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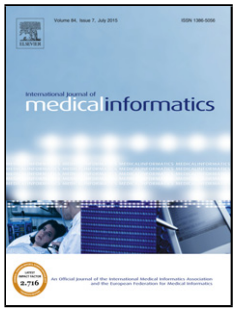

Title: A systematic review of the methodologies used to evaluate telemedicine service initiatives in hospital facilities

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A systematic review of the methodologies used to evaluate telemedicine service initiatives in hospital facilities

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Key Words

Telemedicine, Telehealth, Hospital Services, Evaluation, Planning.

Highlights

- Telemedicine has a poor record of adoption as a routine health service.
- We reviewed papers of deployed telemedicine services in hospital.
- Services were assessed by clinical outcome, economics and satisfaction.
- The reporting of service implementation and planning strategies should be encouraged.
- Applying and reporting more rigorous methodology is needed.

ABSTRACT

Background: The adoption of telemedicine into mainstream health services has been slower than expected. Many telemedicine projects tend not to progress beyond the trial phase; there are a large number of pilot or project publications and fewer 'service' publications. This issue has been noted since 1999 and continues to be acknowledged in the literature. While overall telemedicine uptake has been slow, some services have been successful. The reporting and evaluation of these successful services may help to improve future uptake and sustainability. The aim of this literature review was to identify peer-reviewed publications of deployed telemedicine services in hospital facilities; and to report, and appraise, the methodology used to evaluate these services.

Methods: Computerised literature searches of bibliographic databases were performed using the MeSH terms for "Telemedicine" and "Hospital Services" or "Hospital", for papers published up to May 2016.

Results: A total of 164 papers were identified, representing 137 telemedicine services. The majority of reported telemedicine services were based in the United States of America (n=61, 44.5%). Almost two thirds of the services (n=86, 62.7%) were delivered by real time telemedicine. Of the reviewed studies, almost half (n=81, 49.3%) assessed their services from three different evaluation perspectives: clinical outcomes, economics and satisfaction. While the remaining half (n=83, 50.6%) described their service and its activities without reporting any evaluation measures. Only 30 (18.2%) studies indicated a two-step implementation and evaluation process. There was limited information in all reported studies regarding description of a structured planning strategy.

Conclusion: Our systematic review identified only 137 telemedicine services. This suggests either telemedicine service implementation is still not a part of mainstream clinical services, or it is not being reported in the peer-reviewed literature. The depth and the quality of information were variable across studies, reducing the generalisability. The reporting of service implementation and planning strategies should be encouraged. Given the fast paced technology driven environment of telemedicine, this may enable others to learn and understand how to implement sustainable services. The key component of planning was underreported in these studies. Studies applying and reporting more rigorous methodology would contribute greatly to the evidence for telemedicine.

1.1. Introduction

Providing adequate and equal access to healthcare services is a priority of the World Health Organization (WHO), a priority that has been widely adopted by developed nations [(1)]. Difficulties in acquiring and retaining an adequate and appropriate health workforce is one of the ongoing obstacles that have been faced by rural and remote communities, and affects the access to appropriate care for residents who live in these areas. Unfortunately this problem is not limited to rural areas, but also exists in major cities and urban areas, where the level of expertise may be unavailable due to shortage of medical professionals [(1, 2)].

One proposed solution to problems of quality, accessibility, and costs of medical care is the use of telemedicine, defined broadly as "the use of information technology (IT) to deliver medical services over distances" [(3)].The need for enhancing the equity and efficiency of health service delivery has led to the rapid implementation of telemedicine in different healthcare sectors, in an attempt to increase access to specialist expertise that was previously unavailable or difficult to access[(4)].

Telemedicine success is associated with integration into routine healthcare delivery [(5)]. The concept of telemedicine was first recognised in scientific literature in 1978 [(6)]. Since then, a large number of telemedicine applications have been implemented in the form of proposals and projects by governments, research institutes (academia) and industry [(7)]. Despite the expected benefits and the establishment of national and world-class networks, telemedicine has a poor record of actual adoption and integration as a routine health service (healthcare delivery method) [(5, 8-12)]. Many telemedicine projects have not progressed beyond the trial phase [(13)]. This issue has been noted since 1999 [(3, 9)] and continues to be discussed in the contemporary literature with concerns about the slow uptake of telemedicine [(5, 12, 14)].

Many challenges for the adoption of telemedicine have been reported in the literature such as, funding, technology and planning, as well as many recommendations to overcome these challenges [(15-17)]. Planning for telemedicine as a part of ongoing routine service delivery prior to implementation is

recommended in order to achieve a sustainable service [5] . The first step for planning for a successful implementation is evaluating needs[18]. Telemedicine should be driven by the needs of patients and clinicians rather than technology [19]. Each community has its own unique requirements that should be addressed accordingly. The systematic uptake of telemedicine depends on appropriate understanding of the impact of providing a telemedicine service to different areas. Other steps of planning for implementation such as developing a care services plan, developing a business plan and planning technology should occur following the evaluation and prioritization of the intervention needed, which should lead to offering a value -added medical service [5, 7, 18].

Despite the slow uptake, there are telemedicine services that have been successful with their implementation and emerged into a routine healthcare service delivery model**.** The reporting and evaluation of these successful services may help to improve future uptake and sustainability. A number of systematic reviews have reported on telemedicine evaluation [20-23]. However, none of these reviews focused specifically on the evaluation of telemedicine services, i.e. where telemedicine has been integrated into routine healthcare service delivery. Therefore, the aim of this review was to identify peer-reviewed evaluations of deployed telemedicine services in hospital facilities, and to report, and appraise, the methodologies used to evaluate service implementation. In publications where it is reported, reflections on the planning phase of telemedicine service implementation based on need assessment are provided.

1.2. Methods:

Computerised literature searches of bibliographic databases were performed using PubMed, CINAHL, Medline and Health Source: Nursing/Academic Edition[*]. As this review was focused on hospital telemedicine services the search terms included records in the register that had been coded as "Telemedicine" and "Hospital Services" or "Hospital", using the

[*] A date limited search on one database only (from October 2013 to May 2016) was carried out due to a change in university access to the Health Source database.

terms specified in Table 1. That resulted in a broad search that serves the first aim, and then for the second aim the evaluation papers were identified manually. The search was confined to studies published in English and the availability of an abstract. Papers published up to May 2016 were included in the review.

The inclusion criteria were applied independently at two levels (abstract and full text) by two reviewers (SAD, MMK) and any uncertainty was resolved by consensus. Measurement of inter-rater reliability was not recorded. Papers were excluded if the focus was on technical aspects, education of staff or reliability studies Table 2. For the purpose of this review, a telemedicine service was defined as an established healthcare provider with recurrent funding utilising telemedicine to deliver care or information for a clinician to deliver care. Research studies or pilot telemedicine projects were not included, unless it was reported that they were converted to a service with ongoing funding (duration of a minimum of 12 months). Review papers were retained until full texts of all relevant articles were reviewed. The reference list of each paper was reviewed for relevant additional references; these were included as hand searched papers in the final count. Data were extracted into an excel spreadsheet and they included author, year, country, study methodology, telemedicine modality, specialty, outcome measures, telemedicine sites (provider and recipient).

Quality appraisal: The quality of the studies was assessed independently by three reviewers (SAD, MMK, NB). The quality appraisal tool was adapted from the Australian Primary Health Care Research Institute (APHCRI) systematic review report [24], with modifications (Appendix 1). The quality appraisal criteria were divided into two parts: 1) assessment of the reporting of the service; 2) assessment of the study and evaluation methodology.

The quality of each study was ranked according to the information reported about the service (Part 1), the quality of the study methodology (Part 2), and a total score (created by combining part 1 and part 2). Papers were ranked on a four point scale Table 3.

2. Results

Following the removal of duplicates (n=371), 1348 papers were identified in the online search. Two additional papers were added following the reference list search. One hundred fifty papers were excluded at the title search-level as they were out of scope for this review. The abstracts of 1198 papers were reviewed and 824 papers did not meet the inclusion criteria. The full texts of 376 papers were reviewed. Two hundred and twelve papers were excluded because the focus was technical or educational. In addition, papers which described large national surveys of the adoption of telemedicine were excluded as they were general, largely descriptive and contained scant detail of actual services. The flow diagram of included reviews can be seen in Figure 1.

The final paper count for this review included 164 papers. These papers are summarised in (Appendix 2). Some services were reported in more than one paper; there were 137 services, reported in 164 papers. The majority of reported telemedicine services were based in the

United States of America (n=61, 44.5%), Australia (n=16, 11.6%), the United Kingdom (n=12, 8.7%) and Canada (n=6, 4.3%).

Most services focused on a single clinical speciality, the top reported specialities were Neurology (n=18, 13.1 %), Emergency / Trauma medicine (n=17, 12.4%), and Paediatrics (n=12, 8.7%). Twelve papers described their service as "range of medical specialities" where multiple specialities provided services from one telemedicine network. Most services focused on a single clinical speciality, the top reported specialities were Neurology (n=18, 13.1 %), Emergency / Trauma medicine (n=17, 12.4%), and Paediatrics (n=12, 8.7%). Twelve papers described their service as "range of medical specialities" where multiple specialities provided services from one telemedicine network. Almost two thirds of the services (n=86, 62.7%) were delivered by real time methods, whilst about 25.5% (n=35) were delivered using store and forward methods. Real time includes not only face to face consultation i.e. videoconferencing, but may also include the exchange of data, audio, images (moving and still) and the use of transmitting devices such as telemetry. While store and forward is the electronic exchange and storage of information (e.g. data, images, audio) that would be accessed in a later time.

