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Examining dimensions of patient satisfaction with telemedicine

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Examining Dimensions of Patient Satisfaction with Telemedicine

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Dissertation Verification

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Abstract

During the outbreak of the novel coronavirus (COVID-19) medical institutions and practitioners have drastically increased their adoption of telemedicine. The proliferation of telemedicine systems has sparked renewed interest among IS researchers in evaluating its usage. One of the main indicators used to measure the success of telemedicine services is patient satisfaction. Yet several problems exist with current methods used to evaluate telemedicine satisfaction. Patient satisfaction with telemedicine is frequently evaluated using either single question items or handmade instruments that are seldom assessed for validity. While telemedicine satisfaction is typically evaluated through single measures, satisfaction is considered a complex and multidimensional concept. Because of the lack of insight that satisfaction measures provide it may be difficult to interpret or act upon the results of evaluations. The goal of this study is to examine and evaluate the dimensionality of telemedicine satisfaction and its perceived value. This study achieves this by following a novel multi-phased mixed methods approach. This approach includes exploratory, confirmatory and evaluatory phases that are used to: 1) identify telemedicine satisfaction dimensions and their relationship to satisfaction; 2) develop and confirm a model of patient satisfaction with telemedicine and 3) evaluate the value of the results in practice. The results demonstrate a model of satisfaction informed by system quality, information quality, health service quality, usefulness, and additional intention measures. Additional findings demonstrate the challenges with subjective interpretations of satisfaction's meaning by providers. Results show that interpretations can vary between single-item measures and dimensional views of satisfaction. Implications and recommendations are discussed.

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Chapter 1. Introduction

The focus of this research is on examining patient satisfaction with telemedicine and the dimensions that help define it. Satisfaction can play an important role in the success of information systems (Vaezi, Mills, Chin, & Zafar, 2016). Results of telemedicine satisfaction studies should provide insight that aid future development and decision making. However patient satisfaction remains a loosely defined concept and a lack of well-defined measures can lead to difficulty with utilizing and interpreting results (Ng & Luk, 2019). While many studies have examined patient satisfaction with telemedicine, there remains a need to examine the influence of different dimensions of satisfaction on patient perspectives (E. Shirley, Josephson, & Sanders, 2016). Understanding the impact of different dimensions on patient satisfaction can potentially enhance the design of systems and implementation polices by institutions for telemedicine. This is important because of the impact decisions around telemedicine can have on the outcomes of medical care and the adoption of systems by institutions (E. M. Rogers, 2010; Ye et al., 2021). Decision makers have a need to properly evaluate telemedicine services and policies, particularly as telemedicine adoption continues to become more widespread.

Telemedicine systems are complex socio-technical systems that are made up of interactions between different stakeholders and technology (LeRouse, Hevner, Collins, Garfield, & Law, 2004). The effective management of these systems requires understanding of both the functional quality along with the desired clinical encounters (LeRouse et al.,

2004). Among the critical outcomes used in evaluating the success of telemedicine services is patient satisfaction (Kidholm, Clemensen, Caffery, & Smith, 2017). Patient satisfaction is often measured alongside clinical outcomes, cost, and efficiency in evaluating medical technologies. It is considered an important influence on medical provider decision making.

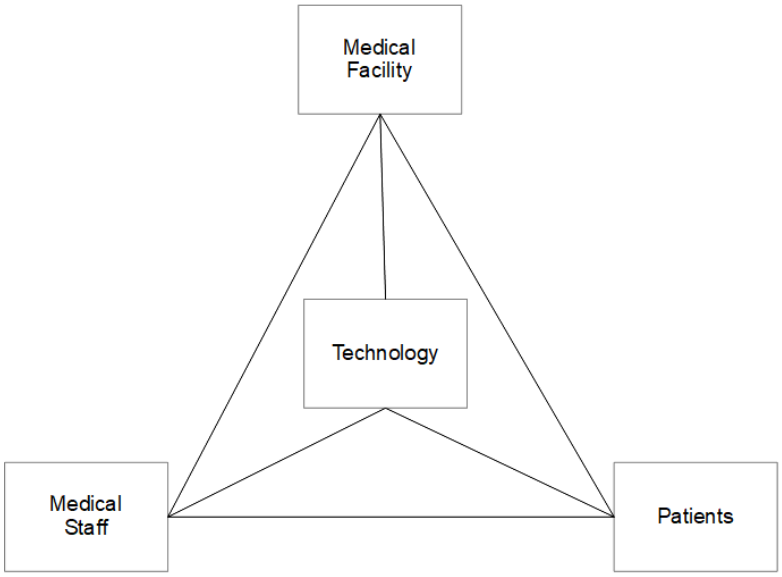

Figure 1: Telemedicine viewed as a complex system adopted from LeRouse et al. (2004)

However, unlike other measures there are unique challenges with the use of satisfaction as a measure of system success. One of the key issues is that satisfaction remains loosely defined and it is often difficult to interpret the meaning of satisfaction results (Manary, Boulding, Staelin, & Glickman, 2013). Some studies have shown relationships between satisfaction, medical outcomes, and needs, although the exact nature of these relationships are uncertain (Fenton, Jerant, Bertakis, & Franks, 2012; Kennedy,

Tevis, & Kent, 2014). Even when telemedicine satisfaction is high, patients may still view telemedicine as inferior to traditional services (Polinski et al., 2016). This can be further complicated by contextual factors that are unique to information systems used in medical practice (Axelsson & Melin, 2014).

While previous studies have identified these issues with evaluating telemedicine satisfaction there remain gaps in the knowledge. Several researchers point out problems with the methodologies used in telemedicine satisfaction research (Ng & Luk, 2019; Zhang, McClean, Jackson, Nugent, & Cleland, 2014). Among the challenges discussed in these studies are those questioning the generalizability and usefulness of findings, instruments used to measure satisfaction, and agreements on the dimensions of satisfaction. Several researchers have already conducted work on improving evaluation instruments (Bhandari et al., 2019; Hajesmaeel-Gohari & Bahaadinbeigy, 2021). There are also several studies that are examining telemedicine methodologies and ways to improve overall evaluations (Ekeland, Bowes, & Flottorp, 2012; Kidholm et al., 2012). However, there remains a need to understand the dimensionality of patient satisfaction with telemedicine and its value in further detail (Zhang et al., 2014). This research will contribute to the knowledge and provide new insights to help fill in these gaps by examining the dimensions of patient satisfaction with telemedicine, how they relate to each other and their usefulness in practice.

7.3 Telemedicine defined.

This study uses the term telemedicine as a means of describing the use of telecommunications technology to provide remote medical care and services across

geographic distances (Sood et al., 2007). This research makes a distinction between telemedicine and other terms such as e-health and telehealth. In the context of this study telemedicine is viewed as using telecommunications technology to remotely diagnose and treat medical issues. Systems designed solely for surveillance and health promotion are not considered telemedicine but can be considered telehealth or e-health (Wilson & Maeder, 2015). To clarify what is being discussed in this research and limit the scope of the study, the definition of telemedicine will be further explored.

Terms such as telehealth, telecare, telematics and variations of medical terms using the prefix "tele" have all been used to describe technologies for providing distant medical care (Wootton, 1998). This has been further complicated as new terms have been adopted to describe similar systems that use newer technologies. With the growth of Internet and mobile many researchers describe services similar to telemedicine (Jovanov & Zhang, 2004). For example, there have been studies on e-health and mobile-health applications. However, there remains no clear consensus in the literature on whether these are indeed telemedicine applications or how to distinguish telemedicine applications from other similar applications (Sood et al., 2007).

The United States Department of Health and Human Services Health Information Technology website distinguishes between telehealth and telemedicine (HRSA, 2016). The site describes telemedicine as referring only to clinical applications of technology while telehealth is a broader term that can include things like education. An American Telemedicine Association issue paper supports the description of telehealth being a broader

term (Association, 2012). While the ATA generally uses the terms telemedicine and telehealth interchangeably the paper acknowledges that telehealth is often used to describe a broader application of technologies to support remote health care services such as education and consumer outreach. Telemedicine, according to the report however is more often related directly to clinical services.

Similarly, reviews of the literature suggest that terms such as e-health can also be considered a broader term that primarily focuses on the themes of health and technology (Oh, Rizo, Enkin, & Jadad, 2005). Unlike e-health however, a similar review of the literature shows that most definitions of telemedicine have four main contexts that included medical, technological, spatial and benefits (Sood et al., 2007). The authors conclude with a definition of telemedicine that attempts to identify it as a subset of e-health that uses communications networks for delivering medical services and education across geographic distances that is used to overcome issues such as the uneven distribution and shortage of infrastructural and human resources (Sood et al., 2007). While this is the definition that will be considered for telemedicine throughout this text, it is important to consider that patients may not make any distinctions between the meaning of these systems.

7.3 Meaning of satisfaction

Satisfaction is a complex construct that make defining it difficult (Griffiths, Johnson, & Hartley, 2007). Satisfaction can be viewed differently based on the research domain and context. For example, satisfaction has historically been used as a means of measuring the success and effectiveness of Information Systems (IS) (Vaezi et al., 2016). However,

satisfaction has also been examined in the Human Computer Interaction literature as a factor that contributes to the usability of a system that is based, in part, on the user experience (Bevan, Carter, & Harker, 2015). In the medical literature, patient satisfaction can be defined as the "individual's positive evaluation of distinct dimensions of health care" (Linder-Pelz, 1982). Research in marketing considers satisfaction as a function of a consumer's expectation and an influencer on the post-purchase attitude (Oliver, 1980).

These different views of what satisfaction is can limit the contributions that can be made from research on satisfaction (Giese & Cote, 2000; Szymanski & Hise, 2000). Melone (1990) describes a lack of theoretical foundation leading to satisfaction being incorrectly viewed as a surrogate for IS effectiveness that limits views on its complexity in relationship to other behavioral constructs. These issues can lead to difficulties in determining whether researchers are comparing the same constructs or different phenomenon when investigating satisfaction (Treacy, 1985; Vaezi et al., 2016).

The International Standards Organization (ISO) has attempted to address some of this confusion through its definition of satisfaction. ISO-9241-11:1998 defines satisfaction as "Freedom from discomfort, and positive attitudes towards the use of the product" (International Organization for Standardization, 1998). This definition follows a similar direction seen in the early marketing literature that supports the idea of satisfaction as relating directly to behavior. This was discussed by Vaezi (2013) which noted that satisfaction in marketing research was often studied in relationship to behavioral concepts such as attitude.

Early research by Fishbein (1963) hypothesized that an individual's attitude toward an object was a function of their beliefs about the object and the evaluation of those beliefs. This view of the behavioral link between satisfaction and attitude was based in part on expectancy-value theories. The expectancy value theory posits that expectancies for success and subjective task values inform related decision making (Eccles, 1983).

Fishbein and Ajzen (1977) developed a model describing this called the Theory of Reasoned Action (TRA). TRA suggests that behavioral intention is due to a person's attitude toward a behavior and subjective norms. In this model the expected outcome is the driving force behind the behavioral belief. Attitude is a person's view of the positive and negative aspects of the behavior and the subjective norm is a result of social influences. With increased intentions a user is more likely to perform a behavior.

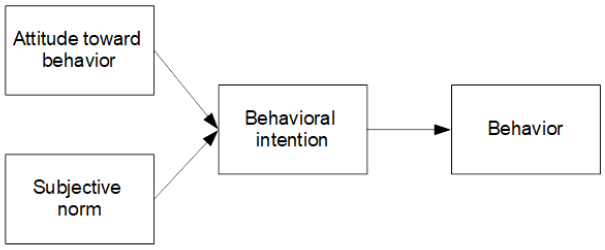

Figure 2: Theory of Reasoned Action Model adapted from Fishbein and Ajzen (1977)

Oliver (1980) linked this idea of behavioral intention to satisfaction. Satisfaction is seen as being a separate construct that has a direct impact on attitude. Satisfaction is also shown to be limited based on the user experiences. Satisfaction is shaped by performance expectations and expectancy disconfirmation. Oliver (1977) demonstrated that user

perception of performance is shaped directly by their expectations. In this view satisfaction is seen as an influencer of attitude which directly informs an intention.

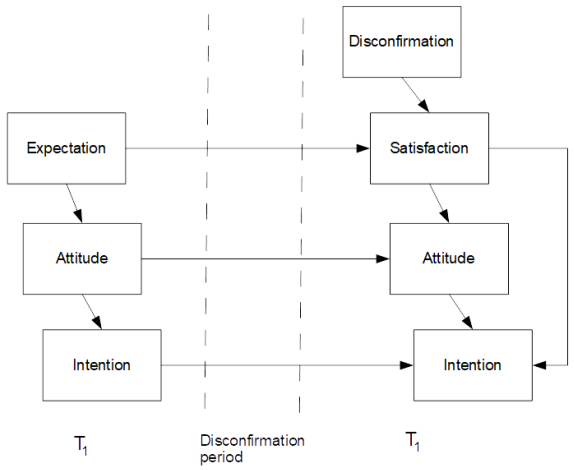

Figure 3: Antecedents and Consequences of Satisfaction Decisions from Oliver (1980)

From this early research we see that satisfaction itself is an aspect of a human evaluation process that informs behavior. However, much of the early research still viewed satisfaction as a simple aspect. Viewing satisfaction as a more complex construct that include aspects of the consumer experience are part of a changing research direction (Oliver, 2010). This changing perception of satisfaction also includes views of it containing emotional and affective components (Babin & Griffin, 1998; Hunt, 1977). As a result of various critiques of the simplicity of ISO-9241-11:1998 a proposed revision is currently under review. The revision ISO/DIS 9241-11, now includes user experience aspects changing the definition to: “positive attitudes, emotions and/or comfort resulting from use of a system, product or service” (Standardization 2015, Bevan et al. 2015).

This view is supported by other attempts to define satisfaction in the literature. Giese

and Cote (2000) for example have noted that there are three main elements to most views of satisfaction. These elements consist of an emotional or cognitive response, a response that pertains to a particular focus, and a response which occurs at a particular time and for a limited duration. Each of these elements demonstrate the complexity of satisfaction. Research shows that satisfaction involves different factors which can vary based on context (Lindgaard & Dudek, 2003). Contextual factors such as the environment and task variations can impact results of satisfaction (Griffiths et al., 2007).

The complexities in defining satisfaction and differing viewpoints in the information systems literature have been discussed by Vaezi et al. (2016). Among these viewpoints are two major areas in which satisfaction is typically investigated and defined. In the process-oriented approach, satisfaction is described according to the processes by which satisfaction develops. This approach often examines how satisfaction develops through cognitive and affective processes. A second approach termed the outcome oriented approach, views satisfaction as an "outcome of a consumption process or user experience" (Vaezi et al., 2016). Using this approach researchers often investigate related dimensions of satisfaction that either influence or are influenced by satisfaction. This research will examine satisfaction using an outcome-oriented approach. In this research satisfaction is considered an outcome of an evaluation of different dimensions informed by a user experience.

7.3 Problem statement

Telemedicine satisfaction measures should provide useful insight for decision making; however, satisfaction is often loosely defined and there remains a lack of agreement into the

dimensions of satisfaction. Further because of the complexities of evaluating satisfaction in a complex system it is difficult to determine the effect of different dimensions on telemedicine satisfaction or their relationship to each other. In an ideal setting, decision makers should easily be able to both evaluate, interpret, and give meaning to the results of satisfaction evaluations. It is therefore important that researchers continue to expand upon the current knowledge of patient satisfaction with telemedicine by identifying existing dimensions and evaluating them in relationship to each other.

7.3 Goals

This research has three goals: (1) determine dimensions of patient satisfaction with telemedicine (2) evaluate the relationship between identified dimensions and satisfaction (3) evaluate how dimensions fit within the understandings of decision makers. These will be evaluated through the following research questions.

Research question 1: What dimensions contribute to patient satisfaction with telemedicine?

Research question 2: How do identified dimensions relate to satisfaction?

Research question 3: How do decision makers interpret data based on identified dimensions?

7.3 Approach

This research follows a pragmatic mixed method approach towards examining dimensions of patient satisfaction with telemedicine. This research was conducted in three phases: an exploratory phase, a confirmatory and explanatory phase.

In the exploratory phase a study is conducted to examine satisfaction and identify the dimensions that inform patient satisfaction with telemedicine. The exploratory research uses a mixture of methods to extract dimensions from previously validate telemedicine instruments identified in the research literature. The results identified 18 dimensions that were used to evaluate telemedicine satisfaction. A chapter is presented that discusses the methods used in the exploratory phase, the results and analysis in detail.

Following the identification of satisfaction dimensions a confirmatory phase is conducted to validate the dimensions in a hospital setting. The confirmatory phase involves constructing a measurement questionnaire to evaluate the dimensions of patient satisfaction with telemedicine. Once the instrument is created a study is conducted to examine which dimensions inform patients satisfaction and how they relate to each other. A chapter describes this process in detail along with the findings.

Once the satisfaction dimensions are confirmed a study is conducted to evaluate how decision makers view the resulting data. While the theoretical implications of the research are important pragmatically it is important to ensure the value of the research results. A qualitative study is conducted to examine the views of medical providers on the results of the dimensional satisfaction evaluation. A chapter provides the insights gained during this process in detail. Table 1 on the following page provides an overview of the research problems, goals and approach used during this study.

Table 1: Research problems, goals, and approach

	Problem	**Goal**	**Approach**
1.	Satisfaction is complex, loosely defined and there remains a lack of standard dimensions	Determine standard dimensions of patient satisfaction with telemedicine	Explore dimensions used in the literature to evaluate patient telemedicine satisfaction.
2.	Because of the complexity of satisfaction, it is difficult to determine the extent to which measures relate to satisfaction.	Evaluate the relationship between identified dimensions and satisfaction	Collect data through survey on satisfaction dimensions and evaluate relationships using statistical analysis.
3.	Decision makers need to be able to effectively interpret the results of satisfaction evaluations.	Examine how dimensions fit within the understandings of decision makers	Use qualitative approach to obtain perspectives of decision makers on resulting satisfaction data and relationship models.

7.3 Practical Relevance

The recent COVID-19 outbreak have also brought increased interest in the use of telemedicine (Ye et al., 2021). The need to reduce close contact to prevent contagion and increase space for quarantine patients in hospitals has many researchers examining the benefits of remote medical care (Smith et al., 2020). The outbreak has brought increased attention to the need to protect healthcare workers and telemedicine is seen as providing many potential benefits (Moazzami, Razavi-Khorasani, Moghadam, Farokhi, & Rezaei, 2020).

Although telemedicine can potentially provide advantages for medical institutions the success of telemedicine projects can depend on the satisfaction of stakeholders such as patients (Kissi, Dai, Dogbe, Banahene, & Ernest, 2020; Menachemi, Burke, & Ayers, 2004). Research has also shown that patient satisfaction can affect the results of medical outcomes

and patient participation in continuing care (Chou & Brauer, 2005).

As more medical institutions invest in telemedicine programs, the means should be available to evaluate the impact of different systems on patient satisfaction. However there still remain concerns on whether methodologies are adequately measuring satisfaction and what exactly satisfaction measures demonstrate (Hajesmaeel-Gohari & Bahaadinbeigy, 2021; Masino & Lam, 2014).

This study provides practical relevance for those seeking to evaluate, compare and make decisions on using telemedicine. The main relevance for practitioners from this study is in the development of dimensions that can be used to evaluate telemedicine systems. Different dimensions can have unique impacts on satisfaction of telemedicine systems. Identifying these dimensions can aid those in evaluating telemedicine services. For instance, Hospitals and other organizations can use these results in examining their own evaluations and how different dimensions may help distinguish the impact of policies or in comparing telemedicine technologies and systems.

7.3 Theoretical Relevance

Satisfaction has historically played a major role in studies on information systems (Vaezi et al., 2016). Satisfaction is considered an important metric for examining the success of information systems (Delone & McLean, 2003). In addition, theories have begun to examine the larger role that satisfaction plays in overall technology acceptance (Wixom & Todd, 2005; Xu, Benbasat, & Cenfetelli, 2013). For instance, research suggests that satisfaction can play a role in continued and habitual usage (Limayem, Hirt, & Cheung,

2007).

Although the literature can provide guidance on satisfaction, there remain gaps in the knowledge on what the term satisfaction should signify (Carlquist, Nafstad, & Blakar, 2018). Further satisfaction can vary based on the context in which an application is used (Griffiths et al., 2007). Unlike in other information systems research, patient satisfaction with medical care can influence the results of telemedicine satisfaction. This can make it difficult to separate the results of satisfaction with the technical or system components from satisfaction with the outcomes of medical care services (P. Whitten & Love, 2005).

While there are a number of models that have been developed in the information systems literature to attempt to predict satisfaction, there still remain questions as to what are the antecedents of satisfaction in different contexts (Vaezi et al., 2016). Further the explanatory power of many models for telemedicine are still limited. By examining satisfaction in medical contexts such as telemedicine that are dependent on both the quality of medical services as well as technology new insight can be gained that can improve on existing theory.

This study contributes to the knowledge on telemedicine satisfaction by providing additional theoretical insight. The theoretical relevance of this study is in providing new insights into models that are used to examining satisfaction in information systems, particularly those in the medical domain that are reliant on remote technology. These insights can aid researchers in understanding how dimensions of satisfaction differ or are similar between different contexts. Further, the study provides additional insight into how

dimensions relate to satisfaction and each other. The identification and confirmation of dimensions linked to satisfaction in the telemedicine domain can provide new areas of investigation.

Chapter 2. Literature Review

The purpose of this section is to provide an extensive literature review on the topic of telemedicine satisfaction. The review will cover both current findings and historical accounts of the issues surrounding satisfaction. Because of the uncertainties surrounding satisfaction and the current push for increased telemedicine adoption, there is a need for research in examining patient satisfaction with telemedicine.

The first section will discuss theories of satisfaction that come from various studies on consumer satisfaction. Although these theories can aid in providing an overall view of satisfaction, different contexts can shape the way satisfaction manifests itself. To examine this further, a section discussing patient satisfaction in the literature will then be presented. This section will describe the uniqueness of patient satisfaction and its evaluation. Following this, satisfaction will be explored in the context of telemedicine. This discussion will be followed by a section discussing the practical relevance of this research and a section discussing the theoretical relevance of this research. Finally, a section describing the theoretical model designed from this study based on satisfaction from an information systems perspective will be presented.

7.3 Theories of the Satisfaction Process

There are several theories that have been developed over the years that can help explain satisfaction and the process by which it is formed. Understanding these theories can help expand on what satisfaction is and the challenges with its evaluation. Several of these theories will be briefly discussed below. This will provide a historical context to views on

what satisfaction consists of and its processes. For a full discussion, readers are urged to review the works by Vaezi (2013) or Yi and Zeithaml (1990).

Early research sought to explain satisfaction and its relationship to customer decision making. Among the theories that provided insight into this relationship was Contrast theory (Cardozo, 1965). In Contrast Theory Cardozo (1965) describes customer satisfaction as being influenced from both a consumer's expectations of a product and the effort expended to acquire the product. When expectations are not met, or disconfirmed, a consumer may exaggerate the differences between the received and expected product. This process is seen as forming satisfaction.

These views of satisfaction were expanded on by Howard and Jagdish (1969). In their work, satisfaction is discussed as the degree of congruence between the consequences of a purchase, consumption of a product and the consumer's expectations. According to Howard and Jagdish (1969) if the outcomes are judged to be better than or equal to what the consumer expected then they will feel satisfied. If, however, the outcomes do not meet the user's expectations then the consumer will feel dissatisfied. These are represented by the formulas:

$$Actual\ Consequences > Expected\ Consequences = Satisfaction$$

$$Actual\ Consequences < Expected\ Consequences = Dissatisfaction$$

Other researchers attempted to expand on these ideas of expectations at their influence on user acceptance and rejection. Assimilation-Contrast theory posits that consumer perceptions such as satisfaction, exist within zones of acceptance and rejection

(R. E. Anderson, 1973).

According to this theory if the difference between performance and expectations falls within a zone of acceptance, consumers will evaluate a product as meeting their expectations. Even if a product performs below expectations it will be viewed as meeting expectations up to a point based on the performance-expectation gap. This point is passed when the gap is so large that consumer beliefs fall into a zone of rejection. If the performance falls into the zone of rejection a contrast effect will occur that will magnify the differences between the consumer's expectations and their views of the product's actual performance.

Others took a more complex approach at examining the outcomes of satisfaction. In their studies, satisfaction was not just the result of an acceptance or rejection evaluation but a more complex cognitive and behavioral phenomena. Festinger (1962) for example, formulated a theory to describe contradictory behavior in human attempts at consistency and the modes in which they responded to inconsistencies. This formed the basis for cognitive dissonance theory.

According to the theory as people are presented with information that contradicts their established beliefs or ideas, they tend to feel a level of mental discomfort. This level of mental discomfort causes them to enact coping mechanisms to reduce this dissonance. This can take the form of changing the behavior that causes the dissonance, changing the environment in which the dissonance occurs, adding new cognitive elements to reduce dissonance, or resist the conflicting information (Festinger, 1962). Yi and Zeithaml (1990)

state that in relationship to satisfaction, that dissonance between product evaluation and expectations can create tension that causes consumers to change their perception of a product.

While these different theories provided some insight into satisfaction there were still several shortcomings. Expectation-disconfirmation theory was presented as a means of addressing shortcomings in contrast, assimilation and dissonance theories (Oliver, 1977). Oliver (1977) suggested that assimilation and contrast theory were not meaningful in the context of product exposure. According to Oliver (1977), confirmation and disconfirmation were actually part of the same aspect.

To address this Expectation-disconfirmation theory presents disconfirmation as a separate independent construct from expectations and performance in evaluating satisfaction. This disconfirmation construct along with expectations have a direct impact on satisfaction, with disconfirmation having a greater impact (Oliver, 1980; Olson & Dover, 1979; Swan & Trawick, 1981).

LaTour and Peat (1979) sought to address some of these issues using comparison level theory. The use of comparison level theory was examined for its potential to address concerns raised about trends that caused issues with evaluations of satisfaction / dissatisfaction. LaTour and Peat (1979) state that a variety of socioeconomic and demographic variables were being used to address inconsistencies between evaluations and predicted results for consumer satisfaction. They suggested that while this approach helped provide more descriptive information the lack of significant relationships did not aid in

identifying actual determinants of satisfaction. To resolve this, they proposed the use of comparison level theory as described by Thibaut and Kelley (1959).

Comparison level theory views interactions in relationship to costs and rewards. Rewards and costs could include product attributes, pleasures or difficulties with acquisition, and responses to the product (LaTour & Peat, 1979). This is considered the product outcome. They also describe a comparison level that consumers use in evaluating products. The comparison level exists between a consumer's experiences with a product and similar products. A comparison level is based on similar product experience, situational expectations, and the experience of others. According to comparison level theory satisfaction is considered a result of the discrepancy between the outcome and comparison level.

Other researchers provided more insights into the comparison criteria. Yi and Zeithaml (1990) provide a discussion of norms as a comparison standard. This theory includes descriptions of an ideal product performance versus the perceived product performance. They describe this as the "should be" perception of product performance versus the usually evaluated predicted expectations of what "will be" the product performance. Using norms as a comparison, a user's perceived expectations will be influenced by perceptions of how a product should perform based on some criteria such as previous experience (Woodruff, Cadotte, & Jenkins, 1983).

Through this Trawick and Swan (1981) showed that satisfaction was highest when

participants felt quality of service exceeded their desired expectations. Some theories attempted to expand upon the cognitive-affective aspects of satisfaction. Value-Percept Disparity Theory is considered an alternative model to the expectation-confirmation model (Vaezi, 2013; Yi & Zeithaml, 1990).

Westbrook and Reilly (1983) proposed this model based on a critique of the failure of other existing models to account for the unique nature of satisfaction and its relationship to cognitive-affective processes. Further the authors argued that the expectation-confirmation model did not differentiate between cognitive and evaluative assumptions.

This theory suggests that differences between a person's values and perceptions are the main determinants of satisfaction. The smaller the differences between a person's percepts and their values the more positive their evaluation of the product (Westbrook & Reilly, 1983). According to this theory this positive evaluation is what causes more favorable affective responses such as satisfaction.

These descriptions provide a general overview of the early evolution of theories on satisfaction. Many of the theories either build on previous theories or add new insight such as potential factors that may contribute to satisfaction. For example, assimilation-contrast theory improves upon contrast theory by adding zones of evaluation in which perceptions can exist.

The theory of expectation-confirmation built upon this by integrating ideas presented in dissonance theory to develop the construct of disconfirmation. Equity theory, value-percept theory and comparison level theories were all presented as alternatives to

components of expectation-confirmation theories. Equity theory however was shown to be compatible with expectation-confirmation theories and some authors suggested it was just another component of satisfaction (Swan & Mercer, 1981).

The lack of appreciation for the complexity of satisfaction was a major aspect in the development of comparison level theory, value percept theory and those considered norms as comparison. Norms as comparison models demonstrate the need for more complex models to describe satisfaction. Comparison level theory presents both outcomes and criteria consumers use for comparison as consisting of multiple components.

This is like ideas presented in the value-percept theory which calls for the need to consider the cognitive-affective as part of the complexity of satisfaction. Theories such as the hypothesis testing theory demonstrate the cognitive aspects but do not evaluate the affective. Theories such as the generalized negativity theory suggest that consumer behavior can be tied to components that do not always coincide with expected results, therefore a product can exceed users expectations but still lead to negative evaluations (Oliver, 1976).

These early theories however provide some insight into the meaning of satisfaction and how it should be evaluated. From Assimilation-Contrast theory we start to gain an understanding of satisfaction as an outcome resulting a person's analysis between their expectations and evaluations. Cognitive dissonance theory and Value-Percept Disparity Theory enhances this view to demonstrate the complexity of the satisfaction outcome as a complex behavioral phenomenon that consists of both cognitive and affective aspects.

The work of researchers such as LaTour and Peat (1979) cautioned about focusing too much on socioeconomic and demographic differences and instead consider the costs and reward outcomes. These outcomes exist as comparisons people make between outcomes and their comparison levels. Meanwhile Yi and Zeithaml (1990) ground these comparisons in a user's norms based on their experiences with similar services.

7.3.1 **Summary**

The descriptions provided in this section describe the complex and evolving knowledge on satisfaction. There are different theories as to how consumers evaluate products and ultimately realize a degree of satisfaction. While many of the theories presented here are effective at describing the process of satisfaction, they do not necessarily describe the attributes of satisfaction.

Distinguishing between process oriented and outcome oriented approaches was a key aspect of the discussion provided by (Vaezi et al., 2016). Based on this, one direction of research is investigating the process by which satisfaction occurs and another looking at what the outcomes of satisfaction are. According to them the process-oriented approach in studies on user satisfaction involve those that attempt to explain the process of satisfaction formation in individuals. This is contrasted with a more common outcome-oriented approach that focuses on identifying measures of satisfaction judgements and factors that contribute or are impacted by satisfaction. To examine this further satisfaction will next be discussed in the context of patient satisfaction. A summary of the different theories of consumer satisfaction are presented in table 2 on the following page.

