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A Conceptual Framework and Pilot Study for Examining Telemedicine Satisfaction Research

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Abstract
Stakeholder satisfaction is often considered a key to the success of telemedicine systems. However, it can be difficult to understand and compare satisfaction evaluations because of variations in reporting and study designs. This research will contribute to the knowledge by developing a conceptual framework around key concepts that relate to understanding studies on telemedicine satisfaction. The framework is built based on a developmental review of the telemedicine and telehealth literature obtained from searches of PubMed and Google Scholar. Using a conceptual matrix, researchers have synthesized the results into a framework that includes: satisfaction dimensions, stakeholders, type of care, type of system, context and methodologies. This research expands these concepts by discussing attributes of each and tests the framework by conducting a pilot study that identifies the concepts in primary study sources. The results of the framework and the pilot study are reported.

Keywords Telemedicine · Telehealth · Satisfaction · Conceptual framework · Review

Introduction

Telemedicine describes information systems that use telecommunications technologies to provide remote medical services across geographic distances [1]. Although other terms can be used to describe similar systems, telemedicine generally refers to systems used in clinical practice [2]. This is an important consideration as systems used in clinical practices can present unique requirements and challenges [3]. As usage of telemedicine grows there is an increased need for decisions makers to evaluate and compare services [4].

Among the criteria that is used to evaluate telemedicine services is stakeholder satisfaction [5]. Despite its widespread use there remain challenges with the use of satisfaction in evaluations [6]. As satisfaction remains a loosely defined term it can be difficult to interpret what satisfaction with telemedicine means. The complex interactions of different stakeholders with technical factors unique to telemedicine can complicate understandings [7]. Issues with the methodologies used to evaluate satisfaction can also limit the replication of efforts and increases uncertainty for those trying to interpret or compare findings [8].

Decision makers should be able to easily interpret the results of telemedicine evaluations and come to actionable conclusions. Yet they face problems because of the challenges with evaluating satisfaction. Although satisfaction has been extensively researched in the information systems literature, there remain gaps in understanding the role of satisfaction in telemedicine, and a need to model factors unique to the contexts in which services are applied [9, 10].

This study will contribute to the knowledge of telemedicine satisfaction by expanding on previous work towards developing a conceptual framework for telemedicine satisfaction [11]. Conceptual frameworks can assist in synthesizing knowledge from different areas to gain a broad understanding of topics [12]. A conceptual framework on telemedicine can provide a starting point for evaluating and comparing studies while providing new direction for future research. This study uses a developmental review for the creation of a conceptual framework on telemedicine satisfaction. These reviews are considered appropriate for developing new insights for more mature topics [13].

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Telemedicine satisfaction

Among the factors considered critical for the success of telemedicine is stakeholder satisfaction [5]. The satisfaction of stakeholders, such as patients and providers, can influence the success and the extent to which telemedicine services are adopted [14–16]. Satisfaction is also considered important in this domain as it can affect medical outcomes and patient participation in continuing care [17].

Satisfaction is a complex construct and its different aspects can affect telemedicine in ways that make results difficult to interpret [18, 19]. Further there are concerns over whether existing methodologies are adequately capturing satisfaction and what exactly measures demonstrate [20, 21, 16]. For example, despite high levels of satisfaction patients may reject the use of telemedicine as a replacement for face to face consultations [22]. Satisfaction can also vary based on different factors such as increased interventions [23] or context [24]. Variations such as these make it difficult to generalize and interpret findings [16].

Researchers have examined these concerns but there remain issues that require additional study [25]. Early studies evaluated telemedicine using existing models but results could only account for minimal variance and explanatory power [26, 27]. Researchers have attempted to address this by developing models specifically for evaluating telemedicine [5, 28]. Yet, these models often remain in need of testing and further improvement [29, 30]. Among the problems faced are the validity of methodologies and the adequacy of measurements [20, 16]. Findings also raise concerns over what is being measured and the extent to which results are generalizable [31]. New instruments have been developed to help address this [32, 33]. However, for comparison and evaluation purposes there remains a need to standardize what is being investigated [20, 34].

Review procedures

This review expands previous work on a conceptual framework for evaluating telemedicine satisfaction [11] using recommendations by [13] and [35]. Google Scholar and PubMed were used for data acquisition. PubMed lists a broad range of citations from the biomedical literature and Google scholar compliments this by including data sources across domains.

Only literature reviews and full papers where the research specifically examined telemedicine satisfaction are considered. This is used because of the large number of studies that only use overall satisfaction as a small part of an investigation [15]. Limiting the search to reviews that focus on telemedicine satisfaction was done to identify and describe major domain concepts.

The search terms "telemedicine", "telehealth", "satisfaction" and "review" were used. The term "review" is used to limit results to studies that conduct literature reviews while not excluding those ignored if the term "literature" is added. On 11/20/2017 separate searches were conducted for telemedicine satisfaction review and telehealth satisfaction review using both search engines. As the initial Google Scholar search returned thousands of results the search was run a second time using the terms "telemedicine satisfaction" review and "telehealth satisfaction" review to limit the scope and obtain the most relevant results.

The results were extracted using Publish or Perish software. Duplicates and non-English results were removed. Literature reviews that focused on telemedicine satisfaction were manually extracted from the results by examining papers. Papers with terms that inferred pilot studies, case studies, etc., were excluded. If either the goals or methods did not specify satisfaction or only minimum content such as overall satisfaction was reported, the studies were excluded. To remove bias, studies in which the authors contributed to were removed. Results were synthesized by two reviewers using a concept matrix [35] to categorize, compare and check conceptual elements for appropriateness. A total of 19 studies were reviewed. One study was inaccessible during the time of the review.

