It’s more than just use: An exploration of telemedicine use quality

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Abstract

“Simply saying that more use will yield more benefits without considering the nature of this use (and context) is clearly insufficient” [W.H. DeLone, E.R. McLean, The DeLone and McLean model of information system success: a ten-year update, Journal of Management Information Systems 19 (4) (2003) 9–30, p. 16]. Our research specifies the use quality construct in the context of a mission critical system deployment—namely, the use of medical video conferencing for patient exams. The product of this field study is a socio-technical framework for use quality in telemedicine service encounters. We also propose generalized categories (which may extend across domains) for identified attributes, provide a comparative overview of patient and provider perspectives, and discuss the effects of and remedies for selected attribute deficiencies.

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Keywords: Telemedicine; Use quality; Video conferencing; Service encounter; IS success model

1. Introduction

“Quality is never an accident; it is always the result of intelligent effort.”—John Ruskin

In medical informatics, the manner in which a technological intervention is used can have a significant impact on the health and well being of patients who depend on it. If we are to effectively manage technology-based medical information systems, we must understand and manage their use, especially as it applies to encounters between health care providers and patients. A critical and increasingly important application of medical informatics is the use of video conferencing for patient exams (see Fig. 1). In this context, video conferencing is frequently used to support a knowledge discovery process (concerning the medical condition of the patient), as well as decision-making in the form of diagnosis and recommended protocols. There is widespread interest in utilizing medical video conferencing technology as an economical method to provide expert medical service to patients in remote and awkward locations, and to address misdistributions of health care resources (i.e., facilities and medical expertise) outside major urban centers [14,35]. There is also a growing recognition that

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telemedicine can facilitate the timeliness of medical care by providing access to a wider range of appropriate medical providers during the ‘golden window’ of treatment opportunity [13].

Advocates of telemedicine believe that telemedicine encounters (e.g., medical video conferencing) should be recognized as a “timely technology to facilitate health decision-making and clinical service support.” These encounters address patients’ needs for communication and caring, as well as physicians’ concerns for high quality clinical care, while having a positive financial impact on containing medical costs (especially after policy and reimbursement constraints are addressed by governing bodies) [27]. In broad terms, the quality of this kind of technology-based service encounter may be described as the expected level of performance and information provided by the organization, technology, employee and, to some degree, customer (as indirect user of the technology) to support the interaction and transaction success [31]. To pronounce a medical video conferencing encounter a success, decisions regarding suitable care and patient satisfaction must be supported by the effective use of the socio-technical system.

Since this form of telemedicine promises to bridge geographic distances in the provision of medical expertise, it is of great concern that mixed results have been reported in terms of utilization rates, even when external issues such as reimbursement issues and policy constraints are not major impediments (e.g., [31,50]). These mixed results suggest that telemedicine-related research should not merely recognize constraints imposed by organizational and legislative policy, but should also look deeper into the telemedicine system as an integrated socio-technical process and product in order to assure its successful utilization. As stated by Jennett et al., “Telehealth systems can have impact at three levels: the health system level, the program level, and the patient encounter level. Each level requires different types of evaluation models” [26] (p. 364). Telemedicine researchers recognize that there is a paucity of explanatory research that predicts and facilitates the success of telemedicine encounters [45].

In our study of telemedicine encounters, we attempt to address this research gap by introducing the term *use quality* to address the effectiveness of the actual encounter usage. In the case of medical video conferencing, *use quality* spotlights the attributes of the socio-technical decision-making process of utilizing telemedicine for patient diagnosis and assessment.

The exploration of *use quality* focuses on work practices and methods of organizing work. Though such studies are needed as a basis for the formation of “post-
bureaucratic” organizational theory, few such studies exist in the modern organizational literature. Barley and Kunda [6] call for the study of new forms of work in emerging, situated contexts to facilitate understanding of changing work patterns. Research by Jennett et al. provides recognition that telemedicine may alter the nature of work in health care [27]. However, the information systems (IS) literature lacks strong models of use quality to serve as guides for providers and researchers. The literature has not qualified use in most studies, though the IS community has known for a long time that unused systems are unsuccessful systems [34]. However, the corollary that system use produces success is not necessarily true, though many IS models and studies portray use as a proxy for, or an implied indicator of, system success [55]. The telemedicine literature has also adopted use as a proxy for success (e.g., [38,56]). Though some researchers assert that continued use is a better indicator of success than simply use, they do not elaborate on the attributes of quality that recur in specific episodes of use that promote successful patterns and continuance of use [7].

Even the industrial and data management literatures, in which strong research efforts exist in the realm of total quality management, lack focused studies about quality in the usage stage, though considerable research exists concerning quality in the design and production stages. “The literature on improving the quality of use is vague, and specific procedures and guidelines for improving the quality of use are nonexistent” [3] (p. 8).

In the telemedicine domain, use quality encompasses technology, medical procedures, decision-making and human interactions in a holistic, integrated view of the system. Medical video conferencing provides an intriguing context for exploring use quality as perceived by people in different roles in the telemedicine encounter (direct/indirect users and health care providers/consumers) via different aspects of system use (technology/human interactions). Of all the uses of medical video conferencing (e.g., education, peer consultation, patient exams), video conferencing for direct medical care, given its immediate impact on patient care, requires the highest use quality standard. There exist no definitive references to use quality attributes based on a thorough search of IS and software engineering literatures. The telemedicine literature does address some instances of use quality-related concepts. For example, the need for training and integration into other modes of care is recognized from an organizational level, though not specified and directly addressed through the encounter experience [26,27]. Other examples reference use in telemedicine adoption and diffusion without qualification regarding the process or standard of use (e.g., [24,57,60]). An interesting project in Canada by the National Telehealth Outcome Indicator Project (NTOIP) [47] has identified four indicators that are related to use quality: (1) quality of the telehealth encounter (ease of use and communication of critical health care information), (2) integration of telehealth with traditional health care, (3) the quality of the technology used and (4) user satisfaction. New to the literature is the NTOIP’s recognition that the actual telemedicine user may participate in different roles (e.g., patient, provider) and have different understandings of the use process [32]. Overall, however, there is currently no high level guidance provided by medical standards, such as JACHO guidelines, that would lead to a clear, generalized understanding of the attributes of use quality in the telemedicine encounter context. Telemedicine researchers indicate that guidelines and standards are needed at a number of levels (e.g., technological, procedural, service) for telemedicine consultation for the health sector to fully embrace and diffuse telemedicine care options [26].