Table 2: Summary of theories of consumer satisfaction

Theory	Description	Source
Contrast theory	Satisfaction is influenced by congruence of performance and expectations.	(Cardozo, 1965; Howard & Jagdish, 1969)
Assimilation-Contrast Theory	Satisfaction occurs within zones of acceptance and rejection.	(R. E. Anderson, 1973)
Dissonance Theory	Dissonance between product evaluations and expectations can cause mental tension that consumers reduce by changing their perceptions with products.	(Festinger, 1962; Yi & Zeithaml, 1990)
Expectation-disconfirmation theory	Satisfaction results from disconfirmation and expectations. Disconfirmation is a separate and more influential construct.	(Oliver, 1977; Olson & Dover, 1979; Swan & Trawick, 1981)
Comparison level theory	Satisfaction is the result of differences between outcome and comparison level. Both outcome and comparison are made up of different components.	(LaTour & Peat, 1979; Thibaut & Kelley, 1959)
Norms as Comparison Standards	Expectations used to evaluate satisfaction can be shaped by a consumer perceived norms of product performance.	(Woodruff et al., 1983; Yi & Zeithaml, 1990)
Value-Percept Disparity Theory	Satisfaction is an affective response to the discrepancies between a person's values and perceptions of a product.	(Westbrook & Reilly, 1983)
Hypothesis Testing Theory	Consumers create hypothesis of product performance based on their expectations. Satisfaction is the confirmation or disconfirmation of these hypotheses.	(Deighton, 1984)
Generalized Negativity Theory	Disconfirmation of expectations has a greater impact on satisfaction regardless of positive or negative disconfirmation than confirmation of expectations.	(Carlsmith & Aronson, 1963; Oliver, 1976)

7.3 Patient Satisfaction

While most of the previous discussion has focused on the relationship between

satisfaction and consumer behavior, in this study patients are considered as a special form of consumer. This is important to consider due to discussions of the transformation of the patient identity towards consumer as discussed in the literature (Andereck, 2007). This identity has caused some debate with scholars arguing about the implications on policy for the view of healthcare in relation to consumerism (Mold, 2015).

Although this debate is well beyond the scope of this research, the important aspect to consider is the views that healthcare services contain items for consideration that may be outside the traditional consumer experience and behavior. For example, a patient's views may be shaped by their underlying medical conditions and the way they perceive the outcomes, regardless of actual treatment. Although economic benefits play a role in consumer satisfaction there are also other potential benefits that a consumer may consider that directly impact their satisfaction (Otani et al., 2009). This is an important aspect to consider regarding patient satisfaction. For example, Manary et al. (2013) describes a view by some practitioners that see patient satisfaction responses as directly related to the resulting health status.

Patient satisfaction is viewed as an important part of the outcomes of medical services themselves. Patient satisfaction is viewed as important in the medical field because of its potential relationship to the outcomes of medical procedures (Kane, Maciejewski, & Finch, 1997). Patient satisfaction and dissatisfaction can not only have a direct impact on outcomes but also on adherence to continuing care. This can ultimately impact a patient's overall health status (Vermeire, Hearnshaw, Van Royen, & Denekens, 2001).

The relationship between satisfaction and medical outcomes is still under investigation and there remains uncertainty about what exactly high satisfaction means in regards to medical practices (Manary et al., 2013). For instance a study that examined the relationship between surgical outcomes and satisfaction did find a relationship between low mortality and satisfaction scores, but the authors concluded that the relationship was more complex (Kennedy et al., 2014). Another study performed on a nationally representative sample in the United States showed that while high satisfaction with medical services correlated with fewer emergency room visits, satisfied patients had higher odds of inpatient admission, expenditures and mortality rates (Fenton et al., 2012).

There have been different approaches towards understanding patient satisfaction described in the literature. Patient satisfaction can be viewed as both a cognitive evaluation and an emotional reaction that is influenced by expectations (E. Shirley et al., 2016; E. D. Shirley & Sanders, 2013; Urden, 2002). However patient satisfaction can also be viewed as the relationship between expectations and outcomes (E. D. Shirley & Sanders, 2013). Linder-Pelz (1982) defines satisfaction as positive evaluations of distinct dimensions of the provided health care. This multidimensional view of patient satisfaction as a complex construct is supported by research over the years (Linder-Pelz, 1982).

Recent studies provide further evidence for the multidimensionality and complexities of patient satisfaction. Batbaatar, Dorjdagva, Luvsannyam, Savino, and Amenta (2017) provide a systematic review of the patient satisfaction literature to examine what researchers

evaluate as its determinants. The review found 9 health care provider-related and 13 demographic and psychological characteristics evaluated for patient satisfaction. Similar reviews were recently conducted on trying to determine dimensions of patient satisfaction for specific medical domains. Miglietta, Belessiotis-Richards, Ruggeri, and Priebe (2018) reviewed the mental health care literature and identified 28 scales that evaluated a total of 19 different dimensions.

When evaluating this research, it is important to consider early studies that helped form the basis for the views of the complexity of patient satisfaction. Early research by Pascoe (1983) summarizes this complexity. Pascoe (1983) discusses a dual level conceptualization of patient satisfaction that considers theoretical models of the satisfaction process. In this model patient satisfaction is viewed as consisting of underlying psychological factors. These factors include cognitive evaluations, affective responses along with the structure, process, and outcome of the provided services. However, satisfaction is also viewed as both a dependent variable and predictor of other health-related behavior such as adherence to care, outcomes and utilization. In their research Strasser, Aharony, and Greenberger (1993) supported the notion that satisfaction is a multidimensional construct. However, they also describe satisfaction for patients as simultaneously being a single global construct. This means that satisfaction can be made up of multiple dimensions but that patients can also form summary judgements about satisfaction based their experiences.

7.3.1 Summary

While theories on consumer satisfaction provide an overview of the complexities of satisfaction, the patient satisfaction literature further distinguish them. Patient satisfaction becomes more distinct in that patients experiences with their healthcare services, particularly medical outcomes, become a major subject of evaluation. Yet, it is not the only criteria that is evaluated by a patient against their expectations. Like consumer satisfaction theories, psychological and cognitive factors also play a role. This is an addition to other dimensions such as organizational factors, discussed in the patient satisfaction literature. This provides a view of patient satisfaction as informed by multiple dimensions that can vary between different subject domains. Among these is the importance of the medical aspects of the provided care and factors associated with it.

7.3 Patient Satisfaction with Telemedicine

Like the way patient satisfaction can be considered contextually different from general consumer satisfaction, patient satisfaction with telemedicine is also distinct. While there are a variety of studies on the effects of technology on health care, a patient's perspectives can vary based on the type of system and services used (Chaudhry et al., 2006). Unlike other forms of information systems that might be used in healthcare, telemedicine services are highly reliant on communications technology (Wade, Karnon, Elshaug, & Hiller, 2010). For example, medical services that use videoconferencing cannot function without the video services. In many cases this reliance on technology and its implications are not entirely understood (Baker & Stanley, 2018). This is an important consideration as the previous

section discussed how patient satisfaction is influenced by various dimensions across domains including organizational factors.

Satisfaction is typically measured as a means of evaluating the success of telemedicine services (Kruse et al., 2017; Williams, May, & Esmail, 2001). Traditionally results of research over the years tend to show high levels of patient satisfaction with telemedicine (Nazi, 2010; von Wangenheim, de Souza Nobre, Tognoli, Nassar, & Ho, 2012). Similarly, examining recent telemedicine evaluations in the literature generally shows high levels of patient satisfaction (Forbes, Solorzano, & Concepcion, 2020; Mauro et al., 2020)

While many studies have shown positive results for patient satisfaction researchers have raised questions on what the results of telemedicine satisfaction actually mean (P. Whitten & Love, 2005). For instance, a patient's satisfaction is not necessarily a clear indicator on whether they would prefer telemedicine versus alternatives. Some comparisons of patient satisfaction between telemedicine and traditional care show no clear preference between the two groups (Brodey, Claypoole, Motto, Arias, & Goss, 2000; Robb, Hyland, & Goodman, 2019; Sultan et al., 2020). But others show that patients can be satisfied with a telemedicine service but can outright reject the idea of using telemedicine to replace face to face consultations (Weatherburn, Dowie, Mistry, & Young, 2006). Still others suggest a preference for using telemedicine to obtain some medical services (Hanson, Truesdell, Stebbins, Weathers, & Goetz, 2019).

Similar issues have led researchers to question what exactly patient satisfaction with

telemedicine means. In some cases, researchers have begun with trying to understand what exactly is being measured in these studies (P. Whitten & Love, 2005). Upon reviewing telemedicine satisfaction methodologies researchers have raised a number of concerns about how patient satisfaction with telemedicine was being measured (Williams et al., 2001). These issues are still persistent in the telemedicine satisfaction literature (AlDossary, Martin-Khan, Bradford, & Smith, 2017).

A number of the concerns center around the differences in methodologies used in patient satisfaction surveys and the extent to which results can be generalizable (Ekeland, Bowes, & Flottorp, 2010). Many instruments used to measure satisfaction with telemedicine are seldom assessed for validity and reliability (Kraai, Luttik, de Jong, Jaarsma, & Hillege, 2011). Studies often use self-developed questionnaires and seldom report information to help researchers determine what is being investigated (Kraai et al., 2011; Robb et al., 2019).

In many cases researchers modify or combine different measures to form their own based on previous questionnaires (Rickwood et al., 2019; G. Rogers, 2020). Yet many of these studies do not consider the impact on the meaning of measures nor the validity of changes. Some researchers introduce new measures that are specific to the study or area of interest (DeAntonio et al., 2019; Müller, Alstadhaug, & Bekkelund, 2017). Yet in many of these studies it is unclear whether the measures can apply to other cases or how they truly relate to satisfaction itself.

To help address these concerns some researchers have designed instruments specifically for measuring satisfaction with telemedicine. These include the Telemedicine

Satisfaction and Usefulness Questionnaire (TSUQ), Telemedicine Perception Questionnaire (TMPQ) and the Telemedicine Satisfaction Questionnaire (TSQ) (Bakken et al., 2006; Demiris, Speedie, & Finkelstein, 2000; Yip, Chang, Chan, & MacKenzie, 2003). These instruments were developed to resolve some of the issues related to the reliability and validity of other instruments. However even these instruments have limitations. For instance, while TSQ and TMPQ were tested for validity and reliability the generalizability is questionable due to limited sample sizes (Bakken et al., 2006; Demiris et al., 2000; Yip et al., 2003).

Still studies have provided evidence for the usefulness of telemedicine satisfaction instruments in evaluations (Lin, 2017; Mauro et al., 2020). However, there remains neither a widespread adoption of these instruments nor extensive comparisons of their differences. Even among these instruments there may be differences in the determined dimensions, their meaning and potential value.

Yip et al. (2003) for example determine dimensions around the quality of care provided similarity between face-to-face encounters and perceptions of the interaction. Among the most frequently used telemedicine satisfaction questionnaire, the Telehealth Usability Questionnaire (TUQ), isn't directly designed around satisfaction but considers it combined with future use as part of a usability evaluation (Hajesmaeel-Gohari & Bahaadinbeigy, 2021; Parmanto, Lewis Jr, Graham, & Bertolet, 2016).

In fact many studies have traditionally relied on single measurements of overall satisfaction which have been questioned by researchers (Williams et al., 2001). Researchers

have raised concerns over what the overall satisfaction construct really entails and its interpretation. Yet one can still find examples of single measures of overall satisfaction commonly used in evaluating patient satisfaction in telemedicine throughout the literature (Douglas et al., 2018; Nawas et al., 2020).

While it is unclear if single measures are good enough for the evaluation of patient satisfaction with telemedicine, the literature provides many examples of different dimensions of satisfaction. Research suggests that the perception of appointment scheduling, travel time, and patient involvement are important parts of user satisfaction with telemedicine (Gustke, Balch, West, & Rogers, 2000). Satisfaction can also be influenced by perceptions of privacy and comfort, not only for themselves, but how they perceive their provider's comfort as well (Dick, Filler, & Pavan, 1999).

Other research shows accessibility, reduced travel and waiting times, cost savings, medical outcomes, personalized care and alleviation of cultural barriers as playing a role (P. Whitten & Love, 2005). While these dimensions may be a part of satisfaction they are not always evaluated. The most common dimensions that are evaluated in research are professional-patient interaction, the patient's feeling about the consultation, and technical aspects of the consultation (Williams et al., 2001).

Yet even when dimensions are considered there remains a lack of consistency in terms of what dimensions of satisfaction are measured. There remains a need for standardizing methodologies due to difficulties in comparing results and questions on what the results should indicate (AlDossary et al., 2017; Mair & Whitten, 2000; Van den Berg,

Schoones, & Vlieland, 2007). These difficulties are in part due to the challenges in interpreting what is meant by satisfaction.

A major issue with measuring telemedicine satisfaction is determining what is being measured by satisfaction instruments. This is due to the complexity of the term satisfaction which can have different interpretations and meanings (Mair & Whitten, 2000; P. Whitten & Love, 2005). Even within the telemedicine measurement instruments there remains little consistency nor real descriptions of what dimension measures are supposed to represent. Because of the wide variety of different telemedicine systems and services and lack of universal measures it is important that researchers provide more guidance on how to evaluate satisfaction and its different dimensions (E. Shirley et al., 2016; Waller & Stotler, 2018).

7.3.1 **Summary**

While researchers have examined the methodologies and have attempted improve the metrics used to measure satisfaction there remain gaps in the literature around the measurement of different telemedicine satisfaction dimensions. It remains unclear which dimensions are being evaluated by existing research as they are not often clearly defined. Researchers typically rely on single measures or self-created measurement instruments.

While researchers have identified and called for more work into examining dimensions of satisfaction it is unclear to what extent this may affect practice. Telemedicine itself is highly technology dependent. This makes it novel in terms of traditional medical practices that may not necessarily require the technology to perform a service. The technical

factors are therefore likely to affect a patient's perspectives of the overall health service provided via telemedicine.

7.3 Summary of Literature Review

This chapter provided an evaluation of relevant literature related to satisfaction and telemedicine. The literature review began with a historical account of evaluations of satisfaction in the consumer literature. As patients are considered a special form of consumer this examination provided insight into the satisfaction process to aid in understanding satisfaction and how it should be evaluated. From the various theories, satisfaction was shown to be a complex construct consisting of multiple dimensions from different domains. Satisfaction is considered an outcome of the evaluation process of these dimensions.

Research on patient satisfaction shows the extent of this complexity lying in dimensions that can relate to cognitive, affective, and organizational issues but that are all tied to the provided healthcare. It also discusses how the multidimensional nature of patient satisfaction can also be formed as parts of summary judgements.

These judgements become influenced by not only the healthcare aspects but the technology aspects when telemedicine is considered. This is due to telemedicine's high reliance on technology. Yet despite the complexities of telemedicine satisfaction there remain several challenges with its evaluation. Among the challenges are gaps in the literature around the dimensional nature of telemedicine satisfaction.

Chapter 3. Theoretical Framework

As the literature demonstrates there remain gaps in the knowledge on the complexity of satisfaction and its relevant dimensions, particularly for patient satisfaction with complex systems such as telemedicine. Despite the typically high reported levels of satisfaction, there are questions on what satisfaction measures are measuring. This research will seek to contribute to the knowledge of information system satisfaction by identifying different dimensions of telemedicine satisfaction, their influence on patient satisfaction and the value they can present to decision makers.

As discussed previously one of the main issues with satisfaction is determining what it is comprised of and its meaning in different contexts. This section will present a theoretical framework for examining patient satisfaction with telemedicine. This framework will be developed in the final section of this chapter. The framework will serve as a general model that will be further developed later in the exploratory and confirmatory phases of the study where the dimensions will be identified and tested.

As telemedicine systems are considered information systems this section will first describe models of satisfaction in the IS literature. Satisfaction is typically evaluated in the information systems in relationship to IS adoption and acceptance. The discussion will examine these models to provide a framework for telemedicine satisfaction.

The following section will then look at the multidimensionality of satisfaction. When examining multidimensional constructs, it is important to consider the way in which the identified constructs relate to each other and the main construct. This section will expand

on the ideas of multidimensionality presented in the literature and apply them to views of telemedicine satisfaction dimensions.

The final section will discuss the proposed theoretical model. The discussion will link descriptions in the previous discussions of the literature to theory derived from existing models. The model will be presented with a high-level overview of the defined constructs and their relationship to each other.

7.3.1 **Models of Satisfaction in Information Systems**

The information systems literature contains many different models that attempt to explain user satisfaction. Satisfaction is often viewed in the information systems literature as a measure of system success (Liu & Khalifa, 2003). Models discussed in the information systems literature show that satisfaction can play an important role in technology use and acceptance. Vaezi et al. (2016) discuss two common approaches towards examining satisfaction in the information systems literature.

Satisfaction can be viewed using either a process-oriented approach or an outcome-oriented approach. Process oriented approaches focus on describing the process through which satisfaction is formed. Outcome oriented approaches view satisfaction in terms of measures that can be used to identify satisfaction and the factors that either contribute to satisfaction or are impacted by it. Contributing factors to satisfaction can be viewed as either antecedents or outcomes. Antecedents are those factors that determine satisfaction while outcomes are considered the consequences (Vaezi et al., 2016).

Among the early models that examined satisfaction in the IS literature is the Model

of Information Systems Success. DeLone and McLean (1992) present this model of information system success as including satisfaction along with both antecedents and outcomes. The original model describes a link between satisfaction and use. The model also describes system quality and information quality as determinants for both use and user satisfaction. Information quality is considered the quality of the information produced by the information system. System quality is the processing system itself. Use and user satisfaction are viewed as having a direct consequence on the individual who holds influence on the organizational impact and consequences.

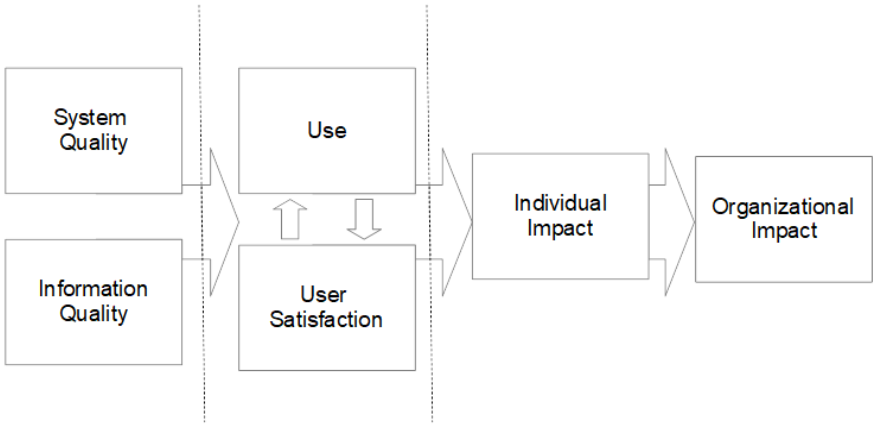

Figure 4: Model of information system success adapted from DeLone and McLean (1992)

Seddon and Kiew (1996) examined a portion of this model in order to look more closely at the satisfaction construct. The model used in their study re-evaluates use as usefulness and adds the importance of the system as an additional construct. The study evaluates the model using empircal tests and the results provide support for the relationships and constructs identified in the DeLone and McLean (1992) model. In particular empirical evidence was provided that supported the relationships between the different constructs.

However unlike the DeLone and McLean (1992) this model ignores the outcomes (individual impacts) and focuses instead on the antecedents of satisfaction (usefulness, system quality, importance of system and user satisfaction).

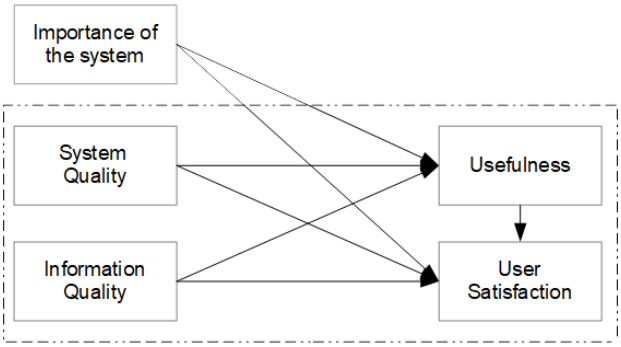

Figure 5: Model of user satisfacton adapted from Seddon and Kiew (1996)

Delone and McLean (2003) provided an expansion of their system success model that considered these additional complexities. Rather than just viewing satisfaction as being informed by information and system quality, the model was expanded to include the concept of service quality. Service quality was added to account for the role that information systems serve in both allowing organizations to provide information along with services, such as support for end users. The ideas of impacts were merged into a new construct termed net benefits. Net benefits include individual, organizational, and other potential impacts. Satisfaction was described as both contributing to net benefits and being impacted by net benefits.

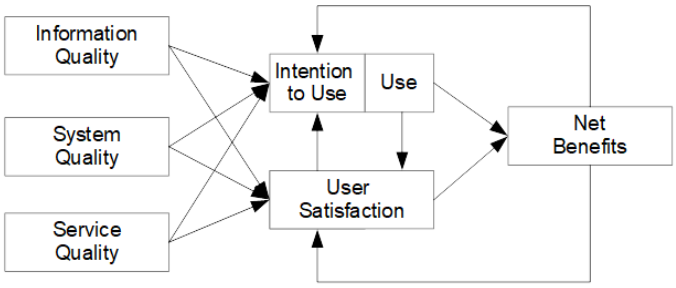

Figure 6: Revised model of information system success (Delone & McLean, 2003)

Other research specifically examines the relationship between satisfaction and acceptance using an approach that merges these understandings. Wixom and Todd (2005) present a model that integrates technology acceptance with satisfaction and define the theoretical relationship between the two. The model indicates a complex relationship between satisfaction and other constructs.

The model describes satisfaction as informed by beliefs revolving around the quality of both the system and information it provides. In this model satisfaction itself forms behavioral beliefs around a systems usefulness and ease of use that ultimately shape both the attitudes a user has towards a system and their intentions on system use and acceptance. Unlike previous models, this model presents a multidimensional view of satisfaction consisting of multiple facets informed by different dimensions with multiple antecedents.

The integration of service quality was also expanded in the model of technology acceptance by Xu et al. (2013) which expanded the model by Wixom and Todd (2005). The model presented by Wixom and Todd (2005) did not consider service quality. However, Xu et al. (2013) considered it important as studies on the integration of newer technology showed that in addition to the system quality and information, users value the resulting

service provided by the IS.

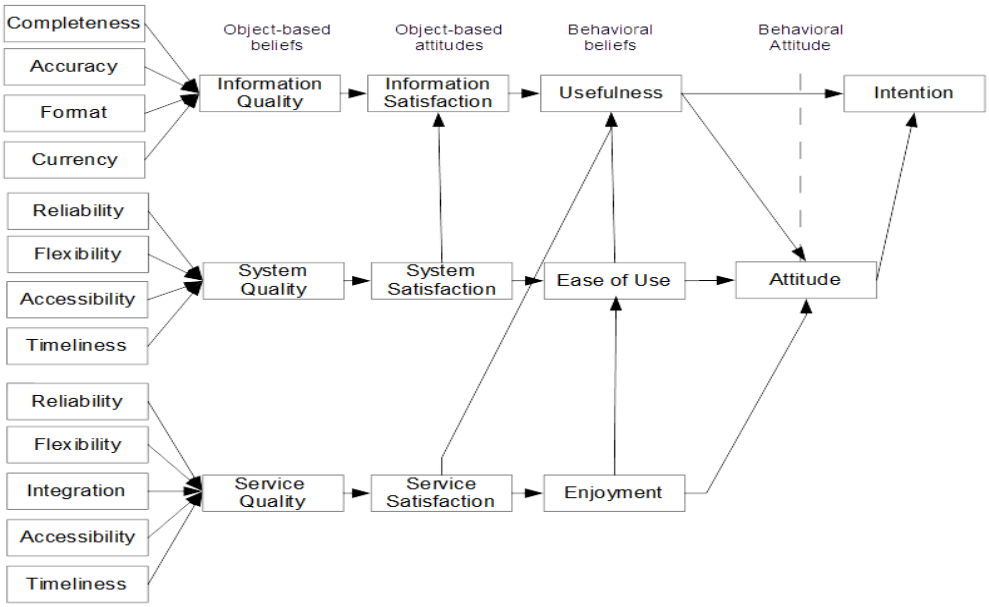

Figure 7: Technology acceptance, satisfaction and service model from (Xu et al., 2013).

The resulting model also further expands on the role that satisfaction can play in terms of object-based attitudes formed by users. The model shows that satisfaction plays a more complex role in relationship to other constructs. In the model satisfaction exists across three aspects: Information satisfaction, system satisfaction and service satisfaction. Each aspect of satisfaction consists of multiple antecedents.

P. J.-H. Hu (2003) attempted to expand on the models of system success and devise a model to describe telemedicine system success. The developed model follows many of the constructs described by DeLone and McLean (1992). Like other models, the telemedicine system success model demonstrates a complex view of user satisfaction. The research supports the idea that service, system, and information quality are key components in user satisfaction. It also adds input data quality as an aspect influencing satisfaction. Input data

quality is a unique construct in this model. This construct attempts to explain the degree to which the input to a telemedicine system preserve important characteristics of the source data (P. J.-H. Hu, 2003). Like other models the telemedicine satisfaction model adds a service component. User views of service however is presented as influencing satisfaction and resulting from satisfaction, as opposed to just an antecedent. The model also recognizes the impact that user satisfaction can have on organizations.

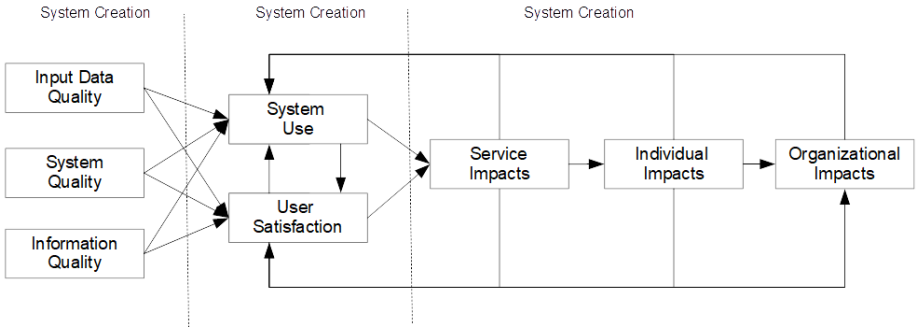

Figure 8: Model of telemedicine system success adapted from P. J.-H. Hu (2003)

The discussed models demonstrate an evolution of the way satisfaction is considered in information systems. Satisfaction can be considered both a property of system success and user acceptance. Both views provide a complex description of satisfaction and its multiple dimensions. The systems success models demonstrate how satisfaction is informed by dimensions around system quality, and information quality. Models of acceptance provide more details on the expected antecedents of each of these aspects.

7.3.2 **Dimensionality: Nature of Relationship**

A developing trend in the Information systems literature has been on understanding the complexity of the relationships between constructs such as satisfaction. This has been

brought on in part due to the increasing popularity of Structural Equation Modeling (SEM) in information systems research (Gefen, Straub, & Boudreau, 2000). Unlike first generation analysis techniques such as regression, SEM is considered a second generation technique that allows the evaluation of independent and dependent variables simultaneously (Gerbing & Anderson, 1988). Because of the emerging insight brought on by these modelling techniques researchers have begun to question the nature of the relationship between constructs (S. Petter, Straub, & Rai, 2007).

Due to these new insight's researchers have raised increasing concerns over the lack of specifications of the relationships between variables in models. Researchers have noted the errors that can result from failures to examine whether constructs are formative or reflective (Freeze & Raschke, 2007). This new direction of analysis has led to more complex views of constructs such as the potential multi-dimensionality of constructs (Gefen, Straub, & Rigdon, 2011; Polites, Roberts, & Thatcher, 2012; Wright, Campbell, Thatcher, & Roberts, 2012). To understand the potential impact of dimensionality on satisfaction it will be discussed further.

A multidimensional construct refers to a theoretical concept that consists of different distinct dimensions. Researchers have presented different ways of modeling multidimensional constructs such as satisfaction (Law & Wong, 1999). Some constructs are directly observable. These are called first-order constructs. Another form of constructs called Second-order constructs are only indirectly observed through other variables which serve as their indicators. The dimensions that contribute to a construct can be viewed in

different ways.

Dimensions themselves and the constructs they inform can be considered formative or reflective. Dimensions are considered formative when combined they form multidimensional constructs (Polites et al., 2012). When dimensions present manifestations of a construct they are referred to as reflective (Polites et al., 2012).

Formative dimensions influence the constructs they relate to and are also called causal indicators (Freeze & Raschke, 2007). This is because formative dimensions can be considered direct parts of the construct they relate to. A construct can be considered as composed of its formative dimensions. S. Petter et al. (2007) provide an example of organizational performance as consisting of three formative dimensions. These include productivity, profitability, and market share. These three dimensions form unique aspects that together determine organizational performance. The meaning of organizational performance is dependent on these three dimensions. If any of these dimensions is missing, the value of organizational performance will differ. These dimensions may or may not correlate with each other.

Reflective dimensions are influenced by or caused by the constructs they relate to. Freeze and Raschke (2007) discuss the example of Perceived Ease of Use (PEU). PEU consists of six different reflective dimensions: easy to learn, controllable, clear, and understandable, flexible, easy to become skillful, and easy to use. A change to PEU will result in changes to each of these six dimensions. Each of these dimensions is not necessary to view PEU. However, these dimensions are expected to correlate with one another.

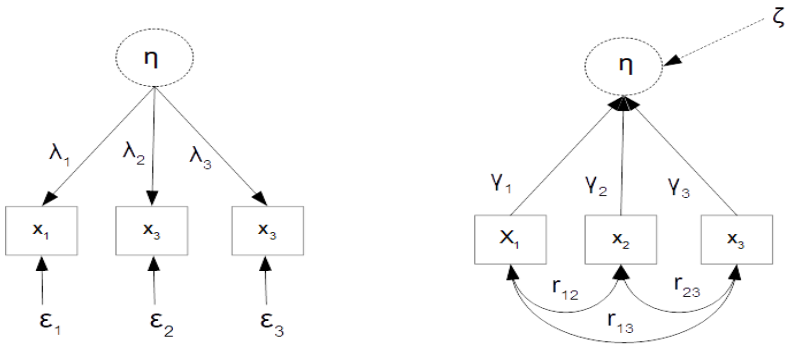

Figure 9:Reflective (left) and formative (right) measurement flow (Diamantopoulos, Riefler, & Roth, 2008)

Law and Wong (1999) discuss two different types of models for examining the relationship between multidimensional constructs and dimensions based on these relationships. In factor models the dimensions are viewed as contributing to the multidimensional construct via common aspects. Dimensions in factor models are viewed as effect indicators of the multidimensional construct. In a composite model the multidimensional construct is viewed as an outcome of the dimensions. However, in a composite model dimensions are considered causal indicators of the multidimensional construct.