Conceptual framework

Six concepts around telemedicine satisfaction have been identified in the review: dimensions of satisfaction, stakeholders, type of care, type of system, context, and methodologies. Fig. 1 2 and 3 on the following page shows the entire framework and how concepts inform each other. These will be discussed along with specific attributes around each concept in the following sections.
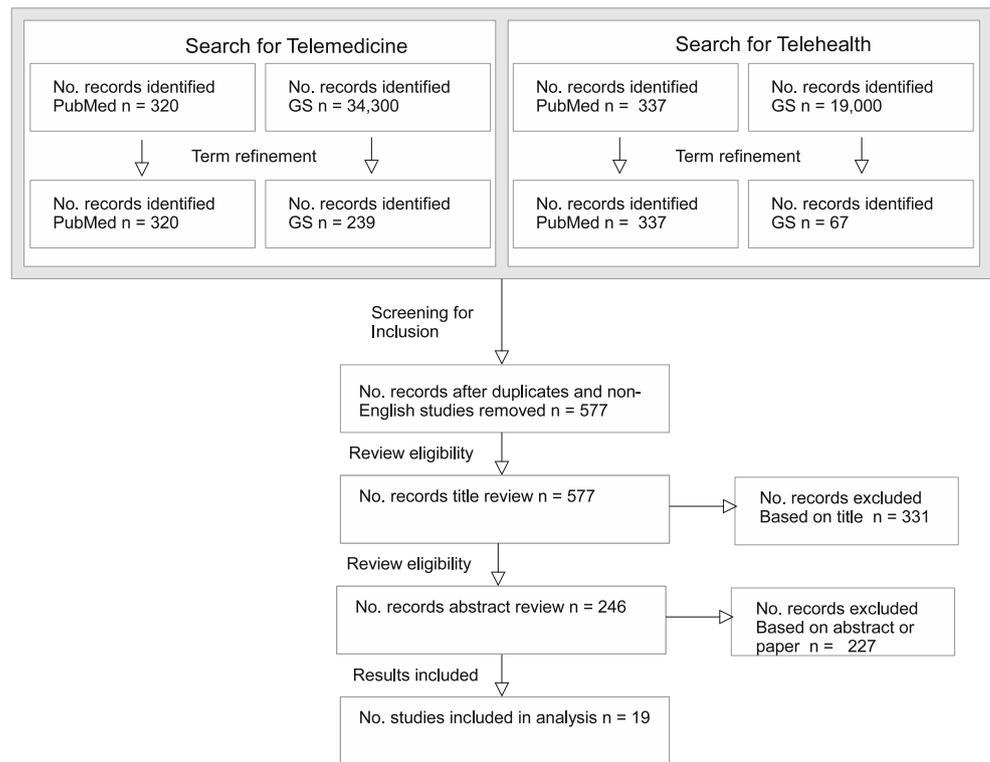
Dimensions of satisfaction

Despite satisfaction being a multidimensional construct studies often rely on broad concepts such as overall satisfaction for their evaluations [15]. This simplistic view of satisfaction makes results of studies difficult to interpret [16].

Satisfaction is made up of multiple dimensions that are experienced by stakeholders. The dimensions that impact satisfaction vary based on which type of stakeholders are evaluated. The way dimensions are viewed and their impact on satisfaction are affected by perceptions of the systems and care provided. This is shown in Fig. 4.

While simple views of satisfaction may be appropriate in some cases, identifying which dimensions make up satisfaction can ensure its adequate measurement. This research has identified three aspects of satisfaction dimensions that should be considered in evaluations: dimensions that influence satisfaction, structure of indicators, and the universality of dimensions.

Fig. 1 Image showing search and screening process [36]

Dimensions that influence satisfaction

Different dimensions influence satisfaction. Studies have used communication, patient provider relationship, convenience, accuracy, reliability, effectiveness, efficiency, ease of use, and usefulness as part of satisfaction measures [37–39]. However, there may be other dimensions that impact satisfaction. As certain

dimensions may have specific effects on satisfaction it is important to consider which dimensions are used.
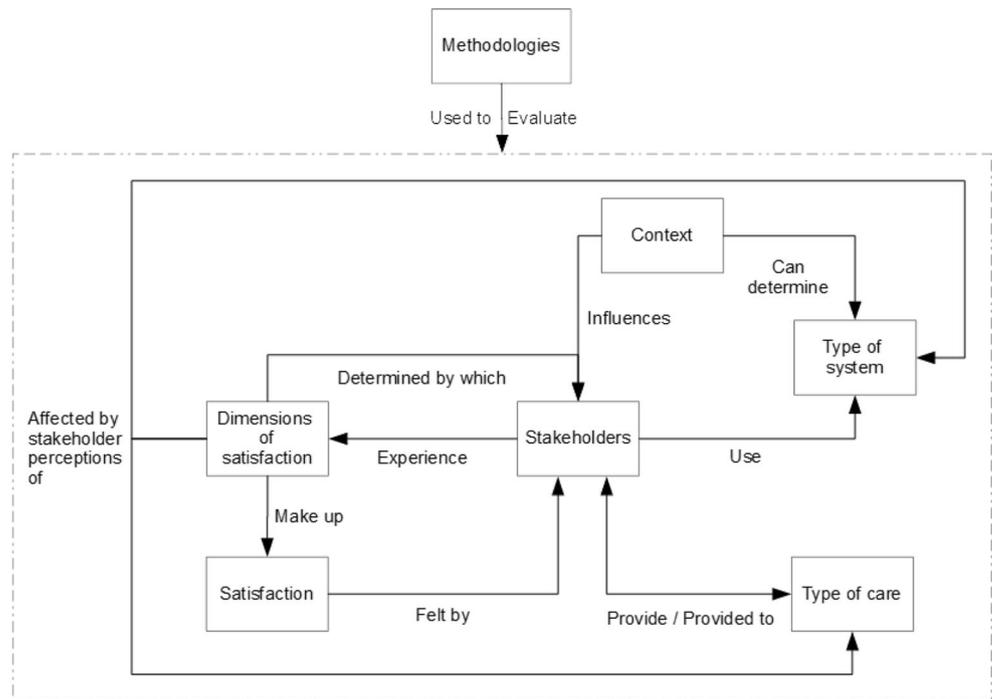
Structure of indicators

The structure of dimensions can play a role in both the interpretation of results and the models that inform them [40].

Fig. 2 Results of conceptual matrix [36]

Fig. 3 Proposed conceptual framework for telemedicine satisfaction

Dimensions may not be formative of satisfaction itself but may still reflect aspects of it. Some dimensions such as cost, age, and time can act as mediators for satisfaction [15].

Universality of dimensions

Dimensions are typically evaluated in different contexts [37–39]. However, the specific dimensions evaluated may vary between studies. As a result, it is unclear whether some dimensions may be context specific or whether they are universally applicable.

Stakeholders

A common element discussed in the literature is the satisfaction of different stakeholders. There can be variations in which stakeholders are examined and the elements of their experiences studied. Fig. 5 outlines the concepts and their relationships. Stakeholders either provide or are provided care by using telemedicine systems. Through this they experience satisfaction dimensions which apply to groups differently. However, their perceptions can be influenced by contextual factors.