The papers are summarised in Table 4 and categorised by speciality and the evaluation methods used to assess telemedicine services. Specialities represented by less than three papers in total (n=11) were grouped under 'others' in Table 4. These included the following specialities: Hematology, Otolaryngology, General Medicine, Geriatric, Nephrology, Obstetrics, and Orthopaedics [25-35].

Of the reviewed studies, eighty-one (49.3%) studies assessed their services from three different evaluation methods (clinical outcomes, economics and satisfaction), and eighty-three (50.6%) studies described their service and its activities without reporting any

evaluation measures. Twelve papers employed a combination of evaluation methods to assess their service (e.g., economics and satisfaction).

Quality assessment:

Papers were assessed for quality on a four point scale, with highest rating in quality being A. There was a variation in quality of papers between the reporting of the service information (Part 1) and the study evaluation methodology (Part 2) Table 3. Sixty-one studies (37.1%) were given the same rating (e.g. A-A, D-D in both services information [Part 1)], and the study evaluation methodology [Part 2]). In relation to information about the establishment and operation of services (Part 1), the majority of papers were ranked "B" (n=59, 35.9%) and A (n=37, 22.5%). For description of study evaluation methodology (Part 2), the majority of papers were ranked "B" (n=56, 34.1%) and "A" (n=45, 27.4%). When the rankings were combined (Total rank Part 1+ Part2), almost one third of all studies (n=45, 27.4%) were ranked as "A" (high quality studies), and a similar proportion (n=57, 34.7%) were ranked as "B" (good quality studies), while (n=45, 27.4 %) were ranked as "C" (fair quality studies). The rest of the studies (n=17, 10.3%) were ranked as "D" (poor quality studies).

2.1.Evaluation methods

Descriptive:

Eighty-three of the identified studies were descriptive in nature, these studies reported information about their activities such as the number of telemedicine consultations provided, the number of patients that were treated, and overall system utilisation, but did not report evaluating the telemedicine intervention by linking usage to outcomes. These studies can be found in (Table 4) arranged by specialty.

Clinical outcome:

Telemedicine services were evaluated from a clinical outcome perspective in 27 studies. These studies have predominantly identified length of stay (LOS), morbidity and mortality as utility outcome measures. Two studies conducted non-randomised open intervention studies [36, 37]. The remaining studies have used a retrospective observational study design [38-52], a prospective observational study design [53-57] four of them were cohort [53-56] , a pre post design [58-61] , and one descriptive study [62].

The studies that conducted a prospective cohort design have followed up with the patients after they were discharged or transferred, to measure the clinical outcome. The follow up was conducted after three months [53, 54], six months [56], or a year [55].

Clinical outcome assessment was most often conducted under the Neurology speciality (n=13) [36-38, 42-46, 53-56, 59] where they reported the modified ranking scale score mRs [36, 38, 53-55, 59, 62], and the Barthel index [36, 37, 55, 56] . These two measures are used to assess the disability or dependence in activities of daily living. The remaining 14 studies were spread into/around 6 specialities as shown in Table 4.

Mortality was studied as a clinical outcome by (n=15) [36-38, 40-42, 44-46, 50, 51, 56, 58, 61, 62] studies. While LOS was reported as a measure in (n=13) [38-41, 44, 45, 47, 48, 52, 57, 58, 60, 61]. Other measures that were considered as a clinical outcome were unplanned hospital admission, discharge or transfer rates and these were reported by five studies (n=5) [37, 49, 57, 60, 61].

Economic:

Twenty-nine studies assessed their telemedicine service from an economic perspective. The most common speciality reporting economic outcomes was paediatrics (n=7) [63-69]. Simple cost analysis was used by (n=14) [52, 63-67, 70-77] studies measuring the cost avoidance, cost saving and added revenue. While (n=15) [27, 30, 35, 58, 68, 69, 78-86] studies conducted a cost minimization analysis as a method to assess the economic benefits of telemedicine. The cost of providing telemedicine services was compared to the cost of providing the same healthcare service in a conventional face-to-face manner, whether it was a hospital based visit where the patient travels to get the service, or an outreach clinic where the provider travels to provide the care. The benefits of providing the healthcare service via the two different methods were not assessed, as it was assumed to be the same. There were no studies that reported using a cost effectiveness analysis, cost utility analysis or cost benefit analysis.

Six studies [27, 63, 69, 81, 84, 86] have measured the threshold, the point at which the telemedicine service was the same cost as the conventional face-to-face service.

While many studies have reported the savings or cost avoided of travel associated with telemedicine services, these five studies [63, 64, 66, 72, 75] have emphasised the cost saving of avoided travel, particularly in a military environment where the cost of flying the patient would be considered high [64].

Satisfaction:

Satisfaction was one of the outcome measures that was used to evaluate telemedicine services in the reported studies. It was examined in 35 studies. Of these (n=27) focused only on satisfaction, while (n=8) combined it with other evaluation measures (economic, clinical outcome).

The studies have assessed telemedicine service satisfaction for different groups. Of the 35 studies that assessed satisfaction (n=14, 41.3%)[41, 66, 73, 76, 87-96] papers have focused on assessing healthcare provider satisfaction, and (n=10, 28.5%) [30, 97-105] papers examined consumer satisfaction, while (n=11, 37.9%)[31, 39, 40, 82, 106-112] papers reported both provider and consumer satisfaction of the service.

A range of satisfaction variables were considered in the reported papers. Papers measured satisfaction with regards to: comfort, perceived privacy, the ease of use and the quality of the sound and image (technical functionality). From all the specialties presented in (Table 4), the fields of Psychiatry (n=6) [82, 92, 99, 100, 109, 110], Emergency / Trauma medicine (n=5) [41, 89, 93, 98, 107] and pharmacy (n=5) [73, 76, 95, 103, 108] had the most reported studies assessing satisfaction.

The majority of the studies assessed satisfaction using questionnaires, and two studies used interviews [89, 106], while two studies combined questionnaires with interviews [91, 110]. The development and validation of the questionnaires were not reported well in the studies, although it is a critical step in assessing and understanding the quality of the tools that were used [113]. Out of the 33 studies that used questionnaires, only four studies (12.1%) [87, 97, 104, 105] have indicated that they used a validated tool, and three studies (9%) [66, 99, 110] reported that the tool they used was independently tested and reviewed by the researchers themselves or by an advisory committee.

2.2. Planning based on need assessment

Of the 164 reviewed studies no direct reference to structured planning based on need assessment was made. Some gave a brief description of the service including an explanation of how it was established. Thirty (18.2%) papers have indicated a two-step implementation and evaluation process that was not based on any formal structured planning strategy. Of those papers six (n=6) [66, 86, 89, 114-116] reported that the rationale for the implementation of the telemedicine services was based on the success of their research project or the pilot study. Other services have implemented their telemedicine service to replace outreach clinics that already existed [25, 72, 117-119]. The rest of the studies (n=19) [29, 41, 50, 61, 70, 80, 84, 110, 116, 120-129] identified the need for additional clinical services –e.g. as a result of having a long waiting list- and explained how providing a telemedicine service would meet that need. One study identified the need by seeking the patients perception to add a speciality to the already existing telemedicine service[129].

3. Discussion:

There is extensive literature relating to telemedicine trials and projects. However, few of these projects have been successfully scaled up into a sustainable service [5, 12, 14, 130, 131] .The aim of most telemedicine services is to improve the delivery of clinical care, and to measure the improvement in services; evaluation should accompany all phases of the implementation, including the planning phase. Nevertheless, evaluation is rarely considered to be a vital component in the implementation of telemedicine[4]. The continuation of telemedicine evaluation even after telemedicine is adopted as a routine healthcare service, can improve our knowledge and provide an evidence base for implementation by others [130]. Feedback on telemedicine service performance provides information about the value of telemedicine as a solution to problems in healthcare delivery services. It also provides knowledge about ways that improvements can be made and what should be avoided in the future adoption of

telemedicine. The objective of this review was to identify published reports of implemented telemedicine services and the methods reported to evaluate them. The results of this review yielded 164 papers that described 137 telemedicine services. The three methods of evaluation reported were: clinical outcomes, economics and satisfaction.

Half of the studies (50.6%) in this review described their service from an activity perspective in which they report on how the service was established and the number of patients treated. Although this is not considered to be a reliable way to assess the clinical impact of a telemedicine service, it can be useful to define ways in which it was used and how it influenced patient care.

Demonstrating and reporting the impact of telemedicine as a means of delivering healthcare services on clinical outcomes is essential to improving the adoption of the service. In this review, neurology was the specialty most often reported that assessed the service from a clinical outcome perspective and was also one of the most commonly reported services. This finding is in agreement with the Hersh review [132] which noted that the best evidence for the efficiency and efficacy of telemedicine can be demonstrated in specialties that depend heavily on verbal interaction for patient assessment. Rigorous study design and evaluation methodology would improve the credibility of the telemedicine evidence. There is some debate as to what this translates to in practice. Traditionally conducting an RCT would be ideal for obtaining the best evidence for measuring the effectiveness of an intervention [133, 134]. However, traditional hierarchies' automatically ranking experimental studies over observational studies have recently been questioned as this may not reflect reality[135]. None of the reviewed studies that assessed the clinical outcomes of telemedicine conducted an RCT, and only two studies conducted a non-randomised, open intervention studies. More evidence from large RCTs is reported to be necessary to measure the effectiveness of

telemedicine and thus influence the expansion of services [136, 137]. However, RCTs are thought to be impractical for telemedicine program evaluation [138, 139]. One solution was suggested by Law& Wason[140] to overcome this problem which is the utilisation of "adaptive designs" in the field of telemedicine, where new unfixed decisions can be applied in the period after the trial have started. Moreover telemedicine research is considered to be, and viewed as, an implementation research which is defined as "the scientific study of the processes used in the implementation of initiatives, as well as the contextual factors that affect these processes" [141]. As such, recommendations are to avoid using less adoptive methods, such as randomized controlled clinical trials to assess the implementation of telemedicine, and to apply a more flexible multiple methods that can study changeable, different sources of information[141].