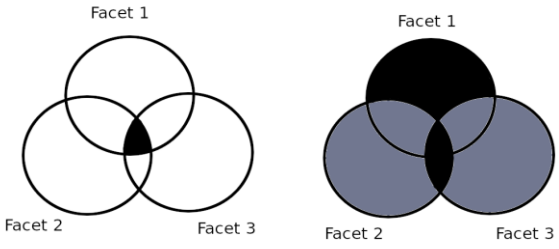

Figure 10: Factor (left) and Composite (right) model (Law & Wong, 1999)

Polites et al. (2012) describe different ways in which the relationship between first

order and second order constructs can manifest in relationship to reflective and formative dimensions. These relationships are briefly described and summarized in table 3.

Table 3:Summary of dimension / construct relationships and model types

Relationship	Model Type	Description
reflective first-order, reflective second-order	Superordinate	Dimensions are different reflections of a higher order concept and themselves are different manifestations of different dimensions
reflective first-order, formative second-order	Superordinate	Dimensions are different reflections of a higher order concept but dimensions themselves are formed by combinations of indicators
formative first-order, formative second-order	Aggregate	Dimensions combined algebraically form a higher order concept and the dimensions themselves are formed by the algebraic relationship of its indicators
formative first-order, reflective second order	Aggregate	Dimensions combined algebraically form a higher order concept, but the indicators of a dimension are different manifestations of dimensions

These views of the multidimensional nature of satisfaction's relationships are also supported in the patient satisfaction literature. Pascoe (1983) states that satisfaction likely consists of different dimensions that can be measured by examining satisfaction from both a micro and a macro level. The micro level is considered measurable by examining indirect measures of satisfaction. The macro level is examined through direct measurements.

In a comparison between different measurement instruments, Pascoe, Attkisson, and Roberts (1983) concluded that differences in the results were a demonstration of the different domains measured by the direct and indirect approaches. The instruments that relied on the direct approach were more effective at examining specific service settings in

which care was given. The instrument that relied on the indirect approach, in contrast, provided more varied results that likely coincided with more generalized attitudes that patients had about healthcare services.

7.3.3 **Framework Development**

The literature suggests that satisfaction is a complex and multidimensional construct that results as an outcome of a person's evaluation of an information system. Patient satisfaction itself is a complex behavioral phenomenon made up of cognitive and affective aspects along with evaluations of organizational factors.

These factors are unique in telemedicine because of its technology dependence. This creates a context in which unique technical factors can potentially influence a patient's perspectives. The evaluation of these factors can present challenges as identified constructs can be either formative or reflective of the existing constructs and therefore should be taken into consideration.

The literature suggests a lack of models that specifically attempt to describe the complexities of patient satisfaction with telemedicine. Although the model of telemedicine success by P. J.-H. Hu (2003) can provide some guidance, there are a number of more recent developments around satisfaction in the information systems literature to consider. While P. J.-H. Hu (2003) does consider the relationship between services and satisfaction, the relationship between satisfaction, net benefits and use differ from revisions described by (Delone & McLean, 2003).

Further findings presented by Xu et al. (2013) demonstrate the further complexities

of satisfaction dimensions suggesting that each aspect of satisfaction itself can be viewed by multiple factors. This is demonstrated in the models presented by both Wixom and Todd (2005) and Xu et al. (2013). These models based on more recent findings of technology usage demonstrate the complexity of satisfaction. Both models suggest users can view aspects of satisfaction differently based on information and system quality. Xu et al. (2013) expands on this by including service quality and service quality satisfaction.

This follows some of the descriptions discussed in the literature review on the complexity of the satisfaction construct. It also supports the idea that satisfaction is not a single concept but an aggregate of different satisfaction dimensions.

This research proposes a model of telemedicine satisfaction that consists of multiple dimensions. As described in the consumer satisfaction literature satisfaction is considered an outcome of the evaluation process of different aspects. Similarly, the patient satisfaction literature discusses how satisfaction can be informed by summary judgements. Therefore, satisfaction is considered formed by its relative dimensions and not directly observable. This model considers the dimensions of telemedicine satisfaction as system quality, information quality, service quality and net benefits as described in the information systems literature.

The discussed literature presents views of satisfaction that exist as unique in the patient satisfaction literature as they are in the telemedicine satisfaction literature. The patient satisfaction literature describes the importance of aspects of healthcare. Users form their evaluations of telemedicine based on both the healthcare aspects and technology aspects of the service. Therefore, service quality is considered as consisting of aspects of

the technical and the healthcare service quality.

This model considers the first order constructs reflective of the underlying concepts and the second-order constructs as formative. Satisfaction itself is not directly observable but is formed by a combination of other underlying constructs. These constructs themselves are observable by examining user perceptions reflected in their views of other concepts. This view follows a structure similar to the one described for by S. B. MacKenzie, Podsakoff, and Podsakoff (2011) as an alternative interpretation of a multiple indicators, multiple causes (MIMIC) model. For example, you cannot directly observe the quality of a healthcare service for a patient. However, you may observe a patient's view on their interactions with medical staff. The model will be expanded upon during the research as different reflective variables that inform the dimensions are identified. The model is shown in figure 11 below.

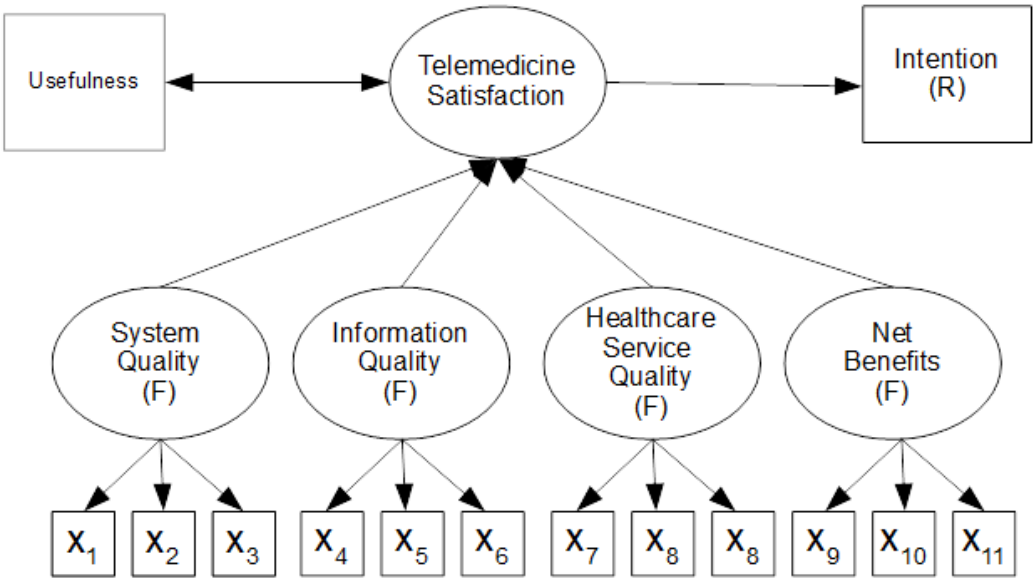

Figure 11: Structural model of telemedicine satisfaction

7.3.4 **Summary of Theoretical framework**

Satisfaction is often viewed as a determinant of the success of information systems. The review described several models used for evaluating information systems success and acceptance that describe satisfaction. From the review several constructs were identified that could potentially influence satisfaction. The review also discusses the need to specify the nature of the relationship in multidimensional evaluations. The nature of the relationship between constructs is an important consideration as it can influence how results should be interpreted. From these insights and the review of the literature a model is presented that describes telemedicine satisfaction as consisting of dimensions that include system quality, information quality, and net benefits.

7.3 Research Questions and Rationale

This section discusses and develops the research questions evaluated during this study. The research questions were developed to contribute both to existing knowledge of researchers and practical needs of decision makers investigating patient satisfaction with telemedicine. From the literature review a gap was identified in the literature around understanding dimensions of patient satisfaction with telemedicine. From this several challenges were identified that will be discussed in this section. Based on these challenges this research has identified three questions that can help in meeting the studies objectives.

1. What dimensions contribute to patient satisfaction with telemedicine?
2. How do identified dimensions relate to satisfaction?
3. What value does data based on identified dimensions provide to decision makers?

The following discussion will describe these questions and the rationale for their selection in further detail.

7.3.1 **Dimensions of satisfaction**

Among the central challenges with evaluating telemedicine satisfaction is the concept of satisfaction itself and how its evaluated (Griffiths et al., 2007; Lindgaard & Dudek, 2003). Satisfaction is a complex construct that consists of multiple dimensions (E. Shirley et al., 2016; Vaezi et al., 2016). Yet some studies still rely on single measures for satisfaction. To further complicate this is the unresolved lack of consistency on what dimensions are used in research that inform telemedicine satisfaction (Williams et al., 2001; Zhang et al., 2014).

Based on these issues it follows that any research attempting to evaluate telemedicine satisfaction should first attempt to identify and understand what the dimensions of telemedicine satisfaction are. Previous research has shown that there are a wide variety of potential dimensions that could inform satisfaction with information systems (Vaezi et al., 2016). Yet there remains a lack of consistency in the dimensions used for evaluating telemedicine satisfaction (Zhang et al., 2014). This lack of consistent dimensions is part of the problem that decision makers face when comparing satisfaction results in their evaluations. Yet without guidelines on what dimensions should be selected it is difficult to assert which dimensions a telemedicine satisfaction study should evaluate. This demonstrates a need to explore which dimensions are generally used in research studies to evaluate telemedicine satisfaction. Based on this the following research question and its

rationale are presented below:

Research question 1: What dimensions contribute to patient satisfaction with telemedicine?

Rationale: There is a need for identifying which dimensions inform patient satisfaction with telemedicine. There remain gaps in the literature on what dimensions contribute towards satisfaction. Satisfaction is considered a complex and multidimensional construct. The loosely defined meaning of satisfaction and its dimensions can create difficulties for those attempting to use the results of satisfaction evaluations in decision making.

While the literature supports the idea that satisfaction is a complex and multidimensional construct, there is a lack of research directed at identifying these different dimensions. As a result, many studies frequently ignore the dimensionality of satisfaction. Even when it is considered there are no standardized set of dimensions evaluated. It remains unclear which dimensions should be used to evaluate patient satisfaction with telemedicine. Identifying the dimensions that form and can be used to identify patient satisfaction will help inform both theory and practice on telemedicine.

7.3.2 Nature of dimensional relationship

Knowledge is developed, clarified and given meaning based on human actions, situations and their consequences (Goldkuhl, 2012). Yet there remains a lack of clarification on the meaning of satisfaction and what it consists of (Griffiths et al., 2007; Lindgaard & Dudek, 2003). By confirming knowledge obtained about the dimensional nature of satisfaction, a stronger case can be demonstrated for its practical use and strengthen its

value. Knowledge aids people in practice by helping them perform actions successfully (Saunders, Lewis, & Thornhill, 2007). In IS for example knowledge is considered an asset when it is put into practical use by decision makers (Baskarada & Koronios, 2013).

For the practical use of knowledge to occur there must be an understanding of the data and information which form the knowledge. Yet even when dimensions are considered the nature of the relationships between constructs can impact their meaning (Polites et al., 2012). This can be an important factor for decisions about telemedicine services. Consider for example the relationship between a patient and a provider using telemedicine. The nature of the relationship can impact what is meant by satisfaction. Views of their relationship could be an inherent part of the patient's satisfaction with the service. This could mean decisions about the service should account for the relationship between that provider and patient. The views on their relationship could also be a manifestation of or reflective of satisfaction. This would suggest that their views of the relationship are mainly an indicator of their satisfaction. In this case decision makers whose sole concern is patient satisfaction with telemedicine would not need to account for the providers relationship with their patients. While the theoretical framework presented suggests a model which can describe these relationships it is important that these relationships are confirmed and examined. As a result, it is posited that a study should consider the nature of the dimensional relationship of satisfaction dimensions. The following research question and its rationale describe this further.

Research question 2: How do identified dimensions relate to satisfaction?

Rationale: There is a need for confirming the identified dimensions of patient satisfaction with telemedicine and their relationships. For the identified dimensions of satisfaction to be of use practically they must be tested and confirmed. As satisfaction already remains loosely defined it is important that these efforts consider the nature of the relationships between dimensions and satisfaction. Relationships between dimensions can change their meaning and how decision makers should interpret them. Examining the relationships between the different dimensions of satisfaction can help determine the way in which they contribute towards satisfaction. Dimensions of constructs often have complex relationships. These relationships play an important role in determining the way in which they contribute to constructs.

7.3.3 Value of satisfaction dimensions

In real world practice, decision makers have needs and goals through which knowledge is important in helping to address. At the very roots of the cognitive decision making processes are the needs to evaluate choices based on selection criteria (Wang & Ruhe, 2007). For decision makers, the satisfaction of patients remains a critical tool for evaluating choices related to telemedicine services. Despite the challenges in understanding the meaning of satisfaction, it remains widely used to evaluate telemedicine services. Although more research is now evaluating multiple dimensions of patient satisfaction, evaluations using overall satisfaction remains a common practice. Researchers suggest that evaluating additional dimensions can provide richer context and clarity to satisfaction

evaluations (Vaezi et al., 2016; Zhang et al., 2014).

Ultimately, however the value may or may not be viewed similarly by decision makers. This is particularly the case when multiple different dimensions are considered. While a single satisfaction dimension may provide some insight into services, the insight that decision makers may gain from multiple dimensions remains unclear. The views of decision makers in terms of multiple dimensions may be complex based on their experience and the context in which the study is taking place. Another challenge is that a decision maker may not initially perceive a value in data until they use it to evaluate services in their context. There is a need to increase the understanding of how the results of multi-dimensional satisfaction evaluations can be used in decision making. Therefore, it is not just matter of questioning whether decision makers view the results as useful or not, but rather how they interpret and attempt to explain the results in relation to their decision making around telemedicine. To examine this the following research question will be explored:

Research question 3: How do decision makers interpret data based on identified dimensions?

Rationale: It is important to understand how decision makers view satisfaction and the extent to which the additional information is useful for their evaluations. While the creation of models for evaluating phenomenon can aid the research community, the value of extensive models in real world applications is important to consider. It is unclear how identified dimensions of patient satisfaction may fit in with the understandings of decision makers. While understanding the dimensions of satisfaction and their relationship to

satisfaction can be important from a theoretical perspective, the results must have some utility to those using the evaluations. As this research seeks to expand on what is meant by patient satisfaction, it is essential to reflect on whether these extensive evaluations are useful in informing decision makers and how.

7.3.4 **Research Question and Rationale Summary**

Telemedicine satisfaction remains a complex concept. From the literature review several challenges were identified. These challenges include identifying dimensions of patient satisfaction with telemedicine, understanding their relationship to satisfaction and examining their value for decision makers. These are formulated into three key research questions that will be evaluated in this study. The first research question revolves around identifying the dimensions of patient satisfaction. This was determined based on the lack of agreed upon measures in the literature. The second involves understanding the nature of the relationship between dimensions and satisfaction. This is based on the need to both confirm the proposed model of satisfaction and interpret the results. A third question seeks to understand the value of evaluating dimensions of satisfaction versus single measures to decision makers. This is important as ultimately for dimensions of satisfaction to be useful for decision making, they must provide some value to those making the decisions around it.

7.3 Summary of Literature Review

This chapter provides a theoretical model by which to consider the multi-dimensional nature of telemedicine satisfaction. The model was developed through an examination of existing success and acceptance models from the information systems literature. This model

consists of telemedicine satisfaction as formed by dimensions of system quality, information quality, healthcare service quality, and net benefits.

Based on the challenges described in the research literature this research proposes several research questions by which to evaluate this model. These include questions around the identification of satisfaction dimensions, the dimensional nature of the measures, and the value of multidimensional satisfaction to decision makers.

4. Methodology and methods

7.3 Introduction

The goals of this research are to evaluate telemedicine satisfaction through a study done in collaboration with a Veteran Affairs (VA) Hospital. This study was designed around the needs of the VA hospital that was seeking to evaluate its telemedicine services. This chapter introduces a pragmatic mixed methods research approach used in this study to identify and evaluate dimensions of patient satisfaction with telemedicine. This approach was selected to provide a greater depth to quantitative data for studying human behavior associated with telemedicine satisfaction by including qualitative methods.

To gain useful insight into phenomena it is important that the approach adequately relates to the goals of a research study. This is particularly important in information systems research that attempts to identify and evaluate phenomena related to variable aspects of human behavior. This chapter will provide insight into the selection of a mixed methods approach for conducting this research.

Evaluations of information systems, like telemedicine, require an understanding of not only human behavior but how that behavior relates to technology in an organizational setting. As discussed in the previous chapters there are questions over what dimensions are adequate for examining telemedicine satisfaction.

To examine this, it is important to both identify the dimensions and ensure they are adequate for evaluating telemedicine satisfaction. Therefore, it is important that the approach used to research telemedicine satisfaction account for the behavioral perspectives

of stakeholders while adopting fixed measures from which to uncover facts of the phenomenon.

This research follows a growing pragmatic tradition that attempts to evaluate research based on the goals of the research project. This research acknowledges both the objective truths of human knowledge but also their inherent subjectiveness to human conjectures. This research also acknowledges the challenges partner institutions face in addressing the problems of evaluating telemedicine in practice.

Pragmatic approaches can provide both practical as well as ideological value. This stance is suited for research in patient-centered studies because of the need to provide objective evidence to aid decision making while considering the human costs of decisions. To conduct this research a mixed method, approach that combines both qualitative and quantitative findings is used to identify and evaluate dimensions of telemedicine satisfaction and their value.

7.3.1 **Paradigms and Foundations**

The central beliefs that inform the approach and how knowledge is derived from a study are important for understanding how the methods are used to address the problem (Kuhn, 1962). These beliefs form what is commonly referred to as a research paradigm. A research paradigm provides a view from which to understand a researcher's beliefs regarding a study. These beliefs are described around four different concepts: Ontology, Epistemology, Axiology and Methodology.

Ontology describes beliefs centered on views around the nature of reality (Killam,

2013). A person's view of the nature of reality is related to how one views existence and the things that exist. Some may believe that there is an objective reality that is not influenced by the context in which things exist. Others view reality as bound by the contexts in which different mental constructs inform reality.

Epistemology refers to the nature of knowledge and its relationship to the person discovering the knowledge (Killam, 2013). The nature of knowledge is based on how a person comes to know and acquire knowledge and how it relates to truth and belief. The nature of knowledge is typically discussed in terms of the objectivity or subjectivity of views.

Objectivity and subjectivity are philosophical terms that describe the degree to which concepts are truly independent from individual perspectives. Subjectivity refers to the idea that concepts are viewed through a lens of human consciousness that influences perspectives. Objectivity refers to the idea that concepts are independent from individual biases and thought. These ideas influence epistemology in that beliefs of the nature of knowledge can be based on the thought that there can be objective or subjective truth to what is discovered.

Axiology is used to address the nature of ethics and values in research (Killam, 2013). Researchers often have different beliefs on what knowledge is valuable and the role of bias in studies. Axiology helps inform the degree to which research may attempt to explain, predict or simply observe to understand what is taking place (Lee & Lings, 2008). Researchers can have different perspectives on the degree to which values impact research.

Some feel research should be conducted in a value-free way in which the researcher maintains independence and objective views. This is contrasted with others who believe research is value laden and cannot be free of subjectiveness including the researcher's inherent biases. While some researchers may attempt to take realist approaches and adjust their methods to compensate for this, others embrace it and attempt to design their research around it. Researchers in this case may follow value bound approaches in which they see themselves as part of a study and focus on subjective views of the subject matter.

Methodology is used to describe the process of how knowledge is discovered (Killam, 2013). The methodology is based on assumptions of ontology, epistemology, and axiology. The methodology describes the specific methods along with the theoretical underpinnings by which research is undertaken (Giddings & Grant, 2006). Methodology is distinguished from methods in that a methodology refers to the principles and theoretical assumptions underlying research. Methods however refer to the specific techniques or tools for collecting and processing data.

7.3.2 **Research paradigms**

There are several different research paradigms that are typically discussed in the literature. Among the more commonly discussed paradigms are positivism, interpretivism, post-positivism, social constructivism, critical theory, and pragmatism,

Positivism is a belief that there is an absolute objective reality that exists regardless of the researchers perspective (Hirschheim, 1985). Positivist research aims to uncover this

truth, using more controlled and structural methods that involve direct observations and measurements (N. Mackenzie & Knipe, 2006). This approach attempts to place the researcher as an objective observer that gathers empirical evidence as to the nature of reality. Positivist methods tend to focus more on statistical and logical approaches towards research evaluation.

These approaches involve determining the cause and effect relationships and predictions of irregularities based on theory (Orlikowski & Baroudi, 1991). However, some researchers reject the idea that all aspects of reality can be viewed without considering how human perspectives shape our understandings of reality.

Interpretivism is a theoretical view that challenges the appropriateness of positivist methods for examining a world influenced by ever changing social orders and human interactions (WenShin & Hirschheim, 2004). Interpretivism stems from beliefs of the relativeness of reality in relation to multiple human perspectives.

Interpretivism is considered an anti-positivist view in which elements of reality are socially constructed (Hirschheim, 1985). Interpretivists attempt to view the world through the lens of the human experience and examine meaning in relation to social constructs. Interpretivist methods are generally more flexible than positivist methods, as they attempt to understand complex meanings and motives behind human behavior rather than direct measures to explain them (Hovorka & Lee, 2010). Yet some feel that the lack of these direct measures places challenges on the reliability, validity, and generalizability of interpretivist approaches.

Post-positivists recognize the challenges in limited world views and attempt to reconcile these differences through integrated approaches. Post-positivism is an extension of positivism that attempts to account for human biases. Among the challenges to positivism observed by researchers was the role of unobservable phenomena in theories that were used for predictions of observable phenomena (Clark, 1998).

This reality was difficult to explain using positivism, as unobservable phenomena were not compatible with the positivist philosophy of existence. This view of existence was also challenged by the question of whether or not researchers themselves could truly be objective observers due to the biases inherent in the human mind (S. C. Petter & Gallivan, 2004).

To resolve this post-positivists attempted to consider the unobservable including inferable evidence of human behavior from self-reporting (Clark, 1998). The result is a post-positivist belief that retains the goal of obtaining objective truth, while also accounting for an inevitable human bias in research. Despite the differences in beliefs post-positivists still rely mainly on controlled and structured methods that are theory based. Yet their different beliefs open them up to using unstructured methods to help confirm or add additional depth to research.

Other researchers have come to similar critiques of the idealist goals of positivism but have reconciled them by placing more value on human social influences. Social constructivism is a view that supports a subjective reality while still leaving open the possibility of an objective truth (Berger & Luckmann, 1991). In social constructivism this

world is described by concepts that exist and are created in the mind within a social context of human interactions and experiences (Berger & Luckmann, 1991; Schwandt, 2000).

Therefore, in order to understand any phenomena it is imperative to understand the way in which language and culture are used to interpret the world and its meaning (Andrews, 2012). As a result, social constructivists may use structured methods, but rely heavily on approaches that help them to understand more in-depth views of behavior in specific contexts.

There are several critiques of social constructivism. Some researchers have questioned whether the reliance on subjective views leaves researchers vulnerable to relying on reporting ambiguous information or fictitious beliefs by participants (Marshall, Kelder, & Perry, 2005; Young & Collin, 2004). Like the challenges faced by interpretivists, unstructured approaches that are context dependent are difficult to generalize.

For social constructivists this may not be a concern as multiple views of reality are expected and social constructivism itself tends to reject the idea of context-independent truth (Cohen, Duberley, & Mallon, 2004; Marshall et al., 2005). This mixture of truth faces further critiques as it makes it difficult, if not impossible to conclude on any truth as all are equally possible and valid. To address these critiques against social constructivism, some researchers have called for merging the context oriented views of social constructivism with other views such as those provided by pragmatists (Marshall et al., 2005).

Unlike other world views pragmatism does not adopt a strict set of beliefs about the state of the nature of reality. Pragmatism is a worldview based on ideas presented by Peirce,

James, Mead and Dewey (Cherryholmes, 1992). Pragmatism is a belief based on the view that there can be both singular and multiple realities that are free to be investigated without the constraints placed on who adopts particular world views (Yvonne Feilzer, 2010).

Pragmatists view value in both subjective and objective views of the world. In pragmatism the "real world" is seen to exist and is measurable but remains part of "existential reality" (Dewey, 1958; Yvonne Feilzer, 2010). Pragmatism is itself based on a view of the world which regards ongoing action and change as part of the "essence" of a society and contrasts this with ideologies based on posited structures of relations (Blumer, 1986; Goldkuhl, 2012).

Pragmatists view knowledge development and clarification as centered around human actions, situations and their consequences (Goldkuhl, 2012). The relationship between these elements forms the basis of meaning. Concepts are given meaning based on their practical consequences as derived from the actions which formed them (Goldkuhl, 2012). In this view reality is seen as being based on the practical effects of meaning in enabling actions to be carried out successfully (Saunders et al., 2007). Pragmatists consider knowledge itself as a means to enable purposeful changes in real world practice (Dewey, 1958; Goldkuhl, 2012)

For pragmatists actions and consequences affect the way in which the world is observed as much as how it is observable. As such pragmatists are similar in their openness to post-positivists when it comes to research methods. However, for pragmatists methods used for research are viewed in terms of their practical effects on addressing research

problems as opposed to their ability at measuring an objective truth (Saunders et al., 2007; Yvonne Feilzer, 2010).

Pragmatists view the specific research problem being addressed as the most important influence on the research methods selected (Creswell & Creswell, 2017; Patton, 1990). This opens pragmatists to considering all different types of research methods including mixed methods that may be appropriate for a specific proposed problem.

7.3.3 **Quantitative, Qualitative, and mixed methods**

There are a wide variety of methods that are used to collect and analyze data in research. Most methods can be classified into three broad categories. These categories include quantitative, qualitative, and mixed methods. The methods selected for most research studies are generally based on a researcher's world view and the problem being addressed.

Quantitative methods focus on trying to obtain objective measurements of observations and rely on statistical or mathematical analysis (Basias & Pollalis, 2018). These methods are generally associated with positivist beliefs that attempt to find an objective truth to reality (Sale, Lohfeld, & Brazil, 2002). Quantitative methods usually involve the testing of models, theories and hypothesis (Martin & Bridgmon, 2012). These are generally tested through the collection of empirical data derived from measurement instruments and experimentation. The collected data is analyzed to determine how well they prove or disprove the test case. The data collected is usually derived from large sample sizes to obtain statistical significance for generalization purposes (Basias & Pollalis, 2018).

Qualitative methods are designed around gathering and analyzing non-numerical data that is often human centered (Basias & Pollalis, 2018). Unlike quantitative methods the research focus of qualitative methods are generally human centered and fit more closely with interpretivist world views of reality (Sale et al., 2002). Qualitative methods are generally descriptive and explanatory, focusing on the why and how of phenomena related to human behavior. These methods generally derive data based on process and meanings (Sale et al., 2002). Qualitative methods are not generally as structured as quantitative methods, allowing for less generalized but more in-depth and contextual data to be collected (Miles & Huberman, 1984). Describing, decoding, and translating concepts is a key focus of qualitative methods (Basias & Pollalis, 2018).

Another approach involves combining both quantitative and qualitative methods in what are termed mixed methods (S. C. Petter & Gallivan, 2004). Early researchers theorized that combining both quantitative and qualitative could provide a more comprehensive view of phenomenon. (Morse, 1991). Among the uses of mixed methods advocated by these early researchers was methodological triangulation. Methodological triangulation is a term used to describe the narrowing of the area of uncertainty that studies address through the use of different types of data (Jick, 1979). Some researchers also use other terms to describe this process such as corroboration and opinions may differ on what exactly is meant by methods and how their relation to research paradigms (S. C. Petter & Gallivan, 2004).

Despite disagreements on mixed methods some researchers have noted the benefits

of mixed methods in IS for their ability to provide greater insight into the complex relations between systems and human behavior (Kaplan & Duchon, 1988). Mixed methods also provide greater depth and validity to studies by adding additional perspectives. Like single method designs there are different ways in which mixed methods can be realized. There are two main designs for mixed methods research: simultaneous and sequential (Giddings & Grant, 2006).

Simultaneous design involves using both types of methods to collect data, analyze data separately and compare findings (Creswell, 2013). Qualitative and quantitative methods used to complement each other in simultaneous designs can provide broader insight into an area of study. Using mixed methods simultaneously for comparison purposes can assist by providing additional insight and confirmatory power to research. As such simultaneous designs are often used to confirm or disconfirm findings from each method (Creswell, 2013; Giddings & Grant, 2006).

Simultaneous designs can be performed in different ways. Some studies use qualitative and quantitative methods independent of each other as part of separate sub-studies (Gallivan, 1997). Once the sub-studies are completed findings between the two methods can be analyzed and compared. In other studies one method can be nested inside another one as a subordinate (Giddings & Grant, 2006). For example, a research questionnaire may contain multiple choice and open-ended questions using similar questions.

This approach can add additional confirmatory power or supporting information by

allowing a participant to answer questions using both item selection and their own words for instance. However, results may not always be compatible, making comparison between the two difficult (Giddings & Grant, 2006; S. C. Petter & Gallivan, 2004). This requires researchers take care in the preliminary phases of a studies design to ensure the results between the two methods will be comparable and meet the goals of the study. For some studies other multi-method designs are more appropriate.

Sequential design is another approach to mixed methods that uses one type of method following another in a sequence (Gallivan, 1997; S. C. Petter & Gallivan, 2004). For instance, a researcher may use a qualitative method followed by a quantitative method or a quantitative method followed by a qualitative method. Researchers often use this approach to gain greater insight than is typically possible using a single type of method. This is because different methods provide unique insights and different types of data. This differs from the simultaneous designs, in that the goals are not comparative as much as they are complimentary.

Similar to simultaneous designs, sequential designs can be performed where methods are used independent of each other in phases or nested within each other (Giddings & Grant, 2006). Sequential design methods can be performed independent of each other in phases. In this approach the results of one study can be used to inform another phase of a study. For example, a researcher may conduct a survey using questions based on knowledge gained from a study in which they conducted a series of interviews.

Another approach is to nest methods within a single study in which one approach

becomes more of a dominant type and the other is used to compliment the results with additional insight (Giddings & Grant, 2006). Methods can have unique roles when used sequentially in mixed mode designs (Creswell, 2013). A design which begins with a quantitative approach to observe phenomena can use qualitative methods to gather evidence for explanatory purposes. Similarly, research can begin with an exploratory qualitative phase that collects sample data that can later be generalized using quantitative methods on a larger population.

In addition mixed methods approaches can be combined into multiphase approaches. (Creswell, 2013). Similar to the way mixed methods are combinations of qualitative and quantitative approaches, simultaneous designs can also be combined with sequential designs. Multiphase approaches may be conducted over multiple studies that have a common objective. For instance, studies done to evaluate programs over time, may include a mixture of both qualitative and quantitative methods and may benefit at times from both the confirmatory capabilities of simultaneous designs as well as the complementary aspects of sequential designs.

7.3.4 **Pragmatism for Evaluating Telemedicine Satisfaction**

This research adopts a pragmatic approach for evaluating patient satisfaction with telemedicine. While there are several different paradigms, a pragmatist approach is considered most compatible with the goals of this research. This perspective is adopted to help address the complexity of the relationship between patient perspective and technology in a way that is practical and adds value for partnering institutions.