By citing literature references and comments made by participants in our study, we aim to provide insights into quality specifications, the effects of attribute deficiencies, and the means of addressing quality issues. In essence, we attempt to define the factors of intelligent effort (i.e., use quality) as users and technologies interact within the telemedicine system. We take a bottom-up approach from which theories within various domains may be extended or synthesized as insight deepens. We contribute to this synthesis by proposing generalized categories for specific attributes that may extend across research domains, a general assessment of constructs, and a comparative overview of patients and provider perspectives. We keep our research at the level of patient encounters and do not directly expose policy, legislative or social influences that act at the organizational level.

2. Use quality in telemedicine

The conceptualization of use quality and its role in the success of telemedicine encounters draws on the DeLone and McLean IS success model [15] (see Fig. 2). There is some concern that research efforts that reference this model are not always consistent with the spirit of the model’s intent. In keeping with the spirit of the model, we heed two directives: context specification and deep probing into system use.
The discipline of quality has gone through the phases of *caveat emptor*, quality control and total quality management (TQM) paradigms [19]. The current emerging paradigm is moving away from a “one size fits all” approach to more context-specific theories and tailored quality models. Contextual specifications refine the more generalized existing knowledge base of quality to fit specific domains, yet provide enough flexibility to address quality issues in environments that are uncertain or deviate from the norm. IS researchers urge the academic community to pay careful attention to domain context in defining and measuring each component of success including quality [15,49]. Research also indicates that it is important to tailor success constructs and measures to the type of system under evaluation in order to facilitate understanding and application [28]. This emerging paradigm takes on a more inductive and less deductive approach to quality specification and management, and is particularly well suited to technological environments that are susceptible to change [5]. It is not until we have a thorough understanding of *use quality* within the telemedicine context that we can determine the applicability of existing information system theories and measures and the contextual implications of applying existing information system generalizations to medical informatics (specifically telemedicine in the present study). In the current paradigm of quality, telemedicine requires its own theories and models of quality.

DeLone and McLean define *use* as a behavior that precedes benefits and they criticize research that conceptualizes *use* simplistically in terms of *amount of use* [15]. As Szajna [55] points out, the notion that system *use* produces success is not necessarily true, though many IS models and studies portray *use* as a proxy for, or an implied indicator of, system success. DeLone and McLean argue that “researchers must also consider the nature, extent, quality and appropriateness of the system use,” and indicate that “even when use is required, variability in the quality and intensity of use is likely to have a significant impact on the realization of system benefits” [15] (p. 16).

In this study, we elaborate on the IS Success Model by specifying a key element of *use*—namely, *quality*—in the telemedicine context. We extend previous research [30], which developed a general taxonomy for telemedicine encounter quality, by focusing on one particular dimension of quality: *use quality*. The *use quality* model attempts to identify and specify indicators of *use quality*, which are objective characteristics of effective system deployment. Defining the focus of *use quality* guides decision-makers (medical providers) who are engaged in the problem-solving context of medical diagnosis and assessment toward effective system deployment and efficacy. IS research indicates that “decision quality improves with higher information quality for a decision-maker who has knowledge of the relationships among problem variables” [46] (p. 275). Thus, it seems that the decision-maker who utilizes telemedicine to overcome information barriers created by distance can make higher quality decisions with an awareness of, and attention to, *use quality* variables (i.e., attributes).

![Fig. 2. Adding use quality to the DeLone and McLean reformulated IS success model [15].](image-url)
It is our position that the concept of \textit{use quality}, rather than a generalized definition of \textit{use}, has the greatest impact on net benefits in the telemedicine context, and that a standard of \textit{use} must be upheld for a successful encounter to take place. \textit{Use quality} synergizes technology with process and with cognitive ability. We define telemedicine \textit{use quality} in this study as \textit{intelligent effort by direct users (medical staff) during the medical video conferencing encounter}, with the \textit{effect that the effort facilitates desired outcomes}. This intelligent effort means that providers use their technical and medical knowledge as they provide care, communicate with the patient and other providers, and coordinate the encounter. Thus, telemedicine use quality is the effective convergence of technological aptitude and ability, communication skill, and encounter orchestration, to provide suitable patient care.

We note that some telemedicine research makes reference to a potential aspect of \textit{use quality} when discussing the importance of a “sense of presence” or “telepresence,” and specifically prescribes ways to establish eye contact while using the technology \cite{25}. Since the purpose of an encounter is to provide medical services, we also surveyed the telemedicine and IS literature, using service quality constructs with key words such as tangibles, reliable, responsiveness, assurance and empathy, in an attempt to discover other tangential references that may have provided part of the foundation for the current study. The search results produced one reference to \textit{empathy} related to mixed results in assessing its effects in a telepsychology encounter \cite{10}. Reliability, as it relates to the need for \textit{clinical experience} in the use of telemedicine technology, is also mentioned \cite{40}. These limited references tend to confirm variances in \textit{use quality} and a connection between \textit{use quality} and encounter success.

To further our understanding of \textit{use quality} in telemedicine and the impact of \textit{use quality} on the net benefits of telemedicine system use, we pose the research question:

\textit{Research question 1:} From the perspectives of both providers and patients, which attributes of \textit{use quality} contribute to the success of medical video conferencing encounters?

3. Telemedicine encounter perspectives

Because of the various roles involved in, and aspects of, social and technical interactions during the encounter process, successful telemedicine system encounters require views from multiple perspectives if they are to be understood properly. Patients and providers may have different perceptions of the system and of the quality of its use. Each group may have insights into \textit{use quality} attributes that may not be readily apparent to the other group. Only a small amount of research into service encounter quality has focused on the perspectives of the service providers, and even less attention, if any, has been given to the providers’ perspective in a technology service encounter. The limited amount of research available suggests that service providers may have a unique vantage point and insights that are worth pursuing in order to better understand the encounter process (e.g., \cite{9}). A provider’s perspective reveals insights, which are derived from technology usage and encounter activity. Past research has demonstrated that health care professionals, as technology users, have characteristics unique to their group, and that these characteristics may affect system success and use \cite{23}. In telemedicine service encounters, providers are classified as producers/consumers of information who operate the telemedicine system directly and often have some decision-making control over the telemedicine systems \cite{12,22}.

