedicine, the service provided can be viewed as the healthcare services. Healthcare can be divided into different components: one based on the outcomes of care and the other on the process. However, this is left up to future research to examine.

### **6.1. Treatment**

Treatment is defined as the degree of satisfaction with the process of medical treatment provided to the patient [42]. [43] shows that treatment can be considered a component of health care satisfaction. Treatment is concerned more with the patient's perspectives on procedures and expectations tied directly to the realization of healthcare outcomes as opposed to the outcomes themselves.

### **6.2. Medical Outcomes**

Medical outcomes is defined as the degree of patient satisfaction with the results, consequences or outcomes of the provided care [41]. The definition is used broadly to define the resulting changes from the medical process which can include biological, behavioral, knowledge, and quality of life changes [41, 43]. Medical outcomes can influence variables such as overall satisfaction that are often used to measure telemedicine satisfaction and there is a need to examine them separately [13].

### **6.3. Comparison of Service Quality**

Quality of service is defined as a global assessment of a patient's interactions with the functional quality or manner in which the service is delivered [44]. Service quality has been examined as a means of measuring the degree of difference between consumers' perceptions and expectations [45]. Unlike patients' perspectives of the overall health care service, in this context, service quality is based on the perceived quality of service delivery of the medical service.

### **6.4. Relationship with Provider**

Relationship with provider is defined as the amount of satisfaction a patient feels with the closeness or strength of the relationship, or partnership, developed between the patient and the medical service provider [46, 47]. This relationship can impact satisfaction and health outcomes [48]. The relationship can be viewed as one in which the

patient feels that their perspectives and preferences are being factored into care [49].

## **6.5. Interaction with Provider**

Interaction with provider is defined as the level of patient satisfaction with the personal interactions or manner and communications between the patient and staff providing the services and care [24, 50]. This study makes a distinction between a patient's relationship with the provider and the interactions with a provide [46]. Communication can be seen as a means of establishing the relationship between patient and provider [24, 46]. Yet the role of communication along with the manner of communication can play a role [47]. [19] shows the relevance of patient-provider interactions as a common mode of studying telemedicine satisfaction.

## **6.6. Comparison of Care Quality**

Comparison of care quality is defined as the extent to which patients are satisfied with telemedicine in comparison to other forms of medical care the patient is familiar with, such as in person care. Research shows that patients have a preference for active roles in the medical decision making [51]. Telemedicine may not be perceived as a replacement for traditional care [52]. As satisfaction can differ between telemedicine services and other forms of health care it should be considered in relationship to telemedicine services [22].

## **7. Second-Order Construct: Information Quality**

Information quality is defined as the degree to which patients perceive the quality of the information the system produces [53, 54]. Information quality is among the most commonly examined measures in the IS literature [53]. In a model that integrates technology acceptance with satisfaction, [30] shows that information and system quality can be viewed as unique constructs that relate to satisfaction. The IS model by DeLone and McClean (2003) also supports information quality as being considered a separate entity. [55] suggests that information quality, system quality and usefulness can explain a majority of the variance in overall user satisfaction. Hu (2003) makes a distinction between the quality of information provided from the system and the quality of information provided to the telemedicine system. However, there are constructs such as privacy that

can be viewed as a component of both information quality and input data quality.

## **7.1. Information Completeness**

Information completeness is defined as the degree to which patients feel their access to all information they deem important on their care, condition and procedures are adequate [50, 56]. Information provided to patients can play a role in health outcomes and patient perspectives [24]. One of the benefits of telemedicine is increased access to information [57]. Gaps between expectations and services received can arise due to lack of data completion [24] leading to dissatisfaction [56].

## **7.2. Privacy**

Privacy is defined as the level to which patients perceive their willingness to share personal information and the control they have over that information is adequate [58]. Privacy is among the factors influencing patient satisfaction [34]. Concerns over privacy can also impact the willingness to adopt telemedicine systems [59].

## **8. Second-Order Construct: System Quality**

System quality is defined as the patients measure of the quality of an IS's processing and technical soundness [54]. System quality has been viewed as a measure of the success of IS [53]. Researchers often model system quality separately from information quality [39, 60]. System quality can explain a majority of the variances in overall satisfaction [55]. Evidence shows strong support for the relationship between system quality and user satisfaction [61]. System quality can consist of unique aspects in the context of telemedicine and support the notion that system quality should be examined separately [62]. There has been other research into this relationship using different measures and systems [30, 63].

### **8.1. Ease of Use**

Ease of use is defined as the extent to which patients perceive the system as "user friendly" or that using the telemedicine system will would minimize physical and mental effort [30, 64]. Ease of use has been used in studies to measure system quality [65]. Studies provide different views on the relationship between satisfaction and ease of use [28, 30].

## 8.2. Reliability

Reliability is defined as the degree to which patients are satisfied with the reliability or dependency, accuracy, and consistency of the system used [66]. Reliability is considered a factor of system quality and satisfaction in information and telemedicine systems [67, 68].