For pragmatists, addressing the research problems are more important than reliance on any specific methodology or world views. Methodologies and the methods they employ are tools for gathering meaningful knowledge. This allows pragmatists to freely switch between both qualitative and quantitative methods in a manner that can adapt to organizational needs or new knowledge as it is discovered. This is important for telemedicine satisfaction research as there is a need to provide results that are both generalizable for comparison purposes as well as contain enough depth to compensate for contextual factors. Unlike post-positivism or social constructivism, the end goal does not necessarily lead to a specific ideological direction, i.e., objective truth or subjective reality. Instead the research direction is focused on practical considerations of addressing the research problem (Shannon-Baker, 2016).

In IS research it is important studies provide results that are useful for decision makers. This can be an important factor when attempting to evaluate satisfaction with IS such as telemedicine. Evaluations of satisfaction are generally not conducted by organizations to understand the theory behind satisfaction itself. Rather these evaluations are often done to understand the relationships between users and systems to aid in specific goals related to the success of systems. In IS, satisfaction is viewed as a key indicator of the success of a system.

These evaluations of system success are used to inform other organizational objectives. These can include system design, marketing or decision making related to usage and practice. From an IS perspective it is just as important to understand what informs user

satisfaction with specific technology as proving theories of what satisfaction itself consists of. Satisfaction studies in IS are typically outcome oriented (Vaezi et al., 2016). This view posits satisfaction as the result or consequence of the process of using a technology. This follows a similar view of knowledge from a pragmatist perspective.

Pragmatism can be a useful approach for examining patient satisfaction with telemedicine. Pragmatists view knowledge as socially valuable for increasing human welfare (Pansiri, 2005). Therefore, knowledge is not just accrued for the sake of inquiry but rather knowledge is seen as achieving a goal towards enhancing the human condition.

The goal of pragmatic research is not set in discovering an ultimate truth. The goal is more of developing an understanding of a temporal condition that can be used for practical purposes. These goals align with those evaluating healthcare services who focus on improving the welfare of patients (Everest, 2014). Similarly, IS investigations into telemedicine should seek to provide the resources to aid those in managing these healthcare services. The practical needs of organizations implementing telemedicine services are an important part of IS studies.

Pragmatism also provides a foundation that supports research into telemedicine satisfaction. Like outcome-oriented satisfaction research, pragmatists view knowledge as centered around actions, situations, and consequences. When viewed from a pragmatic perspective researcher are developing knowledge by examining the satisfaction (consequences) of a patient seeking medical care (situation) by using telemedicine (action). Although this presents a very simplified view of the way in which patients interact with

telemedicine it helps illustrate an overview of several key considerations for pragmatic research into telemedicine satisfaction.

This is an important consideration because organizations are ultimately concerned with ensuring that the act of using telemedicine results in high levels of satisfaction for patients. This suggests that there is a need to provide some means of determining what high levels of satisfaction are and enable comparisons between patients and different potential services. This for example may involve the use of quantitative methods for data collection and analysis.

At the same time, the act of using telemedicine and the consequences of those actions take place in specific situations or contexts. For telemedicine usage, patients exist in contexts in which they are seeking some form of medical care. This contextual information can provide further information that can help decision makers. Information such as this can potentially be obtained through qualitative methods and observations. However, the role of context also demonstrates the importance of describing the case in which the telemedicine satisfaction evaluation is taking place.

Another pragmatic consideration is the reason for knowledge acquisition. From a pragmatic perspective knowledge is not simply accrued for the sake of knowledge and indeed it is important to consider what if any are the goals of those for which the research is being conducted. In telemedicine satisfaction there are various levels of stakeholders. Stakeholders consist of both the patients themselves along with the staff and organizational leaders evaluating the telemedicine services. Therefore, it is important that some

consideration be given to the purpose of the telemedicine evaluation and its impacts on various stakeholders.

7.3 Research Design

This study pursued the research goals by following a pragmatic approach that adopts mixed methods to obtain and analyze data. This approach was selected for the need to provide different types of insight throughout the research process. Pragmatic approaches do not rely on single types of methods and instead use the methods most appropriate for addressing the specific research problems. The ideal methods to use may not be readily understood until more knowledge is developed of the problems themselves.

In some cases, new information may lead to new areas that may need to be explored before other research can be performed. This can be a challenge for specific types of mixed method designs. This challenge was encountered during the performance of this study. This will be discussed in more detail in a later section. This section will describe an overview of the research design, the research questions and hypotheses, data collection methods, and analysis techniques along with the rationalization for their selection.

To evaluate the three research questions presented earlier in this chapter a study on patient telemedicine satisfaction was performed. This study involved the use of a mixed methods approach. The mixed methods approach used was a multiphase design (Creswell, 2013). Each research question is evaluated in a separate phase. This design used a sequential approach in which different methods were used to inform other approaches. This was done both for complementary as well as developmental purposes (Schoonenboom &

Johnson, 2017).

To gain insight that could be useful to partner institutions needing to compare analysis between patients and across systems and institutions, it was necessary to provide quantitative findings. Quantitative methods were used to aid in generalizing the results to aid in comparisons. Qualitative methods were used to complement and confirm some of the findings as applicable to the context in which the study was being performed. These needs conform with rationale for using mixed methods in the literature. Specifically, they conform with using mixed methods to improve the utility of findings and also to confirm and discover new knowledge (Greene, Caracelli, & Graham, 1989; Schoonenboom & Johnson, 2017).

This research follows a mixed phase sequential approach towards examining dimensions of satisfaction to aid in decision making. The study was run across three phases. Each phase was designed to inform another phase similar to the multiphase mixed methods design presented by Creswell (2013). This was done in the purview of pragmatism which encourages research to adapt the designs based on the specific problems being addressed and as new knowledge arises.

The design followed elements of both the exploratory and explanatory sequential designs. The quant -> qual aspects of explanatory design were followed. However, explanatory designs use this approach to explain quantitative findings using qualitative methods from the same population. This research used qualitative results from the provider perspective to evaluate quantitative data obtained from patients. To make descriptions of

this approach easier to follow the rest of the text will refer to them as evaluatory procedures.

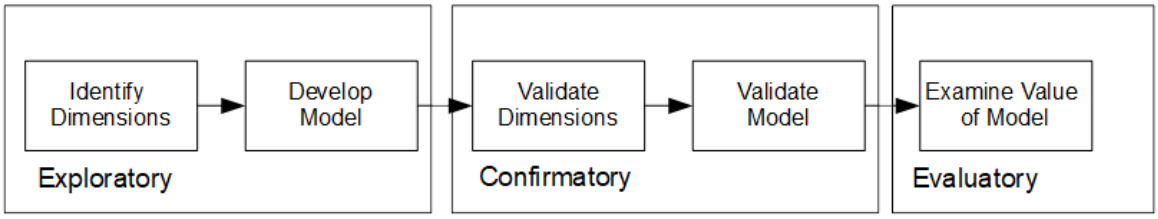

Figure 12: Overview of the multi-phase process

In the case of this study the first phase of the study would involve an exploratory phase that sought to address the initial research question. This would be accomplished by identifying the dimensions of satisfaction that contribute to patient satisfaction with telemedicine. This phase would be conducted primarily using qualitative methods based on a review of the literature, grounded theory, and expert analysis.

The second phase of the study focuses on the confirmatory process. This phase was conducted to confirm results obtained from the exploratory phase as well as provide evidence for the second research question. The second research question revolves around the nature of the identified dimensions to satisfaction. The research questions asks whether the dimensions are formative or reflective of satisfaction. This step was conducted by creating a questionnaire to measure the dimensions of satisfaction and conducting a survey at the partnering VA hospital. The questionnaire was developed using an extensive quantitative process that was complemented with exploratory qualitative data.

The studies third phase was conducted to provide additional insight into the collected data and understand its value for decision makers. Unlike the previous parts of the study,

this portion of the study evaluated the results of satisfaction from the provider perspective. This was done to evaluate the value that understanding the dimensions of satisfaction would provide to decision makers. This portion of the study was done to examine the utility of the research results for medical providers. This phase involved the collection of qualitative data through interviews.

7.3 Research setting

This study is conducted at the Zablocki Veteran Affair's Medial Center (ZVAMC) in Milwaukee, Wisconsin, USA. The Veteran Affairs Hospital (VA) system is currently adopting telemedicine services in some of its facilities. One such facility is the ZVAMC in Milwaukee Wisconsin. The ZVAMC provides primary, secondary, and tertiary care to patients throughout Wisconsin. It services over 500,000 annual outpatient visits and hosts 168 acute operating beds, 113 geriatric programming beds, and 356 domiciliary beds for substance abuse, psychiatric and post-traumatic stress rehabilitation programs (VA Healthcare, 2016). The ZVAMC offers services in collaboration with several regional Community-Based Outpatient Clinics or CBOCs. The CBOCs are operated in four locations around Wisconsin: Appleton, Cleveland, Green Bay and Union Grove.

In November of 2015, two DePaul researchers visited the ZVAMC to view a live telemedicine session and discuss the usage of telemedicine. At the ZVAMC the researchers visited with staff at the department of anesthesiology. The department is currently using telemedicine for pre-surgical evaluations. The telemedicine system consists of videoconferencing and store-and-forward equipment. Connections were made between

practitioners in the ZVAMC and at remote clinics. The anesthesiology department uses telemedicine to conduct presurgical evaluations of patients.

While the department has adopted the use of telemedicine for these evaluations, other departments within the ZVAMC may be reluctant. The reasons for this reluctance are unclear but concerns have been raised about patients views of telemedicine and its impact. The staff at the anesthesiology department would like to evaluate their own services and patient satisfaction with the services to aid other providers in their decision making. While single dimension evaluations of telemedicine satisfaction may provide some insight, it was decided that a multi-dimensional evaluation of satisfaction may provide better insight that can aid other decision makers in understanding its value.

7.3 Data Collection and Approach

To evaluate the research questions discussed in the previous sections this study performed several phases of research and analysis. This section will discuss the objectives, participant selection criteria, approach, and data analysis methods used for each phase of the study. Each phase will be discussed in a separate subsection. As some phases included multiple objectives these will be described individually within each section.

7.3.1 Approach and methods: Exploratory

An important aspect of pragmatic research is to ensure that the research problem remains at the core of any efforts. For pragmatists research methods should be designed around the problems they seek to address (Creswell & Creswell, 2017; Patton, 1990).

An exploratory phase is conducted to help solidify the research direction. The goal of the exploratory phase is to identify dimensions that are commonly used to determine patient satisfaction with telemedicine. During the exploratory phase of this research a single objective is evaluated. The following discussion will describe the objective, approach, participants, and data analysis methods used for this phase of the research.

Objective: The objective of this phase of the study is to identify the dimensions that make up patient satisfaction with telemedicine. There remains a lack of knowledge on which dimensions should be used to evaluate patient satisfaction with telemedicine. This presents challenges for researchers attempting to evaluate telemedicine satisfaction as there is a lack of consistency and agreement on which dimensions should be evaluated. Therefore, this research examines which dimensions inform patient satisfaction with telemedicine. This is done by exploring the following research question:

Research question 1: What dimensions contribute to patient satisfaction with telemedicine?

Approach: To help determine which dimensions contribute to patient satisfaction with telemedicine, this study examines satisfaction through a literature review and grounded theory approach. This approach is used based on recommendations by Hoehle and Venkatesh (2015). Unlike in their study there are no single set of guidelines for evaluating telemedicine satisfaction. There are, however, several different measurement instruments that are typically used in the telemedicine research.

It was decided that examining existing instruments would present the best avenue for

identifying satisfaction dimensions. This would aid researchers in identifying dimensions that are used to measure satisfaction as opposed to just being theorized. Further, this approach would also prevent additional errors resulting from measures that may be context specific and not general enough to apply to the ZVAMC case. Identification of measurement instruments was done through a survey of the literature.

The survey was conducted by searching the National Center for Biotechnology Information's PubMed database. The search was conducted in late 2016 for results between 1/1/2010 to 08/31/2016. The cutoff date was selected as it was the most recent date during the time the search was conducted. As, the study is primarily US based around healthcare, the PubMed database was considered appropriate for identifying studies on telemedicine satisfaction.

The search terms used were "telemedicine satisfaction". Although, other terms such as "telehealth", "e-health", etc. could potentially return additional results, the term "telemedicine" was deemed sufficient given the broad number of results. Telemedicine is considered a narrower term that is encompassed by terms like telehealth. Telehealth may include other types of services that are related to healthcare but not necessarily direct clinical practices like the services offered at the ZVAMC.

The survey only reviewed studies that provided empirical measures of telemedicine. Studies that only provided discussions centering around things such as theoretical models, position papers and literature reviews were excluded. Additionally, studies that were repeated or inaccessible at the time the research was conducted were excluded. Of the

results the team was able to evaluate 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. 23 instruments were examined in total.

A grounded theory approach similar to the one used by Hoehle and Venkatesh (2015) was used to identify the satisfaction dimensions. Grounded theory is based on an approach developed by Corbin and Strauss (1990) that provides an inductive means for analyzing qualitative data. Grounded theory uses open and axial coding to develop categories from patterns in data. Open coding is used to derive concepts from a line-by-line examination of data. Using open coding data is coded before analysis using axial coding. Axial coding is used to identify connections between concepts to derive themes or categories. The open coding procedures were guided by the following questions:

- 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?

Participant selection: Papers were reviewed by 5 students and the primary author for inclusion. These consisted of 2 PhD students, 1 graduate student and 3 undergraduate students. Coding was performed by three reviewers one of which was the primary author. A third reviewer served as a judge to resolve conflicts in decisions between the reviewers. As all of the tasks were primarily based on general reading literacy, comprehension and

analytical skills the participants were considered adequate for the tasks they were assigned (Compeau, Marcolin, Kelley, & Higgins, 2012; Hoehle & Venkatesh, 2015).

Data analysis: Questions contained in the measurement instruments were reviewed to identify salient categories through a grounded theory approach (S. B. MacKenzie et al., 2011). The use of grounded theory for examining questionnaires was seen as appropriate based upon the flexibility and data diversity recommendations suggested in the Information Systems literature and practices (Birks, Fernandez, Levina, & Nasirin, 2013). Open codes were developed for questions. The codes were then grouped into separate analytical categories based on conceptual similarities until themes emerged. Axial coding was then used to group and compare categories and subcategories identified into conceptual units. Two rounds of review occurred. During the first round the primary reviewer performed the axial coding to develop the categories. The secondary reviewer then performed an additional review to revise and clarify descriptions and inform the theoretical model (Corbin & Strauss, 1990). Any disagreements during this time were decided by the third reviewer.

Following the formalization of the dimensions a second round of review occurred. The purpose of the second review was to identify second or third order constructs. This was done using the process described by Hoehle and Venkatesh (2015). Following this, the literature was again examined to define these constructs. An informal search was conducted of the telemedicine, information systems and healthcare literature to define the constructs.

7.3.2 Approach and methods: Confirmatory

A confirmatory phase was conducted to confirm the results obtained during the

exploratory phase. During the confirmatory phase, the goal was to confirm which dimensions of patient satisfaction informed patient perspectives. During this phase, the research examines factors of structural validity and generalizability through internal consistency. This research considers validity is met if the measurements demonstrate adequate content validity and reliability, along with ensuring face, convergent and discriminant validity between constructs (S. B. MacKenzie et al., 2011). Face validity was established in the exploratory phase through expert feedback. This portion of the research will further validate the constructs through model evaluation and instrument testing. The second phase of the research was designed around the following research question:

Research question 2: How do identified dimensions relate to satisfaction?

To determine this, it was necessary to measure the identified dimensions. To measure the dimensions of patient satisfaction was necessary to meet two objectives. The first was to develop an instrument that could be used to measure patient perspectives of the dimensions of patient satisfaction. The second was to use the tool to measure patient satisfaction at the ZVAMC by conducting a survey. The following will describe each objective, the approach, participants, and the data analysis techniques used.

Objective 1 - Instrument development: The purpose of this objective is to develop an instrument that can be used to measure the dimensions of satisfaction identified in the exploratory research. The identified constructs in the exploratory phase were derived from existing validated measurements. To ensure construct validity there was a need to ensure the measures selected for the constructs matched the construct definitions determined from the

literature. Table 6 in the results section lists the constructs identified for the measures. The constructs were derived from the theoretical framework in the exploratory phase.

Among the challenges with developing an instrument to measure the dimensions of satisfaction is removing as much ambiguity as possible from measures. As the dimensions are all considered part of satisfaction there will be some overlap in user views of the dimensions. However, there is a need to ensure that overlap is based on user perceptions of satisfaction and not on the descriptions of the measures themselves. Therefore, this effort attempted to identify and refine measures to eliminate as much overlap as possible.

Participant selection: This objective is completed through different examinations that involved a variety of different participants. 4 domain experts were recruited to assist with the construct and measure development. These include 2 MIS, 1 Telemedicine, and 1 Computer science professional. These are recruited to provide a variety of business, technical and medical feedback.

A pretest that was conducted recruited a total of 135 students and a formal test recruited 448 participants that are mainly students. Although some online outreach was conducted, only a handful of responses were received. In studies such as these that check for content validity in which the primary skills needed are analytical thinking and sorting students are considered appropriate (Compeau et al., 2012; Hoehle & Venkatesh, 2015). Further the participants for the formal testing each completed separate tests. Therefore, each test had 224 participants.

Previous studies that used similar analytical techniques have used between 20 (J. C.

Anderson & Gerbing, 1991) to 318 (Hoehle & Venkatesh, 2015) participants. An additional 27 veteran participants were questioned using a semi-structured questionnaire in a pilot study to examine their views of the satisfaction questions.

Approach: The measurements for the instrument are developed using a variation of the procedures described by both Hoehle and Venkatesh (2015) and S. B. MacKenzie et al. (2011). This research however, used an interactive and multi-faceted approach towards developing the measures. This was done for two reasons. The first is that unlike the previous studies the measures are based off previously validated measures. The second is based on challenges observed during the instrument development process. The iterative approach is used to refine both the measures and the descriptions used to define the measures until a reasonable agreement was reached.

Measures were created by first selecting the two measures reviewers felt most closely match a construct. The measures are selected based on how closely reviewers felt the open coding labels matched the identified constructs during the exploratory phase. The measures and the construct definitions were put into a matrix form similar to the form used by Hoehle and Venkatesh (2015). However, based on the number of measures it was determined that a modified matrix design similar to those described by J. C. Anderson and Gerbing (1991) and S. B. MacKenzie et al. (2011) would be more usable by participants.

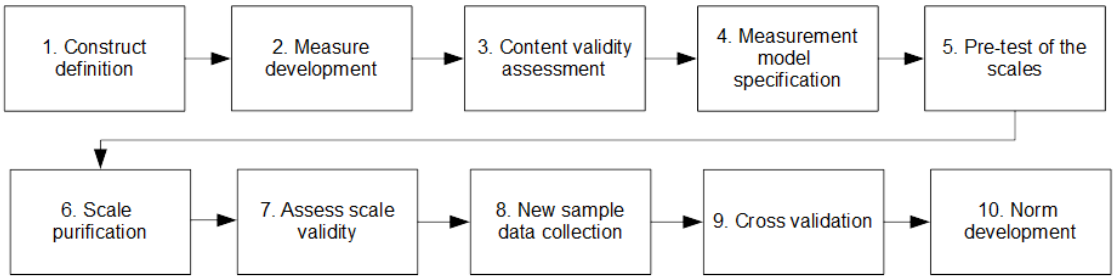

Figure 13: Scale development procedure adapted from (S. B. MacKenzie et al., 2011)

Form development: A form was designed that enabled participants to match measures based on definitions contained in a separate form. A group of 4 experts were asked to use this form to match definitions to constructs. Following the matching exercise, they were asked for additional comments. Based on the provided feedback a new iteration of the form was developed. The new iteration changed the forms design and some of the language used for the construct definitions and measures.

The form was put through several additional rounds of testing before a larger test was conducted. Each of these rounds of testing would include between 3-4 participants and a total of 10 rounds were completed. During these rounds' participants would complete the form and be questioned about their decisions along with any suggestions on improvement. The testing was used to help determine changes to the form, constructs and wording of measures that were needed for clarity. The refinement stage revealed a concern with the matching approach being used. It appeared participants were using a keyword matching strategy to match definitions to constructs, as opposed to relying on the wording that described the meaning of the construct itself. To minimize the impact of this and encourage participants to focus more on the meaning of the construct and measures as opposed to

keywords, an attempt was made to remove keywords from either definitions or measures.

Table 4: Adjustments of definitions and measures

Original **definition**	Adjusted definition
The degree to which patients perceive their privacy will remain protected and safe.	Patients' willingness to share personal information and the control they have over that information is adequate
Original measure	Final measure
How well the telehealth staff respected your privacy	How well the telemedicine staff respected your privacy

Measurement pre-test: A pretest was conducted to examine the effectiveness of the revised form using a quasi-experimental design. This study was conducted with the approval of the DePaul Internal review board. Participants were asked to complete a matching exercise using the revised form. Participants were given 2 versions of the form, each containing different versions of the questions. Each form contained 18 items and participants were asked to match a total of 36 items. In total 135 responses were collected. The pretest questionnaire is in Appendix C.

The pre-test was performed using a convenience sample obtained from both an online and paper form at DePaul University. Convenience sampling is generally not preferred due to the potential bias inherent in non-probability and non-random sampling (Creswell & Creswell, 2017). Further there are concerns over whether certain populations may be oversampled in a convenience study and bias the results against the norms of the target population. Generally, convenience sampling is used in healthcare research because of its effectiveness in reducing costs and enabling research that otherwise may be impossible to

conduct.

Despite the challenges with convenience sampling there were several reasons why it was considered adequate for this research. The main goal of this portion of the study was to ensure that the definition descriptions matched the wording of the measures. Both the measures and definitions which were being evaluated where not created in this research. Measures obtained were from instruments already validated in previous research studies.

Most definitions used were based on constructs from the existing literature that provided both theoretical and empirical support for their meaning. In addition student populations are considered adequate for tasks that involve analytical and thinking skills in research (Compeau et al., 2012; Hoehle & Venkatesh, 2015). As the goals of this objective are on matching sentences to ensure the wording of definitions match the meaning of measures this was viewed as an applicable case.

The final reason is both the practicality and uncertainty surrounding the results of this objective. The ZVAMC places stringent requirements on test studies. As there were no guarantees the results would meet expectations there was the possibility that additional rounds of refinement would be necessary. The matching exercise was also not something that could be quickly performed by patients due to the number of items.

In addition, because the measures and definitions were previously validated and accepted by experts, variations in the wordings that did not result in precise matches were not expected to change the overall outcome of the study. Even if findings suggested ambiguity in the measures the measures were still representative of satisfaction. Based on

these various reasons it was decided that it would be impractical to perform this portion of the study in a hospital setting, the impact would be minimal and therefore the student population was deemed appropriate.

Pre-test revisions: Following the pre-test an analysis was conducted using a similar quasi-experimental design. After the analysis additional revisions and a redesign of the form was conducted. These changes were conducted to improve matching and address usability issues based on participant feedback. The form was redesigned to reduce the number of items per form to 7 +/-2 (Miller, 1956) and easily allow participants to compare definitions to measures.

Additional refinement was performed on measures that did not reach the preferred threshold. Items were grouped into separate forms based on frequency at which participants mismatched them. If two items were frequently confused for each other they were grouped into similar forms. The results used for the groupings will be discussed in the results section.

Redesign testing: Testing was conducted to ensure the redesign was effective at assisting participants. A convenience sample of 34 participants were recruited at DePaul University. 17 participants completed the first form in its entirety and 16 completed the second form. One participant only completed the first grouping. No issues were observed, and participants averaged less than 10 minutes to complete the effort. Results suggested some small revisions were necessary.

During this time it was also determined that because usefulness itself was a multi-

dimensional construct it would also inadvertently influence other dimensions (Saadé, 2007). This was apparent in participant feedback given during testing and historic responses for measures such as medical outcome and end user support. Therefore, it was decided that usefulness would not be checked for further revisions and retain the already established measures and definitions in the final questionnaire. This would allow the study to examine the overlap between other dimensions of satisfaction without the undue influence of usefulness.

Formal testing: A formal test was then conducted to evaluate participant views of the measures. The test was conducted using both a paper and online version of the form. A convenience sample was conducted but extended to other Universities and online recruitment via Reddit. The study was approved by the University Internal Review Board. In total 448 participants were recruited for the formal testing. Of these 224 completed the first form and 224 completed the second form.

An examination of veteran views: An exploratory study was conducted to explore veteran views of the telemedicine satisfaction dimensions (Garcia, Luna, & Adelakun, 2020b). 27 participants were recruited to participate in the study. This study was conducted in collaboration with veteran groups that conducted outreach. Participants were asked to complete an online form that asked them questions about their experience with telemedicine and the definitions and constructs used in this research. This was done to identify any issues with the constructs used and if any additional constructs or measures should be used for the final instrument.

Final instrument design: Following the formal testing additional analysis was conducted. Measures with low ratings from the formal testing were removed. These measures were replaced with measures that had better overall performance using slight variations in the wording. This was done to ensure there were at least two questions that could be used for reliability testing. Two additional measures were added to the final questionnaire.

The first was a measure of overall satisfaction. This was added based on suggestions to provide decision makers something to compare the results of dimensional satisfaction against. The second was a close ended and open-ended question on patient expectations. This was added based on feedback from a veteran in the pilot study, suggestions by the veteran group that assisted in outreach and the novelty of telemedicine to many veterans. The novelty of telemedicine was reflected in the pilot study and the low number of US veterans that regularly use telemedicine.

Data analysis: Data analysis was conducted using methods described by J. C. Anderson and Gerbing (1991) and recommended by Hoehle and Venkatesh (2015) whose work was modeled for the instrument development. The goal of this analysis was to verify content validity. A similar analysis was completed for both the pre-test and the formal test. Two test parameters were evaluated.

The first measure evaluated was the proportion of substantive agreement or P_{sa}. This is a measure that determines whether items were successfully matched to their definitions. It is based on the proportion of correct responses assigned between the correct dimension to its matching construct. It is computed by examining the number of correct responses or nc

divided by the number of total responses or N. Values are calculated between the 0-1 range with higher values meaning higher agreement that the participants matched the construct successfully.

$$P_{sa} = \frac{nc}{N}$$

The second measure evaluated was the substantive validity coefficient or C_{sv}. C_{sv} is a measure of the proportion of responses that matched a construct successfully over any other construct. It is calculated by examining the number of correct responses or nc minus the number of responses for the second most chosen option for a given construct or n0. This value is then divided by the total number of response or N.

Values range between -1 and 1. A negative value indicates that the measure is assigned to another single construct more often than the hypothesized construct. This would suggest that perhaps another construct is more valid for the measure than the one hypothesized. A positive value indicates that a measure is assigned to the correct construct at a greater rate than the closest matching possibility. This suggests that there is very little overlap between measures and different constructs.

$$C_{sv} = \frac{nc - n0}{N}$$

Objective 2 - Patient survey: The second objective of this phase is to confirm the nature of the relationship between identified dimensions and satisfaction. There is lack of formal studies that specifically examine the nature of the relationship between different variables and satisfaction. While some existing models may provide guidance, satisfaction is often not

the main consideration nor are its dimensions fully explored (P.-H. Hu, 2003b). This often leaves a limited understanding of the specific roles that dimensions may play in satisfaction. For example, some identified constructs may be better at explaining the processes of satisfaction while others may exist as actual components of satisfaction.

Although existing models may provide some guidance for evaluating patient satisfaction with telemedicine, they lack in their ability to explain satisfaction with telemedicine. Therefore, to understand patient satisfaction with telemedicine there exists a need to understand the relationship of identified dimensions to satisfaction.

Participant selection: The goal of this objective is to analyze patient satisfaction with telemedicine. To accomplish this, it was important to examine the reliability and validity of the measurements. Two samples were taken to complete this process. The first included a sample of the general population of telemedicine users in the United States. 586 participants were included in an online survey from the general US population.

The modeled approach by Hoehle and Venkatesh (2015) considered 500 participants valid for evaluating the psychometric properties of a measurement instrument. Other studies show this number is on the high end for examining psychometric properties in developing patient outcomes measures (Anthoine, Moret, Regnault, Sébille, & Hardouin, 2014). Factor analysis Garson (2008) suggests that 200 participants is considered the highest number of participants necessary and that the actual amount may be lower.

The second was a sample of patients at the ZVAMC. The data collection occurred during the COVID-19 pandemic outbreak. As many of the services provided were for pre-

operative surgical evaluations the number of cases was dramatically lower than is typical. On average annually the estimated patient population for the examined telemedicine services is 288. During the timeline of data collection 75 participants were recruited for the sample from the ZVAMC. While the results are not considered statistically significant enough to generalize, they were considered adequate to provide a snapshot of patient views during the time of data collection for provider evaluation.

Approach: Two surveys were conducted. The first was done through an online questionnaire. Participants were recruited both through Amazons MTurk, email and online forums that catered to telemedicine users. A pre-screener was provided that restricted participation to people who had previous experiences with systems that are considered telemedicine. The survey was conducted with the approval from the DePaul University internal review board. Participants were provided a copy of the dimensional satisfaction measurement instrument developed in the first objective. The online form contained two versions of the questionnaire based on the results from the formal testing. In cases where both measures performed with acceptable PSA and CSV, each question was used. In other cases, the best performing item was selected with a slight modification used of the question on the second form. An extensive discussion of the approach towards content validity is discussed in Garcia, Kallio, and Adelakun (2021)

The second survey was conducted onsite at the ZVAMC using the same question items from the first survey. The survey was conducted with the approval of both the ZVAMC internal review board and DePaul University internal review board. The survey

used a paper-based questionnaire. The questionnaire was distributed at both the ZVAMC and at regional CBOCs to patients by staff during a patient's intake.

Although adding additional versions of the questionnaire could aid in reliability evaluations only two versions were considered based on feedback from members of the ZVAMC of the practical needs of the study. Concerns were raised over the adverse effects to the patient experience resulting from requests to complete extensive tasks during waiting periods.

As the two questionnaires were included and the number of dimensions examined was large, it was decided risks from not having additional repeating measures would not adversely affect the result. Validity of the measurements themselves was also examined in the previous objective. This provided further validity for the measurements.

Data analysis: Data results were run through a data cleaning process before being evaluated using statistical methods Although it is difficult to gauge the intent of survey respondents, it was decided that only results that showed variation in the answers would be included. Cases in which respondents selected a single value for all the question items would not be included. For example, if a participant only answered 5 on Likert questions for all items, it would not be considered. Similarly, in cases where participants repeated number patterns, these items would be removed. In cases where a participant may have only answered one questionnaire were also not considered for the general survey but were considered for the ZVAMC results due to the limited number of results.

The relationship between variables can assist in identifying which components of a

telemedicine system shape satisfaction. To examine how the different identified dimensions relate to satisfaction and each other the collected data was examined using different factorial statistical methods.

