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Review of Systematic Reviews in the Field of Telemedicine

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Abstract

Background: Although the systematic reviews regarding telemedicine have increased in recent decades, no comprehensive studies have been conducted to review these systematic reviews. The present study aimed to review the published systematic reviews regarding telemedicine applications for the report and appraisal of several aspects.

Methods: The literature search was performed in the PubMed database for the systematic reviews published during January 2010-June 2020 in the field of telemedicine using "telemedicine" Mesh terms. The extracted data from the selected articles were the year of publication, telemedicine specialty, clinical outcomes, cost evaluation, and satisfaction assessment. Data analysis was performed using descriptive statistics.

Results: Among 746 retrieved articles, 191 cases were selected and reviewed. Most of the studies were focused on telemedicine (n=35; 18.3%), followed by telerehabilitation (n=22; 11.5%), tele-diabetes (n=18; 9.4%), telecardiology (n=16; 8.3%), home telecare (n=13; 6.8%), telepsychiatry (n=12; 6.3%), teledermatology (n=11; 5.7%), and teleneurology (n=9; 4.7%). The selected studies were primarily focused on clinical outcomes (72.7%), followed by cost-effectiveness (32.4%) and user satisfaction (29.3%). In addition, they mostly indicated that telemedicine services yielded acceptable clinical outcomes (72.5%), cost-effectiveness (67.7%), and healthcare provider/patient satisfaction (83.9%).

Conclusion: Although telerehabilitation, tele-diabetes, telecardiology, home telecare, and telepsychiatry were studied further, there are still some specific specialties such as teleradiology, telepathology, and telepediatric that should be considered more. Moreover, investigation of various outcomes could result in a more comprehensive view of this field. Therefore, further investigations in this regard would improve telemedicine applications and encourage potential telemedicine providers to initiate these applications.

Keywords: Telemedicine, Telehealth, Systematic Review, Analysis

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Introduction

Telemedicine is the use of electronic information and communication technologies to exchange medical information for the provision of healthcare services and medical education (1). Telemedicine could connect healthcare

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↑What is "already known" in this topic:
With the increased number of publications in the field of telemedicine, it becomes difficult to find its gaps and achieve a comprehensive understanding of telemedicine as a whole. To date, systematic reviews and guidelines have concentrated on specific telemedicine applications. There is no overview of the current situation regarding systematic reviews of telemedicine.

→What this article adds:
This study presents comprehensive data about telemedicine. Telerehabilitation, tele-diabetes, andtelecardiology were studied further. Furthermore, some specific specialties such as teleradiology, telepathology,and telepediatric should be considered more. Studies were focused on clinical outcomes, followed by cost-effectiveness and user satisfaction.

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providers to the patients living in geographically disparate locations, thereby increasing access to specialty and expert care (2) . Telemedicine is used for various purposes, including prevention, diagnosis, consultation, evaluation, monitoring, mentoring, treatment, follow-up, and patient rehabilitation (3, 4). Telemedicine has been classified into several categories, including telepsychiatry, teledermatology, teleradiology, telepathology, telerehabilitation, and tele-education, which provide a wide range of care services (5, 6). Telepathology is a telemedicine application involving the practice of pathology at a distance using video imaging visualizations and telecommunications rather than viewing a specimen directly through a microscope (7). Teleradiology is the transmission of radiological patient images (e.g., X-rays, CT, and MRI) at a distance for diagnostic or consultative purposes (8). Telerehabilitation is a rehabilitation service used in cardiology, neurology, and orthopedics, which is delivered at a distance (9, 10).

Telemedicine plays a key role in healthcare systems as it makes the provision of healthcare services more accessible, especially in rural communities (11). Therefore, the use of telemedicine has significantly increased in recent years, and statistics suggest that telemedicine studies have increased continuously from 56 cases in 1992 to 3,861 studies in 2015 with a fluctuating trend (12, 13). Along with the growing number of original studies in telemedicine, systematic reviews have substantially increased over the past years, focusing on specific aspects of telemedicine. For instance, a systematic review evaluated telepsychiatry in terms of the prevalence and quality of asynchronous telepsychiatry and identified the areas in which more research was required (14). Another systematic review in this regard assessed user satisfaction with teledermatology services (15), and in another similar study, the published articles on telepathology projects were reviewed and compared in several aspects (16).

The number of studies regarding telemedicine has increased dramatically within the past decades, although the most interesting fields of telemedicine and their effectiveness have not been specified for systematic reviewers. There is still no credible evidence on the extended use of telemedicine in various fields, and its clinical, economic, and satisfaction benefits have not been generally considered (17, 18). So by the increased number of publications in the field of telemedicine, it becomes difficult to find its gaps and achieve a comprehensive understanding of telemedicine as a whole. Therefore, a systematic review regarding these studies could inform researchers about the trend of using telemedicine and bridge the gaps while also identifying the outcomes and priorities to evaluate the effectiveness of telemedicine systematic reviews. A study was performed with this purpose in 2010, reviewing the telemedicine systematic reviews published until the end of 2009 and identifying 55 systematic reviews, which indicated that most of the systematic reviews in this regard were focused on general outcomes such as feasibility and clinical, economic, and satisfaction outcomes. Furthermore, home telecare, telecardiology, telepsychiatry were the most interesting specialty fields in these systematic reviews (19).

Given the progress in information and communication technologies and the advancement in internet access, the use of telemedicine has accelerated significantly in the past decade. Moreover, the growing use of telemedicine has increased the number of articles in this regard. Therefore, studies are required to inspect the changes and progress trends in telemedicine research since the past decade (20, 21). The present study aimed to systematically review the review studies focused on telemedicine to identifie the year of the studies, specialty of telemedicine, clinical/cost-effectiveness, and satisfaction outcomes.

Methods

Search Strategy

This review study was performed via searching in the PubMed database in June 2020 to retrieve the articles published from January 2010 to June 2020 using only the "telemedicine" Mesh term. Approximately 80–90% of studies conducted in the field of telemedicine were accessible on the PubMed database (22). The search was limited to systematic reviews, English articles, and studies on human subjects.

Inclusion Criteria

The inclusion criteria were the systematic reviews investigating telemedicine services that use telecommunication technologies such as telephone, videoconferencing, and the short messaging service (SMS) to set mutual communication between patients and healthcare providers for the provision/receiving healthcare services, as well as to foster interactions between healthcare providers for medical consultation.

Exclusion Criteria

Scoping reviews, narrative reviews, conference abstracts, articles without published abstracts, and the article without an available full text were excluded.

Article Selection

The search results were analyzed in the EndNote X9 bibliographic software. The titles and abstracts of the retrieved articles were screened by three authors (S. G, N. J, and S.G) independently, and disagreements were resolved by consulting the other authors (S. H and K.B). In the next step, the full texts of the selected articles were screened by the same three authors, and the final list of the selected articles was prepared.

Data Extraction

Data were extracted from the selected articles by three authors (S. G., N. J., and S. G.) independently, including the name of the first author, the country, and year of publication, telemedicine specialty, clinical outcomes, cost-effectiveness outcomes, and satisfaction outcomes.

Statistical Analysis

Data analysis was performed using descriptive statistics such as frequency and frequency percent.

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Results

In total, 746 articles were retrieved from the search in the PubMed database. After reviewing the titles and abstracts, 483 articles were excluded as they did not meet the inclusion criterion. Following that, the full texts of 263 articles were reviewed, and 72 articles were excluded as they were focused on non-telemedicine issues. Finally, 191 articles were selected based on the predetermined inclusion criterion (Fig. 1). The list of the selected articles and their data is shown in Appendix 1.

Countries

Most of the studies were conducted in the United States (n=44; 23.0%), Australia (n=35; 18.3%), United Kingdom (n=21; 10.9%), Canada (n=14; 7.3%), and China (n=11; 5.7%), and the remaining studies were distributed in other countries in smaller numbers (Fig. 2).

Year of Publication

Most of the studies were published in 2018 (n=43; 22.5%), 2017 (n=36; 18.8%), 2016 (n=24; 12.5%), 2015 (n=22; 11.5%), 2019 (n=15; 7.8%), and 2014 (n=15; 7.8%) (Fig. 3).

Telemedicine Specialty

Most of the studies were focused on general telemedicine (n=35; 18.3%), followed by telerehabilitation (n=22; 11.5%), tele-diabetes care (n=18; 9.4%), telecardiology (n=16; 8.3%), home telecare (n=13; 6.8%), telepsychiatry (n=12; 6.3%), teledermatology (n=11; 5.7%), and teleneurology (n=9; 4.7%) (Table 1).

Among the reviewed studies, 166 cases (86.9%) had reviewed articles using at least three different evaluation methods (clinical, economic, and satisfaction outcomes), and 25 cases (13.0%) had been focused on other outcomes, such as wait/travel times, specialist referral rates, and emergency department visits. In addition, some of the studies were qualitative. Most of the studies also involved the specialty assessment of clinical outcomes (n=139; 72.7%), cost-effectiveness (n=62; 32.4%), and user satisfaction (n=56; 29.3%).

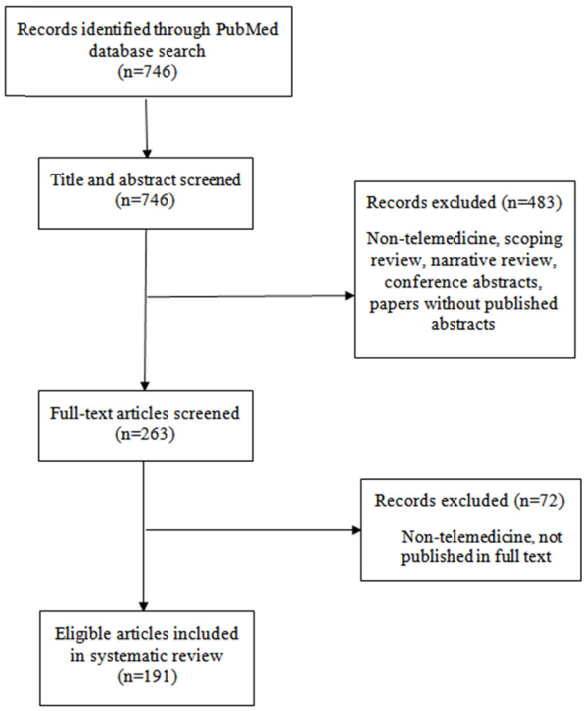

Fig. 1. PRISMA Flow Chart of Data Collection and Analysis

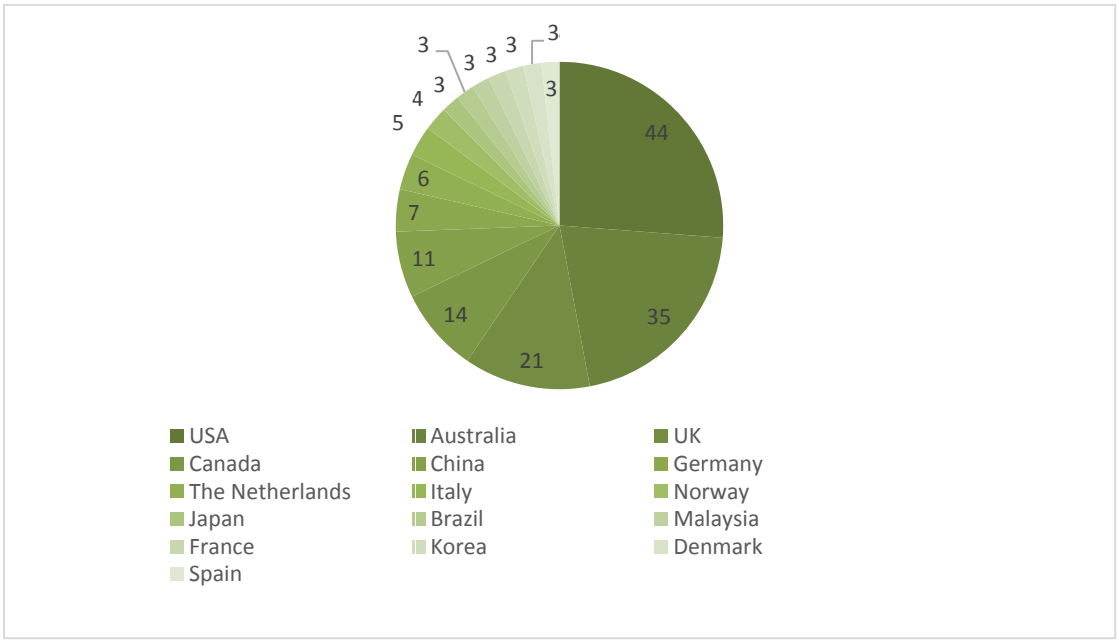

Fig. 2. Countries Involved in Telemedicine Systematic Reviews (n=191)