## 8.3. Environment

Environment is defined as the amount of satisfaction with the environment or contextual and physical features in which the telemedicine procedure takes place [14, 41] [21]. The physical environment where care is provided is considered a dimension of patient satisfaction with telemedicine [21]. In the context of telemedicine, the user's location is affected by the system used and is considered related to system quality [62].

## 9. Second-Order Construct: Net Benefits

Net benefits is defined as the extent to which IS contribute to the success of patients [28]. The model proposed by [28] separates net benefits into a unique category of aspects that inform satisfaction. Empirical evidence strongly supports the relationship between satisfaction and net benefits [61]. The perception of net benefits for an individual are likened to aspects of perceived usefulness and there are a variety of studies that support its relationship to satisfaction [68]. Studies examine aspects of net benefits such as economic impacts in the telemedicine literature [69]. Evidence suggests that some net benefits such as costs in telemedicine vary based on the study [70]. However, the actual benefits of a system may not influence a patients' views similarly to the benefits they perceive.

### 9.1. Usefulness

Usefulness is defined as the extent to which patients believe that the system is useful or that using the telemedicine system will enhance their ability to meet their needs [65]. Models suggest a relationship between usefulness and satisfaction [30]. Perceived usefulness is also one of the most commonly used measures of net benefits [68]. However, there is no agreement on the relationship between usefulness and other constructs such as net benefits and system use [28]. However, [39] describes usefulness as both having objective and subjective characteristics in the context of telemedicine systems. [39] states

subjectively that system use can be perceived as a substitute for perceived benefits for attributes such as usefulness. As the satisfaction of patients is being considered, usefulness is viewed as part of net use.

### 9.2. Cost

Cost is defined as the degree to which patients perceive the cost or monetary expense of using telemedicine [71, 72]. [68] considers factors such as cost savings as relating to net benefits on the organizational level. The medical literature presents a view of patient as consumer and cost is a method used to evaluate care. For example, [24] defines the construct of finances as factors involved in the payment of medical services. This is relevant to telemedicine as although the evidence of cost advantages remains limited, the reported results can vary by application [57, 69, 70].

### 9.3. Ease of Scheduling

Ease of scheduling is defined as the degree to which patients are satisfied with the scheduling and waiting for an appointment with a medical provider. Scheduling is shown to have a correlation to patient satisfaction [33]. [39] considers ease of scheduling as a potential aspect of service impacts. Service impacts was defined based on components of the original DeLone and McClean IS success model. The model was revised and redefined net benefits which is similar to service impacts [28].

### 9.3. Duration

Duration is defined as the degree to which patients perceive the adequacy in the length of time they spend on their visit with a provider and medical care. The amount of time a patient spends with a medical provider influences patients' perspectives of a medical provider [73]. [74] shows that reduced time with a provider negatively impacts the patient provider relationship. Duration is considered as a part of net benefits as opposed to medical care or system quality. In the IS literature duration of use is considered an aspect of system usage not system quality [75]. However, duration in regards to the usage of telemedicine also relates to the patient/provider relationship. A telemedicine patient is likely to evaluate the duration of care in terms of the benefits it provides, i.e. reduced waiting time, longer time with a physician, etc.

## 9.4. Provider Benefits

Provider benefits is defined as the extent to which patients feel the telemedicine services provide an advantage for, or assists their medical providers. This construct is related to trust. Yet the patient's views can vary based on how they feel the benefits relate to their care. For example, some patients may feel a service that increase a provider's comfort can increase the quality of care (Dick, Filler et al. 1999). But, others may feel a lack of trust when a service is being offered to benefit a provider at the expense of a patient (Goold 1998, Hall, Zheng et al. 2002).

## 10. Second-Order Construct: Other

Several constructs were not identified in the literature as directly relating to second order constructs. While they relate to satisfaction, we were unable to relate them to a second-order construct.

### 10.1. End User Support

End user support is defined as the degree of patient satisfaction with the organizational and technical assistance provided to use telemedicine [76]. Users of systems may not have adequate knowledge to use the system and therefore support is often required [77]. Models of telemedicine systems view technical support as an aspect of system quality [62]. Yet this may not apply to telemedicine. Satisfaction is shown to increase when needs for support are fulfilled [76].

### 10.2. Reuse

Reuse is defined as the degree to which the patient feels confident in re-using telemedicine services, increase their use of the system in the future and recommending it to others [78]. Reuse is shown to relate to satisfaction and system quality [78]. [79] define reuse and recommendation as aspects of satisfaction.

## 12. Conclusion and Future Work

This study defined several constructs that were identified from existing measurement instruments and related to the literature. There are likely more items that can define telemedicine satisfaction but are not typically used in validated instruments. The next step in this research will be validating these dimensions of satisfaction with telemedicine and designing an instrument to measure them. Current

work is centered on validating the dimensions described in this paper using methods described by [18]. This will include testing patients using an instrument developed based on the described dimensions.

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