As the primary recipients/consumers of telemedicine encounters, patients can also provide valuable insights. Patients are indirect users of the technology and, as such, are independent observers of the orchestrated actions of direct users (e.g., clinicians in the room with the patient and remote medical providers). Patients may note issues not readily observable by those who use the technology directly, as well as issues with the communication process. Some degree of difference in measured perceptions of quality has been found between direct users and observers of \textit{quality} in hospital studies \cite{20}. An indirect, “consumer only” role is expected to result in a different perspective on system risks, disadvantages and problems \cite{12}. For business reasons, health care organizations need to understand the patients’ perspective. Researchers have observed that improving patients’ perceptions of quality can help health care organizations attract new customers and increase the number of repeat customers. Even small improvements in perceived quality can have dramatic effects on profits \cite{42}. Studies indicate that patients must be queried directly about their perspectives, as gaps exist between patients’ actual expectations and providers’ perceptions of those expectations \cite{20}.

A collective exploration of multiple viewpoints is critical to success when high quality products and services are a goal in any context. Prior research indicates that various types of users (e.g., direct producers/consumers of information vs. indirect system users/consumers) differ significantly in their attitudes.
toward, and use of, computer systems [48]. To develop a comprehensive understanding of use quality, we treat both patients and medical providers as key informants to this research and pose a second research question:

Research question 2: Do the perspectives of use quality of various telemedicine users (patients and providers) differ? If they do, where do these perspectives converge and diverge?

4. Methodology

We use analytic inductive means to determine quality attributes drawn directly from respondents. Thus, we attempt to reveal implicit insights regarding issues and prescriptions for quality attributes [54]. We employ several empirical methods in this field study. Qualitative methods (e.g., focus groups and interviews) are used to elicit, code and analyze data from respondents. Quantitative methods (e.g., close-ended survey questions) are used along with open-ended survey questions to validate and extend the analysis of qualitative data. Grounded empiricism using field research methods has been shown to be especially fruitful when studying work process issues, given that the attempt to understand new images and languages of the nature of work is primarily an inductive, comparative task [6]. Likewise, an interpretive approach is recommended when the researcher is seeking to understand transformation triggered by information technology [36,41]. Reviews of the telemedicine literature find that few articles use qualitative methods to describe telemedicine systems and suggest this domain can benefit from the richness and texture afforded by the integration of qualitative methods and a multi-disciplinary perspective that explores the processes and effectiveness of telemedicine processes [2].

One concern with qualitative research is that subjective judgment is used to collect and analyze data, and that it hence unduly biases the study [61]. This concern, which challenges the validity and reliability of the study, is best addressed through rigor. The triangulation of data, experienced investigators, and methods of data collection all contribute to validation. We utilize several methods and perspectives in our study to enhance research validity and reliability. We also use numerous sources (telemedicine providers and academic researchers) to code and interpret the data as a means to address triangulation in analysis. The logic involved in the development of the use quality construct may be traced both from source to end and from end to source. Four phases are used to support this rigorous research approach.

4.1. Phase 1: foundation for design and interpretation

A straight account of the respondents’ answers to questions in directed interviews and focus groups alone would not, unaided, have brought about an in-depth understanding of the telemedicine encounter process, nor would it have provided sufficiently valuable insights. An interpretive frame of reference was required. This frame enabled the researchers and providers (who helped interpret interview and focus group data) to “see his or her world with new eyes” when designing appropriate protocols for interviews and focus groups and when interpreting the resulting data [18].

To develop an appropriate frame of reference, direct observation (and related archived images), open-ended surveys (assessing satisfaction, motivation for encounters and problems noted) and unstructured interviews (to clarify procedures and protocols) were used in the first phase. Direct observation occurred at several health facilities of various types and sizes, operated by a large national provider of medical video conferencing in the United States. In search of representations of use quality attributes and issues, we directly observed (for over 40 h) telemedicine video conferencing rooms, functional equipment and segments of videoconference sessions. We also captured video and photographic images of our observations for further analysis. The results of these observations, of unstructured interviews with providers and of an open-ended survey of 84 telemedicine patients (querying satisfaction levels, motivation and impressions) provided the preliminary knowledge necessary to raise the researchers’ awareness of the context and informed the researchers of the general types and patterns of communication that occur during a telemedicine encounter. Armed with this knowledge, we worked with providers in the field to design the rest of the study with a new awareness, which took such matters as jargon, current technologies and perspectives into account, and enabled us to communicate more effectively with the participants. We also used this knowledge to facilitate data interpretation and prescriptive insight.

4.2. Phase 2: attribute identification

4.2.1. Health care provider expert panel interviews

Expert panels are routinely used to systematically solicit, organize and structure collective judgments and opinions from authoritative groups on particularly complex subjects [1]. We assembled an expert panel of telemedicine providers engaged in medical video
conferencing in order to identify, validate and rank attributes associated with use quality, using a two-round process. Round 1 consisted of interviews discussed in this section and round 2, described in a later section, consisted of a survey used to validate the analysis of this phase. Our goal was to develop an authoritative listing of use quality attributes from the providers’ perspective.

Empirical studies in the field of health care indicate that a “well-designed expert panel can closely reflect the views of practicing physicians” and incorporate a range of views [4] (p. 1896). In accordance with past studies that used expert panels, we sought a heterogeneous group of experts and preserved anonymity among panel members so as to provide a comprehensive perspective and to reduce bias [33].

We identified and enlisted 12 noted telemedicine experts based on their acknowledged expertise, publications and programs within the telemedicine domain. The selection of panel members was designed to enhance collective knowledge. Our panel included selected telemedicine leaders from prominent telemedicine organizations that provide extensive telemedicine services. Panel members had a very good understanding of hands-on equipment use and the encounter experience through their broad direct and indirect dealings with multiple providers and through their individually acquired proficiency. The panel members averaged approximately 7 years of telemedicine experience—a considerable tenure in the history of this domain. The expert panel included representation from the following telemedicine provider roles:

- **Hands-on telemedicine user**—doctors, nurses and other clinicians responsible for direct patient care and patient orientation involving medical video conferencing.
- **Telemedicine coordinator**—responsible for the selection and installation of equipment, overseeing encounter scheduling and general telemedicine operations.
- **Telemedicine administrator**—responsible for the design of telemedicine policies and procedures.