Fig. 4 Attributes to consider for dimensions of satisfaction
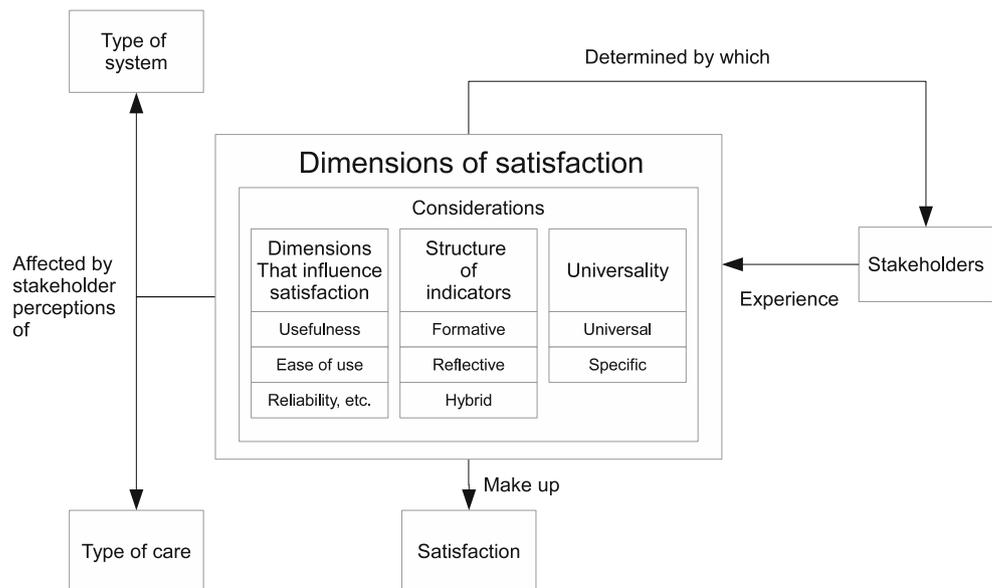
Fig. 5 Attributes to consider for stakeholders

Stakeholder groups

There are a variety of groups whose satisfaction can influence system adoption. The studies examined either evaluate patients, providers or both [16]. There are potentially other stakeholders with dissimilar views and whose satisfaction should be considered. Even within the groups examined however variations and subgroups exist that affect perspectives about telemedicine. Providers for example can include primary care physicians, specialists, nurses, physician assistants, and others [38, 41]. Each may have a different role in administering services or use systems customized to their role. Their specific interactions with telemedicine may result in unique perspectives.
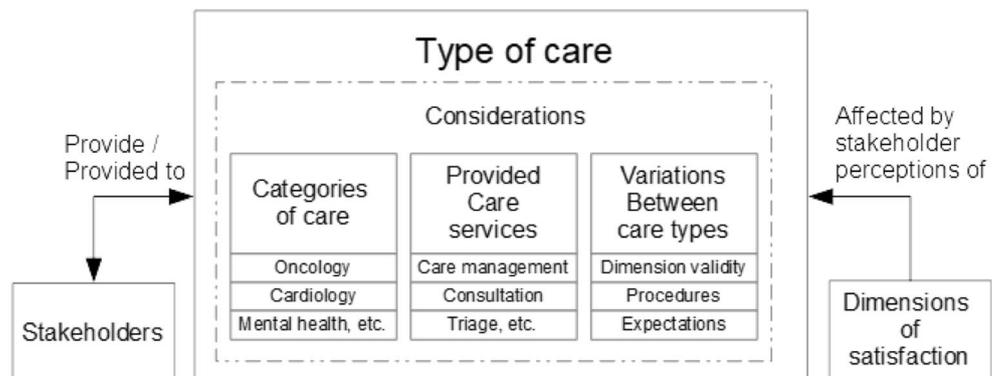
Group satisfaction

Several studies use the results of satisfaction to compare perspectives between groups. In some cases providers may experience greater satisfaction than patients and in others patients may be more satisfied [16]. There is also the possibility that subgroups experience satisfaction differently. For instance, despite both being considered providers nurses may interact differently with a system than doctors and this may reflect in their views of a system.

Dimensions by group

The importance of different dimensions may vary based on the group evaluated. [39]. Providers for example may be more concerned with a systems usefulness whereas patients may place more value on convenience [16]. It is therefore important to consider the appropriateness of dimensions for each group and how they affect satisfaction.

There are three aspects that can aid in examining telemedicine stakeholders: stakeholder groups, group satisfaction and dimensions by group.

Fig. 6 Attributes to consider for type of care

Type of care

The type of medical care being offered is often an important consideration. Patient experiences for instance can be shaped based on the type of care they receive and their expected outcomes [17]. However, differences in the way medical care is described can make comparisons between studies difficult. Type of care is either provided to or by stakeholders and their evaluations of if affect how dimensions of satisfaction are perceived. Fig. 6 shows some considerations for the type of care concept. Considering categories of care, provided care services and variations between care types can assist in evaluations.

Categories of care

The types of care provided can be categorized in different ways. In the studies evaluated care has been examined based on level of care and area of specialty. Studies may evaluate services based on the level of care such as primary, secondary and tertiary [42]. Other studies focus on specific areas of specialty such as orthopedics, oncology, neurology, cardiology, radiology, dermatology, psychology, and nursing [15, 16]. However, even within these areas there are examinations that further narrow the focus of specialties. For instance studies in rheumatology can cater to specific afflictions such as rheumatoid arthritis, juvenile idiopathic arthritis, or osteoarthritis [43].

Provided care services

In evaluating the type of care being administered the provided services should also be considered. Some studies only focus on specific services such as consultation, care management or triage [44, 31]. The workflow for each of these services can vary. For instance, care management involves different processes than triage. The workflow differences also apply when similar services are offered between care types. Care management differs for example between geriatric and mental health patients.

Variations between care types

Stakeholders may have different expectations based on the type of care provided [45]. Expectations may differ based on specialty and the type of services offered. Different types of care may involve unique procedures that impact satisfaction [16]. Further expectations based on the type of services offered can influence the validity of certain dimensions [42]. A patient for example may not consider medical outcomes as critical when evaluating a triage service as when receiving a cancer diagnosis.

Type of system

Differences in systems and technologies used can potentially impact perceptions of telemedicine and the services offered. The studies examined show that the types of technologies used for telemedicine can vary from the use of telephone [46] to SMS on mobile devices [37]. Figure 7 outlines concepts related to the type of system. The type of systems available can be affected by contextual factors. Stakeholders experience satisfaction dimensions based on their use of a system. These experiences are affected by their views of the system. There are three main aspects that were identified in relationship to the type of system: System categories, system perspectives and technology shifts.

System categories

Systems can be classified in different ways. Studies refer to three broad categories of telemedicine: real-time videoconferencing, store and forward and hybrid systems [15, 31, 47]. Terms are also used that provide additional details about system types. Among these are technical descriptions such as mobile, web-based, telephone, SMS and electronic monitoring systems. [37, 48]. While certain categories of systems may be appropriate for some research purposes a lack of consistency and detail make replication and comparisons difficult.

System perspectives

Stakeholder perspectives of different technologies and systems can shape their acceptance and impact satisfaction [49]. Users may have preconceived views of technologies or how they should be used based on past experiences. This concern was mentioned in some of the evaluated studies that describe the mediating impacts of past experience with telemedicine services [15, 16].

Technology shifts

Researchers have noted that because of constant changes in technology there remains a need to constantly evaluate telemedicine systems [20]. The lack of details on the types of systems and services evaluated make evaluating the extent of these shifts difficult from the examined reviews. However, more recent reviews tend to describe additional details such as the use of mobile devices that were not widely used in previous decades.