Many authors have assessed the attitudes toward the use of telemedicine from the perception of consumers (patients) and providers (clinicians). This measure is used to reflect how they assess the service and its value [142] . Aspects of satisfaction that were measured in the reviewed papers were technical (e.g. whether clinicians and patients could hear and see clearly) and whether they felt comfortable and believed that the use of the telemedicine service maintains a sense of privacy. Assessing these aspects is of great importance, especially for services that cover specialties such as psychiatry or deal with sensitive health information. Poor reporting on the validity of questionnaires was noted in the majority of the reviewed studies, with (78.7%) of the studies not reporting any details about the validity of questionnaires, thus making the quality assessment of the tools very difficult. The findings of the current review are consistent with previous studies [21, 143], in which low reporting on the validity of questionnaires was found.

Two key reasons for introducing telemedicine as a means of delivering healthcare services

are cost reduction and improvement of delivery services. Those are the reasons for which measuring the economic benefits of telemedicine is vital [144]. Evaluation of the reviewed papers that considered the economic aspect revealed that almost half of the papers (48.2%) conducted a simple cost analysis of their telemedicine services, while the remaining (51.7%) conducted a cost minimization analysis as a method to assess the economic benefits of telemedicine. This is considered a limitation because the first method uses basic analytic skills, while the second method (cost minimization analysis) compares the cost of providing the same healthcare service using different strategies, without assessing the benefits. These results match those observed in earlier studies [145-147], and suggest that a more rigorous economic evaluation of telemedicine services is needed to encourage a more widespread adoption of telemedicine programs.

Telemedicine can be more effectively evaluated by applying a combination of evaluation methods to overcome the limitations of each method and to provide a better understanding of how the service impacts patient care [4, 20].

Planning based on needs assessment:

Considering the lack of detail in the reviewed papers regarding planning, it was clear that their primary aim was not to specifically report on the developmental process of the service; the focus was on the evaluation of outcomes or a description of the services delivered. Most of the studies, however, did include an introduction of the telemedicine service and gave some background on its establishment. In those papers that did refer to planning, the aspects included were infrastructure, management of the information technology (IT) equipment and cost. While it is difficult to ascertain the extent to which planning was involved in implementation, the lack of attention to planning in the reports potentially indicates a lack of priority placed on this key component. In this context, planning refers to the assessment of the healthcare needs of the targeted community and the study of whether or not telemedicine

is a valid option to meet those needs. Only 30 of the studies, accounting for (18.2%) of those reviewed, addressed planning according to this definition. While there was no reporting of structured planning prior to the implementation of the service, some studies (n=19) based their implementation on available data that reflected, to some extent, the needs of the community. Examples included measuring the number of patients transferred from a specific community to their required healthcare service [72, 120] or responding to an unmet surgical need (by evidence of a waiting list)[29]. The rest of the studies (n=11) justified the implementation of the service based on the success of the pilot study or on the replacement of an existing outreach service.

A limitation of this review may be that using telemedicine as a MeSH term without combining it with "telemedicine" as a free-text keyword may have missed some articles, though we anticipate the number would be small. Similarly, limiting the search to articles in the English language, and only those for which an abstract was available may have excluded some articles. However, to support the computerized search, a hand-search of the included papers reference list was done as an additional step to identify any potential relevant papers that may have been missed. This resulted with two additional papers that were not found in the database search.

Establishing a framework for the utilisation of health data would be useful if incorporated into a larger framework that includes planning, in conjunction with implementation and evaluation, in a standard way, to support the sharing of lessons learned.

4. Conclusion

In this review, 164 papers (137 telemedicine services) were identified that reported on the implementation of telemedicine as an integrated service in a healthcare delivery system. Based on this figure, either: telemedicine service implementation is still not a part of

mainstream clinical service and therefore it may be proposed that the full potential of telemedicine has not yet been realised; or it is not being reported. The reporting of service implementation should be encouraged, to be able to learn and understand how to improve sustainability given the fast paced technology driven environment of telemedicine. The reviewed studies assessed their services from three different perspectives: clinical outcome, economics and satisfaction. To overcome the limitations of each method, telemedicine can be more effectively evaluated by applying a combination of evaluation methods. The key component of planning was not significantly reported in these studies. Studies applying and reporting more rigorous methodology are needed. A framework for the utilisation of health data would be useful if incorporated into a larger framework that includes planning, in conjunction with implementation and evaluation, in a standard way, to support the sharing of lessons learned.

Table 1: Search strategy

Step in search strategy	Search Term
1	TELEMEDICINE. MeSH Terms: Telemedicine
2	HOSPITAL SERVICES. MeSH Terms: Ancillary Services, Hospital; Centralized Hospital Services; Pharmacy Service; Cardiology Service, Hospital; Emergency Service, Hospital; Oncology Service, Hospital; Nursing Service, Hospital; Dental Service, Hospital; Urology Department, Hospital; Surgery Department, Hospital; Radiology Department, Hospital; Psychiatric Department, Hospital; Physical Therapy Department, Hospital; Pathology Department, Hospital; Outpatient Clinics, Hospital; Obstetrics and Gynecology Department, Hospital; Hospitals, Community.
3	HOSPITAL. MeSH Terms: Hospitals
4	1 AND (2 OR 3)

Table 2: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Telemedicine: Provision of a clinical service (Management or Diagnosis) All modes of communication (Store and Forward, Clinical decision support systems, Real Time Video conference, in hospital Monitoring) Service delivery: Traditional hospital to hospital service (inpatient and outpatient) or hospital to primary care.	Studies that primarily focused on: educational, technical, reliability, leadership, ethical and legal studies) Home Telemonitoring studies Review articles Standardised Assessment Tools (Exclusively) Editorial and commentary articles Telemedicine delivered by telephone or fax formats

Table 3: Studies ranked according to the quality appraisal criteria

Part (1) Reporting of the service	Part (2) Study and evaluation methodology	Total	Number of studies N (%)
A	A	A	19 (12%)
A	B	A	12 (7%)
B	A	A	14 (9%)
A	C	B	5 (3%)
B	B	B	22 (13%)
B	C	B	12 (7%)
C	A	B	8 (5%)
C	B	B	8 (5%)
D	A	B	2 (1%)
A	D	C	1 (1%)
B	D	C	10 (6%)
C	C	C	12 (7%)
C	D	C	3 (2%)
D	A	C	2 (1%)
D	B	C	11 (7%)
D	C	C	6 (4%)
B	D	D	1 (1%)
C	D	D	2 (1%)
D	B	D	3 (2%)
D	C	D	3 (2%)
D	D	D	8 (5%)
			164

Rank Scoring explanation:

- Part 1 and Part 2 ranking: 6/6= A: 5/6=B; 4/6= C; 3-0/6=D.
- Total (Part1+Part2): 12-11/12=A; 10-9/12= B; 8-7/12= C; 6-0/12 =D.