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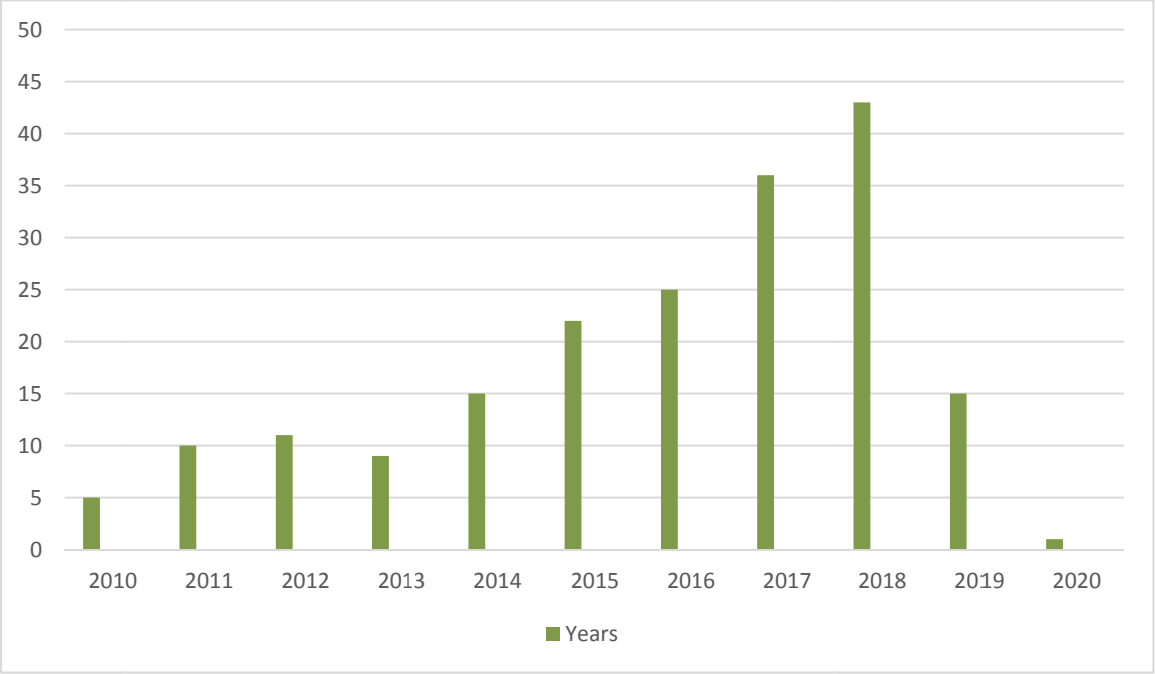

Fig. 3. Year of Publication

Table 1. Number of Specialty and Evaluation Outcomes for Each one

Specialty	Number of Systematic Reviews*	Outcomes		
		Clinical	Cost-effectiveness	Satisfaction
Telemedicine	35	21	14	14
Telerehabilitation	22	20	3	7
Tele-diabetes Care	18	15	3	1
Telecardiology	16	13	6	1
Home Telecare	13	8	7	2
Telepsychiatry	12	9	4	5
Teledermatology	11	4	5	4
Teleneurology	9	7	2	3
Telepulmonary	8	8	1	1
Teledentistry	6	4	3	2
Tele-ICU	6	4	2	3
Tele-emergency	6	4	2	1
Tele-oncology	4	3	0	2
Telegeriatrics	4	2	3	2
Tele-palliative Care	3	3	2	1
Teleaudiology	3	0	1	2
Telepharmacy	3	3	1	1
Teleophthalmology	2	2	1	1
Telegastrointestinal	2	2	0	1
Telerheumatology	2	2	1	1
Telesurgery	1	1	1	0
Teleradiology	1	1	0	0
Telepathology	1	1	0	0
Teleobstetrics	1	1	0	1
Telenephrology	1	1	0	0
Tele-education	1	0	0	0
Total	191	139 (72.7%)	62 (32.4%)	56 (29.3%)

*Number of systematic reviews on each specialty not equal to sum of three outcomes as some studies evaluated more than one outcome.

Outcomes and Their Results

According to our findings, the telemedicine systematic reviews had mostly evaluated articles in terms of clinical outcomes (n=139), identifying clinical outcomes such as mortality and morbidity, quality of life, treatment progress, reduction of pain symptoms, and improved disease symptoms. Among 139 articles that assessed clinical outcomes, 101 (72.5%) studies were effective, 22 (15.8%) were unclear, 15 (10.8%) were similar, and one study (0.7%) was ineffective. In addition, 62 studies assessed telemedicine systematic reviews from an economic perspective, mostly reporting that economic outcomes were cost-effective (n=42; 67.7%) and unclear (n=20; 32.2%). As for the assessment of satisfaction outcomes (n=56; 29.3%), most of the telemedicine systematic reviews (n=47; 83.9%) indicated that patients and healthcare pro-

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Table 2. Assessed Outcomes and Their Results in Reviewed Studies

Outcomes Result	Clinical N (%)	Cost-effectiveness N (%)	Satisfaction N (%)
Effective	101 (72.5)	42 (67.7)	47 (83.9)
Unclear	22 (15.8)	20 (32.2)	9 (16.1)
Similar (no difference)	15 (10.8)	0	0 (0)
Ineffective	1 (0.7)	0	0 (0)
Total	139	62	56

viders were satisfied with using telemedicine services in multiple aspects, while the results were reported to be unclear in some cases (n=9; 16.1%) (Table 2).

Discussion

The number of studies regarding telemedicine has increased dramatically within the past decades. The systematic reviews on telemedicine have been conducted in various fields, mostly investigating general aspects such as telerehabilitation, tele-diabetes care, telecardiology, home telecare, and telepsychiatry. In most of these reviews, the primary objectives were to evaluate clinical outcomes, cost-effectiveness, and user satisfaction.

In the present study, we reviewed 35 systematic reviews focused on the general aspects of telemedicine. The most important reason for the large number of the studies was that most of the studies were focused on the general services and aspects of telemedicine (23-27). Telemedicine specialty was unclear in some cases (28, 29), and some of the studies were conducted on more than one specialty (30, 31); therefore, we also considered the general areas of telemedicine. Many of the studies regarding these general fields have indicated that telemedicine is a state-of-the-art technology (32), while its ambiguities have rarely been addressed (33).

Telerehabilitation is a novel field of study, and most of the investigations in this regard have been focused on telerehabilitation in neurological diseases, such as stroke and multiple sclerosis (MS). Stroke and MS are the most common cause of neurological disability in the community (34, 35). Telerehabilitation could effectively manage neurological issues beyond the clinical settings and provide equal access to patients who are geographically remote from their healthcare providers (36).

According to the current review, 18 systematic reviews were focused on tele-diabetes care. Diabetes is a chronic disease with a high prevalence rate and a leading cause of disability and death worldwide. The global prevalence of diabetes has nearly doubled since 1980, increasing from 108 million cases in 1980 to 422 million cases in 2014 (37), while the rate is predicted to reach 592 million by 2035 (38), making it difficult for diabetic patients to access specialized services, regular monitoring, and individualized treatment (39). Tele-diabetes services could efficiently improve access to healthcare clinicians and may even complete medical management since they could improve early-stage diagnosis, monitor disease progression, and promote disease management (40, 41). In general, telemedicine could remarkably contribute to diabetic patients by improving healthcare access, diagnosis, education, consultation, and clinical outcomes (42, 43).

Telecardiology was the fourth most common focus in the reviewed studies, which was quite predicted considering that cardiovascular diseases have recently become a leading death worldwide, contributing to 17.3 million deaths per year (20). Studies have indicated that telecardiology could effectively decrease all-cause mortality, heart failure mortality, and hospitalization. Therefore, it has received special attention, and several studies have investigated telecardiology (44, 45).

Technology can play a great role in the care of people at home in many ways, and home telecare is one the most growing sector of health care (46), which is mostly applicable in chronic diseases, such as pulmonary and cardiovascular disorders. A study in this regard investigated heart failure telemonitoring, showing that telemonitoring could significantly reduce heart failure mortality (47). Therefore, home telecare technologies have great potential to increase access to healthcare services and improve the quality of care, particularly in the case of chronically ill patients (48).

In the present study, 13 systematic reviews were identified in the field of telepsychiatry. Mental disorders cover a wide range including depression, anxiety, panic disorder, phobias, and obsessive- compulsive disorder. Telepsychiatry could improve these disorders by various methods, such as consultation, training, and increasing physical activity, which may in turn decrease anxiety and depression (6, 49). The results of a systematic review in the field of telemedicine in 2010 are consistent with our findings. The mentioned study also indicated that telemedicine, home telecare, telecardiology, and telepsychiatry were the most compelling fields of research (19)

Only one systematic review was focused on teleradiology, and telepathology, and no studies reviewed telepediatrics. Teleradiology, telepathology, and telepediatrics have been reported to be the most popular, successful, and widely used clinical telemedicine specialties in recent years (50-53). The limited investigations in such specialties of telemedicine may have several reasons. First, telemedicine requires cutting-edge technology and costly equipment to provide healthcare services. Second, the low prevalence of some diseases may not urge the use of telemedicine for patient management. Third, no systematic reviews could be found for these specialties in the PubMed database. Therefore, it is suggested that researchers conduct more systematic reviews on subjects such as telepathology, teleradiology, and telepediatrics.

According to the study by Hersh et al., the review of clinical outcomes is essential to assessing the effectiveness of telemedicine (54). The clinical outcomes of tele-

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medicine services in 72.6% of the reviewed studies were positive, while in 15.8% of the cases, the results of these outcomes were unclear. The lack of clarity in clinical outcome results due to low-quality evidence, which highlights the need to identify the clinical effectiveness of telemedicine (55-57). Moreover, some of the reviewed studies in the current research were only reports, not clarifying the effectiveness aspect, which could be due to the lack of research or significant disparities in the existing studies (23, 58). One study showed that telemedicine has no effects on clinical outcomes (59, 60). The effects of telemedicine depend on several factors, such as telemedicine duration, user adherence rate to the provided services, type of the intervention, and study design (61). In addition, clinical outcomes are influenced by patient-related factors such as age, education level, income status, type of disease, and medication complexity (62).

According to our findings, most of the studies demonstrated that telemedicine could reduce some treatment costs (but not entirely). In total, 20 studies also showed that the cost-effectiveness of telemedicine was unclear, which could be due to the limitations of the economic evaluations of telemedicine, lack of randomized controlled trials, small sample sizes, and absence of quality data and appropriate measures (63, 64). Economic evaluations provide data on the efficiency of telemedicine and clarify the advantages of telemedicine technology compared to face-to-face healthcare services (65).

In the current review, 56 studies assessed the satisfaction of patients and healthcare providers with telemedicine applications, mostly indicating user satisfaction with telemedicine. Assessing the satisfaction aspects of clients and clinicians significantly affects telemedicine outcomes and may enhance the treatment of patients and care delivery as well (66, 67).