Wright et al. (2012) discuss methods for evaluating complex models of multidimensional constructs. According to their descriptions evaluation of these models can be performed using structural equation modelling (SEM). The text provides a framework for evaluating these models and describe software tools that can be used for analysis including AMOS, EQS, and SmartPLS. Using SEM researchers can identify the relationships between observed and latent variables in addition to testing models. SEM was used to test the theoretical model of patient satisfaction with telemedicine. This was done to examine the influence of latent variables and identify the explanatory power of the model described in the approach. A formative and reflective model were examined to understand the directionality of the flow from the dimensions to the antecedents.

The proposed model evaluated using various statistical methods. Cronbach's alpha is used to ensure that the measurement instrument measures are aligned. To test the reliability of measurement models the comparative model fit is used (Hoehle & Venkatesh, 2015; Tanriverdi, 2005). Average variance is used for convergent validity of indicators at the construct level (Hoehle & Venkatesh, 2015; S. B. MacKenzie et al., 2011). The models were refined by removing items with loadings less than .5. The .5 indicator was used to maximize the convergent validity of constructs.

The HTMT is used to assess discriminant validity and Dijkstra-Henseler's rho (pA)

for reliability of construct scores. The analysis of results and development of the models was done through a combination of the R Language and different python libraries. The SEM PLS model was evaluated using the SEMinR package in the R Language. Python libraries including pingouin, factor analyzer and semopy were used for model development.

7.3.3 **Approach and methods: evaluatory**

Pragmatic research is based on the idea that the goals of knowledge are to enable purposeful change in real world practices (Dewey, 1958; Goldkuhl, 2012). This notion of enabling purposeful change is important for practicality in pragmatic research. Pragmatists realize the importance of both qualitative and quantitative findings to develop knowledge in studies (Saunders et al., 2007; Yvonne Feilzer, 2010). However, the value of these findings must always consider the real world context in which the study is conducted (Dewey, 1958; Yvonne Feilzer, 2010). Decision makers rely on satisfaction measures to evaluate telemedicine systems. There is a need to understand the value or lack thereof of evaluating multiple versus single dimensional measures of satisfaction.

Research question 3: How do decision makers interpret data based on identified dimensions?

Objective: This objective examined provider perspectives of the results of patient satisfaction with telemedicine services. The goal of the objective is to understand the value that dimensional considerations can provide to decision makers. To do this the research obtained qualitative feedback from medical providers on the value of measures.

Participant selection: Medical providers are interviewed for this objective. Medical

providers are often considered the gatekeepers for telehealth services in medical institutions (P. S. Whitten & Mackert, 2005). At the ZVAMC feedback from medical providers is included as part of the decision making for new technologies in telemedicine practices. 15 total interviews were conducted.

For qualitative research adequate sample size varies based on a studies context. In general, studies rely on continuing data collection until saturation occurs (Vasileiou, Barnett, Thorpe, & Young, 2018). As the study was designed around having medical providers evaluate the satisfaction of their patients by comparing measures a smaller sample size was thought to have adequate information power.

This is based on the narrow aim, dense specificity, applied theory, strong dialog and case analysis criteria of the study as described by Malterud, Siersma, and Guassora (2016). During the interview process several recurring themes were identified after about 6 participants. After the 9th participant the themes provided seemed to be recurring. Hennink, Kaiser, and Marconi (2017) discuss previous studies in which saturation could occur around 6 participants and attributed this to the use of more controlled means such as semi-structured interviews.

According to their study code saturation could occur around 9 interviews while saturation of meaning would require more. As the purpose of this study was just to identify provider's perspective of the potential value and not consider their rationale deeper, the interview data was deemed adequate.

Approach: Qualitative data is collected via interviews of medical providers that are

involved in using telemedicine at the ZVAMC. Interviews are considered appropriate when the goals of research are to obtain unobservable data such as feelings or how people interpret the world around them (Merriam, 2009). As the objective is to obtain views about the value of dimensional satisfaction to decision makers this is considered a valid means to obtain this data. The interviews are conducted with the approval of the ZVAMC internal review board and the DePaul University internal review board. Medical providers are interviewed at the ZVAMC and audio recorded. The audio recordings of the interviews are transcribed before destruction of the audio.

Providers are given a compiled list of the results of the patient satisfaction survey conducted at the ZVAMC and asked semi-structured questions about their views of the results. Two separate results are given in a randomized order. Some participants were first given the results of overall satisfaction followed by the results of dimensional satisfaction. Others are given the dimensional satisfaction results followed by the overall satisfaction results. The questions centered on how the results could impact their decision making. The questions asked are as follows:

What do you feel these results mean in regard to the telemedicine services?

How do you think these results can help you in making decisions about telemedicine?

What kind of decisions about telemedicine do you think these results would help you to make?

How valuable do you feel these results are to decision making and what kind of value do you think you can get from them?

Data analysis: Qualitative analysis is conducted to provide a description of the provider views. This is done as the goals are to allow providers the opportunity to describe how the results of dimensional satisfaction can influence their decision making and the value they perceive. An inductive thematic analysis was conducted on the results of the interviews (Braun & Clarke, 2012). Thematic analyses are considered useful and flexible methods for developing patterns of meaning across qualitative data sets.

The inductive approach allows patterns to be developed from the data itself rather than relying on previous theory to drive the analysis. This approach was considered appropriate for two reasons. First it would allow for combining the views of several different participants into a shared meaning.

Second it would provide a flexible mechanism to describe the perceived value of the medical providers. Unlike grounded theory, thematic analyses are not designed to develop overarching theories from the ground up but are more directed towards answering specific questions. Methods described in grounded theory such as open and axial coding were used to help synthesize results.

5. Results

This section presents the results of the findings from the three phases of the research. Each section discusses findings from the relevant phase. In cases where multiple objectives are pursued for a phase of the research each objective is described in subsections.

7.3 Research Findings: Exploratory

The goals of the exploratory study were to identify the dimensions of telemedicine satisfaction. The results were obtained using qualitative methods. The results of the exploratory research led to the identification of 18 first order constructs. The items were also looked at for similarities between them to form groupings for second order constructs. It was found that the items could be grouped into 5 categories by reviewers. Usefulness was considered a separate construct.

The literature was then examined to determine any similarities between the groupings and existing theoretical constructs. The review determined similarities between several of the structures and models discussed in the literature. The constructs were refined into the following categories: healthcare service quality, information quality, system quality, and net benefits. Two of the constructs were unmatched in the initial review. Upon further review and development of the theoretical model the constructs were further refined.

Table 5 on the following page shows the grouping of first order constructs and the second order constructs identified.

Table 5: Construct identification and grouping.

Second order	**First order**	
Healthcare service quality	Comparison of care	Quality of care
	Interaction with provider	Relationship with provider
	Medical outcome	Treatment
Information quality	Privacy	Technical Support
	Information completeness	
Net benefits	Cost	Ease of scheduling
	Duration	Provider benefits
System quality	Ease of use	Reliability
	Environment	
Intention	Reuse	Expectations
Usefulness	Usefulness	

The constructs were matched to specific definitions based on the review of the literature.

Table 6 on the following page the list of first order constructs is shown.

Table 6: First order construct identification and definitions

Construct	Definition
Comparison of care	Comparison between telemedicine and face-to-face visits (Babakus & Mangold, 1992)
Cost	Patients' perceived cost or monetary expense of using telemedicine. (Tung, Chang, & Chou, 2008)
Duration	The adequacy in the length of time patients spend in the actual visit with a medical provider and receiving care. (Camacho, Anderson, Safrit, Jones, & Hoffmann, 2006; Kuzel et al., 2004)
Ease of use	The system's technical functions are user friendly and easy to use (Davis, 1989; Wixom & Todd, 2005)
End User Support	The technical assistance and training provided by personnel to aid patients in using the technology (Mirani & King, 1994)
Environment	The environment in which the telemedicine session takes place. (Kraai et al., 2011)
Information completeness	Patients feel they can access and receive all the information they deem important about their healthcare adequately. (Brohman, Watson, Piccoli, & Parasurama, 2003; Ong, De Haes, Hoos, & Lammes, 1995)
Interaction	The attitude in which medical care providers communicate with patients. (Ong et al., 1995; Ware, Snyder, Wright, & Davies, 1983)
Outcome	The resulting change in health of a patient due to a medical intervention (Donabedian, 1988)
Provider benefits	Patient feels the system technology assists their medical providers in their work (Dick et al., 1999)
Privacy	Patients willingness to share personal information and the control they have over that information is adequate (Bussone, Stumpf, & Bird, 2016)
Quality of care	The competency of the physician who cared for the patient (Connors et al., 1995; Weatherburn et al., 2006)
Relationship	The strength of the personal relationship developed between the patient and medical provider(Dagger, Sweeney, & Johnson, 2007; Robinson, Callister, Berry, & Dearing, 2008)
Reliability	The reliability, accuracy and consistency of the technology used.(McKinney, Yoon, & Zahedi, 2002)
Reuse	Patient thoughts on re-using the services and recommending it to others (Li, Duan, Fu, & Alford, 2012)
Scheduling	The time required for scheduling a session with a medical provider. (Gustke et al., 2000; P.-H. Hu, 2003a)
Treatment	The medicine, drugs and medical procedure given to a patient to manage their health condition. (Revicki, 2004)
Usefulness	Patient believes using the system's technical functions enhance their task performance (Rai, Lang, & Welker, 2002)

Second order constructs were also matched to definitions based on constructs identified in the literature. Table 7 lists and defines the second order constructs identified.

Table 7: Second order construct identification and definitions

Construct	Definition
Healthcare service quality	The extent to which a patient perceives aspects of care that contribute to the maintenance, prevention, restoration, and treatment of health conditions (n.d., 2016)
Information quality	Degree to which a user perceives the quality of information produced by the system. (DeLone & McLean, 1992; Gorla, Somers, & Wong, 2010)
Net benefits	The extent to which an information systems contributes to the success of its users (Delone & McLean, 2003).
System quality	The quality of an information system's processing and technical soundness as perceived by the user (Gorla et al., 2010).

The results were used to refine the theoretical model discussed in chapter 2. The research results were able to inform the antecedents that form the different constructs. These are obtained from the first-order constructs identified in the results. The antecedents are viewed as having a reflective relationship to the second order constructs which inform telemedicine satisfaction. Based on the research findings a revision of the proposed theoretical model is presented.

Figure 14 on the following page provides an overview of the revised model with the identified antecedents.

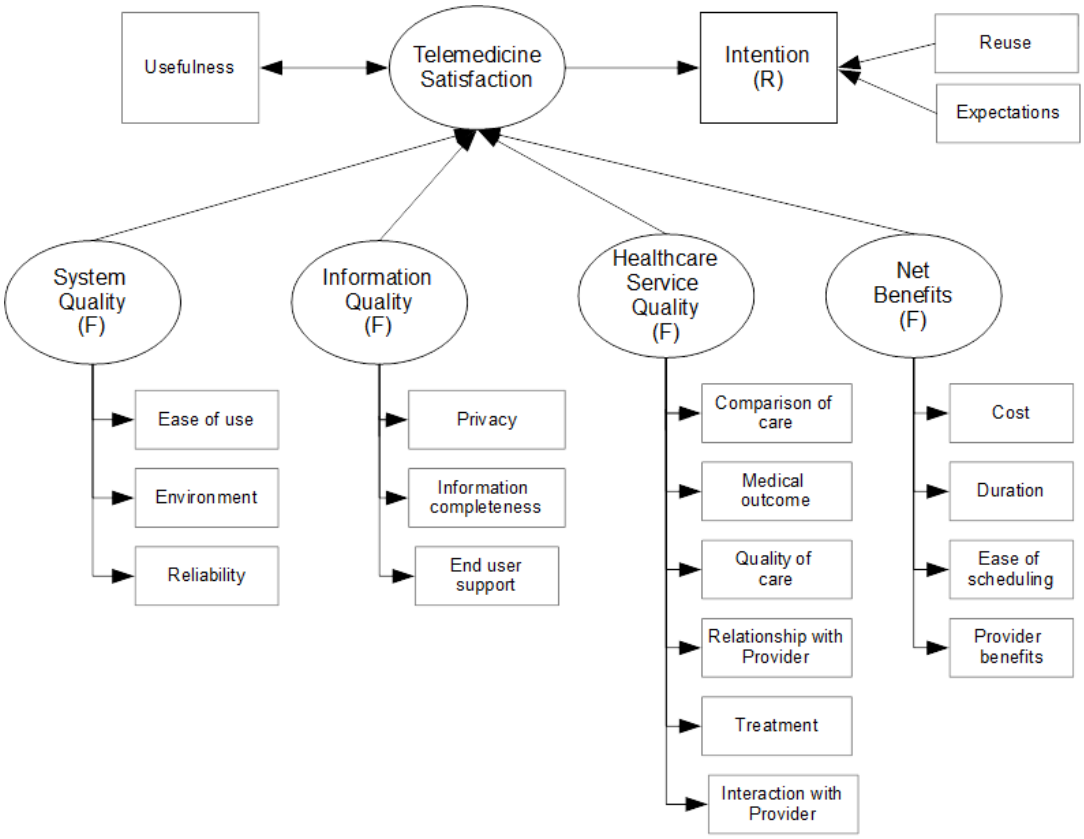

Figure 14: Revised model of telemedicine satisfaction with identified dimensions.

7.3 Research Findings: Confirmatory

The confirmatory research was conducted to achieve two goals: develop the measurement instrument and confirm the nature of the measure's relationship to satisfaction. The following subsections will discuss these, and the results obtained from the studies.

7.3.1 Instrument Development

Results of the pre and formal tests were compiled and analyzed using quantitative evaluations. PSA and CSV values were evaluated for all construct measures. High values for PSA suggest strong agreement on the meaning of the measure amongst participants. High

CSV values suggest there is limited overlap between the meaning of a construct and other potential constructs. Results of the pretest are shown in table 8. Although the results were not grouped in the pre-test, they are grouped for comparison purposes in the table below with the formal test.

Table 6: Pretest results of matching evaluation by participants

Constructs	**Form1**		**Form2**	
	Pretest		Pretest	
	PSA	CSV	PSA	CSV
Group 1				
Cost	0.949	0.949	0.962	0.962
Duration	0.734	0.646	0.646	0.43
Environment	0.823	0.785	0.861	0.823
Information completeness	0.671	0.608	0.696	0.633
Privacy	0.873	0.848	0.924	0.899
Reuse	0.658	0.582	0.772	0.709
Scheduling	0.797	0.747	0.709	0.481
Group 2				
Comparison of care	0.506	0.43	0.671	0.62
End user support	0.519	0.342	0.456	0.367
Interaction	0.608	0.481	0.57	0.443
Outcome	0.329	0.025	0.443	0.316
Provider benefits	0.557	0.481	0.582	0.494
Quality of care	0.633	0.532	0.481	0.342
Relationship	0.772	0.696	0.671	0.582
Treatment	0.282	0.013	0.418	0.253
Variable				
Ease of use	0.582	0.494	0.81	0.734
Reliability	0.744	0.692	0.633	0.544
Usefulness	0.532	0.418	0.418	0.304

The results indicate a mixture of perceptions. Several of the measures were successfully matched in both tests and on both forms. Several of the measures improved between the pre-test and the formal evaluations. Some of the measures were not

successfully matched in either of the tests.

Cost, environment, information completeness and privacy exceeded the .65 thresholds for both PSA and CSV. The thresholds were passed for both measures in the pre-test and in the formal test. This suggests that both measures could be used as representatives of the same construct. Duration, reuse, and scheduling had one measure pass the threshold on the pre-test with one measure only passing the PSA threshold. However, in the formal test both measures passed both PSA and CSV thresholds.

Measures for ease of use, interaction, quality of care, relationship, and reliability each had one measure pass both CSV and PSA thresholds on one form in the formal test. However, each had one measure that did not pass both thresholds.

The second measures for reliability and relationship on form two both had a PSA surpassing the threshold but had CSV lower than the threshold. This suggests slight rewording for these measures can aid in more clearly distinguishing them from other constructs (Hoehle & Venkatesh, 2015).

Similarly measures for end user support, outcome and treatment all had one measure that passed the PSA threshold but did not pass the CSV threshold suggesting additional improvements could help clarify the distinctions. Finally, the measure for provider benefits did not have either measure meeting the proposed threshold. This suggests there is a need for revisions in the construct descriptions and measure.

Table 8 on the following page summarizes the results of the formal test.

Table 7: Formal results of matching evaluation by participants

Constructs	**Form 1**		**Form 2**	
	Formal		Formal	
	PSA	CSV	PSA	CSV
Group 1				
Cost	0.908	0.894	0.876	0.844
Duration	0.78	0.638	0.784	0.702
Environment	0.844	0.789	0.711	0.606
Information completeness	0.766	0.67	0.739	0.661
Privacy	0.821	0.729	0.798	0.748
Reuse	0.83	0.798	0.711	0.642
Scheduling	0.775	0.67	0.821	0.761
Group 2				
Comparison of care	0.803	0.784	0.646	0.58
End user support	0.633	0.488	0.434	0.245
Interaction	0.793	0.746	0.59	0.495
Outcome	0.615	0.479	0.571	0.377
Provider benefits	0.587	0.469	0.439	0.288
Quality of care	0.709	0.648	0.514	0.373
Relationship	0.85	0.822	0.627	0.495
Treatment	0.648	0.46	0.524	0.368
Variable				
Ease of use	0.592	0.451	0.766	0.701
Reliability	0.858	0.821	0.637	0.509
Usefulness	Na	Na	Na	Na

An additional examination was conducted to analyze whether the variations between forms and the separation of items may have impacted the results. To examine this a two-tailed independent t-test was performed using the Python SciPy library. The test examined items between forms and studies without consideration for usefulness.

A significant difference $p <= .05$ between PSA values was observed at $t(32) = 2.085$, $p=0.0452$ between PSA values for form 1 pre-test ($M=0.6492$, $SD= 0.1792$) and formal test ($M= 0.7536$, $SD= 0.1027$). This suggests improvements to the results between pre and

formal test. A similar effect at t (32) =1.6533, p=0.108 was not observed for CSV values between form 1 pretest (M=0.55 SD=0.2539) and formal test (M=0.668, SD=0.1484).

An additional examination was performed on form 1 to see if the form grouping changes made a difference in the PSA values. The results show that at p <=.05 there was no significant difference at t (12) =0.7043 for PSA between pretest (M=0.7864, SD=0.1064) and formal test (M=0.8177, SD=0.0499) items in group 1.

For group 2 items on form 1 a significant difference was observed at the p <=.05 at t (12) =2.3544, p=0.0364 for PSA values between the pretest (M= 0.5606, SD= 0.1357) and formal test (M=0.7129, SD= 0.1042).

When form 2 was examined, there was no significant differences noticeable at p <=.05 for PSA at t (32) =0.1339, p=0.8943 between pre-test (M=0.665, SD=0.1647) and formal test (M=0.6581, SD=0.1332). The results for CSV values also did not show a significant difference at p <=.05 at t (32) =0.2106, p=0.8345 for the pre-test (M=0.5666, SD=0.2072) and formal test (M=0.5526, SD=0.1776).

Except for CSV values in form 1 group 2 there do not seem to be any significant differences in the forms between pre-tests and formal tests. This suggests that other changes rather than form design were responsible for the results.

Following the evaluation, measures were selected to be used in the final questionnaire based on their performance in the formal evaluation. This was done to examine whether an additional evaluation would be necessary to identify context specific dimensions related to veteran culture and observations. The full results of this study were

published in an academic conference (Garcia, Luna, & Adelakun, 2020a). These measures were used to perform a qualitative evaluation of veteran views of the identified dimensions.

Participants were asked to share their views on the constructs and definitions using an online form. Several of the participants provided additional information in their responses. Several did not seem to provide a clear response. Seventeen out of the twenty-seven indicated support for the identified items. Five of the participants responded with answers that did not reflect thoughts on the questions or implied they did not know. Four provided suggestions and one described the questions as invasive. Out of the four that provided suggestions one suggested a consideration of the different medical procedures, one on health assistance, one on accuracy and cost, and one on usefulness.

Participants were also asked about their views on the sufficiency in the identified dimensions and constructs in covering their views for measuring telemedicine satisfaction. The majority suggested support for the identified constructs and measures.

Twenty-three suggested support for the questions. Two responded with indications that they were uncertain. One responded with reliability and the last asked whether it was faster. Participants were also asked to share their suggestions for additional items and questions that should be included to cover their views. There were several suggestions provided. One was around the expectations of the patients, and another was around the cost of insurance. Only three of the respondents provided recommendations. These included expectations, spousal support, animal care, and insurance coverage at non-VA facilities.

The veteran's group that participated in the study to conduct outreach was invited to review and discuss the results. An informal meeting took place between the PI and members of the group to discuss the findings. Based on the findings the group was asked about the different recommendations and other improvement suggestions. Based on the results of the discussions and findings it was determined that a question on expectations should be included in the evaluation.

The group described the lack of experience that many veterans still had with telemedicine and the need to balance their expectations with current experiences. The wording of the recommended question was slightly revised based on group recommendations. This was not further revised or tested as it was considered a contextual question based on the group cultural perceptions the wording of which should match their views.

The group was also consulted about the importance of insurance coverage, but the views were more of an interest related to understanding how to receive telemedicine, rather than the criteria they would use for evaluation. Further the insurance concern seemed to stem around the idea of costs which were already evaluated in the instrument.

The items were then provided to partners at the ZVAMC for additional suggestions and recommendations. Recommendations included balancing the number of questions with the goals and including additional demographic information. A revised questionnaire was then completed and is provided in Appendix A.

7.3.2 **Survey**

The second objective of this phase is to confirm the nature of the relationship between identified dimensions and satisfaction. This was examined through two surveys: one to confirm the nature of the relationship and the other to examine measures in the context of telemedicine usage at the ZVAMC. The following sections will discuss the results. Section 5.2.3 will describe the results obtained from the measurement instrument along with its performance compared to similar instruments.

7.3.3 **Study 1: Instrument evaluation**

The first survey conducted online contained two measurement forms and a questionnaire for demographic information. A total of 587 results were obtained. Of these 532 results were retained after the data cleaning process. A summary of participants is included in table 12 below. Each form was examined for internal consistency using Cronbach's alpha.

Cronbach's alpha is a measurement of how closely related items are within a group and is a standard measure for internal consistency and reliability of measures (S. B. MacKenzie et al., 2011). Cronbach's alpha can be relatively high with an increasing number of measures and for larger number of measures a higher value is considered better (Cortina, 1993).

In general, the accepted standard for Cronbach's alpha is .70. However, alpha values over .90 may be considered more indicative of unnecessary content duplication than homogeneity (Streiner, 2003). The form one alpha was measured at $\alpha = 0.8696$ while form

two alpha was measured at $\alpha = 0.8811$. Similar results were examined for the measurement instrument performance as a single instrument. The alpha for the combined forms was $\alpha = 0.9345$. This suggests that the combined form performance likely contained additional content duplication. This would be expected if items between forms were meant to measure similar items or were similarly worded. Table 12 below shows a comparison between the measured alpha for each form and those for other telemedicine measurement instruments.

Table 82: Comparison of alpha scores to other telemedicine measurement instruments

Instrument	**Cronbach's Alpha score**
Study Form 1	0.87
Study Form 2	0.88
Combined forms	0.92
Telehealth Satisfaction Scale (TeSS)	0.9
Telemedicine Satisfaction and Usefulness Questionnaire (TSUQ)	0.92
Patient Assessment of Communication During Telemedicine (PACT)	0.9
Telemedicine Perception Questionnaire (TMPQ)	0.83
Telehealth Usability Questionnaire (TUQ)	0.8
Telemedicine Satisfaction Questionnaire (TSQ)	0.93

Descriptive statistics were calculated for each item measured in the forms. These are included in Appendix D and Appendix E. Charts of the mean values are displayed in figure 15 and figure 16 on the following page.

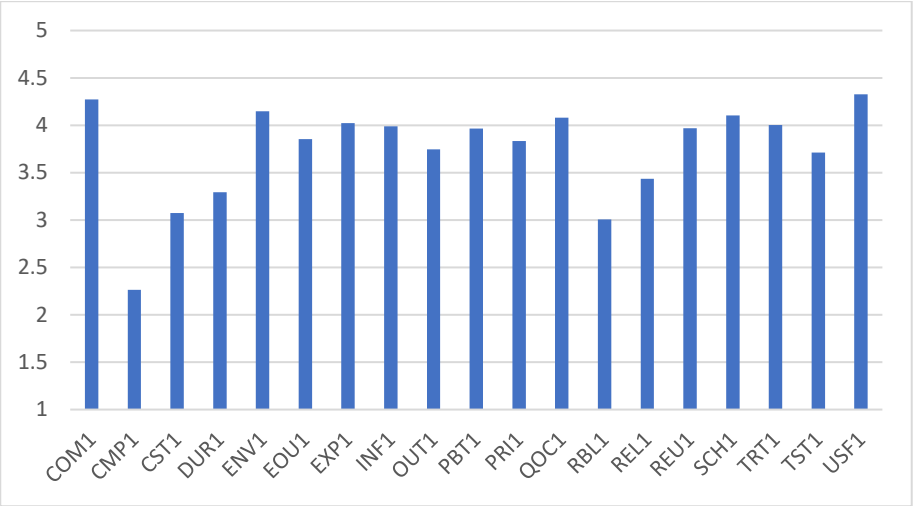

Figure 15: Chart displaying mean values for form 1 results of surveyed measures.

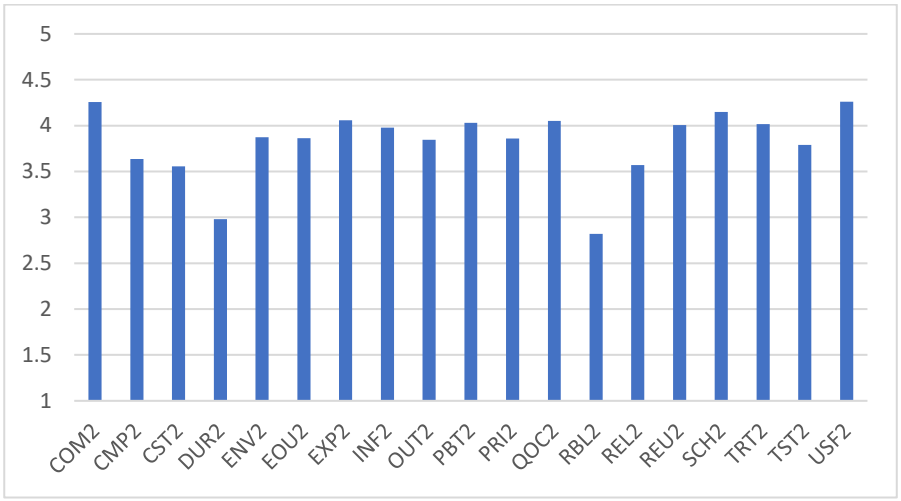

Figure 16: Chart displaying mean values for form 2 results of surveyed measures.

7.3.4 **Study 1: Dimensional nature**

The results of the first survey were also examined to identify the nature of the measurements in relation to the proposed model. The model was examined as both a formative and a reflective model. An alternative model was also developed based on the results and examined. The first model evaluated was based on the original proposed mode.

A SEM model was designed to evaluate the results based on these two different designs. The designs are shown in figure 17 below.

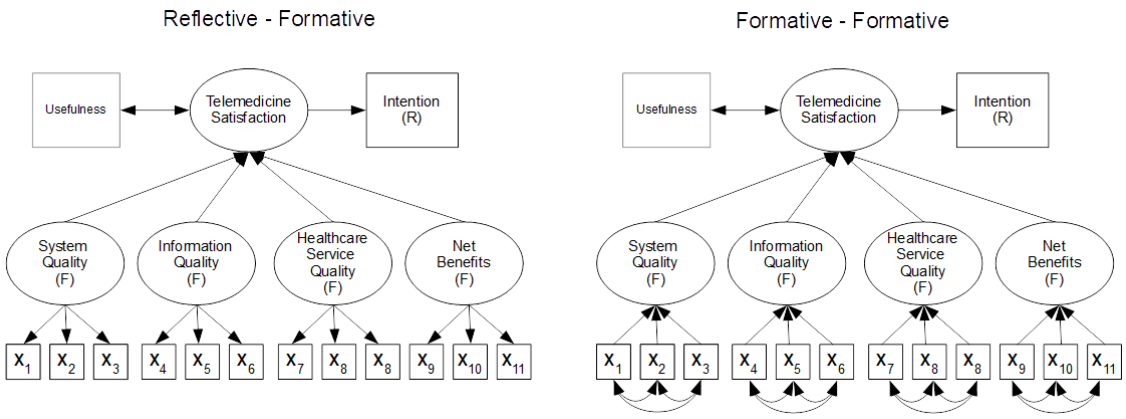

Figure 17: The reflective-formative model (left) and the formative-formative model (right)

The models were developed under the assumption that expectations and reuse informed intention, which were reflective of satisfaction. While the literature suggests satisfaction is not directly observable, it can be potentially indirectly observed through the results of evaluations. In this case the measured results would be an opposition to reuse or disconfirmation of expectations.

First the models were checked independently to examine the loadings of variables for the measured constructs. Items that had loading scores under .5 were removed. The initial item loadings and model results before modifications are in Appendix F.

Following this a comparison was performed to ensure within each model that the measurements corresponded to unique constructs. Table 12 below provides a comparison of the reliability between the two modified models. Full model results are contained in Appendix G. An overview of the models are contained in Figure 18 on the following page

with more detailed figures in Appendix H and I.

Table 9: Comparison of reliability measures

Reflective Formative						**Formative Formative**				
	alpha	**rhoC**	**AVE**	**rhoA**			**alpha**	**rhoC**	**AVE**	**rhoA**
HSQ	0.877	NA	0.503	0.879		HSQ	0.88	0.903	0.512	0.89
INFQ	0.788	NA	0.43	0.801		INFQ	0.809	0.861	0.509	0.821
SYSQ	0.744	NA	0.417	0.746		SYSQ	0.744	0.838	0.565	0.746
NETB	0.776	NA	0.466	0.783		NETB	0.776	0.856	0.597	0.783
USF	0.757	NA	0.609	0.757		USF	0.757	0.892	0.805	0.757
SAT	0.849	0.898	0.689	0.857		SAT	0.849	0.898	0.688	0.858

Due to the nature of relationships different measures are evaluated for different types of constructs. The composite reliability score rho_C is used to examine the reliability among formative measures (Dillon & Goldstein, 1984; S. B. MacKenzie et al., 2011). The rho_A is used to evaluate the reflective measures (Dijkstra & Henseler, 2015). Cronbach's Alpha is also used to ensure reliability. A value for alpha, rho_C and rho_A > .70 are considered adequate. Both models demonstrate high reliability for measures.

The AVE is calculated to examine the convergent validity of measures (Hair, Sarstedt, Ringle, & Mena, 2012). Generally, a .50 score or higher is considered adequate. The results indicate good performance for the formative model following removal of items with poor loadings. The model did not demonstrate the same performance for the reflective formative model indicating poor convergent validity for INFQ, SYSQ, and NETB. An attempt was made to further refine the indicators by removing items below the .70 threshold, but the AVE performance remained the same. For comparison purposes Table 12 lists AVE scores assuming the .50 threshold for both models.