Figure 1 - PRISMA flow diagram of included papers

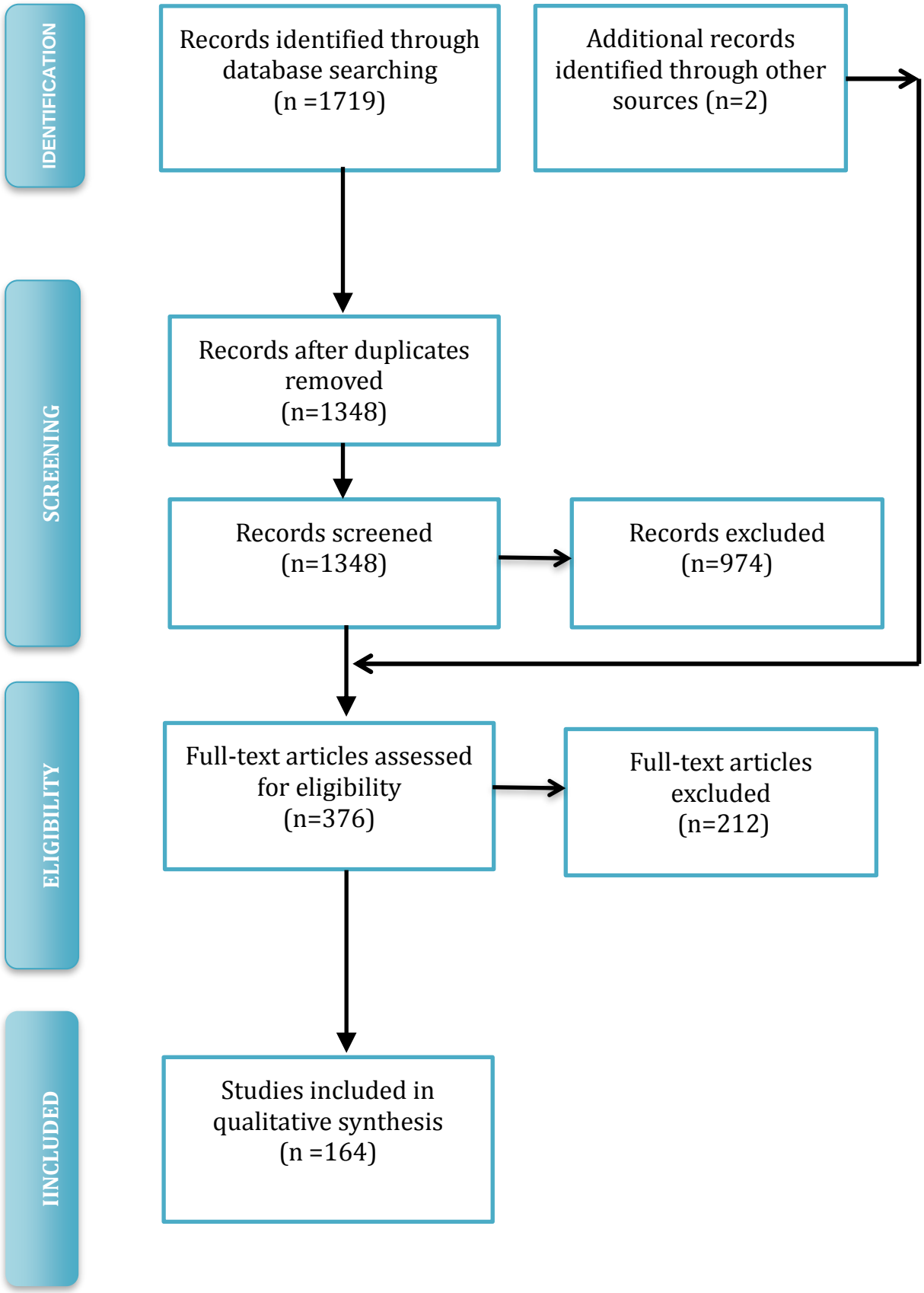

Table 4: Evaluation methods used to assess telemedicine services by specialty

Specialty	Evaluation Method				Planning	Papers ^	Services ^
	Economic	Satisfaction	Clinical outcomes	Descriptive			
Emergency / Trauma medicine	**0**	**5** [41, 89, 93, 98, 107]	**3** [41, 60, 61]	**12** [120, 121, 148-157]	**5** [41, 61, 89, 120, 121]	19	17
Neurology	**2** [70, 77]	**1** [112]	**13** [36-38, 42-46, 53-56, 158]	**11** [116, 159-168]	**2** [70, 116]	27	18
Pediatrics	**7** [63-69]	**2** [66, 105]	**2** [49, 50]	**7** [117, 126, 169-173]	**4** [50, 66, 117, 126]	17	12
Range of specialty	**1** [85]	**4** [94, 102, 104, 111]	**1** [62]	**7** [127, 129, 174-178]	**2** [127, 129]	13	12
Cardiology	**2** [52, 78]	**1** [97]	**1** [52]	**6** [122, 123, 179-182]	**2** [122, 123]	9	9
Critical Care	**2** [58, 80]	**4** [39, 40, 87, 88]	**4** [39, 40, 48, 58]	**3** [183-185]	**1** [80]	10	8
Radiology	**3** [74, 75, 84]	**0**	**1** [57]	**5** [119, 186-189]	**2** [84, 119]	9	9
Pharmacy	**3** [73, 76, 79]	**5** [73, 76, 95, 103, 108]	**0**	**5** [124, 190-193]	**1** [124]	11	11
Psychiatry	**2** [82, 83]	**6** [82, 92, 99, 100, 109, 110]	**1** [47]	**3** [116, 194, 195]	**2** [110, 116]	11	9
Oncology	**2** [71, 81]	**1** [90]	**1** [51]	**6** [128, 196-200]	**1** [128]	10	6
Pathology	**1** [86]	**1** [91]	**0**	**3** [125, 201, 202]	**2** [86, 125]	5	5
Dermatology	**0**	**3** [96, 101, 106]	**0**	**3** [203-205]	**0**	6	6
Ophthalmology	**1** [72]	**0**	**0**	**5** [114, 115, 118, 206, 207]	**4** [72, 114, 115, 118]	6	5
Other	**3** [27, 30, 35]	**2** [30, 31]	**0**	**7** [25, 26, 28, 29, 32, 34, 208]	**2** [25, 29]	11	10
Total	29	35	27	83	30	164	137

^The number of papers and services, and columns and rows for evaluation types do not sum because often individual services were reported in numerous papers, or a single paper reported several evaluation methods.
* Others = for specialties with less than 3 reported papers [Hematology, Otolaryngology, General Medicine, Geriatric, Nephrology, Obstetrics, and Orthopaedics]

Appendices

Appendix 1: The quality assessment tool

Appendix 2: The systematic literature review papers summary

Appendix 1: The quality assessment tool

	QUALITY ASSESSMENTS *RESPONSES: Y= YES N= NO U= UNCLEAR*	**Study number**									
	Part 1 : Assessment of the reporting of the service										
1	Are 6 references cited in the introduction										
2	Is the need for the service explicitly stated (the GAP or problem)?										
3	Is the problem that is stated, in local terms (not global, but a problem derived from the same population that the service targets)										
4	How "representative" is the study sample of the actual population that would be eligible for the service? *RESPONSES: (1)Very/moderately (2)Not very/ Not at all (3)insufficient info*										
5	Are the target service characteristics clearly & explicitly stated?										
6	Is there an adequate description of new/innovation characteristic?										
	Part 2: Assessment of the study and evaluation methodology										
7	Is the objective of enquiry clear & unambiguous? (clear & indicators)										
8	Does method accord with objectivise of the study?										
9	Are methodological limitations acknowledged?										
10	Statement of outcome is in line with results										
11	Relationship of conclusions of existing knowledge discussed										
12	Are findings transferable (lessons learned)										

Appendix 2: List of included papers by Author and publication year

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
B. A., et al, 2012 UK [97]	Quasi-experimental	Real time	Cardiology	Patient's attitude and satisfaction with telemedicine.	Pediatric cardiologist	Hospital (Regional Center)	Radiographer	Hospital
Dowie, R., et al 2008 UK [78]	Quasi-experimental	Real time	Cardiology	Antenatal costs of the referral services; family costs	Fetal cardiologist	Hospital	Multidisciplinary team	Hospital
Huang, T., et al. 2008 USA[179]	Analytic observational study	Real time Store & Forward	Cardiology	Utilization of the telemedicine service and patterns of transfer between (conventional clinic and telemedicine clinic)	Paediatric cardiologist	Hospital (University)	Multidisciplinary team	Remote community hospital
Walsh, C., et al. 2006 Ireland[122]	Descriptive	Real time Store & Forward	Cardiology	Technical performance, Minor problems, Total number of conferences	Multidisciplinary team	Hospital	Cardiologists	Hospital
Rheuban, K. S. and E. Sullivan 2004 Australia[209]	Descriptive	Real time	Cardiology	Utilization of the telemedicine services and the influence of the diagnostic modality on patient care.	Paediatric cardiologist	Specialist Center	Multidisciplinary team	2 Hospitals (Regional)
Solla, D. J. F., et al. 2013 Salvador Bahia Brazil[123]	Descriptive	Store & Forward	Cardiology	Utilization of the telemedicine services, number of suspected STEMI patients, pain-to admission time, obstacles faced.	Multidisciplinary team	Specialist Center	Multidisciplinary team	Community-based emergency units, hospitals and ambulance units
Ho Y l., et al. 2014, Taiwan[52]	Analytic observational study	Store & Forward	Cardiology	LOS, hospitalization, cost effectiveness.	Cardiologist	Cardiovascular center	Physician	Primary care

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Rasmussen MB. et la. 2014 Denmark[181]	Descriptive	Store & Forward	Cardiology	Proportion of tentative diagnoses of STEMI established by telemedicine, association between transport distance and system delay.	Cardiologist	Hospital	Multidisciplinary team	Ambulance
Pearce, L. 2014 UK[182]	Descriptive	Store & Forward	Cardiology	Utilization of the telemedicine service	Cardiologist	National cardiology reporting service	Nurse	Minor injuries units in 8 Community Hospital
Chu-Weininger, M. Y. L., et al 2010 USA[87]	Quasi-experimental	Real time	Critical Care	Teamwork Climate Scale (TWS), Safety Climate Score (SCS) and survey items related to tele-ICU.	Multidisciplinary team	Specialist Center	Multidisciplinary team	2 Community Hospital 1Tertiary care teaching hospital
Heath, B., et al 2009 USA[88]	Descriptive	Real time	Critical Care	Questionnaires about the quality and usefulness (opinion) of the consulting intensivist and referring providers.	Pediatric intensivist	Tertiary referral center and the homes of the three pediatric intensivists.	Referring providers	10 Rural Hospitals
Marcin, J. P., et al 2004 USA[80]	Analytic observational study	Real time	Critical Care	Cost saving, transport cost avoided, revenue to rural hospital.	Pediatric critical care physician	Hospital (University)	Multidisciplinary team	ICU Medical Center, trauma center
Marcin, J. P., et al 2004 USA[39]	Analytic observational study	Real time	Critical Care	The Injury Severity Score, Trauma and Injury Severity Score, mortality rates, LOS. Parental and provider satisfaction with them telemedicine consultations.	Pediatric critical care physician	Hospital (University)	Multidisciplinary team	ICU Medical Center, trauma center