According to the current review, the number of studies regarding telemedicine has increased (especially in the past decade), and most of these articles have been published in the United States and Australia. Notably, these high-income countries have widely dispersed populations and are the pioneers of telemedicine implementation (68). Furthermore, they have specific rules and regulations about telemedicine. Although telemedicine could be an effective approach to receiving health services in developing countries, telemedicine studies are still limited in these countries (69, 70).

To the best of our knowledge, this was the first comprehensive review of the systematic reviews regarding telemedicine. Some of the limitations of our study were that we only searched the PubMed database that might have missed some relevant studies. In addition, only English articles were included in this study. We did not access the full text of seven articles, and they had to be excluded from the study which led to a gap in the number of the relevant studies that may have provided further findings.

Conclusion

In this review study, 191 articles were identified regarding telemedicine interventions. Although telerehabilitation, tele-diabetes, telecardiology, home telecare, and telepsychiatry were studied further, there are still some specific specialties such as teleradiology, telepathology, and telepediatric that should be considered more. Our study also indicates that clinical, cost-effectiveness, and satisfaction were three major criteria to assess the effect of telemedicine services. As the telemedicine field is rapidly growing, further investigations in this regard could undoubtedly improve telemedicine applications and encourage potential telemedicine providers to initiate these services.

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Conflict of Interests

The authors declare that they have no competing interests.

References

1. Sood SP, Negash S, Mbarika VW, Kifle M, Prakash N. Differences in public and private sector adoption of telemedicine: Indian case study for sectoral adoption. Stud Health Technol Inform. 2007;130:257-68.
2. Galvez JA, Rehman MA. Telemedicine in anesthesia: an update. Cure Opin Anaesthesiol. 2011;24(4):459-62.
3. Waller M, Stotler C. Telemedicine: a Primer. Curr Allergy Asthma Rep. 2018;18(10):54.
4. Bashshur R, Shannon G, Krupinski E, Grigsby J. The taxonomy of telemedicine. Telemed J E Health. 2011;17(6):484-94.
5. Kane CK, Gillis K. The use of telemedicine by physicians: still the exception rather than the rule. Health Aff (Millwood). 2018;37(12):1923-30.
6. Fortney JC, Pyne JM, Turner EE, Farris KM, Normoyle TM, Avery MD, et al. Telepsychiatry integration of mental health services into rural primary care settings. Int Rev Psychiatry 2015;27(6):525-39.
7. Farahani N, Pantanowitz L. Overview of telepathology. Surg Pathol Clin. 2015;8(2):223-31.
8. Binkhuysen FB, Ranschaert E. Teleradiology: evolution and concepts. Eur J Radiol. 2011;78(2):205-9.
9. Frederix I, Vanhees L, Dendale P, Goetschalckx K. A review of telerehabilitation for cardiac patients. J Telemed Telecare. 2015;21(1):45-53.
10. Russell TG. Telerehabilitation: a coming of age. J Physiother. 2009;55(1):5-6.
11. Froehlich W, Seitaboth S, Chanpheaktra N, Pugatch D. Case report: an example of international telemedicine success J Telemed Telecare. 2009;15(4):208-10.
12. Viswanathan V, Elango B, Yugapriya S. Authorship Trends in Telemedicine Research. Int J Recent Technol Eng. 2019;8(2):3030-6.
13. Frumento E, Colombo C, Borghi G, Masella C, Zanaboni P, Barbier P, et al. Assessment and analysis of territorial experiences in digital tele-echocardiography. Ann Ist Super Sanita. 2009;45:363-71.
14. O'Keefe M, White K, Jennings JC. Asynchronous telepsychiatry: A systematic review. J Telemed Telecare. 2019:1357633x19867189.
15. Mounessa JS, Chapman S, Braunberger T, Qin R, Lipoff JB, Dellavalle RP, et al. A systematic review of satisfaction with teledermatology. J Telemed Telecare. 2018;24(4):263-70.
16. Hajesmaeel-Gohari S, Bahaadinbeigy K, Ahmadian L, Khajouei R, Pournik O. Published papers on telepathology projects. J Health Manag Inform. 2015;2(4):108-19.
17. Harst L, Timpel P, Otto L, Wollschlaeger B, Richter P, Schlieter H. Identifying Obstacles and Research Gaps of Telemedicine Projects: Approach for a State-of-the-Art Analysis. Stud Health Technol Inform. 2018;247:121-5.
18. Bashshur R, Shannon GW. History of telemedicine: evolution, context, and transformation: Mary Ann Liebert. 2009: 105-14.
19. Bahaadinbeigy K, Yogesan K, Wootton R. Gaps in the systematic reviews of the telemedicine field. J Telemed Telecare. 2010;16(7):414-6.

[DOI: 10.47176/mjiri.35.184]

20. Laslett LJ, Alagona P, Jr., Clark BA, 3rd, Drozda JP, Jr., Saldivar F, Wilson SR, et al. The worldwide environment of cardiovascular disease: prevalence, diagnosis, therapy, and policy issues: a report from the American College of Cardiology. J Am Coll Cardiol. 2012;60(25 Suppl):S1-49.
21. Achimugu P, Oluwagbemi O, Oluwaranti A, Afolabi B. Adoption of information and communication technologies in developing countries: an impact analysis. J Inf Technol. 2009;9(1):37-46.
22. Bahaadinbeigy K, Yogesan K, Wootton R. MEDLINE versus EMBASE and CINAHL for telemedicine searches. Telemed E-Health. 2010;16(8):916-9.
23. AlDossary S, Martin-Khan MG, Bradford NK, Smith AC. A systematic review of the methodologies used to evaluate telemedicine service initiatives in hospital facilities. Int J Med Inform. 2017;97:171-94.
24. Marzorati C, Renzi C, Russell-Edu SW, Pravettoni G. Telemedicine Use Among Caregivers of Cancer Patients: Systematic Review. J Med Internet Res. 2018;20(6):e223.
25. de la Torre-Díez I, López-Coronado M, Vaca C, Aguado JS, de Castro C. Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: a systematic review. Telemed J e-Health. 2015;21(2):81-5.
26. Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: a systematic review of reviews. Int J Med Inform. 2010;79(11):736-71.
27. Kumar G, Falk DM, Bonello RS, Kahn JM, Perencevich E, Cram P. The costs of critical care telemedicine programs: a systematic review and analysis. Chest. 2013;143(1):19-29.
28. Wilcox ME, Adhikari NK. The effect of telemedicine in critically ill patients: systematic review and meta-analysis. Crit Care. 2012;16(4):R127.
29. Nadar M, Jouvet P, Tucci M, Toledano B, Sicotte C. Impact of synchronous telemedicine models on clinical outcomes in pediatric acute care settings: a systematic review. Pediatr Crit Care Med.2018;19(12):e662-e71.
30. Hanlon P, Daines L, Campbell C, McKinstry B, Weller D, Pinnock H. Telehealth Interventions to Support Self-Management of Long-Term Conditions: A Systematic Metareview of Diabetes, Heart Failure, Asthma, Chronic Obstructive Pulmonary Disease, and Cancer. J Med Internet Res. 2017;19(5):e172.
31. Jhaveri D, Larkins S, Sabesan S. Telestroke, tele-oncology and teledialysis: a systematic review to analyse the outcomes of active therapies delivered with telemedicine support. J Telemed Telecare. 2015;21(4):181-8.
32. Li HK. Telemedicine and Ophthalmology. Surv Ophthalmol. 1999;44(1):61-72.
33. Bashshur RL, Mandil SH, Shannon GW. Introduction: State-of-the-Art Telemedicine/Telehealth: An International Perspective. Telemed J e-Health. 2002;8(1):3-4.
34. Khan F, Amatya B, Kesselring J, Galea M. Telerehabilitation for persons with multiple sclerosis. Cochrane Database Syst Rev. 2015(4).
35. Appleby E, Gill ST, Hayes LK, Walker TL, Walsh M, Kumar S. Effectiveness of telerehabilitation in the management of adults with stroke: A systematic review. PloS One. 2019;14(11):e0225150.
36. Hailey D, Roine R, Ohinmaa A, Dennett L. The status of telerehabilitation in neurological applications. J Telemed Telecare. 2013;19(6):307-10.
37. Organization WH. Global report on diabetes. 2016.
38. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. Diabetes Res Clin Prac. 2011;94(3):311-21.
39. Faruque LI, Wiebe N, Ehteshami-Afshar A, Liu Y, Dianati-Maleki N, Hemmelgarn BR, et al. Effect of telemedicine on glycated hemoglobin in diabetes: a systematic review and meta-analysis of randomized trials. CMAJ. 2017;189(9):E341-E64.
40. Bashshur RL, Shannon GW, Smith BR, Woodward MA. The empirical evidence for the telemedicine intervention in diabetes management. Telemed J e-Health. 2015;21(5):321-54.
41. De Guzman KR, Snoswell CL, Taylor ML, Senanayake B, Haydon HM, Batch JA, et al. A systematic review of pediatric telediabetes service models. Diabetes Technol Ther. 2020.
42. Marcolino MS, Maia JX, Alkmim MB, Boersma E, Ribeiro AL. Telemedicine application in the care of diabetes patients: systematic review and meta-analysis. PLoS One. 2013;8(11):e79246.
43. Shi L, Wu H, Dong J, Jiang K, Lu X, Shi J. Telemedicine for detecting diabetic retinopathy: a systematic review and meta-analysis. Br J Ophthalmol. 2015;99(6):823-31.
44. Yun JE, Park J-E, Park H-Y, Lee H-Y, Park D-A. Comparative Effectiveness of Telemonitoring Versus Usual Care for Heart Failure: A Systematic Review and Meta-analysis. J Card Fail. 2018;24(1):19-28.
45. Kotb A, Cameron C, Hsieh S, Wells G. Comparative effectiveness of different forms of telemedicine for individuals with heart failure (HF): a systematic review and network meta-analysis. PLoS One. 2015;10(2):e0118681.
46. Guise V, Wiig SJBhsr. Perceptions of telecare training needs in home healthcare services: a focus group study. BMC Health Serv Res 2017;17(1):1-10.
47. Pekmezaris R, Tortez L, Williams M, Patel V, Makaryus A, Zeltser R, et al. Home telemonitoring in heart failure: a systematic review and meta-analysis. Health Aff (Millwood). 2018;37(12):1983-9.
48. Kitsiou S, Paré G, Jaana M. Effects of home telemonitoring interventions on patients with chronic heart failure: an overview of systematic reviews. J Med Int Res. 2015;17(3):e63.
49. Koblauch H, Reinhardt SM, Lissau W, Jensen PL. The effect of telepsychiatric modalities on reduction of readmissions in psychiatric settings: A systematic review. J Telemed Telecare. 2018;24(1):31-6.
50. Krupinski EA. Teleradiology: current perspectives. Rep Medical Imaging. 2014;7:5.
51. Smith AC. Telepaediatrics. J Telemed Telecare. 2007;13(4):163-6.
52. Weinstein RS, Descour MR, Liang C, Barker G, Scott KM, Richter L, et al. An array microscope for ultrarapid virtual slide processing and telepathology. Design, fabrication, and validation study. Hum Pathol. 2004;35(11):1303-14.
53. Williams S, Henricks WH, Becich MJ, Toscano M, Carter AB. Telepathology for patient care: what am I getting myself into? Adv Ana Pathol. 2010;17(2):130-49.
54. Hersh WR, Helfand M, Wallace J, Kraemer D, Patterson P, Shapiro S, et al. Clinical outcomes resulting from telemedicine interventions: a systematic review. BMC Med Inform Decis Mak. 2001;1(1):5.
55. Amatya B, Galea MP, Kesselring J, Khan F. Effectiveness of telerehabilitation interventions in persons with multiple sclerosis: A systematic review. Mult Scler Relat Disord. 2015;4(4):358-69.
56. Carrasqueiro S, Oliveira M, Encarnação P. Evaluation of telephone triage and advice services: a systematic review on methods, metrics and results. Stud Health Technol Inform. 2011;169:407-11.
57. Chuchu N, Dinnes J, Takwoingi Y, Matin RN, Bayliss SE, Davenport C, et al. Teledermatology for diagnosing skin cancer in adults. Cochrane Database Syst Rev. 2018(12).
58. Farnia T, Jaulent MC, Steichen O. Evaluation Criteria of Noninvasive Telemonitoring for Patients With Heart Failure: Systematic Review. J Med Internet Res. 2018;20(1):e16.
59. Zhao J, Zhai YK, Zhu WJ, Sun DX. Effectiveness of Telemedicine for Controlling Asthma Symptoms: A Systematic Review and Meta-analysis. Telemed e-Health. 2015;21(6):484-92.
60. Suksomboon N, Poolsup N, Nge YL. Impact of phone call intervention on glycemic control in diabetes patients: a systematic review and meta-analysis of randomized, controlled trials. PLoS One. 2014;9(2):e89207.
61. Gruffydd-Jones K, Hollinghurst S, Ward S, Taylor G. Targeted routine asthma care in general practice using telephone triage. Br J Gen Pract. 2005;55(521):918-23.
62. Goldsmith KA, Dyer MT, Buxton MJ, Sharples LD. Mapping of the EQ-5D index from clinical outcome measures and demographic variables in patients with coronary heart disease. Health Qual Life Outcomes. 2010;8(1):54.
63. Fuertes-Guiró F, Girabent-Farrés M. Opportunity cost of the dermatologist's consulting time in the economic evaluation of teledermatology. J Telemed Telecare. 2017;23(7):657-64.
64. Peeters JM, Mistiaen P, Francke AL. Costs and financial benefits of video communication compared to usual care at home: a systematic review. J Telemed Telecare. 2011;17(8):403-11.
65. Mistry H. Systematic review of studies of the cost-effectiveness of telemedicine and telecare. Changes in the economic evidence over twenty years. J Telemed Telecare. 2012;18(1):1-6.
66. Gustke SS, Balch DC, West VL, Rogers LO. Patient satisfaction with telemedicine. Telemed J. 2000;6(1):5-13.
67. Whitten P, Love B. Patient and provider satisfaction with the use of telemedicine: overview and rationale for cautious enthusiasm. J Post-grad Med. 2005;51(4):294.
68. Şenel E, Demir E. A global productivity and bibliometric analysis of telemedicine and teledermatology publication trends during 1980–