Context

Context can impact satisfaction and its determinants [50]. Context can influence the perceptions of stakeholders and also

Fig. 7 Attributes to consider for type of system
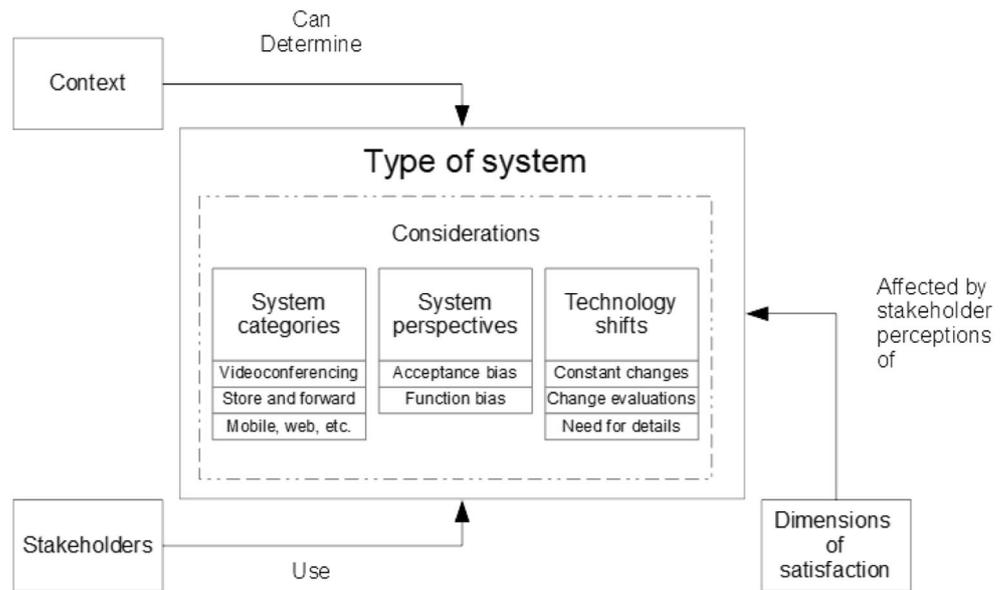
determine the types of telemedicine services available. This relationship is shown in Fig. 8. Information on the context in which studies take place can aid in understanding reports of satisfaction. There are two aspects of context that were identified in the examined studies: environment and regional considerations.

Environment

Although not often evaluated, the physical environment in which a study takes place can affect satisfaction [15] Studies discuss different facilities in which studies takes place such as a home, clinic, or hospital [20, 42, 31]. Each different setting can impact how telemedicine systems are used and different perceptions.

Regional considerations

Regional considerations are also discussed in the literature. The regions described can vary between country, land bodies or urban/rural environments [15, 16, 38]. Some have raised concerns that a lack of investigations into different geographic regions can contribute to biases in studies and limit the generalizability of findings [37]. The regions themselves are not often the focus of studies. Rather aspects such as culture, socioeconomic conditions, availability of resources, etc. that are prevalent in different regions are considered important. For instance, one of the advantages that can enhance stakeholder satisfaction with telemedicine is access to care [20]. However, patients with limited access to healthcare facilities may view any services that increase their access favorably.

Methodologies

Among the issues that is commonly discussed in the telemedicine literature are concerns over the methodologies used to evaluate satisfaction [25, 20, 16]. The methods used in satisfaction research can aid those conducting similar research and evaluating services. Fig. 9 provides an overview of the

Fig. 8 Attributes to consider for context
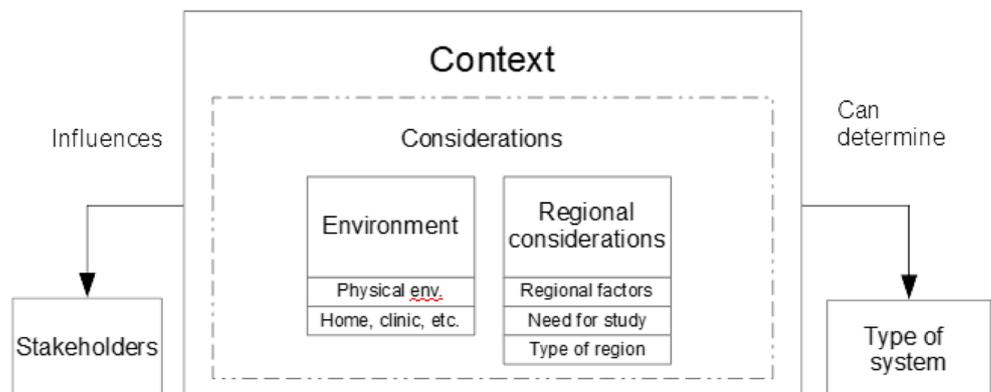
concepts. Three aspects were determined that can aid in understanding methodologies: type of methods, method delivery and quality.

Type of methods

There are different methodologies used for conducting research and various approaches used to collect data. Studies often use quantitative methods for evaluations however some researchers suggest qualitative or mixed methods may provide additional insight [47, 16, 39]. Still, qualitative methods are not often used [48, 39, 51]. In quantitative research questionnaires are the most common approaches used to collect data [15]. For qualitative studies approaches vary with interviews and focus groups being most common [48]. Research variations also exist based on the experimental design of studies and measurement instruments used [15, 20].

Method delivery

There are different ways in which methods are administered. Methods can be administered in person, via snail mail, electronic mail, and telephone [31]. Understanding the way methods are delivered can aid those seeking to replicate studies.

Method quality

Concerns are often raised over the quality of methodologies used in telemedicine studies. Issues such as limited sample sizes and potential selection biases make results difficult to generalize [45, 46, 39]. Many surveys also make use of self-administered questionnaires that are seldom assessed for

reliability and validity, even though previously validated instruments exist [15, 44, 31]. The lack of standardized measures and differences in the goals of research studies can also present challenges when comparing results [41, 52].

Pilot study

The conceptual framework discussed in this study presents several broad concepts based on existing literature reviews of telemedicine satisfaction. In order to gauge the practicality of using the framework to aid researchers in examining telemedicine satisfaction evaluations, a pilot study was conducted. Pilot studies are considered an appropriate first step for testing the adequacy of research tools and analysis techniques [53].