The heterotrait-monotrait ratio of correlations (HTMT) was used to examine the discriminant validity of measures. Results under .90 are considered to show adequate discriminant validity. Overall, the measures performed under the .90 threshold except for HSQ and SAT in the reflective formative model. However, overlap between the indicators and SAT is expected. Table 13 shows the full results.

Table 103: HTMT results

Reflective Formative						
	HSQ	INFQ	SYSQ	NETB	USF	SAT
HSQ	-	-	-	-	-	-
INFQ	0.899	-	-	-	-	-
SYSQ	0.803	0.832	-	-	-	-
NETB	0.786	0.754	0.837	-	-	-
USF	0.754	0.715	0.796	0.889		-
SAT	0.921	0.826	0.84	0.807	0.863	-
Formative Formative						
	HSQ	INFQ	SYSQ	NETB	USF	SAT
HSQ	-	-	-	-	-	-
INFQ	0.883	-	-	-	-	-
SYSQ	0.802	0.833	-	-	-	-
NETB	0.842	0.758	0.837	-	-	-
USF	0.78	0.715	0.796	0.889	-	-
SAT	0.897	0.802	0.84	0.807	0.865	-

Bootstrapping was used to further examine the significance of the individual models (Henseler & Chin, 2010). The full bootstrap results are reported in Appendix G. For the reflective formative model INFQ, SYSQ and NETB contained the null value between the 2.5-97.5% CI. For the formative formative model INFQ and NETB contained the null value between the 2.5-97.5% CI.

The path coefficients of the model were also examined. Overall, both models demonstrated an R^2 and adjusted R^2 above the .70 threshold typically used. Results were obtained for R^2 on both usefulness and satisfaction for both models. For the reflective-formative model an $R^2 = .939$ and adj. $R^2 = .883$ were obtained for the satisfaction measurement. For the formative-formative model an $R^2 = .759$ and adj. $R^2 = .757$ was obtained for satisfaction. The results are reported in figure 18 below. In general results between $.30 < R^2 < .60$ are considered moderate effects whereas $R^2 > .60$ are considered high (Sanchez, 2013). Both models demonstrated high effects for the Satisfaction construct.

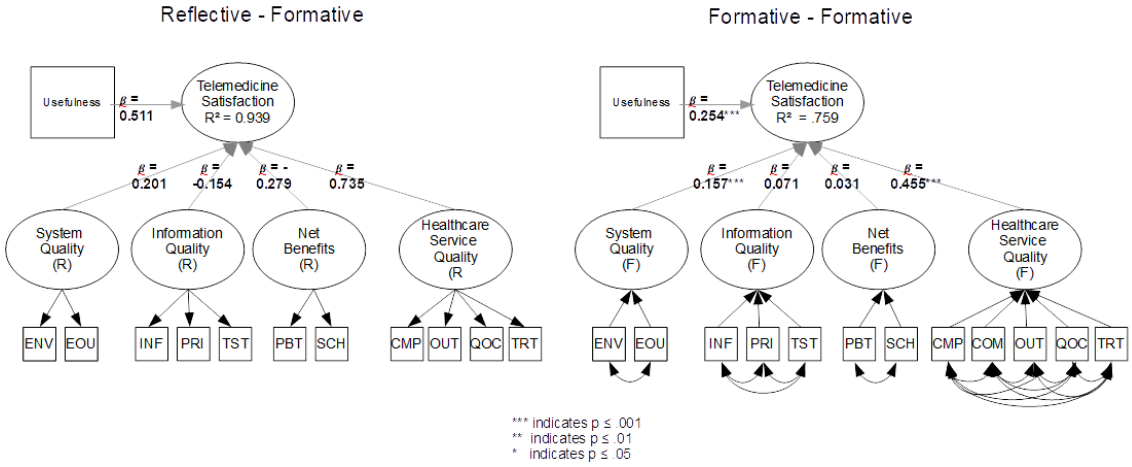

Figure 18: The reflective-formative model (left) and the formative-formative model (right)

7.3.5 **Study 2: Measurement results**

The second survey conducted at the ZVAMC contained two measurement forms, a questionnaire for demographic information and a single measurement question about overall satisfaction. In total 75 surveys were completed. Because a paper copy was used several of the items either did not contain data or contained written results that were illegible.

An analysis was conducted to examine variations in the reported results and measure internal consistency. This was done to investigate whether a different effect would be noticeable for this population. This was completed using a cleaned version of the form which removed any responses that were not fully complete. This left 61 results. The Cronbach alpha measures calculated for form one was α =. 8667 and for form two was α = .8908. Like the online survey the results were both above the .70 acceptance rate and below the .9 rate that would suggest additional repetition. The rates did not suggest a major difference between the internal validity of the measures from the online survey.

The results of alpha between forms α = .9339 suggest similarly high internal validity however also implies unnecessary repetition. This suggests that certain measures between forms closely match. A comparison between the reported responses shows some similarities between forms but also some differences in certain measures. Overall satisfaction scores were high. Summary charts of the mean values obtained are shown in charts 17 below and chart 18 on the following page.

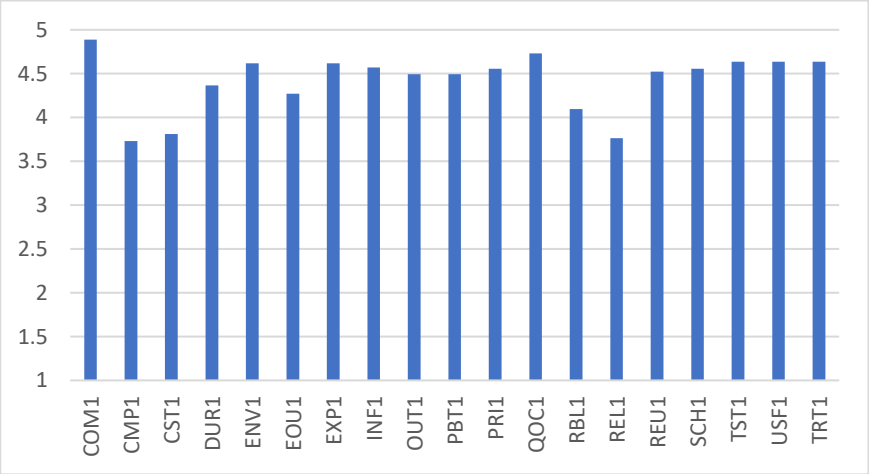

Figure 17: Chart displaying mean values for form 1 results of ZVAMC measures.

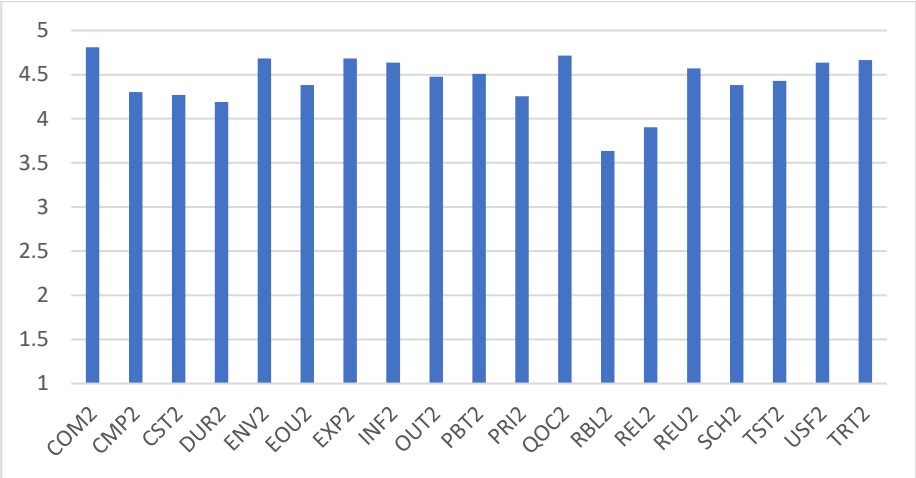

Figure 18: Chart displaying mean values for form 2 results of ZVAMC measures.

The results were also computed for the overall satisfaction single-measurement item. The overall satisfaction rating was relatively high with a mean of 4.67. The results are displayed in table 14 below.

Table 11: Results of ZVAMC single-item measure of overall satisfaction

count	mean	std	min	25%	50%	75%	max
61	4.672131	0.539176	3	4	5	5	5

7.3 Research Findings: Evaluatory

The objective of this phase was to examine provider perspectives on the potential value that dimensional considerations could provide decision makers. This was accomplished by conducting a series of semi-structured interviews with medical providers at the ZVAMC. In total 9 medical providers were interviewed.

All the medical providers were involved in offering telemedicine services as the

ZVAMC. The results were analyzed using a thematic analysis. As there were differences in the reported satisfaction measures per form, it was decided to use the first form version. The first form had a greater variation in reported scores, and it was felt that seeing a greater variety in scores would spur a more relevant discussion. A thematic analysis can be conducted using the following steps (Braun & Clarke, 2006):

1. Familiarize yourself with the data.
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Producing the report

The following subsections will discuss each of these steps in the analysis of the results.

7.3.1 **Familiarizing yourself with the data**

The first step in thematic analysis involves becoming familiar with the data. To do this the data was first transcribed. A comprehensive transcription of the audio was conducted. The transcription noted pauses, gaggles, laughter, and sounds.

During the transcription process researchers can familiarize themselves with the data as they continue to review and write the results. The data was then reviewed several times to increase familiarity.

7.3.2 **Generating initial codes**

Following the initial transcription, data for participants were grouped together based on the questions and whether they were about dimensional or single-item measures. This was done to simplify the initial analysis and identify patterns in the questions asked.

Participant responses were first broken down and relevant concepts from text extracted. An open coding procedure was conducted to synthesize the results. Table 15 on the following page shows the results of the open coding procedure per question for overall satisfaction.

Table 12: Coding process results from single-item measure of overall satisfaction.

Code	**Properties**	**Example text**
Q1: What do you feel these results mean in regards to the telemedicine services?		
Attached meaning	Deriving meaning outside satisfaction, interpreting, assigned attributes	looks beneficial, pretty effective convenient service
Actionable	Results suggest an outcome, resulting action	I would eat there, should continue to try
Value based	Results based views, views of quantitative meaning	Ranked fairly high, pretty satisfied, very satisfied
Q2: How do you think these results can help you in making decisions about telemedicine?		
Confirmation evaluation	Confirming beliefs, justifying efforts, views of acceptance	Its worked out very well, encouraged to continue using it, we can do what we need to
Utilization evaluation	Encourage to use telemedicine, views service as an option, shapes provider and patient views	Encouraged to utilize it, would be a good option, offer to more patients, patients would be open to more
Rating evaluation	Ratings results are considered, views shaped by results	Not enough information, overall, fairly satisfied, scored high
Continued on following page		

Q3: What kind of decisions about telemedicine do you think these results would help you to make?		
Usage decisions	Shapes views on using, addressing uncertainty	Try at least once, accepting new consult, reservations about scheduling follow up
Rating decisions	Views on what the values represent	For patients it works effectively, most satisfied, we're doing something right
Decision challenges	Insufficiency of data for decisions, other data considerations	Not enough data, snippet of information can't draw conclusions
Q4: How valuable do you feel these results are to decision making and what kind of value do you think you can get from them?		
Experience preferred	Personal experiences valued, ownership of decision making, data should not drive decisions	I don't have value, I already know, my own personal, decisions should be made by providers
Limited information	Information deficiencies, additional information needed for decisions	Can't take much from it, not sure, would be nice to know where there's room for improvement
Usage value	Data as a qualifier for usage, encourages usage	Very valuable, important to know, big qualifier, I should continue to offer this option
Reflection and confirmation	Used to evaluate efforts, appeases concerns, eases uncertainty on patient views	Work is worthwhile, no idea patients wanted or appreciated

A similar process was used to examine the interviews on the dimensional results. The results are presented in table 16 beginning on the following page.

Table 13: Coding process results from multi-dimensional satisfaction.

Code	Properties	Example text
Q1: What do you feel these results mean in regards to the telemedicine services?		
Low level itemized	Views of individual items, focus on differences of measures	Easier to get a visit, communication is high, care they received not as good
High level relational	Views of totality of results, lower values influence perceptions of higher values	Lots of pros not many negatives, people somewhat satisfied, they are pretty happy
Rationalization and justification	Rationalize results based on experiences, attempts to determine reasons for reported values	I would agree, I don't know why, I would give it, my experiences, maybe they're getting
Actionable	Resolving issues, make changes to improve, results encourage some action	Room for improvement, maybe we have to, maybe you can give
Q2: How do you think these results can help you in making decisions about telemedicine?		
Confirm option	Confirming existing views or practices	Telemedicine has a place, it's a good option for some patients
Comparing results	Views on face to face versus telemedicine, may be based on reported results	As compared to an actual face to face, practically the same as face to face, they feel care in person is better
Implies action	Results suggest action needed, views of poorer results as areas of improvement, wanting to perfect or improve things	Trying to improve, make some improvements, changes in practice
Rationalize perceived negatives	Attempts to understand why for more negative ratings, explain or rationalize why difference may be occurring	Makes a difference, doesn't convey, face to face you know they can, what the comparison of care
Q3: What kind of decisions about telemedicine do you think these results would help you to make?		
Limited impact	Results have limited impact, based on current views, experience and practice,	Doesn't change my opinion, I already use and like it, I don't know if it would change the way
Uncertain improvements	Acknowledge improvements needed, uncertain on what	Maybe might adjust, potentially make changes, trying to improve

	improvements, willingness to change	the, depends on the patient
Specific ideas	Specifies areas of specific improvement, ideas based on analysis of why problem occurred	Not looking at, being more
Rationalization	Explain or understand behavior, examines data in light of experiences	I don't know if that's because, looks related to how, my experience, then I expected
Q4: How valuable do you feel these results are to decision making and what kind of value do you think you can get from them?		
Analytical	Examine results in term of experience, uses results to identify issues, attempt to understand results	Important to see the problem, not my experience, different type of interaction, conversation different in face-to-face vs telemed
Reassurance	Results used to confirm view, results help reassure feeling,	Reassuring, nice to see they feel, supports why I think
Improvement	Results suggest areas of improvement, identify things to change, seen as improvement as opposed to decision on uses	Help you determine what to improve, improve those, work on the, may improve, can be addressed

7.3.3 **Searching for themes**

The data was then further reviewed using an axial coding process to collate codes into data themes. Relevant data per theme were grouped together. This was done by examining the results for each question in comparison to other questions per group. For example, codes generated for questions under overall satisfaction were compared to each other. Additional themes were then developed by comparing answers between overall and dimensional satisfaction groupings. Distinction between different groupings were made to examine the distinctions and similarities in perceptions between overall and dimensional views of satisfaction. Tables 17, 18 and 19 on the following page shows the results of the

axial coding process that generated themes per grouping for overall satisfaction.

Table 14: Axial coding for overall satisfaction

Axial Codes	**Open codes**
Sufficiency of results	Decision challenges, limited information
Confirming choices on usage	Usage decisions, usage values, utilization evaluation, reflection, and confirmation, actionable
Confirming over shaping views	Experience preferred, confirmation evaluation
Consider results based on attached meaning	Rating evaluation, value based, rating decisions, attached meaning

Table 15: Axial coding for dimensional satisfaction

Axial Codes	**Open codes**
Comparative analysis of results	Low level itemized, high level relational, analytical, comparing results
Rationalize results based on experiences	Rationalization and justification, rationalization, rationalize perceived negatives
Confirming and reassuring beliefs	Confirm option, reassurance
Identifying areas of improvement	Implies action, actionable, improvement,
Levels of improvement	Uncertain improvements, specific ideas, limited impact

Table 19: Axial coding between groupings

Axial Codes	**Open codes**
Confirming choices	confirmation evaluation, Confirm option, reassurance
Experience based decisions	Experience preferred, Rationalization and justification, rationalization, specific ideas, limited impact

7.3.4 **Reviewing themes**

The next step is grouping items and testing them in relation to the coded extracts and

the entire data set. The results of this process are the creation of a theme map. Figure 19 below shows the thematic map generated from the results.

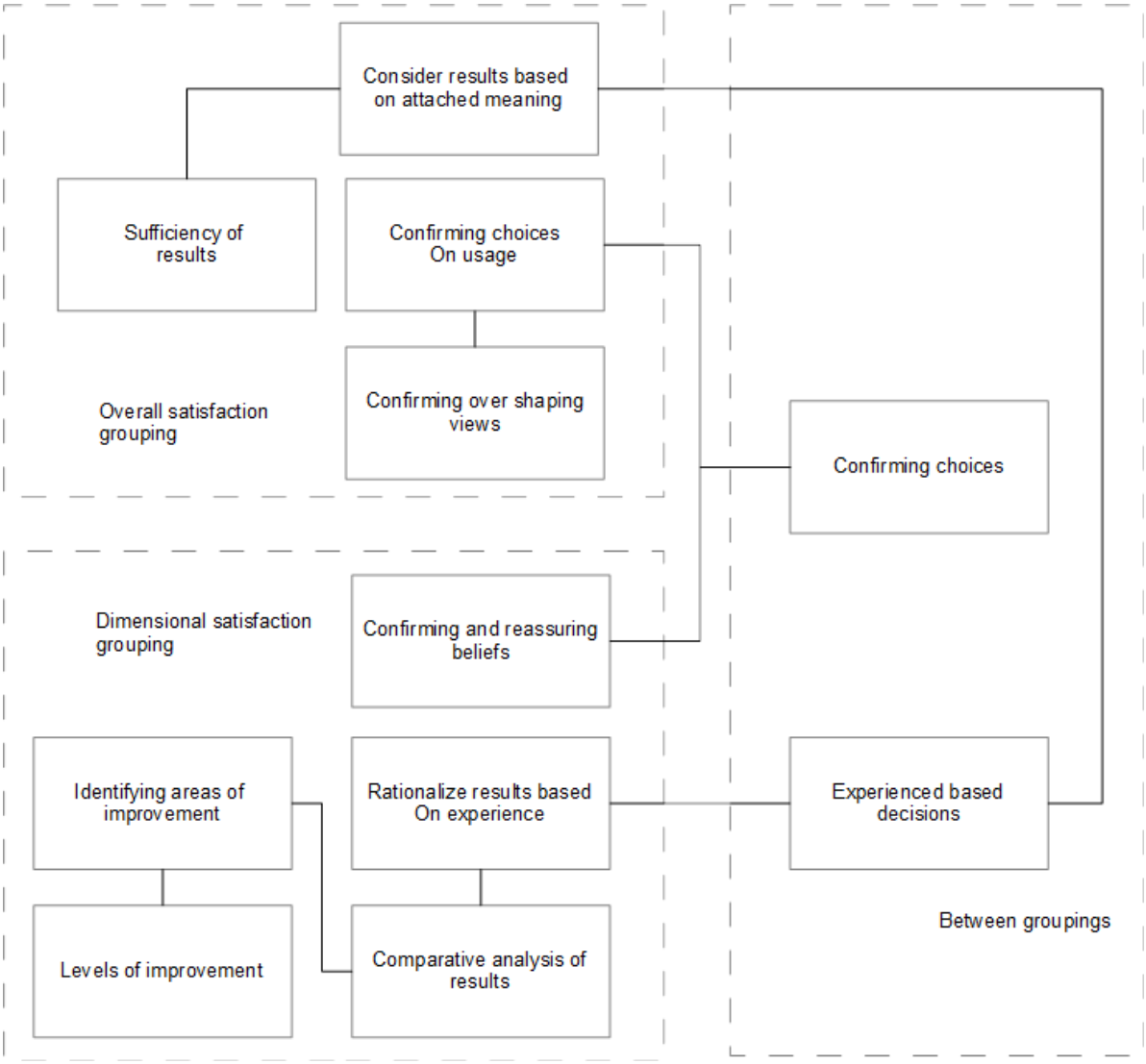

Figure 19: Thematic map derived from axial coding results.

In the mapping the dotted lines are used to represent the item groupings. There were three groupings. Items identified for single measurement responses, items for multi-dimensional responses and items that were repeated in both. The solid lines are used to

indicate some overlap and potential relationships between items. For example, when identifying areas of improvements providers would also indicate potential levels of improvement. Choices were confirmed between both groups but there were differences in how they would manifest themselves based on the groupings.

7.3.5 **Defining and naming themes**

Next results are defined and named. The resulting themes and their relationships between each other were examined. The themes were also defined. Table 20 below shows the results of the defined and named themes.

Table 20: Theme naming and defining.

Name	**Theme**	**Definition**
Single item measure		
Use confirmation	Confirming choices on usage	Results aid in confirming decisions made on the usage of telemedicine
Confirmatory nature	Confirming over shaping views	Providers determine their actions and results are seen as confirming but not sufficient in determining their views
Interpretative analysis	Consider results based on attached meaning	Providers consider the results in light of the meaning they've chosen to attach to the measure
Sufficiency	Sufficiency of results	Limitations the results place on the breadth of decisions and evaluations that can be made
Dimensional measures		
Belief confirmation	Confirming and reassuring beliefs	Results aid in confirming and reassuring beliefs about patients experiences with telemedicine
Explanatory nature	Rationalize results based on experiences	Results that don't conform to the providers understandings are rationalized based on their experiences
Comparative analysis	Comparative analysis of results	Results provide additional depth and breadth that can be analyzed in relation to experiences
Identify improvements	Identifying areas of improvement	Results can aid in identifying areas of and the need for improvement
Improvement levels	Levels of improvement	Results can trigger ideas on types of improvements and can vary from none,

		uncertainty to specific
Applicable to both		
Reassurance	Confirming choices	Results aid in confirming and reassuring providers of decisions
Experiential nature	Experience based decisions	Individual experience is considered stronger driver over decisions than evaluations of results

7.3.6 **Producing the report**

The final step is producing a report that provides a final analysis of the results and to relate it to the research question and relevant literature. This section will describe the relevant details as they relate to the results of the analysis. This will be done by describing the defined themes in additional details. The discussion section will describe the knowledge gained and interpretations in relation to the relevant literature.

As the goals of this part of the research were to understand how decision makers interpret data based on identified dimensions, it was important to compare dimensional satisfaction to single-item measures of overall satisfaction. Based on the interviews it was determined that interpretations can vary based on the measures used and provider experiences. There were also similarities identified between views of measurements. The following sections will describe these and provide additional evidence in detail.

7.3.7 **Overall satisfaction interpretations**

There were several themes that emerged from the discussions with providers on the overall satisfaction measure. Certain views vary based on provider. However, there were several recurring themes between providers. In general providers tend to view overall satisfaction in relation to their experiences to confirm their views on usage. This is

described in table 20 as the use confirmation of the results. For example, one participant states:

“Uh that the patients are satisfied with it that you know it serves its purpose.”

Another states:

“It looks like they’re overall satisfied I agree if this was a restaurant on a Google review, I would eat there”

These views for some providers are not seen as being deterministic of decision making but rather just confirmatory. Table 20 defines the confirmatory nature of these views. This nature is one in which the provider’s own views are the drivers of decisions. Results can be valuable in confirming provider views, but their views are shaped more by their individual experiences. Some providers explicitly state this when discussing the value of measures:

“I think that will be helpful but decisions on which patient should be qualified for telemedicine should be made by provider.”

Other providers discuss these views and the influence of their individual patients and experiences:

“From my own personal (hesitation) I don’t um I don’t have much value with it just because I mean it looks like people may be satisfied but I would have to see what my patient was …”

For other providers, the results seem too limited to make any concrete decisions. The sufficiency of the results can place limitations on the breadth of evaluations and

decisions that can be made. For example, one provider states:

“I don’t know if I can take much from it (laughing) sorry.”

Others clearly state that there is a lack of information in the reported results and additional information would be beneficial. One provider states in answer to the value and decision-making question:

“No. It would be nice to know where there’s room for improvement.”

Still other providers see value in the results and attempt to consider them. These considerations often develop into an interpretive analysis. In this interpretive analysis the providers consider the results but only regarding the meaning they choose to attach to it. This is viewed from descriptions of providers that add additional meaning to what the satisfaction measure entails. For example, one provider states in reply to the meaning of results:

“uh sounds like it’s a pretty effective convenient service.”

Another states:

“Based on this. It looks like it’s very beneficial.”

7.3.8 **Dimensional satisfaction interpretations**

Additional and distinct themes emerged from discussions around the use of dimensional measures of satisfaction. Like the single measure items there were variations in provider views. However, there were also several distinct patterns. For the most part these patterns followed similar types, but their manifestations were different.

Providers held similar experience-based views of the measures and their values. However, instead of the views confirming decisions on usage the views seemed to be directed at confirming the providers beliefs about patient experience with telemedicine. For example, when asked how valuable and what kind of value they could get from the results one provider answered:

"I mean it kind of supports that why I think it's a good option you know for some patients."

Another stated:

"Well I, I guess most of its just reassuring that patients seem to be pretty pleased with it and as I said uh the few categories that score lower uhm that's not been my experience with uhm er not my perceived experience of how patients reacted to when I was uh seeing them."

The nature by which results were reviewed by providers seemed more of an explanatory nature than the confirmatory nature from evaluations of overall satisfaction. This explanatory nature involves trying to understand or explain the reasons for results based on the provider experience. This was observed more on results the provider felt were more negatively rated. For example:

"Well, I think the relationship thing is a little lower than I expected it to be I don't know if that's because they don't feel a connection with the provider over the tele-type visit."

In another example:

"And as far as reliability um I mean this is the screen for it um it it works beautifully on my end and I think it always worked well on the patients."

Providers did consider the variety of results presented and their potential value. The way in which providers considered results was by conducting a comparative analysis that considered the additional value but in relation to their own experiences. For example:

"I think it's important to see what, where the patients see the problem like in this graph that uh the concern of patients on the cost and duration and um patient can be addressed and that may improve for the patient experience with telemedicine"

These analyses were done either at a high level looking at the overall picture of what the measures meant or on a lower more detailed level of the individual measures. Low level views often considered the individual aspects for instance:

"Well, it looks like communication ranks high uh but comparison of care they ranked pretty low so to me it looks like those are the two things that are kind of outliers."

Other participants looked at the how the aspects related to the bigger picture.

"I mean based upon these it looks like it's pretty easy to the ease-of-use there's a lot of pros and not very many negative based upon this graph."

For many participants views of the dimensional satisfaction enabled them to identify areas of improvement and the potential need for some improvements. For example, one participant stated:

"umm well I mean I think if they are valuable, I think if you have this information it can help you determine what things we have to improve upon."

Another mentioned:

"um there's obviously room for improvement…"

Various providers had different views on what the potential for these improvements could involve. There were different levels of improvement that were discussed that ranged from none, uncertain, to specific. Some providers had very specific things they felt could be improved on for example:

“umm just looking at like I said with the comparison of care and the relationship maybe I would say be more interactive with the patients you know not looking at the monitors looking away from the camera and stuff… “

Others provided more general and uncertain ideas of what improvements could look like. For example:

“umm guess I would it would uhh I don’t know if it would change the way that I as far as who I uh you know maybe (pause) might adjust I mean it might change it looks like some of the things they look at is is umm it’s like a lot of it is related to how you communicate with folks over the uh with telemedicine so I guess maybe that would that would you know we potentially make changes to our communication and other things like that”

Still others implied there were no adjustments that the results would encourage them to make, for example:

“it doesn’t necessarily change my opinion of it cause I already use it and like it so”

7.3.9 **Similarities in interpretations**

An overview of the overarching views between the different measurement types was also conducted. There were two main themes that seemed to apply to both. One was the idea that results provided more of a reassurance to providers based on their existing views,

beliefs, and experiences. The other was the experiential nature of views.

Discussions about views and decisions were typically spoken of in terms of the provider experience. While providers seemed open to improvement based on evaluations of dimensional satisfaction, for both measures different providers discussed multiple factors contributing towards their decision making.

Chapter 7. Discussion

Among the challenges with realizing the value of satisfaction measures is that the vagueness in meaning of the term can make it difficult to utilize and interpret results. The vagueness in satisfaction's meaning can be attributed to its multidimensional nature. This research examined this problem in the context of patient satisfaction with telemedicine. This research helped clarify some of the meaning of patient satisfaction in this context. By using a novel mixed method approach this research was able to identify and define several dimensions of satisfaction along with the potential value of examining its dimensional nature.

This chapter discusses the major findings around the identification of satisfaction dimensions, validation of the proposed telemedicine satisfaction model and the value of dimensional considerations from the decision maker viewpoint. The chapter also presents a discussion of some of the studies limitations along with recommendations for future research.

7.3 Analysis of findings

This section provides a more detailed description of the findings and analysis. This research specifically aimed to examine gaps in the literature around the dimensionality of telemedicine satisfaction. It sought to contribute to the knowledge by examining the dimensionality of satisfaction through the following research questions:

Research question 1: What dimensions contribute to patient satisfaction with telemedicine?

Research question 2: How do identified dimensions relate to satisfaction?

Research question 3: How do decision makers interpret data based on identified dimensions?

This section begins with a discussion of the mixed methods phased approach and its value in examining these questions. The section will then discuss how each of the research questions was addressed through specific topics. The measurement and meaning section will describe the effort in examining the dimensions of patient satisfaction with telemedicine and this research's contributions. The telemedicine satisfaction model section will describe the model developed to identify the relationship of dimensions to satisfaction. Finally, the value of multidimensional measures section will discuss the contributions this research made into how decision makers interpret dimensional satisfaction measures and their value.

7.3.1 Mixed methods phased approach.

There remains a lack of variety in methods, particularly those that integrate qualitative findings in telemedicine research studies (AlDossary et al., 2017; Aoki, Dunn, Johnson-Throop, & Turley, 2003). This research contributed to the existing knowledge on telemedicine research methods by demonstrating the use of a novel mixed methods phased approach to examine the research problem. The approach adds on to the traditional exploratory/confirmatory research paradigm by adding an additional component: evaluation of its perceived value (Powell, 2006). Research in the pragmatic tradition seeks to add

meaning to concepts by considering the practical consequences from their formation (Goldkuhl, 2012). It is therefore proposed that pragmatic research not only seek to explore phenomenon that can be used to develop confirmable theory but also attempt to evaluate its practical considerations. In general, the authors of studies often provide their own considerations for the practical implications of research, but how often are these implications evaluated?

The challenges of telemedicine satisfaction evaluations present an ideal test environment for examining this approach. For understanding telemedicine satisfaction, it is important to conduct exploratory research to identify potential dimensions of telemedicine satisfaction, confirm the relation of identified dimensions, and evaluate the relevance of dimensional satisfaction.

The loose definition and lack of testing of satisfaction in telemedicine studies requires exploration to identify the dimensions which inform it (E. Shirley et al., 2016; Williams et al., 2001; Zhang et al., 2014). Defining the meaning of measures and standardizing metrics to evaluate telemedicine is essential for comparing results across different contexts (Zhang et al., 2014). Given the variety of different measurement instruments including study specific questions, it is important that exploratory research seek to identify and define the dimensions that inform telemedicine satisfaction (Weaver et al., 2020). However, identification and defining of dimensions is not enough.