[DOI: 10.47176/mjiri.35.184]

2013. Dermatologica Sin. 2015;33(1):16-20.
69. Laouyane A. Telemedicine and developing countries. J Telemed Telecare. 1998;97(2):543-20.
70. Wootton R. The possible use of telemedicine in developing countries. J Telemed Telecare. 1997;3(1):23-6.

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Appendix 1. The list of the selected articles and their data

Author	Year	Country	Specialty	Clinical Outcomes	Cost_ effectiveness Outcomes	Satisfaction Outcomes
Aldossary, et al.(1)	2016	Australia	Telemedicine	Yes, Unclear	Yes, Unclear	Yes, Unclear
Santos Alves, et al.(2)	2019	Brazil	Telegastrointestinal	Yes, Effective	No	No
Amatya, et al.(3)	2014	Australia	Telerehabilitation	Yes, Unclear	No	Yes, Unclear
Appleby, et al.(4)	2019	Australia	Telerehabilitation	Yes, Effective	No	Yes, Effective
Backhaus, et al.(5)	2012	USA	Telepsychiatry	Yes, Effective	No	Yes, Effective
Banbury, et al.(6)	2018	Australia	Home Telecare	Yes, Effective	No	No
Baron, et al.(7)	2012	UK	Tele-diabetes care	Yes, Unclear	No	No
Bashi, et al.(8)	2017	Australia	Telecardiology	Yes, Effective	No	No
Bashshur, et al.(9)	2016	USA	Telemedicine	No	Yes, Effective	No
Batastini, et al.(10)	2016	USA	Telepsychiatry	No	No	No
Batsis, et al.(11)	2019	Germany	Tele-emergency	No	No	No
Berryhill, et al.(12)	2019	USA	Telepsychiatry	Yes, Effective	No	No
Bittner, et al.(13)	2015	USA	Telerehabilitation	Yes, Effective	No	Yes, Effective
Blank, et al.(14)	2012	UK	Telemedicine	No	No	No
Bolton, et al.(15)	2011	UK	Home Telecare	Yes, Effective	Yes, Effective	No
Brearly, et al.(16)	2017	USA	Teleneurology	Yes, Effective	No	No
Brons, et al.(17)	2018	Netherlands	Telecardiology	No	No	No
Bruce, et al.(18)	2018	USA	Teledermatology	No	No	No
Buekers, et al.(19)	2017	Belgium	Telepulmonary	Yes, Effective	No	No
Bush, et al.(20)	2016	Kenya	Telerehabilitation	Yes, Effective	Yes, Unclear	Yes, Effective
Carrasqueiro, et al.(21)	2011	Portugal	Telemedicine	Yes, Unclear	No	Yes, Unclear
Chen,et al.(22)	2015	China	Telerehabilitation	Yes, Effective	No	No
Chen, et al.(23)	2017	China	Tele-ICU	Yes, Effective	Yes, Effective	No
Chi, et al.(24)	2015	USA	Telemedicine	Yes, Effective	Yes, Effective	Yes, Effective
Chipps(25)	2012	South Africa	Telepsychiatry	Yes, Effective	Yes, Effective	Yes, Effective
Chongmelaxme(26)	2018	Malaysia	Telepulmonary	Yes, Effective	No	No
Chow, et al.(27)	2019	Germany	Teledermatology	No	Yes, Effective	Yes, Effective
Chuchu, et al.(28)	2018	Cochrane Library	Teledermatology	Yes, Unclear	no	No
Cottrell,et al.(29)	2017	Australia	Telerehabilitation	Yes, Effective	No	No
Cox, et al.(30)	2017	UK	Tele-oncology	Yes, Effective	No	No
Cruz, et al.(31)	2014	Portugal	Home telecare	No	No	Yes, Effective
Cruz, et al.(32)	2014	Canada	Home telecare	Yes, Effective	Yes, Effective	No
Daniel,et al.(33)	2013	Shelby	Teledentistry	Yes, Effective	Yes, Effective	Yes, Effective
De la Torre-Dı ´ez, et al.(34)	2015	Spain	Telemedicine	No	Yes, Effective	No
De Waure,et al.(35)	2012	Italy	Telecardiology	Yes, Effective	No	No
Dietz, et al.(36)	2019	USA	Telepathology	Yes, Effective	No	No
Downes, et al.(37)	2017	Australia	Telemedicine	No	No	No
Du Toit, et al.(38)	2017	Australia	Tele-emergency	Yes, Effective	No	No
Edirippulige, et al.(39)	2013	Australia	Telemedicine	No	Yes, Effective	Yes, Effective
Ekelanda, et al.(40)	2010	UK	Telemedicine	Yes, Effective	Yes, Effective	Yes, Effective
Endler, et al.(41)	2019	Sweden	Teleobstetrics	Yes, Effective	No	Yes, Effective
Erridge, et al.(42)	2019	UK	Telesurgery	Yes, No difference	Yes, Unclear	No
Estai, et al.(43)	2016	Australia	Teledentistry	Yes, Effective	No	No
Estai, et al.(44)	2017	Australia	Teledentistry	No	Yes, Unclear	No
Farnia, et al.(45)	2018	France	Telecardiology	Yes, Unclear	Yes, Unclear	No
Faruque, et al. (46)	2017	Canada	Tele-diabetes care	Yes, Effective	No	No
Finnane, et al. (47)	2016	Australia	Teledermatology	Yes, Effective	No	Yes, Effective
French, et al.(48)	2013	UK	Teleneurology	No	No	No
Fuertes-Guiro´, et al.(49)	2016	Spain	Teledermatology	No	Yes, Unclear	No
Fusaro, et al.(50)	2019	USA	Tele-ICU	Yes, Effective	No	No
Garg, et al.(51)	2011	USA	Telemedicine	No	No	No
Gentry, et al.(52)	2018	USA	Telemedicine	Yes, No difference	No	Yes, Effective
Gentry, et al.(53)	2018	USA	Telepsychiatry	No	Yes, Unclear	Yes, Effective
Gorst, et al.(54)	2014	UK	Home telecare	No	No	No
Gregersen, et al.(55)	2016	Denmark	Telepulmonary	Yes, Unclear	No	No
Grona, et al.(56)	2017	Canada	Teleneurology	Yes, Effective	Yes, Effective	Yes, Effective
Guise, et al. (57)	2014	Norway	Telemedicine	Yes, Unclear	No	No
Gunter, et al.(58)	2016	Australia	Telemedicine	Yes, Effective	Yes, Effective	Yes, Effective
Hailey, et al.(59)	2011	Canada	Telerehabilitation	Yes, Effective	No	No
Hameed, et al.(60)	2014	Austria	Telecardiology	No	Yes, Effective	No
Hancock,et al.(61)	2019	UK	Tele-palliative care	Yes, Unclear	Yes, Effective	No
Hanlon, et al.(62)	2017	UK	Telemedicine	Yes, Effective	No	No
Harst, et al.(63)	2019	Germany	Telemedicine	No	No	Yes, Effective
Hasselberg, et al.(64)	2014	South Africa	Telemedicine	Yes, Effective	No	Yes, Effective
Helsel, et al.(65)	2018	USA	Telegastrointestinal	Yes, Effective	No	Yes, Effective