Research design

The pilot study sought to examine how the conceptual framework could be used to examine evaluations of telemedicine satisfaction and if the concepts identified in the literature reviews could be identified in primary sources. In order to accomplish this qualitative data was collected from a sample of primary sources obtained from The Journal of Telemedicine and Telecare and Telemedicine and e-Health. Three graduate students were recruited to review the studies. Data was collected using a form based on the conceptual framework (see appendix Table 2). The form contained the concept along with a brief description and examples. The students were provided the form, the descriptions of the conceptual framework in this

Fig. 9 Attributes to consider for methodologies
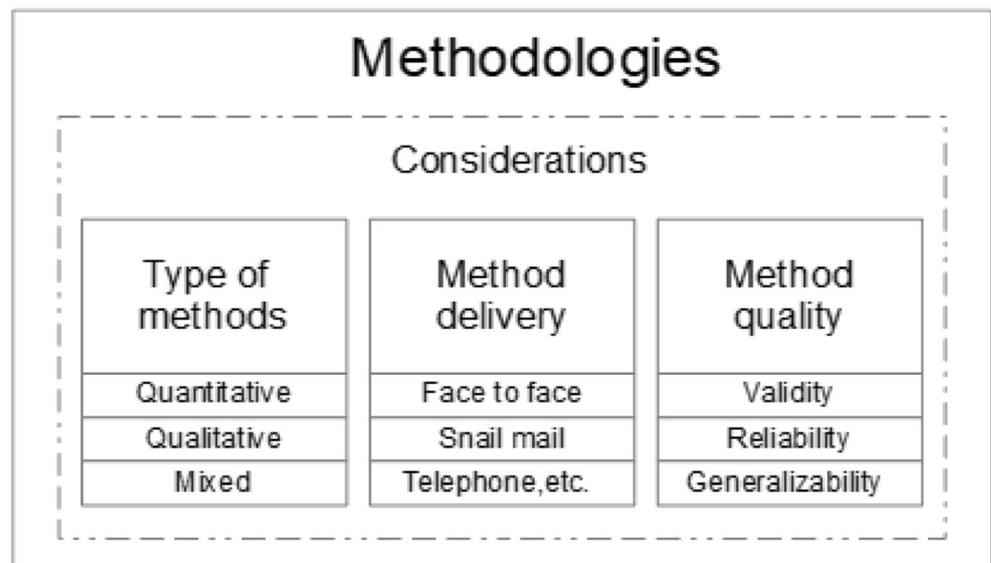
paper and papers to review. The forms were then reviewed by a doctoral student and relevant information extracted.

To test the framework across a broad spectrum while maintain a degree of control, three types of studies were evaluated: case studies, randomized controlled trials (RCT), and pilot studies. These were selected because of the potential variances in the types of details that each type of study might report. It is expected that case studies can provide data that would reflect the type of results obtained from performing a similar analysis at an organization providing telemedicine services. Randomized controlled trials were also examined as they are considered the gold standard in clinical research [54]. Finally, a sample of pilot studies were selected to examine the extent to which concepts could be identified and compared in emerging research. The papers were obtained by searching the journals using Google Scholar and extracting the most relevant results. The searches were performed using the study type as the term followed by satisfaction and the journal listed as the source. For example, to search for case studies in Telemedicine and e-health the following query was used: "case study" satisfaction source: "Telemedicine and e-Health".

Results

A total of 18 studies were examined. 6 of the studies examined were case studies, 6 randomized controlled trials and 6 were pilot studies. Figure 10 below shows a listing of the studies examined and the concepts identified in each study.

The figure is separated based on the type of study evaluated. Concepts that were directly discussed in the studies and clearly identified by reviewers are marked in blue. Occasionally reviewers identified information from studies as relating to a concept that were unclear or minimal. For example, studies may not discuss a relationship between a location and satisfaction, however reviewers tend to present a location as evidence of environment. These are marked in yellow in the Fig. 10 on the previous page.

Reviewers reported information relevant for each of the 6 concepts. From these concepts' information about 9 of the attributes were reported across all studies. These include satisfaction dimensions, universality of satisfaction, stakeholder groups, category of care, provided care services, system category, environment, types of method, and method delivery.

Fig. 10 Concepts identified in case studies (C), RCTs (R), and pilot studies (P)

However, information about the relationship to satisfaction for three of these attributes was inferred and not directly reported. These include, environment, universality of dimensions, and the system category. To examine the value of the provided information a sample of the results for satisfaction dimension are presented in Table 1.

Discussion

This study aimed to develop a conceptual framework that could be used to aid in examining telemedicine satisfaction. Based on a review of the literature 6 concepts for telemedicine satisfaction were identified: satisfaction dimensions, stakeholders, type of care, type of system, context and methodologies. These concepts were expanded by discussing attributes that relate to each concept. Reviewers were able to identify information about each of the 6 concepts and related attributes in a pilot study. However, the information extracted on each attribute varied based on the study. Some attributes were identified clearly in all of studies examined. This includes the

dimensionality of satisfaction, stakeholder groups, category of care, the type of care provided, the methods used to evaluate satisfaction and the way in which the satisfaction measures were delivered.

Some attributes were not identified in all of the studies or varied based on the type of study examined. For example, RCTs were more likely than other studies to include information about the quality of the instruments used. This could reflect the more stringent reporting requirements of these types of studies [53] and provide additional for researchers attempting to understand deficiencies in reporting on methodologies [15].

Information about some attributes were reported that could be used for examining the impacts on telemedicine but the relationship was not directly discussed by the authors. For example, studies reported information about the locations in which the telemedicine services were provided, such as a home or clinic. However, most did not suggest any relationship between factors within the location's context and satisfaction. Two of the studies did mention only including participants that spoke

Table 1 Sample comparison of data collected by reviewers

Study	Type	Dimensions	Stakeholder
[55]	C	Convenience, travel, usefulness	Patients, doctor, caregiver
[56]	C	Effectiveness, overall satisfaction, relationship, motivation, "buy-in", usefulness, workflow, reliability, remuneration	Patient, provider
[57]	C	Job satisfaction, stress, quality of care, retention rate	Patient, nurses
[58]	C	Usability and usefulness	Patient
[59]	C	Job satisfaction	Caregivers
[60]	C	Overall satisfaction	Staff, Managers
[61]	R	Convenience, privacy, technical quality, overall care quality, communication, competence, relationship,	Patient
[62]	R	Overall satisfaction, outcomes, comparison with face to face, communication, organization, information availability	Patient
[63]	R	Hospital care, home based services	Patient
[64]	R	Overall satisfaction, helpfulness, reasons or uptake of intervention	Patient
[65]	R	Information, shared-decision making, sympathy and understanding of healthcare profession, outcome	Patient
[66]	R	Effectiveness, cost-effectiveness	Patient
[67]	P	Overall satisfaction	Patient
[68]	P	Comfort, convenience, communication, overall satisfaction, reuse, ease of use	Patient
[69]	P	Overall satisfaction, appointment, instructions, comfort level, reuse, communication, knowledge of providers, duration of visit	Patient
[70]	P	Overall satisfaction, what user liked about service	Patient
[71]	P	Provider relationship, services, general healthcare organization, technical quality	Patient, provider
[72]	P	Technology, service	Patient

English because of language barriers but this was not directly linked to satisfaction itself [69, 72].