To help clarify the meaning of the satisfaction measure it is important to examine the nature of the relationship between satisfaction and its proposed dimensions. This is due to

the effect of constructs deriving meaning from the indicators that inform it (S. B. MacKenzie et al., 2011). It is therefore necessary to confirm that the identified dimensions relate to satisfaction and the nature of their relationship.

Still beyond the meaning ascribed to satisfaction in its formation is the derived meaning and its actionable consequences. Among the real world challenges in telemedicine satisfaction research is the persistent use of the overall satisfaction measurement (E. Shirley et al., 2016). Yet, the overall satisfaction measurement is thought to be problematic in that its meaning may be difficult to gauge and compare. However, it is unclear how that meaning may differ or remain unchanged from a dimensional view of satisfaction. The meaning of satisfaction can potentially not only be informed by what it consists of and results on the individual level but also how it is viewed by others. Essentially it is possible there is both a derived and interpreted meaning. To understand the meaning of satisfaction it is therefore important to evaluate the implications of dimensional satisfaction's interpretation.

In order to examine these different aspects this research used a multiphase mixed methods approach (Creswell, 2013). The results of the research demonstrate both the practicality of this approach and the potential value of results. Section 4.2 presents the research design model, its rationale and division into exploratory, confirmatory and evaluatory phases. The results showed that using mixed methods can be applied between phases to provide additional insight into complicated phenomenon like satisfaction.

Mixed methods were used between phases in this research. Each major phase of this research used different methods for their evaluations. During the exploratory phase

qualitative methods were used to identify potential dimensions and define them. Grounded theory was used to extract dimensions from existing satisfaction instruments and expert feedback was used to refine them. A quantitative approach was used to refine and confirm the meaning of several dimensions based on non-expert feedback.

The research design allowed the results of each phase to complement subsequent phases and generate novel insights (Schoonenboom & Johnson, 2017). Each phase can be considered separate standalone studies that resulted in deliverables that could inform additional research studies. The exploratory phase discussed in sections 4.4.1 and 5.1 was used to identify and define satisfaction constructs and measures that resulted in a proposed measurement model. The identification of these measurements could aid in understanding the derived meaning of satisfaction. The confirmatory phase discussed in sections 4.4.2 and 5.2 used the results from the exploratory phase to confirm a measurement instrument for measuring satisfaction and the proposed theoretical model. Examining the relationship between constructs in the model allowed for confirming what satisfaction consisted of and what its potential consequences were, i.e., expectations and reuse. The evaluatory phase described in sections 4.4.3 and 5.3 presented the results to providers to evaluate the value of the identified dimensions and compare them to the single item measure of overall satisfaction. The resulting comparison allowed greater insight into the interpreted meaning of satisfaction.

While this research provided additional insight into telemedicine satisfaction, there were several challenges with the multiphase approach. Among the challenges was the

amount of effort required for the research. Conducting a multiphase research study can be time and resource intensive and the practical benefits need to be considered (Creswell, 2013). While there were other potential methods to carry out the research performed in individual phases it is unclear whether the same types of results would be obtained. For example, an existing measurement instrument could have been used to obtain provider perspectives on potential dimensions of satisfaction. The instrument could have been examined for dimensions of satisfaction and provided to providers to compare with overall satisfaction. However, exploratory work would still have to be performed to identify those dimensions and confirm them. While the results of the multiphase mixed methods approach have been applied in this study the extent to which a single phased approach could have obtained similar results is uncertain.

7.3.2 **Measurements and meaning**

There remains a need for research into understanding telemedicine measures and their meaning to help establish more consistent research evaluations (E. Shirley et al., 2016; Zhang et al., 2014). This research contributes to the knowledge by identifying, defining, and confirming measures for different dimensions of telemedicine satisfaction. This research also proposes two reflective indicators that may be useful in further evaluating telemedicine satisfaction: reuse and expectations.

Among the research questions this research sought to answer was what dimensions contribute to patient satisfaction with telemedicine. By understanding the dimensions that contribute to satisfaction greater meaning can be applied to the measure. Research

conducted in the exploratory phase of this study attempted to identify and define potential dimensions of telemedicine satisfaction. The approach discussed in section 4.4.1 yielded several potential dimensions and assigned them meaning. The research proposed four second-order constructs related to telemedicine satisfaction that included system quality, information quality, healthcare service quality and net benefits. The research identified seventeen possible first order constructs that informed them.

Based on the evaluation conducted during the confirmatory phase the research was able to confirm several measures and link them to definitions that added meaning. While not all the proposed measures were well defined based on the resulting CSV values, the approach allowed for comparisons and selection of the best matching results. This is demonstrated in section 5.2.1. Except for provider benefits the results show a match at the PSA level above the .60 threshold for at least one measure for each construct. This means that for every construct there is at least one identified measure which participants felt correctly matched its defined meaning.

The challenge with the measures is that for several the CSV values suggested that the measure could be viewed as closely tied in meaning to other measures. Measures such as technical support, outcome, provider benefits, end user support, and treatment all had CSV values below the agreed upon threshold. This could potentially affect the meaning of their relationship and suggest a stronger tie to other measures either within or outside the identified construct.

Consider for example the evaluation of the formative formative measurement model

in section 5.2.4 of the confirmatory phase. Based on the evaluation the net benefits construct showed a lack of significance and poor loadings for two of the constructs in both models. This suggests that likelihood that the measures either do not share a similar theoretical meaning or that the measures are specified so loosely that they are closer in meaning to other potential measures. The proposed construct consists of cost, duration, scheduling and provider benefits. Yet only provider benefits had a low CSV value and remained an indicator along with scheduling. Given the strength of the CSV values for the other constructs it is possible an error occurred in considering their relationship together as part of a single satisfaction dimension.

On the other hand, it is possible that the low CSV values constituted an overlap that can strengthen the convergence between indicators. Consider the health service quality dimension. Three of the measure's treatment and outcome both had a CSV below the threshold. This suggests that there is likely overlap between each and other measures. As all are related to some aspect of medical care it is likely this strengthens their relationship. However, this is not considered as problematic as they still contribute to the same theoretical dimension. In other words, regardless of the overlap in the measures, they are perceived to still contribute in a similar fashion. Where this could be problematic is in the case of dimensions that are included, whose measures overlap, but do not contribute to the same construct as they will reduce the strength of convergence indicators. The effects of this on the measurement model and its implications will be discussed in section 6.1.3.

Despite the challenges the measurements demonstrated robustness in their

relationship to the proposed intention indicators of experience and reuse. The intentions of users are often considered in various IS models that consider satisfaction (Delone & McLean, 2003; Wixom & Todd, 2005; Xu et al., 2013). This research identified two potential aspects of intention that should be further considered in telemedicine satisfaction research.

The dimension of reuse identified in this research can potentially be considered an aspect of intention. Identifying a meaningful reflective measure of telemedicine satisfaction can aid in further developing models and theory around its manifestation. Previous research has examined the value of reuse as an indicator of intention (Li et al., 2012). This research adds additional insight by examining its use as an indicator of telemedicine satisfaction. Further research on the role of reuse and its relationship with satisfaction can potentially provide greater insight.

An additional dimension identified as an important consideration for satisfaction was the concept of expectations. Expectations has played a role in various theories and models on satisfaction in marketing and business research (Cardozo, 1965; Festinger, 1962; Oliver, 1977; Olson & Dover, 1979; Swan & Trawick, 1981). Studies have also described the role that it plays in satisfaction and its additional complexities (Nguyen, Waller, Pandya, & Portnoy, 2020). However, during the exploration of existing telemedicine satisfaction measurement instruments it was not initially identified by the research team as being a considerable measure. It is not certain if the research team misidentified or did not place value in its usage in instruments or if it is just not widely evaluated in other instruments.

The measurement nonetheless was identified by veterans as playing a role in their satisfaction. Measurements of it in the general population and the resulting analysis confirmed the strength of its ties to other reported measures of satisfaction.

The identification of dimensions is important as the need for identified and agreed upon dimensions and measures for telemedicine satisfaction has been an ongoing and unaddressed issue in the telemedicine satisfaction literature for decades (E. Shirley et al., 2016; Williams et al., 2001). While this research is not likely to result in an agreeable set of measures it will contribute by expanding on the knowledge of existing measures and potentially help identify more consistent themes in relevant measures.

7.3.3 **Telemedicine satisfaction model**

Among the questions this research sought to investigate was the relationship between the identified theoretical constructs and satisfaction. Due to the limited agreement on the meaning of satisfaction and what it consists of, there is a need to understand which dimensions actually inform it and how they relate to satisfaction (Williams et al., 2001; Zhang et al., 2014). This research contributed to the knowledge in this area by developing and examining a theoretical telemedicine satisfaction model based on construct relations from the previous IS, telemedicine and marketing research (Cardozo, 1965; Delone & McLean, 2003; Festinger, 1962; P.-H. Hu, 2003a; Wixom & Todd, 2005; Xu et al., 2013).

This research developed a proposed model of the relationship between dimensions and satisfaction. During the exploratory phase, several potential telemedicine satisfaction dimensions were identified. Based on an examination of theoretical models in the literature,

a model was developed to explain the dimensions of satisfaction and their relationship to constructs that inform them. The model considered satisfaction as formative or caused by other underlying dimensions (Law & Wong, 1999). Based on previous studies this research did not consider whether the satisfaction dimension itself may have been reflective of its underlying dimensions. It is possible satisfaction has a more complex relationship when it comes to other dimensions. For example, satisfaction may be caused by certain dimensions while contributing towards or being reflective of others.

The proposed model considered a simple form of the underlying proposed dimensions of satisfaction. This was done for two reasons. First was to examine whether the relation of the satisfaction dimensions to their determinants would affect the strength of the model in relation to intention and if an alternative would provide a better fit. This was mainly because while the research suggests the nature of satisfaction is formative of its underlying dimensions, there are few studies that consider the actual relation of other constructs to their indicators. The formative view of the model suggested that the identified dimensions combined as a satisfaction measure were reflected in views of the intention measures.

The second reason was to assist in examining the effect of the identified CSV issue discussed in section 6.1.2. By nature a formative measure is considered highly dependent on its underlying constructs (S. B. MacKenzie et al., 2011). In a formative model a missing antecedent or misspecification could fundamentally change the meaning of constructs and their relationship to latent constructs in a model (Collier & Bienstock, 2009). On the other

hand, reflective measures are indicators that can potentially be influenced by other factors. Missing indicators may not necessarily change the overall strength of the model. Both versions of the model performed above the $R^2 > .70$ cutoff indicating an acceptable performance for satisfaction. This is described in section 5.2.4. However, the reflective formative model demonstrated a lack of significance and convergence for several of the constructs. This suggests that the indicators examined are better viewed as informing satisfaction as opposed to being informed by satisfaction. Only the formative formative model demonstrated statistical significance for measures. This included usefulness, system quality and healthcare service quality.

While the model contains similarities to parts of most major satisfaction success or acceptance models there are some key contributions this study makes. First this research examines and provides evidence to suggest a similarly structured model may be successfully applied to patient satisfaction with telemedicine. The P. J.-H. Hu (2003) attempted a similar effort in modeling telemedicine system success. In the telemedicine system success model satisfaction is viewed as relating to input data quality, system quality and information quality. While this research did not specifically identify input data quality, it is possible additional dimensions or regroupings could introduce that element.

This research did however expand on the understandings of additional dimensions that should be considered when modeling patient satisfaction with telemedicine. This research specifically demonstrated the value of a health service quality dimension. While service quality has been examined in IS models this research has identified it in

telemedicine and has been able to quantitatively demonstrate its influence on satisfaction. Further, the first order constructs which were used to model it consisted of measures that fit descriptions by Linder-Pelz (1982) of distinct dimensions of the provided healthcare service. Although other elements traditionally described in IS were included in the model such as system quality and information quality, the proposed model did not identify dimensions unique to a service quality outside of the healthcare space. This implies that the service that is viewed as provided by telemedicine is the healthcare service and not necessarily the technical service. This can have different implications particularly on the ways in which patients view telemedicine. It is possible that some patients do not view the tele aspect of telemedicine and simply view it as medical care. This research also demonstrated value in both the usefulness and system quality dimensions. For system quality the ease of use and environment in which the service is used are significant indicators. There was however no significance shown for the information quality or net benefits dimensions.

7.3.4 **Value of multidimensional measures**

For the results of satisfaction to have value in the decision-making process there must be some meaning attached to the measurement. While additional measures of satisfaction can potentially clarify and add additional context to the measures its impacts are uncertain (Vaezi et al., 2016; Zhang et al., 2014). This is important as an aspect of the meaning of satisfaction, as discussed in section 1.2 and chapter 2, is its interpretation. This research sought to contribute to the knowledge of the evaluation of dimensional satisfaction

by conducting a comparative study between provider views of single-item and multi-dimensional measures. The focus of this analysis was on understanding how decision makers interpret the results from the identified dimensions.

The evaluatory phase of this research provided additional insight into provider perspectives. During this phase results were obtained that led to the identification of eleven themes that describe provider perspectives on the measurements. There were both differences and similarities in the identified themes between measurement types. In general providers described their decisions and views of the measurements in relation to their experiences. This reliance on experience provides a more subjective view of the meaning of the results of satisfaction.

The subjectiveness in the meaning attached to the satisfaction measure was more apparent during provider evaluations of the overall satisfaction construct. This provides additional evidence to the challenges described with understanding the meaning of the satisfaction measurement as described in the literature (Manary et al., 2013; E. Shirley et al., 2016; Zhang et al., 2014). The qualitative findings from this study also provide a more descriptive view of the results of those challenges. As opposed to just being uninterpretable, these results can potentially be viewed by some providers as actionable based on whatever meaning they ascribe to them. While this can increase the potential for poor decision-making, providers supplement these decisions based on their experiences and direct feedback from participants. However, this does not alleviate the potential negative impacts on systems. For example, one provider described their evaluation with satisfaction as “you

know if they aren't satisfied, because they won't use the service again". The results suggest these views are shaped in part by the lack of sufficiency in the results in providing analyzable information.

Views of dimensional satisfaction also contained subjective interpretations, but the types of interpretations differed. For multidimensional satisfaction, the interpretation of measures was more comparative and analytical. The results are compared to other reported results in addition to provider experiences and beliefs. Unlike the unidimensional measures these interpretations allowed for more directed views of improvement. Providers were able to identify the need for improvement as well as specific areas in need of improvement.

While the unidimensional measure may suggest a need for improvement no evidence of that was observed. It is likely that this is because the single value measurement was high and did not allow for additional insight into the need for improvement. However, the results of telemedicine satisfaction research often demonstrate high levels of satisfaction (Nazi, 2010; von Wangenheim et al., 2012). As demonstrated in this research a high overall satisfaction view can obstruct views of underlying aspects of dissatisfaction. For example, had it not been for the dimensional views of satisfaction, providers at the ZVAMC may not have considered a need to improve areas such as provider / patient relationship. That is, unless of course, they themselves have experienced and acknowledged it.

The research results suggest that the value that providers place on satisfaction depends on the measures they are provided as viewed through the lenses of their experiences. The experiences were used differently in evaluations based on the measure

provided. For single-measure items they became a confirmation of decisions made to use telemedicine. For the dimensional measures results were described as confirming certain beliefs or past experiences with telemedicine. In the cases of negative results, providers attempted to understand and explain them.

It is unclear as to the extent to which these results may apply to other providers in other facilities. Among the challenges with qualitative findings such as this, is that they may be limited by contextual factors (Howarth, Devers, Moore, O'Cathain, & Dixon-Woods, 2016). This presents challenges as to the generalizability of the findings, particularly in cases where small sample sizes are limited to single locations. It is possible that the way in which the ZVAMC medical providers view satisfaction is different from the way other medical providers view satisfaction.

However, the goal of this portion of the research was not to confirm or explore the problem in further detail as much as it was to evaluate it. This the study was able to demonstrate that at least among some medical providers, there are differences in perceptions of the meaning of dimensional and overall satisfaction. This suggests that there is a potential added value in its evaluation. This research also provides additional insights as to what the potential differences may be that future research can further develop. These understandings can not only inform additional patient satisfaction research but can potentially provide additional insight into provider decision making on adoption and satisfaction with telemedicine services (Menachemi et al., 2004).

7.3 Study Limitations

This research aimed to contribute to the knowledge by specifically identifying, examining, and evaluating dimensions of patient satisfaction with telemedicine. This research examined a broad range of dimensions that contributed to satisfaction including service, information and system attributes (LeRouse et al., 2004). However, the scope of this research was limited to evaluating dimensions that had previously been identified and under which there is some agreement. This was done to aid in future studies looking to standardize dimensions, as currently there is no agreement on which dimensions contribute to satisfaction with telemedicine (Zhang et al., 2014).

This study aimed to identify the dimensions, provide an initial evaluation and insight into their usefulness for decision makers. This study only attempted to identify and provide initial evidence for the dimensional distinctions. This study did not attempt to fully refine each construct. It is possible that some constructs identified themselves may be multidimensional or not fully explored. This will be left up to future research to explore.

There are several limitations to the research methods that future research should consider. Some of these have already been addressed in the previous sections.

While the research was able to identify and provide evidence for several distinct telemedicine satisfaction dimensions there are possibly other dimensions not considered. However, as the measurement model was able to explain a large part of the variance in measurements the impact of missing constructs is seen to be minimal. Further the similarities between the proposed model and well-established theory on satisfaction and its

relationships suggest the model and data explain important considerations in the dimensionality of satisfaction.

In addition, the meaning of some measures may also overlap with other constructs. For example, two measures that may have an impact on telemedicine satisfaction are views of insurance and travel. However, measures such as cost, and location as described by environment were considered good enough indicators that there would be considerable overlap in their meaning. It is assumed this would apply to other measures as well.

A valid criticism of this research is the wording of some measures. This research originally began under the assumption that the pre-validation of these measures would provide a stronger fit in the long run, in terms of reliability and validity. Similarly, a critique could be made about the measurement confirmation based on the selected population. While results in the confirmatory phase showed overlap in some measures as measured by CSV, the results obtained from the evaluated model suggests the impact may have been minimal based on grouping.

A critique of the evaluation approach is that the model was primarily developed based on existing theory and assumptions as to the relationship between measures and satisfaction. While other statistical methods such as PCA may have been able to provide a better fit for the existing data, this research selected PLS to provide a better fit for established theory. While future research should consider other potential models, it is important that well established and tested theoretical understandings are addressed.

Finally, the generalizability of certain findings may need improvement. The model in this research focused more on United States telemedicine users who had online access. It is uncertain whether other demographics will have similar responses. Further, while results such as those obtained in the evaluatory study may be more contextual, the results of each aspect of this study were designed around providing insight into the research questions that future research could expand upon.

Chapter 7. Conclusion

As a loosely defined construct that is often not fully specified, satisfaction remains a difficult measure to interpret and use to gain useful insights. This research sought to contribute to the knowledge in addressing this problem by examining the dimensional nature of satisfaction and the value of its interpretation. Based on the results of this research several key contributions were made.

First this research was able to contribute to the knowledge by specifying several dimensions that inform satisfaction and provide evidence to suggest their relationship. This research provides evidence to support the view of patient satisfaction with telemedicine existing as a multidimensional construct that is formed from evaluations of dimensions that include evaluations of constructs related to system quality, healthcare service quality, and usefulness. This research was inconclusive on the extent of contributions of dimensions identified as net benefits and information quality. Further, the satisfaction dimension can potentially be viewed from its impact on a patient view of whether the service met their expectations and their considerations of reusing telemedicine.

Second this research was able to provide insight into challenges with interpreting and using satisfaction in evaluations. This research contributed to these understandings by demonstrating that different subjective interpretations of satisfaction's meaning can result between evaluations of dimensional and single measures of overall satisfaction.

Finally, this research was able to demonstrate the use of a multidimensional phased approach for exploring, confirming, and evaluating research theory. Further implications of

this research and recommendations are discussed in the following sections.

7.3 Study implications and contributions

The results of this research provided several contributions that contribute to both the theory and practical considerations of telemedicine satisfaction measurement. This section will discuss the implications and contributions of these research to both aspects in the following subsections.

7.3.1 Practical considerations

The increasing usage of telemedicine following the COVID-19 pandemic has created a growing need for evaluating offerings (Smith et al., 2020; Ye et al., 2021). However, despite decades of research into telemedicine satisfaction there are few guidelines for its evaluation. While the literature contains many examples of measurement instruments and its evaluation, there are still no commonly accepted guidelines as to what measures should be used or what they are meant to identify (Hajesmaeel-Gohari & Bahaadinbeigy, 2021). The results of this research can aid both researchers and practitioners by providing additional clarity to satisfaction measures, artifacts for evaluating telemedicine satisfaction, insight into provider perspectives and a novel approach for exploring, confirming, and evaluating research problems.

First the results of this research have provided additional insights into aspects of telemedicine satisfaction. The results have identified nineteen constructs that can be used in evaluating or understanding telemedicine satisfaction. These constructs and the dimensions they inform are described in section 5.1. Section 5.1 provides an overview of the

relationship between these proposed measurements and their expected meaning. As there is a lack of well identified dimensions and agreement on their meaning, researchers and practitioners can use these descriptions to compare and understand the potential meaning behind the measures they are using. The measures and the dimensions they inform can also serve as descriptions that can help inform and define future measurements or attempts to standardize measures.

A measurement instrument for evaluating the identified constructs is provided in appendix A. Unlike other instruments developed these meanings are informed by a combination of expert and non-experts. While the wording of several of the measurements can use refinement, the proposed model has demonstrated an acceptable reliability for examining satisfaction as a measure that reflects intentions reuse and expectations. While there are other instruments that may provide better performance, this instrument can be used to evaluate the telemedicine satisfaction construct further.

Finally, this research has described and demonstrated a novel research design. The approach integrates both qualitative and quantitative methods in the development of measurements for examining theoretical constructs. The combination of exploratory, confirmatory and evaluatory phases allowed researchers to investigate, model and obtain additional insight into the satisfaction dimension. By separating research into multiple unique phases research can be organized in a manner that allows results of a single phase to inform future and separate research studies. This model can assist other researchers in examining new methods for integrating qualitative research into telemedicine studies

(AlDossary et al., 2017; Aoki et al., 2003).

7.3.2 **Theoretical considerations**

Throughout the years there have remained gaps in the understanding of satisfaction as a measure Griffiths et al., 2007; Lindgaard & Dudek, 2003). While this research has attempted to provide insight into satisaction with telemedicine the theoeretcial implications of this resarch may provide new insight and theory beyond telemedicine.

Among the challenges in satisfaction research in general is the quest to understand the meaning behind the construct (Griffiths et al., 2007; Lindgaard & Dudek, 2003). To address this challenge this research described a multiphase approach that is made up of an exploratory, confirmatory and evaluatory phase. While evaluatory research is not new, the integration of it using the approach described in this study may be novel (Pawson & Tilley, 1994). The evaluatory process as proposed in this research should not be viewed as a confirmatory process in which the value of knowledge is viewed as valid or invalid. The evaluatory process should be viewed in a manner that helps inform and build on the implications of the knowledge. Evaluation makes no implications as to whether knowledge has value or is worth obtaining. Instead, the evaluatory process seeks to understand the implications of the knowledge, open new lines of questioning into its value and examine whether those implications need to be re-examined.

This research provided a proposed model for telemedicine satisfaction. The identified model was demonstrated to perform at an acceptable level for the identified dimensions except for net benefits and information quality. The model demonstrates the relevance of

additional influences of telemedicine satisfaction that are not typically described in telemedicine satisfaction research. This model builds on previous IS theory by integrating a health service quality dimension (Griffiths et al., 2007; Lindgaard & Dudek, 2003). The lack of identified measures around a technical or other service quality suggests patients may view the health service as playing a more critical role in their satisfaction than the technical service. The importance of health service for patient evaluations is discussed in section 2.2. As the LeRouse et al. (2004) model indicates, the technology serves as a bridge between patients providers and institutions. Our research could suggest that this bridge may indeed be more transparent and that patients may feel the healthcare services plays a more critical role in shaping their views. However, it is also important to consider that components of the model may be over specified, or additional factors are not considered. Future research should examine this further.

This research also builds on previous studies by integrating both reuse and expectations into the satisfaction evaluation model. The results demonstrate the value of examining these constructs as reflective of the underlying satisfaction dimension. The results suggest that these indicators have a strong relationship with other perceived indicators of the satisfaction construct. The significance of this should be further examined as their validation may assist in providing reflective indicators that can be used as comparators for the satisfaction construct in measurement models.

Finally, research has also provided insight into provider perspectives of evaluations of the satisfaction construct. The research demonstrates differences and similarities of

provider evaluations based on the type of measurements used. This is an important consideration as it suggests that single measurement items may not provide the same impact on decision making as multi-dimensional views of measurements. This can have theoretical implications on the meaning of single measurement items and whether they are indeed good enough measures or not.

The results were also used to develop a thematic mapping that can potentially aid in information additional theory on provider perspectives. The tables provided in section 4.3 provide listings that can help those interested in understanding views of telemedicine satisfaction gain additional insight. The results suggest that providers have different views depending on the satisfaction measure. The results also suggest that providers have evaluation criteria that depends on their experiences and that results of satisfaction evaluations may not directly lead to decisions but may instead serve to confirm beliefs and choices. These themes should be further explored.

7.3 Recommendations for future research

Several areas of future research and improvements to the research model are suggested. First there is a need to identify any potential missing measures or dimensions they may inform. While the current instrument may provide an overview of the satisfaction construct it is possible additional measures may strengthen the results. Further it is important to consider refinements to the measurements used. As discussed, there are concerns with measurements that can potentially be further improved on. Similarly, the proposed model can potentially also be improved on. While dimensions have been

examined that follow results identified in traditional IS theories, there may be additional dimensions that are context specific or otherwise not defined that can add value to the existing model. Additional research should also consider other models that expand on the interrelationship between dimensions of both the satisfaction measure and other measures such as usefulness that inform satisfaction. Finally, additional research should be conducted on examining and verifying the results obtained from the evaluatory phase of the research project on provider perceptions of the meaning of satisfaction. This can help confirm the examined differences between provider perspectives and the expectations of other decision makers and patients.

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Appendix A – Patient satisfaction with telemedicine questionnaire

Dimensions of Patient Satisfaction Questionnaire

Please circle the number of the response that best fits your views of the service you have received

		Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1	Telemedicine cannot save me any money	1	2	3	4	5
2	The amount of time I was allowed to spend with the provider was not long enough to deal with everything I wanted	1	2	3	4	5
3	I was given all the information I wanted about any continuing medical services I might need	1	2	3	4	5
4	Sensitive data is protected from those who should not have access to it	1	2	3	4	5
5	Would you suggest this form of treatment to someone else with your condition?	1	2	3	4	5
6	The telemedicine appointments you make are set up quickly	1	2	3	4	5
7	I cannot always trust the equipment to work	1	2	3	4	5
8	When speaking with my medical providers I have been shown kindness and respect	1	2	3	4	5
9	I cannot be examined over telemedicine as well as I can by seeing a physician in person	1	2	3	4	5
10	Because of our close ties this physician knows all about me	1	2	3	4	5
11	I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
12	As an outcome of your care do you feel you are now better able to deal with your illness?	1	2	3	4	5
13	I am getting the technical help I need by staff to access and use the telemedicine system	1	2	3	4	5

Dimensions of Patient Satisfaction Questionnaire

Please circle the number of the response that best fits your views of the service you have received

		Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
14	Telemedicine can help my provider perform their jobs	1	2	3	4	5
15	Telemedicine is useful	1	2	3	4	5

		Strongly Dissatisfied	Dissatisfied	Uncertain	Satisfied	Strongly Satisfied
16	Satisfaction with the medications, therapy and advice you were given to treat your illness	1	2	3	4	5
17	How satisfied were you with the location?	1	2	3	4	5
18	Skill of provider: Ability to diagnose problems, thoroughness of examinations, skill in treating your condition, and scientific knowledge	1	2	3	4	5

		Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
19	Telemedicine met my expectations	1	2	3	4	5

What did you expect from the telemedicine service?

Dimensions of Patient Satisfaction Questionnaire

Please circle the number of the response that best fits your views of the service you have received

		Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1	Telemedicine reduces the price of health care	1	2	3	4	5
2	Do you feel you were provided all the information you wanted during your visit to understand your medical condition?	1	2	3	4	5
3	I will continue using the telemedicine system	1	2	3	4	5
4	I am as satisfied receiving care with telemedicine as I am receiving care in person	1	2	3	4	5
5	I can't always trust the equipment will work	1	2	3	4	5
6	When communicating with my medical providers I have been shown respect and kindness	1	2	3	4	5
7	Because of our close relationship this physician knows all about me	1	2	3	4	5
8	I believe that most people would learn to use this system very quickly	1	2	3	4	5
9	As an outcome of your care do you feel you are better able to handle your medical issue?	1	2	3	4	5
10	I am getting the technical help I need by staff to access and use telemedicine	1	2	3	4	5
11	The amount of time I spent with the provider was not enough to deal with everything I wanted to	1	2	3	4	5
12	Telemedicine can assist my provider in performing their job	1	2	3	4	5

Dimensions of Patient Satisfaction Questionnaire

Please circle the number of the response that best fits your views of the service you have received

		Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
13	Sensitive information is kept from those who should not access to it	1	2	3	4	5
14	The telemedicine appointments you make are scheduled quickly	1	2	3	4	5
15	The Telemedicine service is useful	1	2	3	4	5

		Strongly Dissatisfied	Dissatisfied	Uncertain	Satisfied	Strongly Satisfied
16	How satisfied were you with the rooms and facilities?	1	2	3	4	5
17	Provider skill: Scientific knowledge, thoroughness of examinations, ability to diagnose problems, and skill in treating your condition	1	2	3	4	5
18	Satisfaction with the therapy, advice and medications you were given for your medical condition	1	2	3	4	5

		Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
19	My expectations of telemedicine were met	1	2	3	4	5

Dimensions of Patient Satisfaction Questionnaire

Please fill in the circle next to the response that best describes you

Demographics

Please specify your gender

○ Male ○ Female ○ Oth _____

What is your current age?

○ 18-20 ○ 21-30 ○ 31-40 ○ 41-50 ○ 51-60 ○ 61 or older

What is the highest level of school you have completed or degree you have earned?

○ Less than high school degree
○ High school degree or equivalent (e.g. GED)
○ Some college but no degree
○ Bachelor's degree
○ Master's degree
○ PhD or Equivalent

Please specify your race or ethnicity

○ Asian
○ Black or African American
○ Hispanic or Latino
○ White
○ American Indian or Alaskan
○ Native Hawaiian or other
○ Mixed race
○ Oth _____

Have you ever served in the armed services?

○ Yes ○ No

Branch of service (all that apply)

☐ Air Force
☐ Air Force Reserve
☐ Air National Guard
☐ Army
☐ Army National Guard
☐ Army Reserve
☐ Coast Guard
☐ Coast Guard Reserve
☐ Marine Corps
☐ Marine Corps Reserve
☐ Navy
☐ Navy Reserve

Appendix B – Single-item questionnaire

Dimensions of Patient Satisfaction Questionnaire

Please circle the number of the response that best fits your views of the service you have received

		Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1	Overall I am satisfied with telemedicine	1	2	3	4	5

Appendix C – Pretest questionnaire

Instructions for instrument rating

This effort is part of a study on the development and measuring of telemedicine satisfaction. The purpose of this procedure is to help match measurement items with construct definitions. This will aid us in creating a measurement instrument for telemedicine satisfaction.