Letters describing our study and our interview process were sent to all participants to enable them to create a mental model of their roles before being interviewed. All interviews were reflexive and exploratory so as to solicit high quality information and not restrict the breadth of comments from the individuals. Participants were asked to individually identify attributes of use quality. The responses to these questions guided the remaining interview process. Participants were probed for further explanations, examples, and applications regarding specific attributes mentioned. Given the varied backgrounds of the subjects, the specific language used to elicit details was customized to best match each subject’s perspective. Interviews lasted between 30 and 70 min. All interviews were taped and later transcribed.

### 4.2.2. Patient focus groups

Patient encounters may be sporadic or limited (e.g., one- or two-time occurrences) and may thus preclude the development of expertise. Therefore, individual semi-structured interviews of the kind used with provider expert panels were not appropriate for the patient population. A viable alternative was to use focus groups to obtain patient assessment of use quality through collaborative construction [39].

To develop protocols that were comparable to provider protocols, we used the expert panel interview protocol to inspire a focus group protocol suitable for a patient audience. Six focus groups were conducted with an average of six participants per group. All patients were affiliated with a large health care organization that provides a diverse spectrum of medical specialties through clinics, hospitals and video conferencing. The clinics’ histories (newly established to on-going sites) and the providers’ experience with telemedicine (new to telemedicine and seasoned) were also diverse. We believe that diversity among these factors was important to the aggregations of expertise. We chose not to introduce inter-organizational diversity into the focus group sample in order to avoid inter-organizational noise and not to detract from focus on the encounter level.

### 4.2.3. Open coding procedures

Open coding was used to identify and define use quality attributes based on information gathered from focus group and interview transcripts (see [54] for discussion of open coding). A second researcher dual-coded a random 33% stratum from each focus group and interview transcript, using attributes and definitions provided by the first coder as a coding schema, with high inter-rater reliability (consistently >90%). The stability of codes over time was assessed through intra-rater reliability using similar dual-coding procedures with excellent intra-rater reliability (consistently >95%).

The providers (medical doctors and telemedicine coordinators) who were brought in as co-analysts to code expert panel interviews and patient focus group transcripts (using open coding) provided various
dimensions of insight and supported coding reliability [59]. Finally, several rounds of parallel form procedures were used to assess correspondence among meanings of the attributes identified by providers and researchers through open coding. Common themes were found between researcher and provider identified attributes throughout the process and labels for the attributes were derived through consensus.

In enlisting domain resources throughout the research process, we address Klein’s and Myers’ observation that interpretive research in the IS domain has generally ignored the social interaction between the participants and the researcher. This principle states that “the participants, just as much as the researchers, can be seen as interpreters and analysts” [29] (p. 74).

4.3. Phase 3: validating survey

Validating surveys followed our qualitative interpretation of the results from focus groups and from expert panel interviews. The validating surveys included both quantitative and qualitative questions, meant to assess the participants’ perspectives of the correctness, completeness and relevance of model attributes identified through the analyses of the data collected from the focus groups and interviews. Focus group and interview participants completed the surveys. Patients and providers completed surveys parallel in form, yet containing only questions pertinent to the attributes identified by each respective group. Hence, attributes identified by both groups were contained in both surveys, while attributes identified by only one group were contained only in that group’s survey. The participants also assessed the propriety of proposed attribute definitions. All attributes had a mean in excess of three (anchor point important) on a four-point scale (four anchor point—critical) for both patient and provider surveys, indicating important on a four-point scale (four anchor point—critical) for both patient and provider surveys, indicating that the participants considered all attributes to be relevant. Though given the opportunity, participating patients and providers did not mention any missed attributes.

4.4. Phase 4: attribute specification and dimensions

Interpretive coding allows researchers to focus on more abstract issues and concerns, such as causal conditions and differences among perspectives, and to move across substantive areas [44,58]. The underlying goal is to foster conceptual power, depth and comprehensiveness [11,21]. Using interpretive coding, we revisited transcripts, observation notes, archived data, open-ended survey questions and the comments on the validating surveys to attempt to further specify each attribute in terms of the conditions that gave rise to it, the context in which it was embedded, the action/interaction strategies by which it was handled or managed or carried out, and the consequences of those strategies [21]. We also looked for aggregated themes in the attributes and for possible reasons for distinctions among the attributes identified by patients and providers. In essence, we used interpretive coding to look for insights that would guide performance during the encounter process.

Interpretive coding was followed by a form of axial coding in which the nature and spirit of each attribute was assessed so as to synthesize attributes into dimensions of overarching drivers that move use toward encounter success. Axial coding facilitates the building of connections among categories and subcategories, and thus serves to deepen the theoretical framework that underpins analyses [58]. Three individuals interpreted the data set associated with the current study. They assessed the propriety of the overarching dimensions and the associated attributes under each category until they reached model consensus.

5. Results and discussion: use quality framework

To address the first research question, we specify a framework of use quality attributes based on the union of use characteristics identified by providers and patients as critical to the success of telemedicine encounters. Use quality characteristics are categorized into three critical factors for success in telemedicine encounters: technological aptitude and ability, communication skills and orchestration (see Fig. 3). Appendix A provides a tabular description of the use quality attributes elicited from providers and patients [30]. Quantitative indicators of importance are attached to each attribute. We discuss the meaning and derivation of these use quality attributes in this section.

5.1. Technological aptitude and ability

Three use quality attributes determined how well the system technology was used during the encounters.

5.1.1. Telemedicine-trained staff

Specific training is needed to address telemedicine nuances. One patient stated:

“Well, this is a different way of conducting medicine and it is a unique situation. Normally doctors are trained to meeting right with the patient and reach out and that doesn’t happen here.”
Participants listed training needs for a wide spectrum of roles (e.g., administrators, clinicians and technicians): direct training to allow each role to achieve their particular purpose and cross training, to a lesser degree, for awareness. Concerning the scope of training and performance improvement, participants discussed the importance of:

- Self-education
- Job aids (labeling equipment)
- Patient presentation
- Supplementation of camera views of a patient’s body with verbal descriptions of location
- Verbal commands to clinicians regarding equipment placement
- Training concerning interaction with patients.