Reviewers commented on additional difficulties with identifying information about certain attributes due to a lack of clarity. There was disagreement between reviewers on what qualified as the structure of indicators and how these could be identified in studies. Most reviewers had limited experience working with research measurements such as formative, reflective and mediating. While, some reviewers cited dimensions as having specific relationships it was unclear how they determined these relationships from the study. Reviewers also had difficulty with identifying information related to technology shifts and variations of care types. For variations in care types reviewers were unsure whether telemedicine qualified as a unique care type or whether it was a variation of an existing care type. For example, in RCT studies that compared traditional versus telemedicine services some reviewers were uncertain whether telemedicine alone constituted a different type of care or just a way of delivering the service. For technology shifts, some reviewers were unclear on whether information should be identified only when technology changed over time or whether it was due to differences in older and newer technology such as telephone vs SMS.

Conclusions

This research contributes to studies on telemedicine satisfaction research by developing a conceptual framework that could be used in examining telemedicine evaluations and research. The framework identifies 6 key concepts and related attributes that can aid in understanding telemedicine satisfaction studies. This research tested the conceptual framework using a pilot study. The pilot study demonstrated that the concepts identified in literature reviews could be identified in primary sources. However, challenges existed with identifying some of the attributes clearly in the literature. Some of these challenges could be related to the form used to extract data and the lack of training for reviewers. There is also a need to further examine the concepts identified and expand on the attributes. While, there are limitations to this research, the pilot study demonstrated that the conceptual framework could be used to extract information from different types of studies. Future work will examine how this information can be used for organizing data and comparing evaluations of telemedicine satisfaction.

Compliance with Ethical Standards

Appendix

Table 2   Pilot study evaluation form

Category	Description	Examples	Review
Satisfaction dimensions Concepts			
Dimensions of satisfaction	Dimensions that the study discusses as being related or influencing satisfaction	efficiency, usefulness, ease of use, reliability, cost, scheduling	
Structure of indicators	How do the dimensions relate to satisfaction	Cause effect, formative / reflective or mediating relationships	
Universality	The dimensions are general to most studies or specific to this study	Were you satisfied with the home IoT telemonitor	
Stakeholders Concepts			
Stakeholder group	The group of stakeholders whose satisfaction was evaluated	Patient, provider, doctor, nurses, management	
Group satisfaction	Comparisons of satisfaction between different groups	Are doctors more satisfied than patients or nurses?	
Dimensions by group	The variations or uniqueness of different dimensions by group	Liability is a factor doctors consider whereas transportation may impact patients	
Type of care Concepts			
Categories of care	The area of medical practice in which the care falls under	oncology, radiology, radiology, mental health, etc.	
Provided care services	The types of medical services provided	care management, triage, consultations, prescriptions	
Variations between types of care	Differences between the type of care or services provided	Patients were more satisfied receiving telemedicine for oncology than radiology or for care management over triage	
Type of system Concepts			
System categories	Types of systems and technologies used	Videoconferencing, store and forward, web, mobile, IoT	
System perspectives	Stakeholder perspectives of the different technologies	Patients never used IoT before. Doctors hated using the web site.	
Technology shifts	Technical changes in technology over time	Telephone systems were used in older studies and now	

Table 2 (continued)

Category	Description	Examples	Review
		mobile systems are used.	
Context Concepts			
Environment	The physical environment in which the study took place	Did study take place in a home, clinic, emergency room, were condition of the facilities mentioned, etc.	
Regional considerations	Regional considerations based on where the study took place such as country, rural/urban can impact culture, etc.	Sub-Saharan African cultural difference from Western European. Study taking place in middle east or in rural America.	
Methodologies Concepts			
Type of methods	Type of methods used in the study to evaluate satisfaction	Quantitative, qualitative, mixed method research, quasi-experimental design, Randomized control trial, etc.	
Method of delivery	The way in which the study was administered	Face to face interview, telephone, email questionnaire, snail mail	
Method quality	Information provided about the quality of the methodologies used	Is validity/reliability reported of the instruments used, where they validated in previous studies or are the questionnaires created just for this study with no validation reported?	

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References

1. Sood, S., Mbarika, V., Jugoo, S., Dookhy, R., Doarn, C. R., Prakash, N., and Merrell, R. C., What is telemedicine? A collection of 104 peer-reviewed perspectives and theoretical underpinnings. *Telemed. e-Health* 13(5):573–590, 2007.
2. HRSA, How does telehealth differ from telemedicine? . U.S. Department of Health and Human Services Accessed 6/30/2016 2016
3. Saliba, V., Legido-Quigley, H., Hallik, R., Aaviksoo, A., Car, J., and McKee, M., Telemedicine across borders: A systematic review of factors that hinder or support implementation. *Int. J. Med. Inform.* 81(12):793–809, 2012.
4. Pubmed., Home - Pubmed – NCBI, 2015.
5. Kidholm, K., Ekeland, A. G., Jensen, L. K., Rasmussen, J., Pedersen, C. D., Bowes, A., Flottorp, S. A., and Bech, M., A model for assessment of telemedicine applications: Mast. *Int. J. Technol. Assess. Health Care* 28(1):44–51, 2012.
6. Vaezi, R., Mills, A., Chin, W., and Zafar, H., User satisfaction research in information systems: Historical roots and approaches. *Comm. Assoc. Inform. Syst.* 38(27):501–532, 2016.
7. Axelsson, K., and Melin, U., Contextual factors influencing health information systems implementation in public sector–investigating the explanatory power of critical success factors. International Conference on Electronic Government. Springer. 59–71, 2014.
8. Ekeland, A. G., Bowes, A., and Flottorp, S., Methodologies for assessing telemedicine: A systematic review of reviews. *Int J. Med. Inform.* 81(1):1–11, 2012.
9. Sun, Y., Wang, N., Guo, X., and Peng, Z., Understanding the acceptance of mobile health services: A comparison and integration of alternative models. *J. Electron. Commerce Res.* 14(2):183, 2013.
10. Maillet, É., Mathieu, L., and Sicotte, C., Modeling factors explaining the acceptance, actual use and satisfaction of nurses using an electronic patient record in acute care settings: An extension of the UTAUT. *Int. J. Med. Inform.* 84(1):36–47, 2015.
11. Garcia, R., and Adelakun, O., Towards a conceptual framework for the evaluation of telemedicine satisfaction. World Conference on Information Systems and Technologies. Springer, pp 1188–1197, 2018.
12. Imenda, S., Is there a conceptual difference between theoretical and conceptual frameworks? *Sosyal Bilimler Dergisi/J. Soc. Sci.* 38 (2), 2014.
13. Templier, M., and Paré, G., A framework for guiding and evaluating literature reviews. *Comm. Assoc. Inform. Syst.* 37, 2015.
14. Menachemi, N., Burke, D. E., and Ayers, D. J., Factors affecting the adoption of telemedicine—A multiple adopter perspective. *J. Med. Syst.* 28(6):617–632, 2004.
15. Williams, T. L., May, C. R., and Esmail, A., Limitations of patient satisfaction studies in telehealthcare: A systematic review of the literature. *Telemed. J. e-Health* 7(4):293–316, 2001.
16. Whitten, P., and Love, B., Patient and provider satisfaction with the use of telemedicine: Overview and rationale for cautious enthusiasm. *J. Postgrad. Med.* 51(4):294, 2005.
17. Chou, C.-Y., and Brauer, D. J., Temperament and satisfaction with health status among persons with rheumatoid arthritis. Clin. Nurse Spec. 19(2):94–100, 2005.
18. Linder-Pelz, S., and Struening, E. L., The multidimensionality of patient satisfaction with a clinic visit. *J. Commun. Health* 10(1):42–54, 1985.
19. Garcia, R., Olayele, A., and Han, W., Defining dimensions of patient satisfaction with telemedicine: An analysis of existing measurement instruments. Proceedings of the 50th Hawaii international conference on system sciences, 2017.
20. Mair, F., and Whitten, P., Systematic review of studies of patient satisfaction with telemedicine. *Bmj* 320(7248):1517–1520, 2000.
21. Masino, C., and Lam, T. C., Choice of rating scale labels: Implication for minimizing patient satisfaction response ceiling effect in telemedicine surveys. *Telemed. e-Health* 20(12):1150–1155, 2014.
22. Weatherburn, G., Dowie, R., Mistry, H., and Young, T., An assessment of parental satisfaction with mode of delivery of specialist advice for paediatric cardiology: Face-to-face versus videoconference. *J. Telemed. Telecare* 12(suppl 1):57–59, 2006.
23. Finkelstein, S. M., Speedie, S. M., Demiris, G., Veen, M., Lundgren, J. M., and Potthoff, S., Telehomecare: Quality, perception, satisfaction. *Telemed. J. e-Health* 10(2):122–128, 2004.
24. Kifle, M., Payton, F. C., Mbarika, V., and Meso, P., Transfer and adoption of advanced information technology solutions in resource-