There are two forms and a definition list included. Review the definition list. Compare the definition list with each item in the form. Write the number of the definition that most closely matches the item on the form. An item can be matched to only one definition per form.

Form 1: Measurement Items	Matching Definition – Write the # of the construct definition that best fits each item on the left
How well the telemedicine staff respected your freedom to protect your information from unauthorized disclosure	
I trust my health care provider with concerns I have even when he or she does not ask	
How satisfied are you with the therapy and/or medications you received for your condition?	
I would imagine that most people would learn to use this system very quickly	
Telemedicine can assist my physician/nurse in their work	
How satisfied are you with the amount of help you received by staff to use the telemedicine system?	
The technical features of the telemedicine system helped you accomplish your tasks efficiently	
Do you feel you were provided all the information you wanted during your visit to understand your medical condition?	
I will continue using telemedicine and recommend it to others	
Telemedicine reduces the hours you spend on health-related issues	
Telemedicine reduces the price of health care	
The courtesy, respect, sensitivity and friendliness shown by medical staff during discussions	
Has your visit ultimately helped you to deal more effectively with your medical conditions?	
How satisfied were you with the rooms and facilities?	
The system is stable in its performance	
The thoroughness, carefulness, and skillfulness in which the provider cared for you?	
I can be as satisfied receiving care using telemedicine as I can be receiving care in person	
The length of time to get a telemedicine appointment	

Construct definitions

Satisfaction with …

1. **Treatment** – The medical treatment or management and care given to a patient to combat disease or disorder.
2. **Environment** - The environment or contextual and physical features in which the telemedicine procedure takes place.
3. **Interaction with provider** - The interactions and communications between the patient and staff providing the medical care.
4. **Relationship with provider** - The closeness or strength of the relationship developed between the patient and the medical service provider.
5. **Quality of care** - The quality and skill through which the provider provides care to the patient.
6. **Information completeness** - Patients feel their ability to access and receive of all the information they deem important about their care, condition, ongoing needs and procedures are adequate.
7. **Medical outcome** - The resulting outcomes of the medical care on the biological/physiological, symptoms, or well-being of the patient.
8. **End user support** - The organizational and technical assistance provided by staff to patients to be able to use the system.
9. **Cost** - Patient perceived cost or monetary expense of using telemedicine.
10. **Scheduling** - The scheduling and waiting for a session with a medical provider.
11. **Duration** - The adequacy in the length of time patients personally spend on their medical care or actual visit with a provider.
12. **Reliability** - The reliability or dependency, accuracy and consistency of the technology used.
13. **Usefulness** - Belief that the technical functions of the system will enhance a user's ability to complete their goals.
14. **Ease of use** – Patients perceive technical features as "user friendly" or easy to use.
15. **Privacy** – Patient's willingness to share personal information and the control they have over private information is adequate.
16. **Comparison of care**– Satisfaction with the telemedicine service in direct comparison to other forms of medical care the patient is familiar with such as in person care.
17. **Reuse** – Patient confidence in re-using telemedicine services, recommending it to others and increasing their use of the system in the future.
18. **Provider benefits** – Patient feels telemedicine provides a direct benefit to their medical providers.

Form 2: Measurement Items	Matching Definition – Write the # of the construct definition that best fits each item on the left
The appointments you make with the telemedicine professionals are obtained quickly	
I have been spoken to with kindness and respect by those who provided my medical care	
How satisfied were you with the quality in which your doctors provided care?	
Because of our ties this doctor knows and cares about me	
I cannot be examined over telemedicine as well as I can in face-to-face visits	
Would you recommend this form of treatment to someone else with your condition?	
Did the technical features of the telemedicine system efficiently help you meet your needs?	
I was given all the information I wanted about the continuing medical services I would need after my telemedicine visit	
I cannot always trust the equipment to work	
I am getting the technical help I need in accessing, using and understanding the telemedicine system	
Telemedicine can help my nurse / physician in their work	
As a consequence of your visit do you feel you are now better able cope with your illness?	
How satisfied were you with the location?	
The amount of time I was allowed to spend with the provider was not long enough to deal with everything I wanted	
Telemedicine cannot save me any money	
Satisfaction with the medical procedures, medications or advice you were given for your condition	
The use of the necessary equipment seems difficult to me	
Sensitive data is protected from those who should not have access to it	

Appendix D – Form 1 descriptive statistics of general survey measured values.

Form 1 general survey results										
	COM1	**CMP1**	**CST1**	**DUR1**	**ENV1**	**EOU1**	**EXP1**	**INF1**	**OUT1**	**PBT1**
count	532	532	532	532	532	532	532	532	532	532
mean	4.272556	2.263158	3.073308	3.293233	4.148496	3.853383	4.022556	3.990602	3.744361	3.966165
std	0.843139	1.139232	1.309203	1.304963	0.907459	0.961171	0.970108	0.945754	0.946033	0.932153
min	1	1	1	1	1	1	1	1	1	1
25%	4	1	2	2	4	3	4	4	3	3
50%	4	2	3	3	4	4	4	4	4	4
75%	5	3	4	4	5	5	5	5	4	5
max	5	5	5	5	5	5	5	5	5	5

Form 1 general survey results									
	PRI1	**QOC1**	**RBL1**	**REL1**	**REU1**	**SCH1**	**TRT1**	**TST1**	**USF1**
count	532	532	532	532	532	532	532	532	532
mean	3.834586	4.078947	3.007519	3.434211	3.969925	4.103383	4.00188	3.712406	4.325188
std	0.990961	0.910996	1.235058	1.185837	1.028336	0.921918	0.945799	1.076192	0.848997
min	1	1	1	1	1	1	1	1	1
25%	3	4	2	3	3	4	4	3	4
50%	4	4	3	4	4	4	4	4	5
75%	5	5	4	4	5	5	5	5	5
max	5	5	5	5	5	5	5	5	5

Appendix E – Form 2 descriptive statistics of general survey measured values.

Form 2 general survey results										
	COM2	**CMP2**	**CST2**	**DUR2**	**ENV2**	**EOU2**	**EXP2**	**INF2**	**OUT2**	**PBT2**
count	532	532	532	532	532	532	532	532	532	532
mean	4.255639	3.635338	3.554511	2.979323	3.87218	3.864662	4.058271	3.979323	3.845865	4.030075
std	0.869263	1.170298	1.181639	1.328219	0.938112	0.908482	0.959827	0.927476	0.926042	0.91598
min	1	1	1	1	1	1	1	1	1	1
25%	4	3	3	2	3	3	4	3	3	4
50%	4	4	4	3	4	4	4	4	4	4
75%	5	5	4	4	5	5	5	5	4	5
max	5	5	5	5	5	5	5	5	5	5

Form 2 general survey results									
	PRI2	**QOC2**	**RBL2**	**REL2**	**REU2**	**SCH2**	**TRT2**	**TST2**	**USF2**
count	532	532	532	532	532	532	532	532	532
mean	3.859023	4.050752	2.819549	3.569549	4.005639	4.150376	4.016917	3.791353	4.261278
std	1.006969	0.891083	1.227952	1.176053	0.999984	0.893553	0.909096	1.043174	0.851146
min	1	1	1	1	1	1	1	1	1
25%	3	4	2	3	3	4	4	3	4
50%	4	4	3	4	4	4	4	4	4
75%	5	5	4	4	5	5	5	5	5
max	5	5	5	5	5	5	5	5	5

Appendix F – Initial model item loadings and model performance

Reflective Formative

Path Coefficients:	SAT
R^2	0.900
AdjR^2	0.900
HSQ	0.656
INFQ	-0.159
SYSQ	0.194
NETB	-0.175
USF	0.494

	alpha	rhoC	AVE	rhoA
HSQ	0.857	-	0.360	0.896
INFQ	0.809	-	0.412	0.821
SYSQ	0.699	-	0.300	0.755
NETB	0.729	-	0.278	0.778
USF	0.757	-	0.609	0.757
SAT	0.849	0.898	0.688	0.858

Reflective Formative - HTMT score

	HSQ	INFQ	SYSQ	NETB	USF	SAT
HSQ	.	.	.	.	.	.
INFQ	0.897	.	.	.	.	.
SYSQ	0.781	0.753	.	.	.	.
NETB	0.796	0.677	0.877	.	.	.
USF	0.718	0.715	0.78	0.877	.	.
SAT	0.866	0.802	0.809	0.837	0.865	.

Formative Formative

Path Coefficients:	SAT
R^2	0.716
AdjR^2	0.713
HSQ	0.411
INFQ	0.077
SYSQ	0.132
NETB	0.126
USF	0.233

	alpha	rhoC	AVE	rhoA
HSQ	0.857	0.885	0.411	0.896
INFQ	0.809	0.861	0.509	0.821
SYSQ	0.699	0.788	0.403	0.755
NETB	0.729	0.807	0.362	0.778
USF	0.757	0.892	0.805	0.757
SAT	0.849	0.898	0.688	0.858

Formative Formative - HTMT score

	HSQ	INFQ	SYSQ	NETB	USF	SAT
HSQ	.	.	.	.	.	.
INFQ	0.897	.	.	.	.	.
SYSQ	0.781	0.753	.	.	.	.
NETB	0.796	0.677	0.877	.	.	.
USF	0.718	0.715	0.78	0.877	.	.
SAT	0.866	0.802	0.809	0.837	0.865	.

Reflective Formative Bootstrapped Structural Paths – nboot = 5000

	Original Est.	Bootstrap Mean	Bootstrap SD	T Stat.	2.5% CI	97.5% CI
HSQ -> SAT	0.656	0.605	6.207	0.106	0.333	1.425
INFQ -> SAT	-0.159	-0.14	4.89	-0.033	-0.973	0.209
SYSQ -> SAT	0.194	0.198	2.5	0.077	-0.193	0.876
NETB -> SAT	-0.175	-0.198	8.117	-0.022	-2.109	0.293
USF -> SAT	0.494	0.54	4.888	0.101	0.119	2.092

Formative Formative Bootstrapped Structural Paths - nboot = 5000

	Original Est.	Bootstrap Mean	Bootstrap SD	T Stat.	2.5% CI	97.5% CI
HSQ -> SAT	0.411	0.41	0.05	8.155	0.31	0.507
INFQ -> SAT	0.077	0.078	0.05	1.519	-0.023	0.174
SYSQ -> SAT	0.132	0.134	0.046	2.897	0.047	0.226
NETB -> SAT	0.126	0.127	0.042	3.008	0.045	0.207
USF -> SAT	0.233	0.23	0.047	5.01	0.139	0.321

Reflective Formative – loadings

	HSQ	INFQ	SYSQ	NETB	USF	SAT
CMP1	0.187	0	0	0	0	0
CMP2	0.798	0	0	0	0	0
COM1	0.438	0	0	0	0	0
COM2	0.483	0	0	0	0	0
OUT1	0.708	0	0	0	0	0
OUT2	0.763	0	0	0	0	0
QOC1	0.661	0	0	0	0	0
QOC2	0.645	0	0	0	0	0
REL1	0.255	0	0	0	0	0
REL2	0.238	0	0	0	0	0
TRT1	0.792	0	0	0	0	0
TRT2	0.738	0	0	0	0	0
INF1	0	0.733	0	0	0	0

Formative Formative – loadings

	HSQ	INFQ	SYSQ	NETB	USF	SAT
CMP1	0.197	0	0	0	0	0
CMP2	0.652	0	0	0	0	0
COM1	0.555	0	0	0	0	0
COM2	0.58	0	0	0	0	0
OUT1	0.733	0	0	0	0	0
OUT2	0.767	0	0	0	0	0
QOC1	0.742	0	0	0	0	0
QOC2	0.736	0	0	0	0	0
REL1	0.412	0	0	0	0	0
REL2	0.409	0	0	0	0	0
TRT1	0.804	0	0	0	0	0
TRT2	0.788	0	0	0	0	0
INF1	0	0.73	0	0	0	0

INF2	0	0.807	0	0	0	0
PRI1	0	0.483	0	0	0	0
PRI2	0	0.522	0	0	0	0
TST1	0	0.62	0	0	0	0
TST2	0	0.627	0	0	0	0
ENV1	0	0	0.749	0	0	0
ENV2	0	0	0.631	0	0	0
EOU1	0	0	0.602	0	0	0
EOU2	0	0	0.612	0	0	0
RBL1	0	0	0.233	0	0	0
RBL2	0	0	0.221	0	0	0
CST1	0	0	0	0.359	0	0
CST2	0	0	0	0.357	0	0
DUR1	0	0	0	0.463	0	0
DUR2	0	0	0	0.279	0	0
PBT1	0	0	0	0.727	0	0
PBT2	0	0	0	0.682	0	0
SCH1	0	0	0	0.575	0	0
SCH2	0	0	0	0.592	0	0
USF1	0	0	0	0	0.778	0
USF2	0	0	0	0	0.783	0
EXP1	0	0	0	0	0	0.87
EXP2	0	0	0	0	0	0.855
REU1	0	0	0	0	0	0.778
REU2	0	0	0	0	0	0.813

INF2	0	0.775	0	0	0	0
PRI1	0	0.634	0	0	0	0
PRI2	0	0.681	0	0	0	0
TST1	0	0.731	0	0	0	0
TST2	0	0.721	0	0	0	0
ENV1	0	0	0.731	0	0	0
ENV2	0	0	0.723	0	0	0
EOU1	0	0	0.731	0	0	0
EOU2	0	0	0.766	0	0	0
RBL1	0	0	0.342	0	0	0
RBL2	0	0	0.351	0	0	0
CST1	0	0	0	0.496	0	0
CST2	0	0	0	0.285	0	0
DUR1	0	0	0	0.561	0	0
DUR2	0	0	0	0.377	0	0
PBT1	0	0	0	0.751	0	0
PBT2	0	0	0	0.745	0	0
SCH1	0	0	0	0.69	0	0
SCH2	0	0	0	0.717	0	0
USF1	0	0	0	0	0.896	0
USF2	0	0	0	0	0.898	0
EXP1	0	0	0	0	0	0.87
EXP2	0	0	0	0	0	0.855
REU1	0	0	0	0	0	0.778
REU2	0	0	0	0	0	0.813

Appendix G – Refined model item loadings and model performance

Reflective Formative

Path Coefficients:	SAT
R^2	0.939
AdjR^2	0.939
HSQ	0.735
INFQ	-0.154
SYSQ	0.201
NETB	-0.279
USF	0.511

	alpha	rhoC	AVE	rhoA
HSQ	0.877	.	0.503	0.879
INFQ	0.788	.	0.43	0.801
SYSQ	0.744	.	0.417	0.746
NETB	0.776	.	0.466	0.783
USF	0.757	.	0.609	0.757
SAT	0.849	0.898	0.689	0.857

Reflective Formative - HTMT score

	HSQ	INFQ	SYSQ	NETB	USF	SAT
HSQ	.	.	.	.	.	.
INFQ	0.899	.	.	.	.	.
SYSQ	0.803	0.832	.	.	.	.
NETB	0.786	0.754	0.837	.	.	.
USF	0.754	0.715	0.796	0.889	.	.
SAT	0.921	0.826	0.84	0.807	0.865	.

Formative Formative

Path Coefficients:	SAT
R^2	0.715
AdjR^2	0.712
HSQ	0.455
INFQ	0.071
SYSQ	0.157
NETB	0.031
USF	0.254

	alpha	rhoC	AVE	rhoA
HSQ	0.88	0.903	0.512	0.89
INFQ	0.809	0.861	0.509	0.821
SYSQ	0.744	0.838	0.565	0.746
NETB	0.776	0.856	0.597	0.783
USF	0.757	0.892	0.805	0.757
SAT	0.849	0.898	0.688	0.858

Formative Formative - HTMT score

	HSQ	INFQ	SYSQ	NETB	USF	SAT
HSQ	.	.	.	.	.	.
INFQ	0.883	.	.	.	.	.
SYSQ	0.802	0.833	.	.	.	.
NETB	0.842	0.758	0.837	.	.	.
USF	0.78	0.715	0.796	0.889	.	.
SAT	0.897	0.802	0.84	0.807	0.865	.

Reflective Formative Bootstrapped Structural Paths – nboot = 5000

	Original Est.	Bootstrap Mean	Bootstrap SD	T Stat.	2.5% CI	97.5% CI
HSQ -> SAT	0.735	0.771	0.538	1.365	0.427	1.211
INFQ -> SAT	-0.154	-0.193	0.546	-0.283	-0.699	0.204
SYSQ -> SAT	0.201	0.227	0.584	0.344	-0.165	0.748
NETB -> SAT	-0.279	-0.436	3.757	-0.074	-1.338	0.065
USF -> SAT	0.511	0.646	3.45	0.148	0.196	1.468

Formative Formative Bootstrapped Structural Paths - nboot = 5000

	Original Est.	Bootstrap Mean	Bootstrap SD	T Stat.	2.5% CI	97.5% CI
HSQ -> SAT	0.455	0.454	0.05	9.021	0.356	0.551
INFQ -> SAT	0.071	0.072	0.049	1.45	-0.021	0.168
SYSQ -> SAT	0.157	0.157	0.048	3.285	0.066	0.255
NETB -> SAT	0.031	0.032	0.043	0.713	-0.05	0.117
USF -> SAT	0.254	0.252	0.047	5.349	0.159	0.344

Reflective Formative – loadings

	HSQ	INFQ	SYSQ	NETB	USF	SAT
CMP2	0.774	0	0	0	0	0
OUT1	0.687	0	0	0	0	0
OUT2	0.74	0	0	0	0	0
QOC1	0.641	0	0	0	0	0
QOC2	0.625	0	0	0	0	0
TRT1	0.768	0	0	0	0	0
TRT2	0.716	0	0	0	0	0
INF1	0	0.718	0	0	0	0
INF2	0	0.791	0	0	0	0
PRI2	0	0.511	0	0	0	0

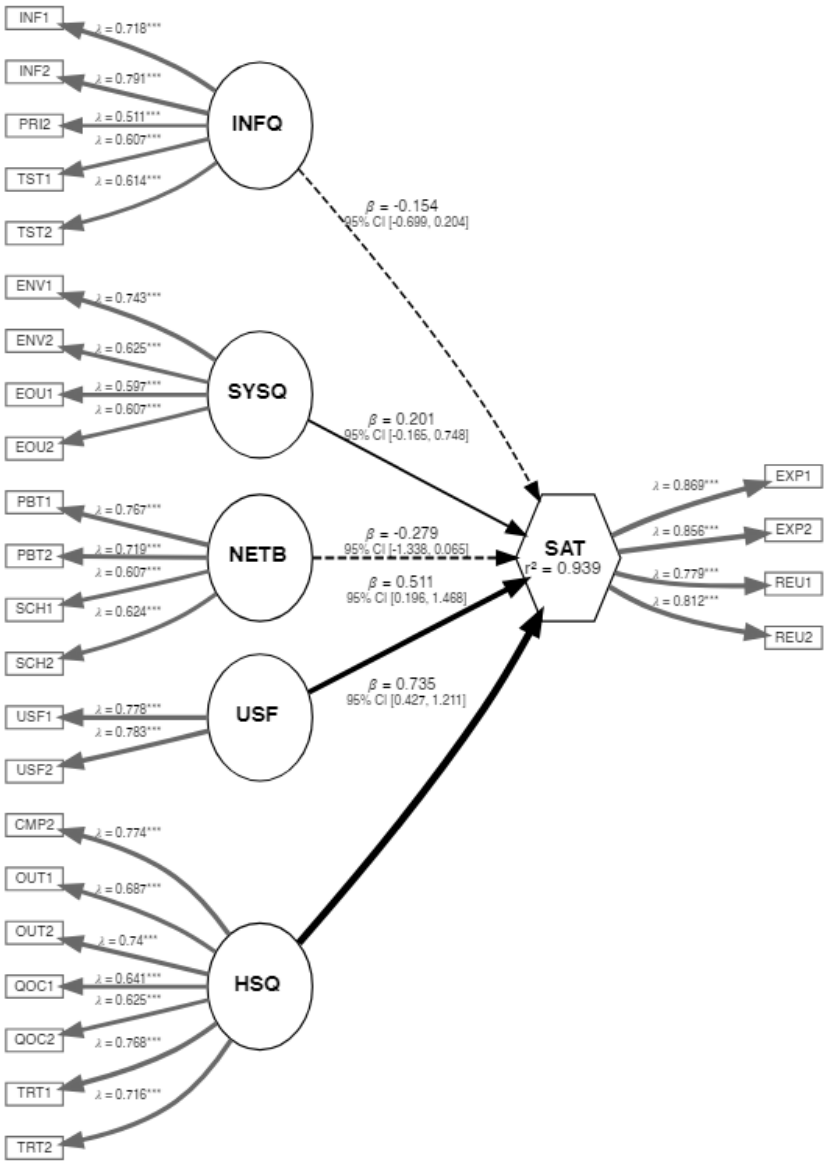
Formative Formative – loadings

	HSQ	INFQ	SYSQ	NETB	USF	SAT
CMP2	0.647	0	0	0	0	0
COM1	0.564	0	0	0	0	0
COM2	0.591	0	0	0	0	0
OUT1	0.733	0	0	0	0	0
OUT2	0.764	0	0	0	0	0
QOC1	0.746	0	0	0	0	0
QOC2	0.746	0	0	0	0	0
TRT1	0.811	0	0	0	0	0
TRT2	0.795	0	0	0	0	0
INF1	0	0.73	0	0	0	0

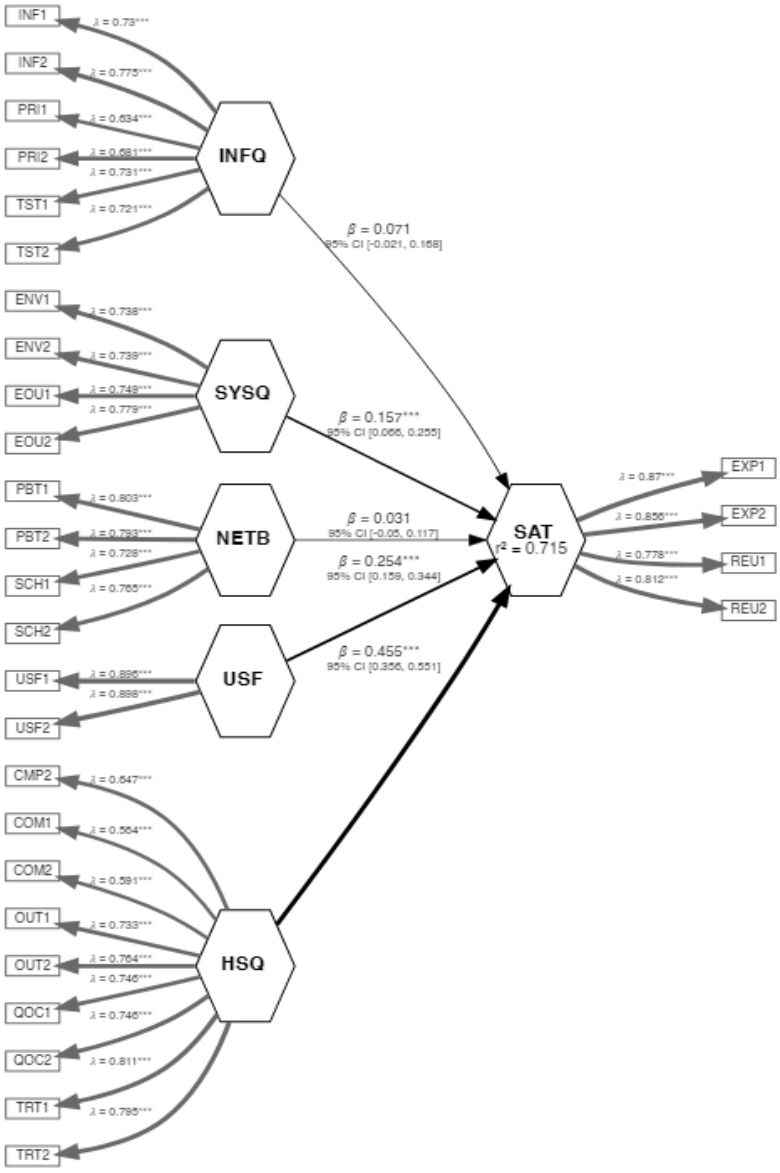
TST1	0	0.607	0	0	0	0
TST2	0	0.614	0	0	0	0
ENV1	0	0	0.743	0	0	0
ENV2	0	0	0.625	0	0	0
EOU1	0	0	0.597	0	0	0
EOU2	0	0	0.607	0	0	0
PBT1	0	0	0	0.767	0	0
PBT2	0	0	0	0.719	0	0
SCH1	0	0	0	0.607	0	0
SCH2	0	0	0	0.624	0	0
USF1	0	0	0	0	0.778	0
USF2	0	0	0	0	0.783	0
EXP1	0	0	0	0	0	0.869
EXP2	0	0	0	0	0	0.856
REU1	0	0	0	0	0	0.779
REU2	0	0	0	0	0	0.812

INF2	0	0.775	0	0	0	0
PRI1	0	0.634	0	0	0	0
PRI2	0	0.681	0	0	0	0
TST1	0	0.731	0	0	0	0
TST2	0	0.721	0	0	0	0
ENV1	0	0	0.738	0	0	0
ENV2	0	0	0.739	0	0	0
EOU1	0	0	0.749	0	0	0
EOU2	0	0	0.779	0	0	0
PBT1	0	0	0	0.803	0	0
PBT2	0	0	0	0.793	0	0
SCH1	0	0	0	0.728	0	0
SCH2	0	0	0	0.765	0	0
USF1	0	0	0	0	0.896	0
USF2	0	0	0	0	0.898	0
EXP1	0	0	0	0	0	0.87
EXP2	0	0	0	0	0	0.856
REU1	0	0	0	0	0	0.778
REU2	0	0	0	0	0	0.812

Appendix H – Full Reflective Formative Model Plot with Loadings



Appendix I – Full Formative Formative Model Plot with Loadings



Appendix J – Form 1 descriptive statistics of ZVAMC survey measured values.

Form 1 ZVAMC survey results										
	COM1	**CMP1**	**CST1**	**DUR1**	**ENV1**	**EOU1**	**EXP1**	**INF1**	**OUT1**	**PBT1**
count	63	63	63	63	63	63	63	63	63	63
mean	4.888889	3.730159	3.809524	4.365079	4.619048	4.269841	4.619048	4.571429	4.492063	4.492063
std	0.316794	1.234012	1.401119	1.09694	0.52143	0.723039	0.580005	0.755929	0.644406	0.692658
min	4	1	1	1	3	3	3	1	3	1
25%	5	3	3	4	4	4	4	4	4	4
50%	5	4	4	5	5	4	5	5	5	5
75%	5	5	5	5	5	5	5	5	5	5
max	5	5	5	5	5	5	5	5	5	5

Form 1 ZVAMC survey results									
	PRI1	**QOC1**	**RBL1**	**REL1**	**REU1**	**SCH1**	**TST1**	**USF1**	**TRT1**
count	63	63	63	63	63	63	63	63	63
mean	4.555556	4.730159	4.095238	3.761905	4.52381	4.555556	4.634921	4.634921	4.634921
std	0.690436	0.573792	1.073347	0.995381	0.715207	0.713415	0.48532	0.517487	0.547769
min	3	2	1	1	1	2	4	3	3
25%	4	5	3	3	4	4	4	4	4
50%	5	5	4	4	5	5	5	5	5
75%	5	5	5	4.5	5	5	5	5	5
max	5	5	5	5	5	5	5	5	5

Appendix K – Form 2 descriptive statistics of general survey measured values.

Form 2 ZVAMC survey results										
	COM2	**CMP2**	**CST2**	**DUR2**	**ENV2**	**EOU2**	**EXP2**	**INF2**	**OUT2**	**PBT2**
count	63	63	63	63	63	63	63	63	63	63
mean	4.809524	4.301587	4.269841	4.190476	4.68254	4.380952	4.68254	4.634921	4.47619	4.507937
std	0.434672	0.891445	0.807352	1.075492	0.502426	0.68223	0.502426	0.517487	0.618457	0.535001
min	3	1	3	1	3	3	3	3	3	3
25%	5	4	4	4	4	4	4	4	4	4
50%	5	4	4	4	5	4	5	5	5	5
75%	5	5	5	5	5	5	5	5	5	5
max	5	5	5	5	5	5	5	5	5	5

Form 2 ZVAMC survey results									
	PRI2	**QOC2**	**RBL2**	**REL2**	**REU2**	**SCH2**	**TST2**	**USF2**	**TRT2**
count	63	63	63	63	63	63	63	63	63
mean	4.253968	4.714286	3.634921	3.904762	4.571429	4.380952	4.428571	4.634921	4.666667
std	0.897456	0.52143	1.311261	0.928306	0.587896	0.658164	0.755929	0.517487	0.538816
min	1	3	1	2	3	3	1	3	3
25%	4	4.5	3	3	4	4	4	4	4
50%	4	5	4	4	5	4	5	5	5
75%	5	5	5	5	5	5	5	5	5
max	5	5	5	5	5	5	5	5	5

Appendix L – Demographic breakdown of online study participants

		N	%
Gender	Female	291	55.22
	Male	233	44.21
	Other	3	.57
Age	18-20	15	2.83
	21-30	139	26.23
	31-40	181	34.15
	41-50	90	16.98
	51-60	53	10
	61 or older	52	9.81
Education	<High School	2	.34
	High School or GED	56	10.59
	Some College/No Degree	86	16.26
	Bachelors	251	47.45
	Masters	119	22.5
	PhD or Equal	15	2.84
Race/Ethnicity	American Native	4	.75
	Asian	59	11.13
	Black / African American	46	8.68
	Latino	32	6.04
	Mixed	10	1.89
	White	376	70.94
	Other	3	.57
Military Service	Yes	105	19.96
	No	421	80.0

Appendix M – Demographic breakdown of ZVAMC participants

		N	%
Gender	Female	58	96.67
	Male	2	3.33
	Other	0	0
Age	18-20	0	0
	21-30	2	3.33
	31-40	2	3.33
	41-50	3	5
	51-60	7	11.67
	61 or older	46	76.67
Education	<High School	2	5.41
	High School or GED	24	65.87
	Some College/No Degree	23	62.16
	Bachelors	10	27.02
	Masters	0	0
	PhD or Equal	0	0
Race/Ethnicity	American Native	0	0
	Asian	1	1.7
	Black / African American	1	1.7
	Latino	1	1.7
	Mixed	1	1.7
	White	55	93.22
	Other	0	0
Military Service	Yes	59	100
	No	0	0

Branch	**Number**
Army	21
Navy	13
Air force	10
Army / Army national guard	9
Army / Army reserve	1
Navy	1
Air force / Army reserve	1
Army / Army national guard	1
Navy / Army reserve	1
Coast guard	1