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Marcin, J. P., et al. 2004 USA[40]	Analytic observational study	Real time	Critical Care	Pediatric Risk of Mortality version 3 (PRISM 3), LOS, Nurse, respiratory therapist, physician, and parent/guardian satisfaction with telemedicine consultations.	Pediatric critical care physician	Hospital (University)	Multidisciplinary team	ICU Medical Center, trauma center
Berg, B. W., et al 2003 USA[183]	Descriptive	Real time	Critical care	Utilization of the telemedicine service.	Intensivists	Army Medical Center	Multidisciplinary team	Hospital
Hawkins, C.L., 2012 USA[184]	Descriptive	Real time	Critical care	Utilization of the telemedicine service, estimated cost avoidance.	Registered nurse	Veterans Affairs (VA) Medical Center's	Registered nurse	Medical Center
Morrison, J. L., et al 2010 USA[58]	Analytic observational study	Real time	Critical Care	Mortality, LOS, total hospital costs, trauma status, acute physiology and chronic health evaluation score, and physician utilization of the eICU.	Multidisciplinary team	Specialist Center	Multidisciplinary team	4 community hospitals
McCoy, M. et al. 2014 USA[185]	Descriptive	Real time	Critical Care	Utilization of the telemedicine services.	Neonatologists	Hospital	Multidisciplinary team	Hospital
Labarbera, Jaclin M. et la. 2013 USA[48]	Analytic observational study	Real time	Critical Care	Transfer rate and rate of diversion from the pediatric intensive care unit to the tertiary ward between (conventional, telephone and telemedicine clinic).	Consulting intensivist	Tertiary hospital	Physician	Community hospital

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Scheinfeld, N., et al 2003 USA[101]	Descriptive	Store & Forward	Dermatology	Patient acceptance	Dermatologists	Specialist Center	Emergency medicine physicians	Urban emergency department
Hsiao, J. L. and D. H. Oh 2008 USA[203]	Analytic observational study	Store & Forward	Dermatology	Time intervals for conventional and telemedicine referrals	Dermatologist	Medical Center dermatology surgery clinics	Multidisciplinary team	3 remote primary care clinics
Weinstock, M.A et al 2002 USA[106]	Descriptive	Store & Forward	Dermatology	Patient satisfaction ,Provider satisfaction	Dermatologist	VA Medical Center	Multidisciplinary team	VA facilities
Duong, T. A. et al. 2014 France[204]	Descriptive	Real time Store & Forward	Dermatology	Utilization of the telemedicine services, diagnosis agreement, management concordance.	Dermatologist	4 Hospitals	Emergency Department physician	4 Hospitals
Van der Heijden, J. P. et al. 2014 The Netherlands[205]	Descriptive	Store & Forward	Dermatology	Dermatologists view on the effect of Tertiary Teledermatology (TTD).	Dermatologist	University Hospital & Tertiary Centre	Dermatologist	Secondary care centers
McFarland, L. V. et al. 2013 USA[96]	Descriptive	Store & Forward	Dermatology	Dermatologist and imaging technician satisfaction.	Dermatologist consultant	Teledermatology center	Multidisciplinary team	Veterans Rural outpatient clinics
Westbrook, J. I., et al 2008 Australia[60]	Quasi-experimental	Real time	Emergency / Trauma medicine	Changes in patterns of management, rapid acute physiology scores, LOS	ICU Multidisciplinary team	Hospital (Tertiary)	ED physicians	Hospital (District)

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Galli, R., et al. 2008 USA[107]	Descriptive	Real time Store & Forward	Emergency / Trauma medicine	Patient Satisfaction, Hospital Administrator Satisfaction	Multidisciplinary team	Hospitals	Nurse practitioners	10 Rural emergency departments
Ellis, D. G. and J. Mayrose 2003 USA[148]	Descriptive	Real time	Emergency / Trauma medicine	Utilization of the telemedicine service.	Emergency Medicine Physician	Hospital (University)	Practitioner	Hospital, rural primary care emergency department
Chi, C. H., et al. 1999 Taiwan[149]	Descriptive	Real time	Emergency / Trauma medicine	Utilization of the telemedicine service, physician assessment of clinical consultation.	Emergency physician	Hospital (University)	Physician	Hospital
Brebner, E.M., et al. 2004 UK[89]	Descriptive	Real time	Emergency / Trauma medicine	Utilization of radiograph, degree of user satisfaction and whether the patient was treated locally or transferred.	Accident and emergency specialists	Hospital	Multidisciplinary team	4 Community hospitals
Brebner, E. M., et al 2002 UK[93]	Descriptive	Real time	Emergency / Trauma medicine	Satisfaction by health-care staff, patients avoided travel.	Multidisciplinary team	Hospital	Multidisciplinary team	14 community hospitals
Tachakra, S., C. Uko Uche, and A. Stinson 2002 UK[121]	Descriptive	Real time	Emergency / Trauma medicine	Reason for consultation, the type of case for which teleconsultation was used, image and sound quality, accuracy of radiological diagnosis, disposition of patient after teleconsultation.	Accident and emergency consultant	Hospital	Emergency nurse practitioners	Minor accident and treatment service
Ferguson, J., et al 2003 UK[150]	Analytic observational study	Real time	Emergency / Trauma medicine	Transfer rates by (grade of practitioner providing telemedical advice, the confidence on using telemedicine).	Multidisciplinary team	Hospital	Multidisciplinary team	community hospitals

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Salmon, S., et al. 2000 Ireland[151]	Descriptive	Real time	Emergency / Trauma medicine	Utilization and type of telemedicine service, the duration of the consultation.	Specialist	Hospital (district)	Emergency nurse practitioners	Two minor injuries units
Beach, M., et al. 2000 UK[120]	Descriptive	Real time Store & Forward	Emergency / Trauma medicine	Utilization and type of telemedicine service.	Multidisciplinary team	Hospital	Multidisciplinary team	Hospital
Latifi, R., et al. 2009 USA[152]	Descriptive	Real time	Emergency / Trauma medicine	Utilization of the telemedicine service, perceived impact on survival, and cost saved by the number of prevented transfers.	Trauma surgeon	Hospital (University)	Multidisciplinary team	5 rural Medical Centers
Boulanger, B., et al 2001 USA[98]	Descriptive	Real time	Emergency / Trauma medicine	Number of follow up, number of tele referred; total travel distances to the TeleTrauma Clinic site, total distances to the university center, and satisfaction questionnaire for patients.	Surgeon	Hospital (University)	Registered nurse in rural community	Medical Center
Tachakra, S., M. Loane, and C.U. Uche 2000 UK[153]	Analytic observational study	Real time	Emergency / Trauma medicine	Diagnostic accuracy of the teleconsultations, change of treatment, the need for additional medical help after their teleconsultation; changes in patients' perceptions of their illnesses.	Multidisciplinary team	Hospital	Emergency nurse practitioners	Community Hospital
Tachakra, S., et al. 2000 UK[154]	Analytic observational study	Real time	Emergency / Trauma medicine	Utilization of the telemedicine services, the disposition of the patient after the teleconsultation, the accuracy of the radiographic diagnosis.	Multidisciplinary team	Hospital	Emergency nurse practitioners	Community Hospital

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Duchesne, J. C., et al 2008 USA[61]	Analytic observational study	Real time	Emergency / Trauma medicine	Injury Severity Score, LOS in LCH, mortality, and hospital cost.	ED physician	Specialist Center	Nurse practitioners	Seven rural hospital ED
Roccia, F., et al 2005 Italy[155]	Descriptive	Store & Forward	Emergency / Trauma medicine	Utilization of the telemedicine services, number and type of transfer.	Maxillofacial consultant	Specialist Center	Emergency physician	35 Hospitals (Regional)
Ricci, M.A., et al 2003 USA[41]	Analytic observational study	Real time	Emergency / Trauma medicine	Mortality , LOS, Injury severity scores (ISS) assessing both referring and consulting physicians perceptions of the usefulness of telemedicine (survey/observations/ interviews)	Surgeon	Specialist Center	Multidisciplinary team	4 rural hospitals
Clegg, A., et al 2011 USA[156]	Descriptive	Real time	Emergency / Trauma medicine	Utilization of the telemedicine service.	Wound Care Nurse	Hospital	Nurse	Rural Community Hospital
Takeuchi, I. et al. 2015 Japan[157]	Analytic observational study	Store & Forward	Emergency / Trauma medicine	Utilization of the telemedicine services, door-to-balloon time for STEMI patients.	Emergency physician & nurse	Ambulance car- University Hospital	Cardiologist	University Hospital
Fatehi, F. et al. 2015 Australia[104]	Descriptive	Real time	Endocrinology	Patient's satisfaction with telemedicine.	Endocrinologists	Hospital	Multidisciplinary team	Remote health center
Doarn, C. R., et al. 2002 Ecuador[29]	Analytic observational study	Real time	General Medicine	The rate agreement between telemedicine consults and on site examination	General surgeon	Specialist Center	Primary care physician	Rural medical clinics

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Theodore, B. R. et la. 2015 USA[35]	Analytic observational study	Real time	General Medicine	Proof of concept for the application of transaction cost economic analysis.	Pain and symptom management experts.	University hospital	Primary care provider	NC
Schulz, T. R. et la. 2014 Australia[34]	Descriptive	Real time	General Medicine	Utilization of the telemedicine service.	Specialist	Tertiary referral center	GP	GP practice
Gray, L.C., et al. 2009 Australia[30]	Analytic observational study	Real time	Geriatric	Hospital staff acceptance of the service; patient satisfaction with the service; comparative cost of providing in-person and VC-mediated consultations.	Geriatrician	Specialist Center	Multidisciplinary team	Hospital
Woods, K. F., et al. 2000 USA[25]	Descriptive	Real time	Hematology	Utilization of the Sickle cell disease telemedicine network	Multidisciplinary team	Hospital (University)	Nurse	4 clinics in rural areas
Woods, K., et al 1998 USA[26]	Descriptive	Real time	Hematology	Utilization of the Sickle cell disease telemedicine network	Multidisciplinary team	Hospital (University)	Nurse	4 clinics in rural areas
Campbell, M., et al 2012 Canada[31]	Descriptive	Real time	Nephrology	Utilization data (Number of patients, average visit length, the number of no shows and the reasons), patients and provider - nurses and physicians satisfaction.	Nephrologists	Hospital	Nurses	Community Hospital and a District Hospital
Pedragosa, Angels, et al 2012 Spain[53]	Analytic observational study	Real time	Neurology	Patients' outcome data: National Institute of Health Stroke Scale (NIHSS) and modified Rankin Scale (mRS) scores.	Neurovascular specialist	Specialist Center	Physicians	Several community hospitals