One seasoned provider mentioned that the communication of an overall purpose and perspective is an important aspect of training:

“Invoking training and core rationale for why we are adopting this technology is important. So not only do they get the technical training, the hands-on training, they get an overall organizational perspective as to why this technology is being adopted, and why it is critical, and what we do on a daily basis.”

Expert panel members also found that providing information regarding successes in telemedicine in general and, within the organization in particular, promotes confidence in new and prospective users. Patients believed that some “television training” ought to be an additional training requirement:

“They have to have some video training and to have it critiqued on their performance, because it’s really a performance, they’re on television.”

After the initial training session, users should be able to operate equipment and understand the functions that facilitate the different clinical exams. However, one provider pointed out the importance of practice to transfer training to actual application and maintain skills:

“If you practice (telemedicine procedures) for a week, I think you will be able to learn it. However,
you need to ‘be able to go back...on it many, many times after that.’ Training also involves practice.’

The coordinator can exert some control in conjunction with the provider(s) through requisite telemedicine training before the exam begins. Furthermore, the telemedicine coordinator should consider some degree of customized training to suit the provider’s medical specialty and to assess his/her capabilities.

### 5.1.2. Focus on patient care

Assuming the available equipment is appropriately designed, the provider must be able to communicate with others during the exam and simultaneously operate the equipment. One patient describes an awkward situation of technological distraction:

“Well, I found that there was a lot of time wasted in adjusting the cameras. Half the time was adjusting the cameras and instructing the nurse to focus in on different parts of my body, rather than to talk to me directly about my symptoms and my problems.”

Providers indicated that the extent of possible distraction varies with the type of exam performed.

### 5.1.3. Adaptability

Telemedicine introduces change into the care process. Both the consulting provider and the clinician in the examination room are called upon to successfully adapt to the changes imposed. In the minds of these users, adaptability refers to the ability to adjust procedural processes to the medical video conferencing situation:

“You do exams in a little bit different way...you have to learn how to think before the exam how you are going to structure it because you want it to flow. We did a couple of dry runs so that we can see what we could see over the TV versus what we couldn’t see over the TV.”

Some expert panel members doubted that all providers possess the ability to adapt even following telemedicine training. Providers enumerated the following hurdles:

- “The clinician also has to have the view that my hands are not what gets the person better. My hands contribute maybe. But that’s not the end-all. If the clinician feels there is no other way for that person to get better without touching them, I think that is a problem.”

- The consulting provider must be flexible and tolerant of equipment issues and of communication challenges (especially with clinicians in the room).

- One therapist explained that providers must learn to “touch” differently. The providers must learn new ways of asking questions, of educating patients and of working “through” a remote person (e.g., the clinician in the patient examination room). The therapist described his transition when learning to replace touch with “questions, compliments and detailed instructions”.

Participants believed that a seasoned clinician generally adapts best. The expressed premise was that the seasoned provider possesses developed medical skills and that he/she only needs to be concerned with the means of porting those skills to the telemedicine context. A seasoned professional would have the benefit of experience, having confronted challenges in selecting among alternative possible courses of action in telemedicine encounters. When queried about the suitability of a new graduate, one provider commented:

“You could get a new grad, but they have got to have support people there that are going to help them. They have people that they can go to with questions. But to really be in charge of the patient, you had better have somebody that knows what they are doing with this.”

Telemedicine adaptability is not only an issue of style; it also includes the ability to make do with the equipment at hand. Medical video conferencing capabilities vary. Variations do not preclude the delivery of medical video conferencing, but may require physicians to adapt or modify the extent or nature of their service to provide maximum effectiveness within given capability constraints, as some providers stated:

“As long as you have ability to video conference, you can tailor what you do according to what the level of video conferencing is.”

“You could do it (retinal exams) with a peripheral, but that would involve the cost of getting a peripheral, and so we’ve elected not to do headaches because of the need for a retinal exam.”

### 5.2. Communication skills

The use quality of communication is not only a matter of style, but also of content. This study indicated that both what is said and how it is said matters.
5.2.1. Consultant telepresence

The use of interpersonal skills has historically been an important subject in medical education [8,51] and is receiving even more attention now. To achieve high quality, the consultant and medical staff should strive for a ubiquitous presence (i.e., “telepresence”). To achieve telepresence we must first understand what it is and then how it is best exhibited throughout the course of the exam. Effective telepresence requires that “we go from the premise that using telemedicine should be analogous to the patient’s sitting there in the room.” The ability of individuals’ telepresence to mimic their “in person” presence is a function of various social and technical factors. The social indicators of telepresence are well articulated in the following quotes from patients:

- Providing explanations: “Well, of course, he’s (the doctor) very friendly. But he’s very business-like. He’s explaining everything to you in a nice way so that you understand it, and he’s making sure that you understand it, and I think that’s it, he’s really seriously trying to help you to understand what you, what’s going to happen. I think that’s why I thought it was a good experience.”
- Body language awareness: “I just wanted to say that I felt that ‘Doctor X’ was real. It was like he was in the same room, because he could pick up on your body language, it was so good. My wife asked a question, and I reacted to it, and he recognized my reaction to the question, and her answer.”
- Sustained communication: “Well, I think that one of the things also was that she (the doctor) would talk to you a little bit and do things, and then there was a long period of silence. That was kind of an awkward thing.”
- Cordiality: “Small talk makes a lot of difference when you first go into the room, you know Hi, How are you? Just make you feel welcome, warm, friendly, like he is inviting you in.”

Technical factors include camera placement. Providers indicate that good camera placement facilitates telepresence. The objective is to position the camera in the consulting room so as to create the image of virtual eye contact and focus on the patient. Experts recommend placing the camera at least three feet from the consultant to achieve this virtual eye contact. The size of the monitor is another important technical issue. Patients indicated that a larger “life sized” screen would make the doctor appear more real. The consulting physician must prepare (achieve the appropriate mind set) for telepresence prior to initiating the encounter and must maintain that telepresence throughout the encounter.