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Author	Year	Country	Specialty	Clinical Outcomes	Cost_ effectiveness Outcomes	Satisfaction Outcomes
Hong, et al.(66)	2018	Korea	Telepulmonary	Yes, Effective	No	No
Hu, et al.(67)	2018	China	Tele-diabetes care	Yes, Effective	No	No
Huang, et al.(68)	2018	Taiwan	Telemedicine	Yes, Effective	No	No
Huang, et al.(69)	2015	China	Telerehabilitation	Yes, No difference	Yes, Unclear	No
Hubers, et al.(70)	2011	Netherlands	Tele-emergency	Yes, Effective	No	No
Hwang, et al.(71)	2015	Australia	Telerehabilitation	Yes, No difference	No	No
Meurer,et al.(72)	2015	Australia	Teledentistry	Yes, Unclear	No	No
Irving,et al.(73)	2017	Australia	Teledentistry	Yes, Effective	Yes, Effective	Yes, Effective
Ito, et al.(74)	2017	Japan	Telemedicine	No	No	No
Jayakody, et al.(75)	2016	Australia	Telemedicine	Yes, Unclear	No	No
Jess,et al.(76)	2019	Denmark	Tele-palliative care	Yes, Unclear	Yes, Effective	No
Jhaveri,et al.(77)	2015	Australia	Telemedicine	Yes, Unclear	No	No
Jiang, et al.(78)	2017	Japan	Telepsychiatry	Yes, Effective	No	No
Jiang, et al.(79)	2016	China	Telerehabilitation	Yes, Effective	No	No
Tim Johansson, et al.(80)	2010	Austria	Telerehabilitation	Yes, Effective	No	Yes, Effective
Tomoko, et al.(81)	2014	Japan	Home telecare	Yes, Effective	No	No
Kane-Gill, et al. (82)	2017	US	Telepharmacy	Yes, Effective	Yes, Effective	No
Aikaterini, et al.(83)	2017	UK	Telecardiology	Yes, Effective	No	No
Kepplinger, et al.(84)	2016	Germany	Teleneurology	Yes, Effective	No	No
Fary khan, et al. (85)	2015	Australia	Telerehabilitation	Yes, Unclear	No	Yes, Unclear
Khanal, et al. (86)	2015	Nepal	Telemedicine	No	No	No
Kitsiou, et al. (87)	2013	Canada	Home telecare	No	No	No
Kitsiou, et al.(88)	2015	USA	Home telecare	Yes, Effective	Yes, Unclear	No
Klersy, et al. (89)	2016	Italy	Telecardiology	Yes, Effective	Yes, Effective	No
Koblauch, et al. (90)	2016	Denmark	Telepsychiatry	Yes, Unclear	No	No
Kotb, et al. (91)	2015	Canada	Telecardiology	Yes, Effective	No	No
Kraft, et al. (92)	2017	Germany	Teleneurology	Yes, Unclear	No	No
Kruse, et al. (93)	2016	USA	Telemedicine	Yes, Effective	Yes, Effective	Yes, Effective
Kumar, et al. (94)	2015	USA	Telemedicine	No	Yes, Effective	No
Larson, et al. (95)	2018	USA	Tele-oncology	Yes, Effective	No	No
Laver, et al. (96)	2020	Australia	Telerehabilitation	Yes, No difference	No	Yes, Unclear
Lee, et al. (97)	2018	Malaysia	Tele-diabetes care	No	Yes, Effective	No
Lee, et al. (98)	2018	Canada	Telecardiology	Yes, No difference	No	No
Lee, et al. (99)	2018	UK	Tele-diabetes care	Yes, Effective	No	No
Lee, et al. (100)	2017	Malaysia	Tele-diabetes care	Yes, Effective	No	No
Ling Li, et al. (101)	2018	China	Tele_ICU	No	No	Yes, Effective
Liddy, et al. (102)	2018	Canada	Telemedicine	Yes, Effective	Yes, Effective	Yes, Effective
Lin, et al. (103)	2017	China	Telecardiology	Yes, Effective	No	No
Liptrot , et al.(104)	2017	UK	Tele-oncology	Yes, Effective	No	Yes, Effective
Lo´pez-Villegas, et al.(105)	2015	Norway	Telecardiology	Yes, Effective	Yes, Effective	No
Lu, et al. (106)	2018	USA	Telemedicine	Yes, Effective	No	Yes, Effective
Lundell, et al. (107)	2015	Sweden	Telepulmonary	Yes, Effective	No	No
Li Luo, et al. (108)	2017	China	Telenephrology	Yes, Effective	No	No
Luxton, et al. (109)	2010	USA	Telepsychiatry	No	No	No
Mackintosh, et al. (110)	2016	UK	Telemedicine	Yes, Effective	Yes, Unclear	No
Marcolino, et al. (111)	2013	The Netherlands	Tele-diabetes care	Yes, Effective	No	No
Marcolino, et al. (112)	2019	The Netherlands	Telecardiology	Yes, Effective	No	No
Marin˜o, et al. (113)	2013	Australia	Teledentistry	No	No	No
Marsh-Feiley, et al. (114)	2018	United Kingdom	Teleradiology	Yes, Effective	No	No
Martin, et al. (115)	2017	Australia	Tele-education	No	No	No
chiara, et al. (116)	2018	Italy	Tele-oncology	No	No	Yes, Unclear
McDougall, et al. (117)	2017	USA	Telerheumatology	Yes, Effective	Yes, Unclear	No
McGill, et al. (118)	2017	USA	Teleaudiology	No	No	Yes, Effective
Tzeyu L. Michaud, et al.(119)	2018	USA	Home telecare	No	Yes, Effective	No
Ming, et al. (120)	2016	UK	Tele-diabetes care	Yes, Unclear	No	No
Mistry. (121)	2012	UK	Telemedicine	No	Yes, Unclear	No
Molini-Avejonas, et al.(122)	2015	Brazil	Teleaudiology	No	Yes, Effective	Yes, Effective
Moreira, et al. (123)	2014	Brazil	Telepharmacy	Yes, Unclear	No	No
Mounessa, et al. (124)	2017	USA	Teledermatology	No	No	Yes, Effective
Murphie, et al. (125)	2017	UK	Telepulmonary	Yes, Effective	Yes, Unclear	Yes, Effective
Nadar, et al. (126)	2018	Canada	Telemedicine	Yes, Unclear	No	No
Nair, et al. (127)	2018	Australia	Telepsychiatry	Yes, Unclear	No	No
Narasimha, et al.(128)	2017	USA	Telegeriatrics	No	Yes, Unclear	Yes, Effective
Nordheim, et al. (129)	2014	Norway	Tele-diabetes care	Yes, No difference	No	No
Nordio, et al. (130)	2018	Italy	Telerehabilitation	No	No	No
Debra Parker Oliver , et al.(131)	2012	USA	Telemedicine	Yes, No difference	No	No
Orlando , et al.(132)	2019	Australia	Telemedicine	No	No	Yes, Effective

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Author	Year	Country	Specialty	Clinical Outcomes	Cost_ effectiveness Outcomes	Satisfaction Outcomes
Ownsworth, et al. (133)	2018	Australia	Telerehabilitation	Yes, Effective	No	No
Pandor, et al. (134)	2013	England	Home telecare	Yes, Effective	Yes, Effective	No
Pastora-Bernal, et al.(135)	2017	Spain	Telerehabilitation	Yes, Effective	No	No
Pedone, et al.(136)	2015	Poland	Telepulmonary	Yes, Effective	No	No
Peeters, et al. (137)	2011	Netherland	Home telecare	No	Yes, Unclear	No
Pekmezaris, et al. (138)	2018	USA	Home telecare	Yes, Effective	No	No
Peretz, et al. (139)	2018	Canada	Telegeriatrics	No	Yes, Unclear	No
Piga, et al. (140)	2017	Italy	Telerheumatology	Yes, Effective	No	Yes, Effective
Proctor, et al. (141)	2018	UK	Telepsychiatry	Yes, Effective	No	No
Purcell, et al. (142)	2014	Australia	Telecardiology	Yes, Effective	Yes, Effective	No
Radhakrishnan, et al.(143)	2016	USA	Home telecare	Yes, Effective	Yes, Effective	Yes, Effective
Ramnath, et al.(144)	2014	USA	Tele-ICU care	Yes, Effective	Yes, Effective	Yes, Effective
Raphael, et al. (145)	2016	New Zealand	Telegeriatrics	Yes, Effective	No	Yes, Unclear
Rasekaba, et al. (146)	2015	Australia	Tele-diabetes care	Yes, No difference	No	No
Rawstorn, et al. (147)	2016	New Zealand	Telerehabilitation	Yes, Effective	No	No
Ricci-Cabello, et al.(148)	2019	Canada	Telecardiology	No	No	No
Rietdijk, et al. (149)	2012	Australia	Teleneurology	Yes, Effective	No	Yes, Effective
Rogers, et al. (150)	2017	USA	Tele-emergency	Yes, Effective	Yes, Unclear	No
Rubin, et al. (151)	2013	USA	Teleneurology	No	Yes, Effective	No
Rubin, et al. (152)	2013	USA	Telerehabilitation	No	No	Yes, Effective
Rush, et al. (153)	2018	Canada	Telemedicine	Yes, Effective	No	Yes, Effective
Saleh, et al. (154)	2018	USA	Telemedicine	Yes, Effective	Yes, Effective	No
Salmoiraghi, et al. (155)	2015	UK	Telepsychiatry	Yes, Effective	Yes, Effective	Yes, Effective
Sarfo, et al. (156)	2017	Ghana	Teleneurology	Yes, No difference	No	Yes, Effective
Sarfo , et al.(157)	2018	Ghana	Telerehabilitation	Yes, No difference	No	No
Scott Kruse, et al. (158)	2018	USA	Telemedicine	No	No	No
Shi , et al. (159)	2015	China	Tele-diabetes care	Yes, Effective	No	No
Shukla , et al. (160)	2017	India	Telerehabilitation	Yes, Effective	No	No
Snoswell, et al. (161)	2016	Australia	Teledermatology	No	Yes, Effective	No
So, et al. (162)	2018	Korea	Tele-diabetes care	Yes, Effective	No	No
Speyer, et al. (163)	2018	Australia	Tele-diabetes care	Yes, No difference	Yes, Effective	No
Strnad, et al. (164)	2018	USA	Telepharmacy	Yes, Effective	No	Yes, Effective
Su, et al. (165)	2016	USA	Tele-diabetes care	Yes, No difference	No	No
Suksomboon , et al.(166)	2014	Thailand	Tele-diabetes care	Yes, Effective	No	No
Sutherland, et al. (167)	2018	Australia	Telepsychiatry	Yes, No difference	Yes, Effective	Yes, Effective
Tan, et al. (168)	2017	Australia	teleophthalmology	Yes, Effective	No	No
Tao, et al. (169)	2018	Australia	Teleaudiology	No	No	No
Tchero, et al. (170)	2017	France	Tele-diabetes care	Yes, No difference	No	Yes, Effective
Tchero, et al. (171)	2018	France	Telerehabilitation	Yes, Effective	No	No
Thomas, et al.(172)	2014	Canada	Teleophthalmology	Yes, Effective	Yes, Effective	No
Trettel, et al. (173)	2018	Germany	Teledermatology	No	No	No
van den Berg, et al. (174)	2012	Germany	Telegeriatrics	Yes, Effective	Yes, Effective	No
Van Egmond, et al.(175)	2018	Netherland	Telerehabilitation	Yes, Effective	Yes, Effective	No
Verberk, et al. (176)	2011	England	Telecardiology	Yes, Effective	Yes, Unclear	No
Vyas, et al. (177)	2017	USA	Teledermatology	Yes, Effective	Yes, Effective	Yes, Unclear
Wade, et al. (178)	2010	Australia	Telemedicine	No	Yes, Effective	No
Wallace, et al. (179)	2012	UK	Teleneurology	Yes, Effective		No
Ward, et al. (180)	2015	USA	Tele-emergency	Yes, Effective	Yes, Unclear	Yes, Effective
Warshaw, et al. (181)	2011	USA	Teledermatology	Yes, Unclear	Yes, Effective	No
Wickramasinghe, et al. (182)	2016	Australia.	Tele-diabetes care	No	No	No
Wilcox, et al. (183)	2012	Canada	Telemedicine	Yes, Effective	No	No
Winburn , et al.(184)	2018	USA	Tele emergency	No	No	No
Wootton, et al. (185)	2011	Norway	Teledermatology	No	No	No
Young, et al. (186)	2011	USA	Tele-ICU	No	No	Yes, Effective
Young , et al.(187)	2011	USA	Tele-ICU	Yes, Unclear	No	No
Yun, et al. (188)	2018	Korea	Telecardiology	Yes, Effective	No	Yes, Unclear
Zhai, et al.(189)	2014	China	Tele-diabetes care	No	Yes, Unclear	No
Zhao, et al.(190)	2015	China	Telepulmonary	Yes, Ineffective	No	No
Zheng, et al. (191)	2016	USA	Tele-palliative care	Yes, Effective	No	Yes, Effective