poor environments: The case of telemedicine systems adoption in Ethiopia. *Telemed. e-Health* 16(3):327–343, 2010.

25. Zhang, S., McClean, S. I., Jackson, D. E., Nugent, C., and Cleland, I., Patient satisfaction evaluation of telemedicine applications is not satisfactory. XIII Mediterranean Conference on Medical and Biological Engineering and Computing 2013. Springer, pp 1140–1143, 2014.

26. Hu, P. J., Chau, P. Y., Sheng, O. R. L., and Tam, K. Y., Examining the technology acceptance model using physician acceptance of telemedicine technology. *J. Manag. Inform. Syst.* 16(2):91–112, 1999.

27. Chau, P. Y., and Hu, P. J. H., Information technology acceptance by individual professionals: A model comparison approach. *Dec. Sci.* 32(4):699–719, 2001.

28. Jansen-Kosterink, S., Vollenbroek-Hutten, M., and Hermens H., A renewed framework for the evaluation of telemedicine. Venice, Italy: 8th international conference on eHealth, telemedicine, and social medicine: eTELEMED, 2016.

29. Ekeland, A. G., and Grøttland, A., Assessment of MAST in European patient-centered telemedicine pilots. *Int. J. Technol. Assess. Health Care* 31(5):304–311, 2015.

30. Kidholm, K., Clemensen, J., Caffery, L. J., and Smith, A. C., The model for assessment of telemedicine (MAST): A scoping review of empirical studies. *J. Telemed. Telecare* 23(9):803–813, 2017.

31. Kraai, I. H., Luttik, M., de Jong, R. M., Jaarsma, T., and Hillege, H., Heart failure patients monitored with telemedicine: Patient satisfaction, a review of the literature. *J. Cardiac Fail.* 17(8):684–690, 2011.

32. Bakken, S., Grullon-Figueroa, L., Izquierdo, R., Lee, N.-J., Morin, P., Palmas, W., Teresi, J., Weinstock, R. S., Shea, S., and Starren, J., Development, validation, and use of English and Spanish versions of the telemedicine satisfaction and usefulness questionnaire. *J. Am. Med. Inform. Assoc.* 13(6):660–667, 2006.

33. Yip, M., Chang, A. M., Chan, J., and MacKenzie, A. E., Development of the telemedicine satisfaction questionnaire to evaluate patient satisfaction with telemedicine: A preliminary study. *J. Telemed. Telecare* 9(1):46–50, 2003.

34. Van den Berg, M. H., Schoones, J. W., and Vlieland, T. P. V., Internet-based physical activity interventions: A systematic review of the literature. *J. Med. Internet Res.* 9(3):e26, 2007.

35. Webster, J., and Watson, R. T., Analyzing the past to prepare for the future: Writing a literature review. MIS quarterly:Xiii-xxiii, 2002.

36. Kruse, C. S., Krowski, N., Rodriguez, B., Tran, L., Vela, J., and Brooks, M., Telehealth and patient satisfaction: A systematic review and narrative analysis. BMJ open 7(8):e016242, 2017.

37. Mounessa, J. S., Chapman, S., Braunberger, T., Qin, R., Lipoff, J.B., Dellavalle, R. P., and Dunnick, C. A., A systematic review of satisfaction with teledermatology. *J. Telemed. Telecare*: 1357633X17696587, 2017.

38. Hubley, S., Lynch, S. B., Schneck, C., Thomas, M., and Shore, J., Review of key telepsychiatry outcomes. *World J. Psychiatr.* 6(2): 269, 2016.

39. Diamantopoulos, A., Riefler, P., and Roth, K. P., Advancing formative measurement models. *J. Bus. Res.* 61(12):1203–1218, 2008.

40. Hasselberg, M., Beer, N., Blom, L., Wallis, L. A., and Laflamme, L., Image-based medical expert teleconsultation in acute care of injuries. A systematic review of effects on information accuracy, diagnostic validity, clinical outcome, and user satisfaction. *PloS one* 9(6):e98539, 2014.

41. Leibowitz, R., Day, S., and Dunt, D., A systematic review of the effect of different models of after-hours primary medical care services on clinical outcome, medical workload, and patient and GP satisfaction. *Family Pract.* 20(3):311–317, 2003.

42. Piga, M., Cangemi, I., Mathieu, A., and Cauli, A., Telemedicine for patients with rheumatic diseases: Systematic review and proposal for research agenda. *Sem. Arthrit. Rheumat.*, 2017. Elsevier.

43. Iseli, M. A., Kunz, R., and Blozik, E., Instruments to assess patient satisfaction after teleconsultation and triage: A systematic review. *Pat. Pref. Adher.* 8:893, 2014.

44. Whitten, P. S., and Mair, F., Telemedicine and patient satisfaction: Current status and future directions. *Telemed. J. e-Health* 6(4):417–423, 2000.