5.2.2. Clear future directives

Patients expressed the desire for a summary of future directives to be provided at the end of the encounter. Some patients felt that they had actually received more information than they would have been given during an “in person” exam. However, patients also commented that they had been captivated by the “television” and were not as attentive to noting specific instructions. Regarding both issues, patients felt that a summary would remedy information loss, particularly information that pertains to important future directives.

As one would expect, patients would like the summary to include clinical directives. Participants indicated that the directives should include instructions on how to follow up with the provider or an alternative party (if appropriate), how to obtain a copy of the recorded session (if recorded) and future appointment directives. Follow-up may be somewhat confusing if the consulting provider is performing a one-time or first-time encounter with a patient. Patients recommended that instructions be put in writing either by the clinician in the patient’s examination room or by the caregiver who accompanies the patient. Alternatively, instructions may come in the form of a follow-up letter from the consulting provider.

5.2.3. Conveys access/review of patient records

Patients indicated that an important component of any form of medical encounter is the provider’s access to the patients’ medical records. One issue pertaining to patient records that distinguishes a telemedicine exam from an “in person” exam is the patient’s inability, in the former case, to readily determine whether the consulting provider has access to relevant records. One patient verbalized his concern as follows:

“I just assumed that she had the records, so I have no way of knowing that she didn't have.”

The consulting provider and in-room clinician may communicate with each other and with the patient about their access to records verbally or by transmitting visual images of the documents. The consulting provider may also refer to the records during the course of the exam.

5.2.4. Professionalism: clinician in room

Patients expressed their preference for the physical exam portion of the telemedicine encounter to be performed by a clinician who exhibits professionalism, the ability to make the patient comfortable and the skills
to help patients relax. The clinician in the room with the patient (often a nurse or nurse practitioner) must live up to these standards, starting with the introductory greeting and patient orientation before the encounter and lasting until the patient leaves the examination room. It is up to the consulting clinician (often a physician), as the point of authority, to ensure that the clinician does not significantly violate these standards.

5.3. Orchestration

Competent orchestration of the telemedicine encounter goes a long way in giving the perception of a high quality, successful system use. Orchestration includes the professional coordination among providers during encounters, as well as over time and across encounters.

5.3.1. Mix with “in person” exams

Some patients expressed a desire for periodic or first exams to be performed “in person” to complement and support the telemedicine encounter(s). The need for “in person” exams is situational and ranges from several such exams to only one (the first) or even none. For example, one participant indicated that an “in person” exam was not necessary because he felt that the telemedicine exam was less threatening, and he was better able to communicate using the “safety” of distance. The patient believed that he had consequently established a stronger bond with the medical provider than he would have during an “in person” exam.

In contrast, other patients pointed out that an “in person” session enabled them to assess the doctor’s communication skills:

“'There's a lot you can learn about the doctor by the way he handles you and how close he gets and his demeanor. It's important to the care of the patient and that's what you get from that first visit in person.'"

“Then also I think it is a trust factor that if you can be in the same room first and they hear you, they see you, they know what you're trying to do, that this really helps.”

The medical center’s managers and telemedicine coordinator may provide general guidelines regarding the appropriateness of “in person” vs. telemedicine exams. The physicians must follow these guidelines, decide upon a course of action and recommend an appropriate mix of encounters to suit individual situations. However, ultimate control typically rests with the patients, who make the final choices regarding their medical care. Once all parties reach agreement, the scheduler books the appropriate type of exam and should provide appropriate notification highlighting the form (e.g., video conferencing) of the exam.

5.3.2. Medical team coordination

There are two aspects of team coordination to consider. First, telemedicine allows the numerous providers in different locations who are engaged in a patient’s case to collectively meet with the patient. Patients reported several advantages in reference to this capability, including collective input, confidence that information is appropriately shared, time efficiencies (the avoidance of multiple encounters and repetition) and more extensive information.

The second aspect of coordination is that all clinicians, particularly the clinician in the patient examination room (acting as the “hands” of the remote consultant) and the consulting clinician work harmoniously and congruently. Patients reported improved congruency when the remote consultant was directing the local clinician:

“The nurse practitioner did exactly what he (the doctor) told her to do. She didn't do anything on her own with me. But during the examination he told her what he wanted her to do.”

Good rapport is also required, as suggested by the following patient:

“It was also like she knew exactly what he wanted done...and good. And she did seem to know...when he said something...what he meant...without trying to...discuss it with him. The time was not taken away from my appointment so that they could have a little learning session. They already knew.”

One patient described this rapport as the kind of heightened communication that should exist among paramedics and emergency room doctors. It appears that such rapport needs to be nurtured by both the consulting provider and the clinician in the room before, during and after the encounter. The coordinator might be able to facilitate this process through training sessions, including demonstrations (possibly captured video) led by effective teams.

6. Results and discussion: comparing patient and provider views

A summary of our findings is provided in Table 1.

To address the second research question, we compared the use quality attributes specified by providers and patients. It is interesting to note that, as
the table in Appendix A demonstrates, patients identified eight of the nine use quality attributes (one attribute, adaptability, was identified only by providers). Five of the eight attributes were identified solely by patients (not by providers). Thus, we propose that use quality constructs in this context are most apparent to indirect users. For example, medical team coordination may be more apparent to patients, who are independent observers of team interactions, than to people engaging in the coordination process. Our results demonstrate the importance of measuring use quality from multiple perspectives in contexts in which the information system serves many different types of users (as only three attributes were identified by both groups).

The concepts of patient-centered care and patient participation in clinical decision-making has been a theme in the discipline of medical care for some time [52], yet providers did not identify certain attributes that seem to be consumer-focused. For example, presumably due to their role as consumers of telemedicine systems, patients singly identified use quality attributes that emphasized the service they would expect in any medical exam (e.g., clear future directives and professionalism). Patients also solely identified attributes that would provide more “consumer comfort” (e.g., convey access to, or reviews of, patient records, as well as mix with “in-person” exams not identified by providers). Given their roles as direct operators of telemedicine technology and as consumers of the information it generates, providers’ attention might be drawn away from pure consumer-oriented issues.