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1. AlDossary S, Martin-Khan MG, Bradford NK, Smith AC. A systematic review of the methodologies used to evaluate telemedicine service initiatives in hospital facilities. International journal of medical informatics. 2017;97:171-94.
2. Alves DS, Times VC, da Silva É MA, Melo PSA, Novaes MA. Advances in obstetric telemonitoring: a systematic review. International journal of medical informatics. 2020;134:104004.
3. Amatya B, Galea MP, Kesselring J, Khan F. Effectiveness of telerehabilitation interventions in persons with multiple sclerosis: A systematic review. Multiple sclerosis and related disorders. 2015;4(4):358-69.
4. Appleby E, Gill ST, Hayes LK, Walker TL, Walsh M, Kumar S. Effectiveness of telerehabilitation in the management of adults with stroke: A systematic review. PloS one. 2019;14(11):e0225150.
5. Backhaus A, Agha Z, Maglione ML, Repp A, Ross B, Zuest D, et al. Videoconferencing psychotherapy: a systematic review. Psychological services. 2012;9(2):111-31.
6. Banbury A, Nancarrow S, Dart J, Gray L, Parkinson L. Telehealth Interventions Delivering Home-based Support Group Videoconferencing: Systematic Review. Journal of medical Internet research. 2018;20(2):e25.
7. Baron J, McBain H, Newman S. The impact of mobile monitoring technologies on glycosylated hemoglobin in diabetes: a systematic review. Journal of diabetes science and technology. 2012;6(5):1185-96.
8. Bashi N, Karunanithi M, Fatehi F, Ding H, Walters D. Remote Monitoring of Patients With Heart Failure: An Overview of Systematic Reviews. Journal of medical Internet research. 2017;19(1):e18.
9. Bashshur RL, Howell JD, Krupinski EA, Harms KM, Bashshur N, Doarn CR. The Empirical Foundations of Telemedicine Interventions in Primary Care. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2016;22(5):342-75.
10. Batastini AB, King CM, Morgan RD, McDaniel B. Telepsychological services with criminal justice and substance abuse clients: A systematic review and meta-analysis. Psychological services. 2016;13(1):20-30.
11. Batsis JA, DiMilia PR, Seo LM, Fortuna KL, Kennedy MA, Blunt HB, et al. Effectiveness of Ambulatory Telemedicine Care in Older Adults: A Systematic Review. Journal of the American Geriatrics Society. 2019;67(8):1737-49.
12. Berryhill MB, Halli-Tierney A, Culmer N, Williams N, Betancourt A, King M, et al. Videoconferencing psychological therapy and anxiety: a systematic review. Family practice. 2019;36(1):53-63.
13. Bittner AK, Wykstra SL, Yoshinaga PD, Li T. Telerehabilitation for people with low vision. The Cochrane database of systematic reviews. 2015;8:Cd011019.
14. Blank L, Coster J, O'Cathain A, Knowles E, Tosh J, Turner J, et al. The appropriateness of, and compliance with, telephone triage decisions: a systematic review and narrative synthesis. Journal of advanced nursing. 2012;68(12):2610-21.
15. Bolton CE, Waters CS, Peirce S, Elwyn G. Insufficient evidence of benefit: a systematic review of home telemonitoring for COPD. Journal of evaluation in clinical practice. 2011;17(6):1216-22.
16. Brearly TW, Shura RD, Martindale SL, Lazowski RA, Luxton DD, Shenal BV, et al. Neuropsychological Test Administration by Videoconference: A Systematic Review and Meta-Analysis. Neuropsychology review. 2017;27(2):174-86.
17. Brons M, Koudstaal S, Asselbergs FW. Algorithms used in telemonitoring programmes for patients with chronic heart failure: A systematic review. European journal of cardiovascular nursing : journal of the Working Group on Cardiovascular Nursing of the European Society of Cardiology. 2018;17(7):580-8.
18. Bruce AF, Mallow JA, Theeke LA. The use of teledermoscopy in the accurate identification of cancerous skin lesions in the adult population: A systematic review. Journal of telemedicine and telecare. 2018;24(2):75-83.
19. Buekers J, De Boever P, Vaes AW, Aerts JM, Wouters EFM, Spruit MA, et al. Oxygen saturation measurements in telemonitoring of patients with COPD: a systematic review. Expert review of respiratory medicine. 2018;12(2):113-23.
20. Bush ML, Thompson R, Irungu C, Ayugi J. The Role of Telemedicine in Auditory Rehabilitation: A Systematic Review. Otology & neurotology : official publication of the American Otological Society, American Neurotology Societyand) European Academy of Otology and Neurotology. 2016;37(10):1466-74.
21. Carrasqueiro S, Oliveira M, Encarnação P. Evaluation of telephone triage and advice services: a systematic review on methods, metrics and results. Studies in health technology and informatics. 2011;169:407-11.
22. Chen J, Jin W, Zhang XX, Xu W, Liu XN, Ren CC. Telerehabilitation Approaches for Stroke Patients: Systematic Review and Meta-analysis of Randomized Controlled Trials. Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association. 2015;24(12):2660-8.
23. Chen J, Sun D, Yang W, Liu M, Zhang S, Peng J, et al. Clinical and Economic Outcomes of Telemedicine Programs in the Intensive Care Unit: A Systematic Review and Meta-Analysis. Journal of intensive care medicine. 2018;33(7):383-93.
24. Chi NC, Demiris G. A systematic review of telehealth tools and interventions to support family caregivers. Journal of telemedicine and telecare. 2015;21(1):37-44.
25. Chipps J, Brysiewicz P, Mars M. Effectiveness and feasibility of telepsychiatry in resource constrained environments? A systematic review of the evidence. African journal of psychiatry. 2012;15(4):235-43.
26. Chongmelaxme B, Lee S, Dhippayom T, Saokaew S, Chaiyakunapruk N, Dilokthornsakul P. The Effects of Telemedicine on Asthma Control and Patients' Quality of Life in Adults: A Systematic Review and Meta-analysis. The journal of allergy and clinical immunology In practice. 2019;7(1):199-216.e11.
27. Chow A, Soon C, Smith HE, Apfelbacher CJ. Outcome Measurements Used in Randomized Controlled Trials of Teledermatology: A Systematic Mapping Review. Acta dermato-venereologica. 2019;99(13):1210-7.
28. Chuchu N, Dinnes J, Takwoingi Y, Matin RN, Bayliss SE, Davenport C, et al. Teledermatology for diagnosing skin cancer in adults. The Cochrane database of systematic reviews. 2018;12(12):Cd013193.
29. Cottrell MA, Galea OA, O'Leary SP, Hill AJ, Russell TG. Real-time telerehabilitation for the treatment of musculoskeletal conditions is effective and comparable to standard practice: a systematic review and meta-analysis. Clinical rehabilitation. 2017;31(5):625-38.
30. Cox A, Lucas G, Marcu A, Piano M, Grosvenor W, Mold F, et al. Cancer Survivors' Experience With Telehealth: A Systematic Review and Thematic Synthesis. Journal of medical Internet research. 2017;19(1):e11.
31. Cruz J, Brooks D, Marques A. Home telemonitoring in COPD: a systematic review of methodologies and patients' adherence. International journal of medical informatics. 2014;83(4):249-63.
32. Cruz J, Brooks D, Marques A. Home telemonitoring effectiveness in COPD: a systematic review. International journal of clinical practice. 2014;68(3):369-78.
33. Daniel SJ, Wu L, Kumar S. Teledentistry: a systematic review of clinical outcomes, utilization and costs. Journal of dental hygiene : JDH. 2013;87(6):345-52.
34. de la Torre-Díez I, López-Coronado M, Vaca C, Aguado JS, de Castro C. Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: a systematic review. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2015;21(2):81-5.
35. de Waure C, Cadeddu C, Gualano MR, Ricciardi W. Telemedicine for the reduction of myocardial infarction mortality: a systematic review and a meta-analysis of published studies. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2012;18(5):323-8.
36. Dietz RL, Hartman DJ, Pantanowitz L. Systematic Review of the Use of Telepathology During Intraoperative Consultation. American journal of clinical pathology. 2020;153(2):198-209.
37. Downes MJ, Mervin MC, Byrnes JM, Scuffham PA. Telephone consultations for general practice: a systematic review. Systematic reviews. 2017;6(1):128.
38. du Toit M, Malau-Aduli B, Vangaveti V, Sabesan S, Ray RA. Use of telehealth in the management of non-critical emergencies in rural or remote emergency departments: A systematic review. Journal of telemedicine and telecare. 2019;25(1):3-16.
39. Edirippulige S, Martin-Khan M, Beattie E, Smith AC, Gray LC. A systematic review of telemedicine services for residents in long term

[DOI: 10.47176/mjiri.35.184]