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Sairanen, T., et al 2011 Finland[54]	Analytic observational study	Real time	Neurology	NIHSS and mRS scores, treatment time, the follow up outcome.	Neurologist	Hospital (University)	Physician	5 community hospitals
Switzer, J.A., et al. 2009 USA[159]	Analytic observational study	Real time	Neurology	Utilization of the telemedicine service, treatment time between (conventional clinic and telemedicine clinic).	Neurologist	Hospital (University)	Emergency physicians	Medical Center and Regional Medical Center
Ionita, C.C., et al. 2009 USA[38]	Analytic observational study	Real time	Neurology	Inpatient mortality, rate of post-thrombolysis intracranial hemorrhage, discharges, mRS score and LOS.	*NC	Specialist Center	NC	10 Community Hospitals
Müller, R., et al 2007 Germany[55]	Analytic observational study	Real time	Neurology	In-hospital mortality, mRS score, Barthel Index (BI).	Neurologists	2 Specialist Center	Multidisciplinary team	12 community hospitals
Audebert, H. J., et al 2006 Germany[36]	Non-randomized open intervention study	Real time	Neurology	Mortality, mRS score, Barthel Index (BI).	Neurologists	2 Specialist Center	Multidisciplinary team	10 community hospitals
Schwab, S., et al 2007 Germany[56]	Analytic observational study	Real time	Neurology	Mortality, mRS score, Barthel Index (BI).	Neurologists	2 Specialist Center	Multidisciplinary team	12 community hospitals
Audebert, H. J., et al. 2009 Germany[37]	Non-randomized open intervention study	Real time	Neurology	Mortality, dependency, Barthel Index (BI).	Neurologists	2 Specialist Center	Multidisciplinary team	10 community hospitals

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Audebert, H.J., et al 2005 Germany[160]	Analytic observational study	Real time	Neurology	Utilization of the telemedicine service , stroke care quality (conventional clinic and telemedicine clinic)	Neurologists	Two hospitals (academic)	Multidisciplinary team	12 regional hospitals
Vatankhah, B., et al. 2008 Germany[161]	Descriptive	Real time	Neurology	Utilization of the telemedicine service.	Neurologist	Two hospitals (academic) 2 stroke centers	Multidisciplinary team	12 regional general hospitals
Pedragosa, A., et al 2009 Spain[59]	Analytic observational study	Real time	Neurology	Discharge NIHSS score, Symptomatic and Asymptomatic haemorrhagic	Neurologists	Specialist Center	Physicians	Community hospital
Hess, D. C., et al 2005 USA[162]	Descriptive	Real time	Neurology	Utilization of the telemedicine service, number of patients who received tPA, (NIHSS) Score.	Neurologists	Specialist Center	Multidisciplinary team (ED)	8 community hospitals
Wang, S., et al. 2004 USA[163]	Descriptive	Real time	Neurology	Utilization of the telemedicine service, patient treated with tPA, NIHSS scores.	Neurologists	Specialist Center	Multidisciplinary team (ED)	7 Hospitals
Chodroff, P. H 1999 USA[70]	Analytic observational study	Real time Store & Forward	Neurology	Financial performance (Start-up cost, operating cost, Air transport avoided, Net project savings).	Neurosurgeon	Specialist Center	Physician	Hospital
Postuma, R. and L. Loewen 2005 Canada[164]	Analytic observational study	Real time	Neurology	Intraoperative and postoperative complications (conventional clinic and telemedicine clinic) reasons for telemedicine consultations.	Multidisciplinary team	Specialist Center	Multidisciplinary team	Hospital

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Wiborg, A. and B. Widder 2003 Germany[112]	Analytic observational study	Real time	Neurology	User satisfaction, and patient satisfaction.	Neurologists	Specialist Center	Physicians	Seven rural hospitals
LaMonte, M.P., et al. 2003 USA[165]	Descriptive	Real time	Neurology	Utilization of the telemedicine service, number of transfer; reasons for telephone consultation rather than telemedicine, encountered problems.	Multidisciplinary team	Hospital (University)	Healthcare provide	Hospital
Sanders, Keith A. et al. 2013 USA [45]	Analytic observational study	Real time Store & Forward	Neurology	Utilization of the telemedicine service.	Neurologist	Hospitals	Emergency Room physician	7 Hospitals
Cadilhac, D. A. et al. 2014 Australia[116]	Descriptive	Real time	Neurology	Baseline clinician survey, technical problems.	Neurologist	Hospital	Emergency Department physician	Regional Hospitals
Switzer, J. A. 2015, USA[166]	Analytic observational study	Real time	Neurology	Utilization of the telemedicine service between spokes.	Multidisciplinary team	Medical center	Emergency Room physician	17 rural and community hospitals
Lazaridis, Christos et la. 2013 USA[44]	Analytic observational study	Real time	Neurology	Utilization of the telemedicine service, onset-to-treatment time, door-to-needle times, LOS, discharge statues between No thrombolysis and IV t-PA.	Multidisciplinary team	Medical center	Emergency Room physician	12 rural and community hospitals

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Muller-Barna, P. et la. 2014 Germany[167]	Descriptive	Real time	Neurology	Utilization of the telemedicine service, onset-to-treatment time, door-to-needle times.	Neurologists	2 Specialist center	Multidisciplinary team	15 community hospitals
Martinez-Sanchez, P. et la. 2014 Spin[42]	Analytic observational study	Real time	Neurology	Number of intravenous thrombolysis (IVT), door-to-needle times, in hospital mortality.	Neurologist	University Hospital	Emergency department physician	Community hospital
Dadlani, R. et al. 2014 India[77]	Descriptive	Real time Store & Forward	Neurology	Utilization of the telemedicine service, financial Implications and psychosocial advantages for avoidable travel	Neurologist	Telemedicine center	Physician	2 nodal centers
Backhaus, R et al. 2015 Germany(46)	Analytic observational study	Real time Store & Forward	Neurology	Frequency and locations of intracranial hemorrhage, risk factors, and the proportion of patients transferred to specialized hospitals and mortality rate.	Neurologists	Specialist Center	Multidisciplinary team	10 community hospitals
Heffner, D. L. et al. 2015 USA [43]	Analytic observational study	Real time	Neurology	Hospital mortality, LOS, and lower long-term survival.	Neurologists	Medical center	NC	Community hospital
Huddleston, P et al 2014 USA[168]	Descriptive	Store & Forward	Neurology	Utilization of the telemedicine service.	Multidisciplinary team	Hospital	Multidisciplinary team	Community based hospitals

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Britt, D.W., et al 2006 USA[32]	Analytic observational study	Real time	Obstetrics	Utilization of the telemedicine service, number of maternal transports, LOS and the type of contact between specialist-provider and specialist -patient (conventional clinic and telemedicine clinic).	Multidisciplinary team	Hospital (University)	Physicians	Hospitals
Donnem, T., et al, 2012 Norway[90]	Descriptive	Real time	Oncology	Healthcare providers' satisfaction.	Oncologist	Hospital (Tertiary level-University)	GPs and nurses in charge of primary cancer care	Hospital (Local Primary Cancer healthcare)
Doolittle, G.C., et al. 2004 USA[71]	Descriptive study	Real time Store & Forward	Oncology	The cost of the telemedicine expenses: (technical expenses, practice expenses).	Oncologist	Hospital (academic)	Oncology-nurses	Rural Medical Center
Doolittle, G. C., et al. 1998 USA[81]	Analytic observational study	Real time Store & Forward	Oncology	Cost for (conventional clinics, outreach clinics, and telemedicine clinics).	Oncologist	Hospital (academic)	Oncology-nurses	Rural Medical Center
Sabesan, S., et al. 2012 Australia[196]	Descriptive	Real time	Oncology	Utilization of the telemedicine service.	Oncologists	Specialist Center	Multidisciplinary team	18 rural towns rural hospital
Larcher, B., et al 2002 Italy[197]	Analytic observational study	Store & Forward	Oncology	Questionnaire assessing the beliefs and attitudes towards the electronic patient record and teleconsultation.	Oncology consultant	Hospital	Physician	District general hospital
Billingsley, K. G., et al. 2002 USA[198]	Descriptive	Real time	Oncology	Utilization of the telemedicine service.	Multidisciplinary team	VA Health Care System	Local care provider	VA facilities