The demands of the tasks at hand during the exam are probably best understood by the medical providers. The provider—in particular, the consulting provider (often a doctor)—is clearly the person in charge of conducting the exam and of modifying work processes. It is therefore reasonable to assume that the provider understands the nature and the extent of modifications required, and

<table>
<thead>
<tr>
<th>Critical success factor</th>
<th>Key practices</th>
<th>Use quality attributes</th>
</tr>
</thead>
</table>
| Training providers to develop aptitude and comfort with the new telemedicine setting | • All providers need training on both the rationale for adopting telemedicine and operation (as suited to their role)  
• Adequate practice must be given in order to instill confidence in use and so that the technology use does not interfere with patient care  
• Specific training is needed on how to be successful with the video conferencing medium  
• Training should encompass the actual exam as well as technical and patient interaction immediately preceding and after the exam  
• Training should encompass technical skills as well as communication skills suited to medical video conferencing | • Telemedicine-trained staff  
• Focus on patient care  
• Adaptability  
• Professionalism: clinician in the room  
• Consultant telepresence |
| Medical clinician that can communicate effectively using the new telemedicine setting and adapt it appropriately | • Medical clinicians need to give clear directions at the end of an encounter, perhaps using both verbal and written directives  
• Medical clinicians need to make it clear that they have access to the patient’s records during the examination, since the patient cannot see this for him/herself  
• Medical clinicians need to adapt their care giving to the new setting  
• Medical clinicians need to consider process explanations, body language awareness, sustained communications, cordiality and camera placement to facilitate the communication process | • Clear future directives  
• Conveys access/review of patient records  
• Adaptability  
• Consultant telepresence |
| Attention is paid to the orchestration of the telemedicine encounter | • Administrators need to plan for how to mix “in-person” with telemedicine examinations  
• Patients may prefer an initial “in-person” examination prior to using the telemedicine setting, in order to increase comfort with the doctor  
• All medical clinicians engaged in an encounter need to work together harmoniously and communicate effectively as a unified health care team | • Mix with “in-person” exams  
• Medical team coordination |
would thus solely identify the need for adapting their exam procedures to suit the telemedicine context (adaptability was not identified by patients). The fact that this attribute was mentioned at all indicates that an important goal is for patients to perceive no change (detrimental or otherwise) in the care they receive relative to the care that would be provided to them “in person”.

7. Conclusion: the socio-technical nature of telemedicine encounters

We stress the need to re-characterize the construct of use to use quality when exploring systems success and when assessing use quality from the perspectives of several types of users (see Fig. 3). Our experience with both patients and providers confirms the viability of the use quality construct.

Parasuraman and Colby [43] have shown that the effectiveness of a technology service encounter depends on the use of state-of-the-art technology and the quality of technology-based interactions. Recent empirical efforts in the telemedicine domain (specifically, telehome health care) support the requirement that both the technology and the nature of interactions between the patient and medical clinician during a telemedical visit need to acknowledged when studying the care process [17]. The findings of our study support these assertions, as identified attributes have both social and technological implications. Since medical video conferencing is a technology-based service encounter, there are social as well as technical implications among attributes and within the meaning of attributes. Many social factors are mentioned or implicitly referred to in discussions about use quality attributes, including telepresence, mix with “in person” exams and professionalism (e.g., clinician in room). Social factors are particularly evident in commentaries about telepresence. The following patients’ comments exemplify a range of social implications:

- Congenial/empathetic: “Well, you know, she (referring to the doctor) could ask you, like, how long have you lived here, and do you like Florida...Little things like that to relax the individual, you know.”
- Attentive: “He looks straight at you. The doctor’s got to look halfway interested.”
- Intimacy: “It was very personal because he was talking directly to me and I was talking directly to him.”
- Reduced social clues: (Interviewee) “The body language in person; you could more or less have intuition that he’s paying attention.”

Technical use factors were apparent in the meanings of the telemedicine-trained staff, the focus on patient care and the medical team coordination, as evidenced by the following comments:

- Medical team coordination: “She (the doctor) was giving him (the clinician) verbally, like, the instructions, move it a little bit more to the right, move it here and there, stop there for a minute, you know, and so she was scanning my back for that melanoma that I had 20 years ago, looking for a scar.”
- Telemedicine-trained staff: “Special training for both the doctor and the nurse. This is a unique system and it sure is a great one, but it has to mature and the staff has to be fine-tuned to really make it work so it is savings for the patient.”

The list of use quality attributes indicates that use quality begins to develop before the actual telemedicine exam. The prerequisites of use quality during the encounter are professional training, technology training and a medical team who possesses the coordination skills to operate technology and simultaneously keep the exam on track. The identified attributes also indicate that specific types of communication are necessary to use quality, including effective team collaboration, clear future directives and communication conveying reviews of, and access to, medical records.

The use quality constructs address the stakeholders’ assumption that there is an appropriate manner for conducting a telemedicine exam if it is to “flow” smoothly. We propose that use quality, rather than a generalized definition of use, has the greatest impact on net benefits in the telemedicine context, and that a standard of use must be upheld to achieve successful encounters. In integrating these elements of use quality, we offer the following definition, valid in the telemedicine context:

*Teledicine use quality is the effective convergence of technological aptitude and ability, communication skill and encounter orchestration, to provide suitable patient care.*

We also offer a generalized definition for the collaborative technology context:

*Use quality is the effective convergence of social and technical factors in the deployment of a...*
collaborative technology meant to produce desired results.

By exploring and identifying the attributes of use quality in this context, we aim to provide the IS community with additional insights into, and refinements of, the concept of use, in order to facilitate understanding and specify post-adoptive appropriation of technology.

In reference to the methods used in our study, we believe that the integration of providers into research roles (in addition to their role as a data source) would promote opportunities and provide understanding, both of which research could assimilate into practice and practice could assimilate into research. Involving providers in the analysis of data and specification of use quality attributes enriched our study.

Information systems research prescribes assessment of the individual impact of an information system on the basis of whether the information causes the receiver to change his or her behavior or decisions [37]. The underlying proposition of the collection of attributes identified in this study is that compromised use (that does not appropriately address attributes identified) could impede the communication process and information flow among the patient, technology and medical providers during the telemedicine encounter. Ultimately, this breakdown in the communication process could negatively impact the behavior or health care decisions made by patient and provider due to incomplete information transfer, inadequate information or inadequate integration into other modes of care [26].