care facilities. Journal of telemedicine and telecare. 2013;19(3):127-32.
40. Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: a systematic review of reviews. International journal of medical informatics. 2010;79(11):736-71.
41. Endler M, Lavelanet A, Cleeve A, Ganatra B, Gomperts R, Gemzell-Danielsson K. Telemedicine for medical abortion: a systematic review. BJOG: An International Journal of Obstetrics & Gynaecology. 2019;126(9):1094-102.
42. Erridge S, Yeung DK, Patel HR, Purkayastha S. Telementoring of surgeons: a systematic review. Surgical innovation. 2019;26(1):95-111.
43. Estai M, Bunt S, Kanagasingam Y, Kruger E, Tennant M. Diagnostic accuracy of teledentistry in the detection of dental caries: a systematic review. Journal of Evidence Based Dental Practice. 2016;16(3):161-72.
44. Estai M, Kanagasingam Y, Tennant M, Bunt S. A systematic review of the research evidence for the benefits of teledentistry. Journal of telemedicine and telecare. 2018;24(3):147-56.
45. Farnia T, Jaulent M-C, Steichen O. Evaluation criteria of noninvasive telemonitoring for patients with heart failure: systematic review. Journal of medical Internet research. 2018;20(1):e16.
46. Faruque LI, Wiebe N, Ehteshami-Afshar A, Liu Y, Dianati-Maleki N, Hemmelgarn BR, et al. Effect of telemedicine on glycated hemoglobin in diabetes: a systematic review and meta-analysis of randomized trials. Cmaj. 2017;189(9):E341-E64.
47. Finnane A, Dallest K, Janda M, Soyer HP. Teledermatology for the diagnosis and management of skin cancer: a systematic review. JAMA dermatology. 2017;153(3):319-27.
48. French B, Day E, Watkins C, McLoughlin A, Fitzgerald J, Leathley M, et al. The challenges of implementing a telestroke network: a systematic review and case study. BMC medical informatics and decision making. 2013;13(1):125.
49. Fuertes-Guiro F, Girabent-Farrés M. Opportunity cost of the dermatologist's consulting time in the economic evaluation of teledermatology. Journal of telemedicine and telecare. 2017;23(7):657-64.
50. Fusaro MV, Becker C, Scurlock C. Evaluating Tele-ICU Implementation Based on Observed and Predicted ICU Mortality: A Systematic Review and Meta-Analysis. Critical care medicine. 2019;47(4):501-7.
51. Garg V, Brewer J. Telemedicine security: a systematic review. Journal of diabetes science and technology. 2011;5(3):768-77.
52. Gentry MT, Lapid MI, Clark MM, Rummans TA. Evidence for telehealth group-based treatment: A systematic review. Journal of telemedicine and telecare. 2019;25(6):327-42.
53. Gentry MT, Lapid MI, Rummans TA. Geriatric telepsychiatry: systematic review and policy considerations. The American Journal of Geriatric Psychiatry. 2019;27(2):109-27.
54. Gorst SL, Armitage CJ, Brownsell S, Hawley MS. Home telehealth uptake and continued use among heart failure and chronic obstructive pulmonary disease patients: a systematic review. Annals of behavioral medicine : a publication of the Society of Behavioral Medicine. 2014;48(3):323-36.
55. Gregersen TL, Green A, Frausing E, Ringbaek T, Brøndum E, Ulrik CS. Do telemedical interventions improve quality of life in patients with COPD? A systematic review. International Journal of Chronic Obstructive Pulmonary Disease. 2016;11:809.
56. Grona SL, Bath B, Busch A, Rotter T, Trask C, Harrison E. Use of videoconferencing for physical therapy in people with musculoskeletal conditions: a systematic review. Journal of telemedicine and telecare. 2018;24(5):341-55.
57. Guise V, Anderson J, Wiig S. Patient safety risks associated with telecare: a systematic review and narrative synthesis of the literature. BMC health services research. 2014;14(1):588.
58. Gunter RL, Chouinard S, Fernandes-Taylor S, Wiseman JT, Clarkson S, Bennett K, et al. Current use of telemedicine for post-discharge surgical care: a systematic review. Journal of the American College of Surgeons. 2016;222(5):915-27.
59. Hailey D, Roine R, Ohinmaa A, Dennett L. Evidence of benefit from telerehabilitation in routine care: a systematic review. Journal of telemedicine and telecare. 2011;17(6):281-7.
60. Hameed AS, Sauermann S, Schreier G. The impact of adherence on costs and effectiveness of telemedical patient management in heart failure: a systematic review. Applied clinical informatics. 2014;5(3):612.
61. Hancock S, Preston N, Jones H, Gadoud A. Telehealth in palliative care is being described but not evaluated: a systematic review. BMC palliative care. 2019;18(1):114.
62. Hanlon P, Daines L, Campbell C, McKinstry B, Weller D, Pinnock H. Telehealth interventions to support self-management of long-term conditions: a systematic metareview of diabetes, heart failure, asthma, chronic obstructive pulmonary disease, and cancer. Journal of medical Internet research. 2017;19(5):e172.
63. Harst L, Lantzsch H, Scheibe M. Theories predicting end-user acceptance of telemedicine use: systematic review. Journal of medical Internet research. 2019;21(5):e13117.
64. Hasselberg M, Beer N, Blom L, Wallis LA, 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. 2014;9(6):e98539.
65. Helsel BC, Williams JE, Lawson K, Liang J, Markowitz J. Telemedicine and Mobile Health Technology Are Effective in the Management of Digestive Diseases: A Systematic Review. Digestive diseases and sciences. 2018;63(6):1392-408.
66. Hong Y, Lee SH. Effectiveness of tele-monitoring by patient severity and intervention type in chronic obstructive pulmonary disease patients: A systematic review and meta-analysis. International Journal of Nursing Studies. 2019;92:1-15.
67. Hu Y, Wen X, Wang F, Yang D, Liu S, Li P, et al. Effect of telemedicine intervention on hypoglycaemia in diabetes patients: a systematic review and meta-analysis of randomised controlled trials. Journal of telemedicine and telecare. 2019;25(7):402-13.
68. Huang J-W, Lin Y-Y, Wu N-Y. The effectiveness of telemedicine on body mass index: A systematic review and meta-analysis. Journal of telemedicine and telecare. 2019;25(7):389-401.
69. Huang K, Liu W, He D, Huang B, Xiao D, Peng Y, et al. Telehealth interventions versus center-based cardiac rehabilitation of coronary artery disease: a systematic review and meta-analysis. European journal of preventive cardiology. 2015;22(8):959-71.
70. Huibers L, Smits M, Renaud V, Giesen P, Wensing M. Safety of telephone triage in out-of-hours care: a systematic review. Scandinavian journal of primary health care. 2011;29(4):198-209.
71. Hwang R, Bruning J, Morris N, Mandrusiak A, Russell T. A systematic review of the effects of telerehabilitation in patients with cardiopulmonary diseases. Journal of cardiopulmonary rehabilitation and prevention. 2015;35(6):380-9.
72. Inês Meurer M, Caffery LJ, Bradford NK, Smith AC. Accuracy of dental images for the diagnosis of dental caries and enamel defects in children and adolescents: a systematic review. Journal of telemedicine and telecare. 2015;21(8):449-58.
73. Irving M, Stewart R, Spallek H, Blinkhorn A. Using teledentistry in clinical practice as an enabler to improve access to clinical care: A qualitative systematic review. Journal of telemedicine and telecare. 2018;24(3):129-46.
74. Ito J, Edirippulige S, Aono T, Armfield NR. The use of telemedicine for delivering healthcare in Japan: Systematic review of literature published in Japanese and English languages. Journal of telemedicine and telecare. 2017;23(10):828-34.
75. Jayakody A, Bryant J, Carey M, Hobden B, Dodd N, Sanson-Fisher R. Effectiveness of interventions utilising telephone follow up in reducing hospital readmission within 30 days for individuals with chronic disease: a systematic review. BMC health services research. 2016;16(1):403.
76. Jess M, Timm H, Dieperink KB. Video consultations in palliative care: A systematic integrative review. Palliative medicine. 2019;33(8):942-58.
77. Jhaveri D, Larkins S, Sabesan S. Telestroke, tele-oncology and teledialysis: a systematic review to analyse the outcomes of active therapies delivered with telemedicine support. Journal of telemedicine and telecare. 2015;21(4):181-8.
78. Jiang S, Wu L, Gao X. Beyond face-to-face individual counseling: A systematic review on alternative modes of motivational interviewing in substance abuse treatment and prevention. Addictive behaviors. 2017;73:216-35.
79. Jiang S, Xiang J, Gao X, Guo K, Liu B. The comparison of telerehabilitation and face-to-face rehabilitation after total knee arthroplasty: A systematic review and meta-analysis. Journal of telemedicine and telecare. 2018;24(4):257-62.

[DOI: 10.47176/mjiri.35.184]

80. Johansson T, Wild C. Telerehabilitation in stroke care--a systematic review. Journal of telemedicine and telecare. 2011;17(1):1-6.
81. Kamei T, Yamamoto Y, Kajii F, Nakayama Y, Kawakami C. Systematic review and meta-analysis of studies involving telehome monitoring-based telenursing for patients with chronic obstructive pulmonary disease. Japan journal of nursing science : JJNS. 2013;10(2):180-92.
82. Kane-Gill SL, Niznik JD, Kellum JA, Culley CM, Boyce RD, Marcum ZA, et al. Use of Telemedicine to Enhance Pharmacist Services in the Nursing Facility. The Consultant pharmacist : the journal of the American Society of Consultant Pharmacists. 2017;32(2):93-8.
83. Kassavou A, Sutton S. Automated telecommunication interventions to promote adherence to cardio-metabolic medications: meta-analysis of effectiveness and meta-regression of behaviour change techniques. Health psychology review. 2018;12(1):25-42.
84. Kepplinger J, Barlinn K, Deckert S, Scheibe M, Bodechtel U, Schmitt J. Safety and efficacy of thrombolysis in telestroke: A systematic review and meta-analysis. Neurology. 2016;87(13):1344-51.
85. Khan F, Amatya B, Kesselring J, Galea M. Telerehabilitation for persons with multiple sclerosis. The Cochrane database of systematic reviews. 2015;2015(4):Cd010508.
86. Khanal S, Burgon J, Leonard S, Griffiths M, Eddowes LA. Recommendations for the Improved Effectiveness and Reporting of Telemedicine Programs in Developing Countries: Results of a Systematic Literature Review. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2015;21(11):903-15.
87. Kitsiou S, Paré G, Jaana M. Systematic reviews and meta-analyses of home telemonitoring interventions for patients with chronic diseases: a critical assessment of their methodological quality. Journal of medical Internet research. 2013;15(7):e150.
88. Kitsiou S, Paré G, Jaana M. Effects of home telemonitoring interventions on patients with chronic heart failure: an overview of systematic reviews. Journal of medical Internet research. 2015;17(3):e63.
89. Klersy C, Boriani G, De Silvestri A, Mairesse GH, Braunschweig F, Scotti V, et al. Effect of telemonitoring of cardiac implantable electronic devices on healthcare utilization: a meta-analysis of randomized controlled trials in patients with heart failure. European journal of heart failure. 2016;18(2):195-204.
90. Koblauch H, Reinhardt SM, Lissau W, Jensen PL. The effect of telepsychiatric modalities on reduction of readmissions in psychiatric settings: A systematic review. Journal of telemedicine and telecare. 2018;24(1):31-6.
91. Kotb A, Cameron C, Hsieh S, Wells G. Comparative effectiveness of different forms of telemedicine for individuals with heart failure (HF): a systematic review and network meta-analysis. PloS one. 2015;10(2):e0118681.
92. Kraft P, Hillmann S, Rücker V, Heuschmann PU. Telemedical strategies for the improvement of secondary prevention in patients with cerebrovascular events-A systematic review and meta-analysis. International journal of stroke : official journal of the International Stroke Society. 2017;12(6):597-605.
93. Kruse CS, Bouffard S, Dougherty M, Parro JS. Telemedicine Use in Rural Native American Communities in the Era of the ACA: a Systematic Literature Review. Journal of medical systems. 2016;40(6):145.
94. Kumar G, Falk DM, Bonello RS, Kahn JM, Perencevich E, Cram P. The costs of critical care telemedicine programs: a systematic review and analysis. Chest. 2013;143(1):19-29.
95. Larson JL, Rosen AB, Wilson FA. The Effect of Telehealth Interventions on Quality of Life of Cancer Patients: A Systematic Review and Meta-Analysis. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2018;24(6):397-405.
96. Laver KE, Adey-Wakeling Z, Crotty M, Lannin NA, George S, Sherrington C. Telerehabilitation services for stroke. The Cochrane database of systematic reviews. 2020;1(1):Cd010255.
97. Lee JY, Lee SWH. Telemedicine Cost-Effectiveness for Diabetes Management: A Systematic Review. Diabetes technology & therapeutics. 2018;20(7):492-500.
98. Lee M, Wang M, Liu J, Holbrook A. Do telehealth interventions improve oral anticoagulation management? A systematic review and meta-analysis. Journal of thrombosis and thrombolysis. 2018;45(3):325-36.
99. Lee PA, Greenfield G, Pappas Y. The impact of telehealth remote patient monitoring on glycemic control in type 2 diabetes: a systematic review and meta-analysis of systematic reviews of randomised controlled trials. BMC Health Serv Res. 2018;18(1):495.
100. Lee SWH, Chan CKY, Chua SS, Chaiyakunapruk N. Comparative effectiveness of telemedicine strategies on type 2 diabetes management: A systematic review and network meta-analysis. Scientific reports. 2017;7(1):12680.
101. Li L, Cotton A. A Systematic Review of Nurses' Perspectives Toward the Telemedicine Intensive Care Unit: A Basis for Supporting Its Future Implementation in China? Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2019;25(5):343-50.
102. Liddy C, Moroz I, Mihan A, Nawar N, Keely E. A Systematic Review of Asynchronous, Provider-to-Provider, Electronic Consultation Services to Improve Access to Specialty Care Available Worldwide. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2019;25(3):184-98.
103. Lin MH, Yuan WL, Huang TC, Zhang HF, Mai JT, Wang JF. Clinical effectiveness of telemedicine for chronic heart failure: a systematic review and meta-analysis. Journal of investigative medicine : the official publication of the American Federation for Clinical Research. 2017;65(5):899-911.
104. Liptrott S, Bee P, Lovell K. Acceptability of telephone support as perceived by patients with cancer: A systematic review. European journal of cancer care. 2018;27(1).
105. López-Villegas A, Catalán-Matamoros D, Martín-Saborido C, Villegas-Tripiana I, Robles-Musso E. A Systematic Review of Economic Evaluations of Pacemaker Telemonitoring Systems. Revista espanola de cardiologia (English ed). 2016;69(2):125-33.
106. Lu K, Marino NE, Russell D, Singareddy A, Zhang D, Hardi A, et al. Use of Short Message Service and Smartphone Applications in the Management of Surgical Patients: A Systematic Review. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2018;24(6):406-14.
107. Lundell S, Holmner Å, Rehn B, Nyberg A, Wadell K. Telehealthcare in COPD: a systematic review and meta-analysis on physical outcomes and dyspnea. Respiratory medicine. 2015;109(1):11-26.
108. Luo L, Ye M, Tan J, Huang Q, Qin X, Peng S, et al. Telehealth for the management of blood pressure in patients with chronic kidney disease: A systematic review. Journal of telemedicine and telecare. 2019;25(2):80-92.
109. Luxton DD, Sirotin AP, Mishkind MC. Safety of telemental healthcare delivered to clinically unsupervised settings: a systematic review. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2010;16(6):705-11.
110. Mackintosh N, Terblanche M, Maharaj R, Xyrichis A, Franklin K, Keddie J, et al. Telemedicine with clinical decision support for critical care: a systematic review. Systematic reviews. 2016;5(1):176.
111. Marcolino MS, Maia JX, Alkmim MB, Boersma E, Ribeiro AL. Telemedicine application in the care of diabetes patients: systematic review and meta-analysis. PloS one. 2013;8(11):e79246.
112. Marcolino MS, Maia LM, Oliveira JAQ, Melo LDR, Pereira BLD, Andrade-Junior DF, et al. Impact of telemedicine interventions on mortality in patients with acute myocardial infarction: a systematic review and meta-analysis. Heart (British Cardiac Society). 2019;105(19):1479-86.
113. Mariño R, Ghanim A. Teledentistry: a systematic review of the literature. Journal of telemedicine and telecare. 2013;19(4):179-83.
114. Marsh-Feiley G, Eadie L, Wilson P. Telesonography in emergency medicine: A systematic review. PloS one. 2018;13(5):e0194840.
115. Martin P, Lizarondo L, Kumar S. A systematic review of the factors that influence the quality and effectiveness of telesupervision for health professionals. Journal of telemedicine and telecare. 2018;24(4):271-81.
116. Marzorati C, Renzi C, Russell-Edu SW, Pravettoni G. Telemedicine Use Among Caregivers of Cancer Patients: Systematic Review. Journal of medical Internet research. 2018;20(6):e223.
117. McDougall JA, Ferucci ED, Glover J, Fraenkel L.