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Shea C M., et al. 2014, USA [200]	Descriptive	Real time	Oncology	The feasibility of a new virtual tumor board VTB program.	Multidisciplinary team	Cancer Center	Clinicians	Community clinics
Chan BA., et al. 2015 Australia[51]	Analytic observational study	Real time	Oncology	Dose intensity, toxicity rates, hospital admissions and mortality.	Oncologists	Hospital	Multidisciplinary team	Rural medical centers
Sabesan, Sabe et la. 2014 Australia[199]	Descriptive	Real time	Oncology	Utilization of the telemedicine service, waiting time for referrals.	Oncologists	Cancer Centre	Multidisciplinary team	21 rural towns
Sabesan, S. et al. 2014 Australia[128]	Descriptive	Real time	Oncology	Description of telemedicine service.	Oncologists	Specialist Center	Multidisciplinary team	Rural hospital
M., et al., 2010 Australia[118]	Descriptive	Real time	Ophthalmology	Utilization of the telemedicine service.	Ophthalmologist	Hospital	Nurse practitioners	Hospital
Massin, P., et al. 2008 France[114]	Descriptive	Store & Forward	Ophthalmology	Utilization of the telemedicine service, number of referral to an ophthalmologist.	Ophthalmologist	Specialist Center	Multidisciplinary team	11 hospitals 3 primary care. 1 prison
Schulze-Döbold, C., et al 2012 France[206]	Descriptive	Store & Forward	Ophthalmology	Utilization of the telemedicine services, number of referral to an ophthalmologist.	Ophthalmologist	Specialist Center	Multidisciplinary team	17 hospitals 11 primary care. 2 prisons
Blackwell, N. A., et al 1997 Australia[72]	Analytic observational study	Real time	Ophthalmology	Cost based on the use of the patient transit scheme for isolated patients.	Ophthalmologist	Hospital	Emergency physician	Hospital

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Tsan G l., et al. 2015, USA[115]	Analytic observational study	Store & Forward	Ophthalmology	Rate of timely diabetic retinal examination	Optometrist or ophthalmologist	Medical Center	Imaging technician	Outpatient clinics
Hautala, N. et al. 2014 Finland[207]	Descriptive	Store & Forward	Ophthalmology	Delays from screening to treatment, Rate of visual impairment.	Ophthalmologist	University hospital	Nurse and Imaging technician.	Mobile examination unit
Tachakra, S., et al 2001 UK[33]	Descriptive	Real time	Orthopaedics	Utilization of the telemedicine service, technical quality, the disposition of patients after the teleconsultation, the accuracy of radiological diagnosis.	Multidisciplinary team	Hospital	Emergency nurse practitioners	A free standing minor accident and treatment service
Xu, C. Q., et al 2008 Australia[27]	Analytic observational study	Real time	Otolaryngology	Cost for (conventional clinic, and telemedicine clinic), travel distance and travel mode and travel reimbursement information.	ENT specialist	Hospital	Pediatrician	Hospital
Made, C., et al., 1999 Sweden[28]	Descriptive	Real time	Otolaryngology	Utilization of the telemedicine service, average time for consultation, technical quality of the consultation.	Multidisciplinary team	Hospital (University)	General practitioner	two primary-care centers
Desai, S., et al. 2004 India[201]	Analytic observational study	Store & Forward	Pathology	Utilization of the telemedicine service (conventional clinic, and telemedicine clinic), total cost of static telepathology workstation.	Pathologist	Specialist Center	Pathologist or technician	Hospital
Moser, P.L., et al 2003 Austria[86]	Analytic observational study	Store & Forward	Pathology	Cost for (Outreach clinics, and telemedicine clinics)	Pathologist	Hospital (University)	NC	Hospital

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Weisz-Carrington, P., et al., 1999 USA[125]	Descriptive	Store & Forward	Pathology	Utilization of the telemedicine service, number of discrepancies between telepathology and final diagnosi, cost associated with the telespathalolgy equipment compered to routine microscopy.	Pathologist	Veterans Administration Medical Center-	Multidisciplinary team	Hospitals
Callas, P.W., J.J. McGowan, and K.O. Leslie 1996 USA[91]	Analytic observational study	Real time	Pathology	Interview with the referring pathologists covering attitudes toward telepathology and reasons for seeking a consultations, questionnaire sent to the referring and consulting pathologists.	Pathologists	Hospital tertiary-care academic	physicians	Regional Medical Center
Battmann, A., et al 2000 Germany[202]	Descriptive	Store & Forward	Pathology	Number of consultations and the amount of time saved compared to the transfer to the next available pathologist.	Pathologist	Specialist Center	NC	Community hospital
Zachariah, R., et al., 2012 Somalia Kenya[169]	Analytic observational study	Real time	Pediatrics	Utilization of the telemedicine service, Paediatric ward outcomes (conventional clinic, and telemedicine clinic), added value of telemedicine as perceived by the clinicians	Paediatrician	Consultation office in an organization for medical aid	Clinicians	District hospital
Smith, A.C., P. Scuffham, and R. Wootton 2007 Australia[63]	Analytic observational study	Real time	Pediatrics	Cost for (conventional clinic, and telemedicine clinic).potential savings.	Specialist	Hospital	Paediatricians	Two regional hospitals

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Callahan, C. W., et al. 2005 USA[64]	Descriptive	Store & Forward	Pediatrics	Access, quality, cost saving (travel avoided).	Paediatric Specialist	Hospital	Paediatrician or a family practitioner	22 military treatment facilities
Ono, C. M. and J. L. Lindsey 2004 USA[117]	Descriptive	Real time	Pediatrics	Utilization of the telemedicine service and learned lessons.	Physician	Hospitals	Healthcare providers	6 remote sites care provider
Smith, A. C., et al 2003 Australia[67]	Descriptive	Real time	Pediatrics	The survey addressed three topics (Time, Travel, Additional costs).	NC	Hospital	NC	Regional area
McConnochie, K.M., et al. 2009 USA[65]	Experimental non-randomized study	Real time Store & Forward	Pediatrics	Utilization Patterns (conventional clinic, and telemedicine clinic)	NC	University Medical Center	NC	10 city and suburban practices
McConnochie, K.M., et al 2007 USA[69]	Analytic observational study	Real time Store & Forward	Pediatrics	Utilization (before and after telemedicine), reimbursement, Costs	Multidisciplinary team	Specialist Center	Telehealth assistant	Three childcare centers
Dick, P. T., et al. 1999 Canada[66]	Descriptive	Real time	Pediatrics	Participant (family) Satisfaction, Comfort, and estimated cost savings.	Specialists	Hospital	Physician	Hospital
Dowie, R., et al 2007 UK[68]	Quasi-experimental	Real time Store & Forward	Pediatrics	Cost for (conventional clinic and telemedicine clinic), family cost, surveys assessing the health-related quality of life after their initial consultation.	Pediatric cardiologists	Specialist Center	Multidisciplinary team	4 district hospitals

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Kruger, C. and M. Niemi 2012 Tanzania[170]	Descriptive	Store & Forward	Pediatrics	Utilization of the telemedicine service, time of response.	Multidisciplinary team	Online consultation network	Multidisciplinary team	40 remote hospitals
Ehrlich, A.I., et al. 2007 Chechnya[171]	Descriptive	Real time Store & Forward	Pediatrics	Utilization of the telemedicine service, outcome of consultation.	Specialists	Specialist Center	Physicians	Hospital
Smith AC., et al. 2014 Australia [173]	Descriptive	Real time	Pediatrics	Utilization of the telemedicine service, factors for expansion of services.	Specialists	Hospital	Physician	Hospital
Sandra da Silva Mattos., et al. 2015 Brazil [50]	Analytic observational study	Real time Store & Forward	Pediatrics	Utilization of the telemedicine service, Mortality.	Pediatric Cardiology	Hospital	Neonatologists	Maternity centers
Yang NH., et al.2015 USA [49]	Analytic observational study	Real time	Pediatrics	Pediatric Risk of Admission (PRISA II) ratio and the Revised Pediatric Emergency Assessment Tool (RePEAT) ratio between (telephone and telemedicine clinic).	Pediatric critical care	Hospital	ED physician	Rural EDs
Dharmar, Madan et al. 2013 USA[105]	Analytic observational study	Real time	Pediatrics	Assessment of Quality of care, change in care, parent satisfaction survey.	Pediatric critical care physician	Academic children's hospital	Emergency Department physician & nurse	5 Rural Emergency Department
Dharmar, M et la. 2013 USA[126]	Analytic observational study	Real time	Pediatrics	Medication errors numbers and types, utilization of the telemedicine service.	Pediatric critical care physicians	Academic hospital	Emergency department physician	8 rural EDs

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Miyamoto, S. et al. 2014 USA [172]	Analytic observational study	Real time	Pediatrics	Accuracy of diagnostic care quality, the quality and completeness of documentation (conventional clinic and telemedicine clinic).	Pediatric and adult Sexual Assault Nurse Examiner.	Medical center	Multidisciplinary team.	8 Rural Hospitals.
Meidl, T. M., et al. 2008 USA[79]	Quasi-experimental	Real time	Pharmacy	Drug-cost savings, Timeliness of medication order entry and order verification.	Multidisciplinary team	Specialist Center	Multidisciplinary team	13 hospitals(acute care)
Forni, A., et al. 2010 USA[190]	Quasi-experimental	Store & Forward	Pharmacy	Utilization of the telemedicine service, pharmacist intervention, patient outcome (conventional clinic and telemedicine clinic)	Multidisciplinary team	Specialist Center	Multidisciplinary team	Hospital (tertiary)
Garrelts, J. C., et al 2010 USA [73]	Quasi-experimental study	Store & Forward	Pharmacy	Staffing and workload evaluation, Health professional level of satisfaction, Cost evaluation.	Pharmacists	NC	Nurses	5 hospitals
Wakefield, D. S., et al 2010 USA[191]	Descriptive	Store & Forward	Pharmacy	Order review, volume and cost.	Pharmacists	Medical Center	Nurses	7 critical access hospitals
Keeys, C. A., et a 2002 USA[124]	Descriptive	Store & Forward	Pharmacy	Utilization of the telemedicine services.	Multidisciplinary team	Specialist Center	Multidisciplinary team	Hospital
Gordon, H.L., M. Hoeber, and A. Schneider 2012 Canada[108]	Descriptive	Real time	Pharmacy	Patient satisfaction survey, and physicians, nurses, and pharmacy staff satisfaction.	Pharmacists	Specialist Center	Pharmacy technicians	Rural Cancer Center