Research by the NTOIP project specifies that the successful transfer of critical health information is a key outcome measure (with ease of use) for the quality of a telemedicine encounter [47]. Empirical studies indicate that the style and content of communications in a medical encounter can affect patient compliance to prescribed medical protocols, patient anxiety levels, patient satisfaction, symptom burden, number of referrals and medical outcomes [53]. The integration of technology introduces additional challenges during a telemedicine encounter that could alter the quality of care if the flow and patterns of information exchange cannot mimic those of an in-person exam [17]. Recent empirical efforts, which seem to indicate that acceptable/neutral (as opposed to good or excellent) technical quality can produce good and even excellent ratings of encounter success (as determined by medical clinicians) with attention to the tele-home health encounter process, draw attention to the need to recognize use quality as a construct [16].

Therefore, the proposition that effective use leads to favorable results supports the need for researchers to look beyond mere use. We maintain that it is use quality (as opposed to a generally applied construct of use) that is the more relevant construct in studying IS success. We call upon researchers to heed the call to look beyond use by contextually specifying use quality and by applying the use quality construct [15].

8. Limitations and future research

As discussed earlier in the paper, the qualitative, inductive approach taken in this study may create bias in the study. The multiple methods and validation processes employed in the study seek to improve the rigor of the research effort, but cannot remove the subjectivity in interpretation inherent in the research approach. Moreover, the study subjects were drawn from one large health care provider with multiple hospitals and clinics in order to limit differences due to variations in telemedicine technologies and policies. This limits the generalizability of the research. These limitations are typical of intensive research.

Future research building on this study should test the findings using more extensive research methods, such as surveys, with subjects scientifically sampled from the population of all telemedicine providers. One particularly interesting question is whether training, and what kinds of training, would improve use quality attributes such as focus on patient care and ability to adapt to the telemedicine setting. While this study focuses on the differences between provider and patient perspectives on use quality, it would also be interesting to test whether knowledge of the other perspective on quality impacts patients’ or providers’ views or behaviors. This study also focuses on a single, technology mediated health care encounter, but in fact there exists a spectrum of technology mediation in health care. A logical next step would be to explore the issue of use quality in face-to-face technology mediated health care encounters, such as medical imaging and technology-delivered treatments, perhaps in contrast to the no-technology-mediation in-person setting and the virtual telemedicine setting.

Acknowledgements

This research was conducted in cooperation with the Veterans Integrated Service Network 8 (VISN 8) of the Department of Veterans Affairs health care system and the INTEGRIS Telehealth Network and Rural Telemedicine Project.
Appendix A. Use quality attributes [scale of 1 “not important” to 4 “highly important”]

<table>
<thead>
<tr>
<th>Quality attribute</th>
<th>Definition</th>
<th>Patient, mean</th>
<th>Patient, S.D.</th>
<th>Provider, mean</th>
<th>Provider, S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological aptitude and ability: how well the system technology was used during the encounter</td>
<td>The degree to which users are able to operate equipment and understand the functions to facilitate the different clinical exams after a limited formal or informal initial learning period. Initial learning is supported by follow-up practice.</td>
<td>3.619</td>
<td>0.498</td>
<td>3.333</td>
<td>0.651</td>
</tr>
<tr>
<td>Telemedicine-trained staff [both patient and provider]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus on patient care [both patient and provider]</td>
<td>The degree to which the medical care provider is able to focus on patient care rather than figure out technology. The consulting physician should not be distracted by the technology when fulfilling the objectives of the encounter. In essence, the equipment is subordinate to the exam process; it is merely a tool.</td>
<td>3.333</td>
<td>0.483</td>
<td>3.500</td>
<td>0.522</td>
</tr>
<tr>
<td>Adaptability [provider only]</td>
<td>The degree to which medical providers are able and willing to adapt or modify the extent, nature or procedural process of their service to provide maximum effectiveness within given medical video conferencing constraints. Adaptability influences the sequencing and nature of tasks performed during the telemedicine exam process.</td>
<td>N/A</td>
<td>N/A</td>
<td>3.333</td>
<td>0.492</td>
</tr>
<tr>
<td>Communication skills: style and content of communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consultant telepresence [both patient and provider]</td>
<td>The degree to which the remote consultant is able to convey a ubiquitous, virtual presence (e.g., eye contact, warm atmosphere, congenial atmosphere, interactive atmosphere), as well as medical expertise and authority. Telepresence may be thought of as a warm and confident virtual bedside manner.</td>
<td>3.476</td>
<td>0.512</td>
<td>3.333</td>
<td>0.492</td>
</tr>
<tr>
<td>Clear future directives [patient only]</td>
<td>The degree to which the consulting doctor instructs the patient regarding what to do after the encounter is over. Clear future directives includes such things as medical instructions, whom to contact in the future, will there be another telemedicine exam, will there be an “in person” exam and a status summary at the end of the encounter.</td>
<td>3.762</td>
<td>0.700</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Conveys access/review of medical records [patient only]</td>
<td>The extent to which the consulting doctor indicates to the patient that he/she has reviewed the patient’s records and has access to the records during the encounter.</td>
<td>3.524</td>
<td>0.602</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Professionalism—clinician in room [patient only]</td>
<td>The extent to which the medical person in the room with the patient (e.g., nurse practitioner) is professional and courteous toward the patient.</td>
<td>3.524</td>
<td>0.512</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Orchestration: coordination among providers during encounters as well as over time and across encounters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mix with “in person” exams [patient only]</td>
<td>The degree to which relationship building and other data gathering during “in person” meetings are needed to provide a necessary foundation for telemedicine encounter communications. The medical providers should assess the need for “in person” meetings. The need may range from no meetings in person or only the first meeting in person to intermittent “in person” meetings.</td>
<td>3.050</td>
<td>0.510</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Medical Team Coordination [patient only]</td>
<td>The extent to which the consulting doctor and other medical staff involved in the encounter work together as a team when conducting the telemedicine exam.</td>
<td>3.571</td>
<td>0.507</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

References


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