45. Bunn, F., Byrne, G., and Kendall, S., The effects of telephone consultation and triage on healthcare use and patient satisfaction: A systematic review. *Br. J. Gen. Pract.* 55(521):956–961, 2005.

46. Collins, K., Nicolson, P., and Bowns, I., Patient satisfaction in telemedicine. *Health Inform. J.* 6(2):81–85, 2000.

47. Harrison, S., Stadler, M., Ismail, K., Amiel, S., and Herrmann-Werner, A., Are patients with diabetes mellitus satisfied with technologies used to assist with diabetes management and coping?: A structured review. *Diab. Technol. Therapeut.* 16(11):771–783, 2014.

48. Wixom, B. H., and Todd, P. A., A theoretical integration of user satisfaction and technology acceptance. *Inform. Syst. Res.* 16(1): 85–102, 2005.

49. Vaezi, R., User satisfaction with information systems. University of Houston, 2013.

50. Aoki, N., Dunn, K., Johnson-Throop, K. A., and Turley, J. P., Outcomes and methods in telemedicine evaluation. *Telemed. J. e-Health* 9(4):393–401, 2003.

51. Jenkins-Guarnieri, M. A., Pruitt, L. D., Luxton, D. D., and Johnson, K., Patient perceptions of telemental health: Systematic review of direct comparisons to in-person psychotherapeutic treatments. *Telemed. e-Health* 21(8):652–660, 2015.

52. Van Teijlingen, E. R., and Hundley, V., The importance of pilot studies, 2001.

53. Meldrum, M. L., A brief history of the randomized controlled trial: From oranges and lemons to the gold standard. *Hematol./Oncol. Clin. North Am.* 14(4):745–760, 2000.

54. Beijer, L. J., Rietveld, T. C., Hoskam, V., Geurts, A. C., and de Swart, B. J., Evaluating the feasibility and the potential efficacy of e-learning-based speech therapy (EST) as a web application for speech training in dysarthric patients with Parkinson's disease: A case study. *Telemed. e-Health* 16(6):732–738, 2010.

55. Carlisle, K., and Warren, R., A qualitative case study of telehealth for in-home monitoring to support the management of type 2 diabetes. *J. Telemed. Telecare* 19(7):372–375, 2013.

56. Gagnon, M.-P., Breton, E., Courcy, F., Quirion, S., Cote, J., and Pare, G., The influence of a wound care teleassistance service on nursing practice: A case study in Quebec. *Telemed. e-Health* 20(6): 593–600, 2014.

57. Katalinic, O., Young, A., and Doolan, D., Case study: The interact home telehealth project. *J. Telemed. Telecare* 19(7):418–424, 2013.

58. Khoja, S., Casebeer, A., and Young, S., Role of telehealth in seating clinics: A case study of learners' perspectives. *J. Telemed. Telecare* 11(3):146–149, 2005.

59. Oliver, D. P., and Demiris, G., Comparing face-to-face and telehealth-mediated delivery of a psychoeducational intervention: A case comparison study in hospice. *Telemed. e-Health* 16(6):751–753, 2010.

60. Agha, Z., Schapira, R. M., Laud, P. W., McNutt, G., and Roter, D. L., Patient satisfaction with physician–patient communication during telemedicine. *Telemed. e-Health* 15(9):830–839, 2009.

61. Buvik, A., Bugge, E., Knutsen, G., Småbrekke, A., and Wilsgaard, T., Patient satisfaction with remote orthopaedic consultation by using telemedicine: A randomised controlled trial. Journal of telemedicine and telecare:1357633X18783921, 2018.

62. Chumbler, N. R., Li, X., Quigley, P., Morey, M. C., Rose, D., Griffiths, P., Sanford, J., and Hoenig, H., A randomized controlled trial on stroke telerehabilitation: The effects on falls self-efficacy and satisfaction with care. *J. Telemed. Telecare* 21(3):139–143, 2015.

63. Gulec, H., Moessner, M., Túry, F., Fiedler, P., Mezei, A., and Bauer, S., A randomized controlled trial of an internet-based posttreatment care for patients with eating disorders. *Telemed. e-Health* 20(10): 916–922, 2014.

64. Hulsbosch, A. M., Nugter, M. A., Tamis, P., and Kroon, H., Videoconferencing in a mental health service in the Netherlands: A randomized controlled trial on patient satisfaction and clinical outcomes for outpatients with severe mental illness. *J. Telemed. Telecare* 23(5):513–520, 2017.

65. Marhefka, S. L., Buhi, E. R., Baldwin, J., Chen, H., Johnson, A., Lynn, V., and Glueckauf, R., Effectiveness of healthy relationships video-group—A videoconferencing group intervention for women living with HIV: Preliminary findings from a randomized controlled trial. *Telemed e-Health* 20(2):128–134, 2014.

66. Dixon, R. F., and Stahl, J. E., Virtual visits in a general medicine practice: A pilot study. *Telemed. e-Health* 14(6):525–530, 2008.

67. Elford, D., White, H., St John, K., Maddigan, B., Ghandi, M., and Bowering, R., A prospective satisfaction study and cost analysis of a pilot child telepsychiatry service in Newfoundland. *J. Telemed. Telecare* 7(2):73–81, 2001.

68. Mulgrew, K. W., Shaikh, U., and Nettiksimmons, J., Comparison of parent satisfaction with care for childhood obesity delivered face-to-face and by telemedicine. *Telemed. e-Health* 17(5):383–387, 2011.

69. Prabhakaran, L., Chee, W. Y., Chua, K. C., Abisheganaden, J., and Wong, W. M., The use of text messaging to improve asthma control: A pilot study using the mobile phone short messaging service (SMS). *J. Telemed. Telecare* 16(5):286–290, 2010.

70. Tousignant, M., Boissy, P., Moffet, H., Corriveau, H., Cabana, F., Marquis, F., and Simard, J., Patients' satisfaction of healthcare services and perception with in-home telerehabilitation and physiotherapists' satisfaction toward technology for post-knee arthroplasty: An embedded study in a randomized trial. *Telemed. e-Health* 17(5):376–382, 2011.

71. Verwey, R., van der Weegen, S., Spreeuwenberg, M., Tange, H., van der Weijden, T., and de Witte, L., A pilot study of a tool to stimulate physical activity in patients with COPD or type 2 diabetes in primary care. *J. Telemed. Telecare* 20(1):29–34, 2014.

72. Tchero, H., Noubou, L., Becsangele, B., Mukisi-Mukaza, M., Retali, G.-R., and Rusch, E., Telemedicine in diabetic foot care: A systematic literature review of interventions and meta-analysis of controlled trials. Int. J. Lower Extrem. Wounds 0(0): 1534734617739195, 2017. https://doi.org/10.1177/1534734617739195.