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Stratton, T. P., et al 2008 USA[95]	Quasi-experimental	Store & Forward	Pharmacy	Nursing Satisfaction Survey	Multidisciplinary team	Hospital (tertiary)	Nurse	16 rural hospitals
Schneider, P. J. 2013 USA[76]	Quasi-experimental	Store & Forward	Pharmacy	Utilization of the telemedicine services, number of medication errors, adverse drug events, cost avoidance. Nurse and pharmacist satisfaction.	Pharmacist	3 Community Hospitals	Nurse	3 Community Hospitals
Singh, L. G. et al. 2015 USA [103]	Descriptive	Real time	Pharmacy	Patient's satisfaction,	Pharmacists	VA medical center	Pharmacists	Outpatient clinic
Stading, Julie A et al. 2013 USA [192]	Quasi experimental	Real time	Pharmacy	Number of patients attaining HbA1c and LDL-cholesterol (conventional clinic and telemedicine clinic)	Pharmacists	Medical Center	Nurse	Outpatient clinic
Scott, D. M. et al. 2014 USA[193]	Descriptive	Real time	Pharmacy	Rates and types of quality-related event including medication errors and adverse drug events.	Pharmacists	Hospitals	Clinicians	17 Rural Hospitals
Mielonen, M.L., et al. 2000 Finland[82]	Descriptive	Real time	Psychiatry	Cost for (telemedicine clinic, travel) technical properties of the videoconferencing, quality of care, questionnaire covering technical quality of the sound and picture and the outcome of teleconsultation	Psychiatrists	Hospital (University)	Multidisciplinary team	2 primary-care centers
Myers, K. M., et al. 2007 USA[92]	Descriptive	Real time	Psychiatry	Utilization of telepsychiatry visits. The Provider Satisfaction Survey.	3 child and adolescent psychiatrists	Hospital	Multidisciplinary team	4 outpatient clinics

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Myers, K. M., et al. 2008 USA[99]	Descriptive	Real time	Psychiatry	Parent satisfaction survey	3 child and adolescent psychiatrists	Hospital	Multidisciplinary team	4 outpatient clinics
Grady, B.J., 2002 USA[83]	Descriptive	Real time	Psychiatry	Total monthly mental healthcare cost per method of care delivery, Network costs, Military provider costs, Telemental health-care costs, The transmission costs, Hospitalization costs, operational Unit/Patient Costs.	Psychiatrist	Medical Center	Primary care providers	8 remotely located medical clinics
Urness, D.A 1999 Canada[109]	Descriptive	Real time	Psychiatry	Feedback and satisfaction from consumers, service providers, psychiatrists and site coordinators.	Psychiatrists	Hospital	Physician	5 rural general hospitals
Doze, S., et al., 1999 Canada[110]	Descriptive	Real time	Psychiatry	Utilization of telepsychiatry, Opinions about telepsychiatry (service providers, psychiatrists and site coordinators), costs for telepsychiatry and travelling consultation.	Psychiatrists	Hospital (Tertiary)	Physician	5 hospitals housing mental health clinics
Blackmon, L. A., et al 1997 USA[100]	Descriptive	Real time	Psychiatry	Satisfaction of parents and children with a telemedicine child psychiatry consultation.	Child psychiatrist	Hospital (University)	Multidisciplinary team	3 Medical Centers+ 1 hospital
Mielonen, M. L., et al. 1998 Finland[194]	Descriptive	Real time	Psychiatry	Utilization, quality and cost of the telemedicine service.	Psychiatrists	Hospital	Physician	Health center

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
2014 USA[116]	Descriptive	Real time	Psychiatry	Utilization of the telemedicine service.	Psychiatrists	Telehealth center	Emergency Room physician	Medical center
Southard, E. P. et la. 2014 USA[47]	Analytic observational study	Real time	Psychiatry	Time to treatment, length of stay, door-to-consult time among patients presenting to the ER between (conventional clinic and telemedicine clinic).	Mental health specialist	Community mental health center	Emergency Room physician	Rural hospitals
Saurman, E. et al. 2014 Australia(195)	Descriptive	Real time	Psychiatry	Utilization of the telemedicine service.	Multidisciplinary team	NC	Emergency department physician	Rural and remote hospitals
Helck, A., et al. 2009 Germany[74]	Descriptive	Store & Forward	Radiology	Utilization of telerediology, total revenue for the academic tertiary care center.	Radiologist	Academic tertiary care center	Physician	5 secondary care centers
Daucourt, V., et al 2005 France[57]	Analytic observational study	Store & Forward	Radiology	Avoided transfers, the degree of compliance with the recommendations of the referral, avoided hospitalizations, LOS.	NC	Hospital (university)	physicians	15 public hospitals
Franken, E. A., Jr., et al. 1997 USA[119]	Analytic observational study	Store & Forward	Radiology	Factors that influence the request for teleradiology consultation, discrepancies between teleradiology and plain radiography reports.	Radiologists	Private practice	Physician	County hospital
Armstrong, I. J. and W. S. Haston 1997 UK[186]	Descriptive	Real time	Radiology	Utilization of the telemedicine service, technical problems, patient management and the transfers saved costs.	Consultant	Hospital	Physician	Community hospital

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					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Kehler, M., et al., 1996 Sweden[187]	Descriptive	Real time	Radiology	Utilization of the telemedicine service.	Multidisciplinary team	Hospital (University)	Cardiologist	Hospital
Bergmo, T.S. 1996 Norway[84]	Descriptive	Store & Forward	Radiology	Cost for (telemedicine clinic, visiting radiologist service)	Radiologists	Hospital (University)	NC	Military hospital
Bailes, J. E., et al. 1997 USA[75]	Descriptive	Store & Forward	Radiology	Cost savings (transportations and room cost)	Multidisciplinary team	General Hospital	Physician	20 hospitals
Soong, B., et al., 2002 Australia[189]	Descriptive	Real time	Radiology	Utilization of the telemedicine service, technical difficulties, perceptions of patients and their experiences of tele-ultrasound.	Multidisciplinary team	Hospital	Multidisciplinary team	Hospital
Hishitani, T. et la. 2014 Japan[188]	Descriptive	Real time Store & Forward	Radiology	Utilization of the telemedicine service.	Pediatric cardiologist	Tertiary centers	sonographer	Maternity Hospitals
Jury, Susan C. and Kornberg, Andrew. 2014 Australia[178]	Descriptive	Real time	Rang of specialties	Utilization of the telemedicine service, income required to meet the cost of a telehealth coordinator.	Multidisciplinary team	Hospital	Clinicians	NC
Maalim, A. M. et la. 2014 Somalia[62]	Descriptive	Real time	Rang of speciality	Morbidity and mortality rate	Multidisciplinary team	NC	Multidisciplinary team	Hospital

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Walters, T. J. 1996 USA to somalia ,Haiti, Croatia, and Macedonia[174]	Descriptive	Real time Store & Forward	Range of specialty	Utilization of the telemedicine service, factors affecting the utilization, change in patient treatment as a result of telemedicine consultation.	Range of specialties	Specialist Center	GP Or specialist	Military medical units
Gunawardane, K.J. 2000 Marshall Islands, Hawaii[175]	Descriptive	Store & Forward	Range of specialty	Number of referrals, type (disease category), outcome of consultations, Cost.	Specialist	Army Medical Center	Physicians	Hospital
Ricci, M. A., et al 1997 USA[176]	Descriptive	Real time	Range of specialty	Telemedicine utilization by specialty and interaction type, provider evaluation of video and audio quality.	Specialist	Academic medical center	Physicians	8 rural hospitals
Mathews, K. A., et al 2008 Australia[94]	Descriptive	Real time	Range of specialty	Questionnaire covering doctors' impressions of telemedicine, number and type of flight and length of stay for transferred patients, The reasons for not using the telemedicine.	Physicians	Hospital	Physicians	Primary healthcare
Labiris, G., C. Tsitlakidis, and D. Niaka 2005 Greece[85]	Quasi-experimental	Real time	Range of specialty	Cost for (telemedicine clinic, referrals)	Range of specialists	Hospital	Physicians	2 military health centres
Wan, A.C., Y. Gul, and A. Darzi, 1999 UK[111]	Descriptive	Real time	Range of specialty	Patients, trainees and clinicians satisfaction.	A senior registrar or consultant	Hospital	A resident or senior house officer	Community hospital

Author, Year, Country	Study Methodology	Telemedicine Method	Specialty	Outcome measures	Telemedicine sites			
					Provider		Recipient	
					Specialty	Setting	Specialty	Setting
Rheuban, K. S. and E. Sullivan 2005 USA [177]	Descriptive	Store & Forward	Range of specialty	Utilization of the telemedicine service.	Multidisciplinary team	Hospital (University)	Multidisciplinary team	55 site community hospitals, clinics, health centers and prisons
Smith, A. C. et al, 2014 Australia[127]	Descriptive	Real time	Range of specialty	Utilization of the telemedicine service, clinician awareness and attitudes.	Multidisciplinary team	Hospital	Local clinicians	Public health services, general practice clinics and residential aged care facilities.
Stypulkowski, K, et la. 2015 USA[129]	Descriptive	Real time	Range of specialty	Survey to determine patients' preference for postoperative follow-up-care.	Specialist	Veterans Affairs Medical Center	Physicians	Community outpatient clinic
Qiang, J. K. et la, 2015 Canada[102]	Descriptive	Real time	Range of specialty	Patient satisfaction and the perspective of non-users.	Multidisciplinary team	Telehealth center	Multidisciplinary team	Community clinics or Hospitals

* NC = Not clear, Insufficient or unclear information provided in the reviewed paper.

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