[DOI: 10.47176/mjiri.35.184]

Telerheumatology: A Systematic Review. Arthritis care & research. 2017;69(10):1546-57.
118. McGill M, Noureal N, Siegel J. Telepractice Treatment of Stuttering: A Systematic Review. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2019;25(5):359-68.
119. Michaud TL, Zhou J, McCarthy MA, Siahpush M, Su D. COSTS OF HOME-BASED TELEMEDICINE PROGRAMS: A SYSTEMATIC REVIEW. International journal of technology assessment in health care. 2018;34(4):410-8.
120. Ming WK, Mackillop LH, Farmer AJ, Loerup L, Bartlett K, Levy JC, et al. Telemedicine Technologies for Diabetes in Pregnancy: A Systematic Review and Meta-Analysis. Journal of medical Internet research. 2016;18(11):e290.
121. Mistry H. Systematic review of studies of the cost-effectiveness of telemedicine and telecare. Changes in the economic evidence over twenty years. Journal of telemedicine and telecare. 2012;18(1):1-6.
122. Molini-Avejonas DR, Rondon-Melo S, Amato CA, Samelli AG. A systematic review of the use of telehealth in speech, language and hearing sciences. Journal of telemedicine and telecare. 2015;21(7):367-76.
123. Moreira Tde C, Signor L, Figueiró LR, Fernandes S, Bortolon CB, Benchaya MC, et al. Non-adherence to telemedicine interventions for drug users: systematic review. Revista de saude publica. 2014;48(3):521-31.
124. Mounessa JS, Chapman S, Braunberger T, Qin R, Lipoff JB, Dellavalle RP, et al. A systematic review of satisfaction with teledermatology. Journal of telemedicine and telecare. 2018;24(4):263-70.
125. Murphie P, Little S, McKinstry B, Pinnock H. Remote consulting with telemonitoring of continuous positive airway pressure usage data for the routine review of people with obstructive sleep apnoea hypopnoea syndrome: A systematic review. Journal of telemedicine and telecare. 2019;25(1):17-25.
126. Nadar M, Jouvet P, Tucci M, Toledano B, Sicotte C. Impact of Synchronous Telemedicine Models on Clinical Outcomes in Pediatric Acute Care Settings: A Systematic Review. Pediatric critical care medicine : a journal of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies. 2018;19(12):e662-e71.
127. Nair U, Armfield NR, Chatfield MD, Edirippulige S. The effectiveness of telemedicine interventions to address maternal depression: A systematic review and meta-analysis. Journal of telemedicine and telecare. 2018;24(10):639-50.
128. Narasimha S, Madathil KC, Agnisarman S, Rogers H, Welch B, Ashok A, et al. Designing Telemedicine Systems for Geriatric Patients: A Review of the Usability Studies. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2017;23(6):459-72.
129. Nordheim LV, Haavind MT, Iversen MM. Effect of telemedicine follow-up care of leg and foot ulcers: a systematic review. BMC Health Serv Res. 2014;14:565.
130. Nordio S, Innocenti T, Agostini M, Meneghello F, Battel I. The efficacy of telerehabilitation in dysphagic patients: a systematic review. Acta otorhinolaryngologica Italica : organo ufficiale della Societa italiana di otorinolaringologia e chirurgia cervico-facciale. 2018;38(2):79-85.
131. Oliver DP, Demiris G, Wittenberg-Lyles E, Washington K, Day T, Novak H. A systematic review of the evidence base for telehospice. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2012;18(1):38-47.
132. Orlando JF, Beard M, Kumar S. Systematic review of patient and caregivers' satisfaction with telehealth videoconferencing as a mode of service delivery in managing patients' health. PloS one. 2019;14(8):e0221848.
133. Ownsworth T, Arnautovska U, Beadle E, Shum DHK, Moyle W. Efficacy of Telerehabilitation for Adults With Traumatic Brain Injury: A Systematic Review. The Journal of head trauma rehabilitation. 2018;33(4):E33-e46.
134. Pandor A, Thokala P, Gomersall T, Baalbaki H, Stevens JW, Wang J, et al. Home telemonitoring or structured telephone support programmes after recent discharge in patients with heart failure: systematic review and economic evaluation. Health technology assessment (Winchester, England). 2013;17(32):1-207, v-vi.
135. Pastora-Bernal JM, Martín-Valero R, Barón-López FJ, Estebanez-Pérez MJ. Evidence of Benefit of Telerehabitation After Orthopedic Surgery: A Systematic Review. Journal of medical Internet research. 2017;19(4):e142.
136. Pedone C, Lelli D. Systematic review of telemonitoring in COPD: an update. Pneumonologia i alergologia polska. 2015;83(6):476-84.
137. Peeters JM, Mistiaen P, Francke AL. Costs and financial benefits of video communication compared to usual care at home: a systematic review. Journal of telemedicine and telecare. 2011;17(8):403-11.
138. Pekmezaris R, Tortez L, Williams M, Patel V, Makaryus A, Zeltser R, et al. Home Telemonitoring In Heart Failure: A Systematic Review And Meta-Analysis. Health affairs (Project Hope). 2018;37(12):1983-9.
139. Peretz D, Arnaert A, Ponzoni NN. Determining the cost of implementing and operating a remote patient monitoring programme for the elderly with chronic conditions: A systematic review of economic evaluations. Journal of telemedicine and telecare. 2018;24(1):13-21.
140. Piga M, Cangemi I, Mathieu A, Cauli A. Telemedicine for patients with rheumatic diseases: Systematic review and proposal for research agenda. Seminars in arthritis and rheumatism. 2017;47(1):121-8.
141. Proctor BJ, Moghaddam N, Vogt W, das Nair R. Telephone psychotherapy in multiple sclerosis: A systematic review and meta-analysis. Rehabilitation psychology. 2018;63(1):16-28.
142. Purcell R, McInnes S, Halcomb EJ. Telemonitoring can assist in managing cardiovascular disease in primary care: a systematic review of systematic reviews. BMC family practice. 2014;15:43.
143. Radhakrishnan K, Xie B, Berkley A, Kim M. Barriers and Facilitators for Sustainability of Tele-Homecare Programs: A Systematic Review. Health services research. 2016;51(1):48-75.
144. Ramnath VR, Ho L, Maggio LA, Khazeni N. Centralized monitoring and virtual consultant models of tele-ICU care: a systematic review. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2014;20(10):936-61.
145. Raphael D, Waterworth S, Gott M. Telephone communication between practice nurses and older patients with long term conditions - a systematic review. Journal of telemedicine and telecare. 2017;23(1):142-8.
146. Rasekaba TM, Furler J, Blackberry I, Tacey M, Gray K, Lim K. Telemedicine interventions for gestational diabetes mellitus: A systematic review and meta-analysis. Diabetes research and clinical practice. 2015;110(1):1-9.
147. Rawstorn JC, Gant N, Direito A, Beckmann C, Maddison R. Telehealth exercise-based cardiac rehabilitation: a systematic review and meta-analysis. Heart (British Cardiac Society). 2016;102(15):1183-92.
148. Ricci-Cabello I, Bobrow K, Islam SMS, Chow CK, Maddison R, Whittaker R, et al. Examining Development Processes for Text Messaging Interventions to Prevent Cardiovascular Disease: Systematic Literature Review. JMIR mHealth and uHealth. 2019;7(3):e12191.
149. Rietdijk R, Togher L, Power E. Supporting family members of people with traumatic brain injury using telehealth: a systematic review. Journal of rehabilitation medicine. 2012;44(11):913-21.
150. Rogers H, Madathil KC, Agnisarman S, Narasimha S, Ashok A, Nair A, et al. A Systematic Review of the Implementation Challenges of Telemedicine Systems in Ambulances. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2017;23(9):707-17.
151. Rubin MN, Wellik KE, Channer DD, Demaerschalk BM. A systematic review of telestroke. Postgraduate medicine. 2013;125(1):45-50.
152. Rubin MN, Wellik KE, Channer DD, Demaerschalk BM. Systematic review of telestroke for post-stroke care and rehabilitation. Current atherosclerosis reports. 2013;15(8):343.
153. Rush KL, Howlett L, Munro A, Burton L. Videoconference compared to telephone in healthcare delivery: A systematic review. International journal of medical informatics. 2018;118:44-53.
154. Saleh J. Practice of Teledermatopathology: A Systematic Review. The American Journal of dermatopathology. 2018;40(9):667-70.
155. Salmoiraghi A, Hussain S. A Systematic Review of the Use of Telepsychiatry in Acute Settings. Journal of psychiatric practice. 2015;21(5):389-93.
156. Sarfo FS, Adamu S, Awuah D, Ovbiagele B. Tele-neurology in sub-Saharan Africa: A systematic review of the literature. Journal of the

[DOI: 10.47176/mjiri.35.184]

neurological sciences. 2017;380:196-9.
157. Sarfo FS, Ulasavets U, Opare-Sem OK, Ovbiagele B. Tele-Rehabilitation after Stroke: An Updated Systematic Review of the Literature. Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association. 2018;27(9):2306-18.
158. Scott Kruse C, Karem P, Shifflett K, Vegi L, Ravi K, Brooks M. Evaluating barriers to adopting telemedicine worldwide: A systematic review. Journal of telemedicine and telecare. 2018;24(1):4-12.
159. Shi L, Wu H, Dong J, Jiang K, Lu X, Shi J. Telemedicine for detecting diabetic retinopathy: a systematic review and meta-analysis. The British journal of ophthalmology. 2015;99(6):823-31.
160. Shukla H, Nair SR, Thakker D. Role of telerehabilitation in patients following total knee arthroplasty: Evidence from a systematic literature review and meta-analysis. Journal of telemedicine and telecare. 2017;23(2):339-46.
161. Snoswell C, Finnane A, Janda M, Soyer HP, Whitty JA. Cost-effectiveness of Store-and-Forward Teledermatology: A Systematic Review. JAMA Dermatol. 2016;152(6):702-8.
162. So CF, Chung JW. Telehealth for diabetes self-management in primary healthcare: A systematic review and meta-analysis. Journal of telemedicine and telecare. 2018;24(5):356-64.
163. Speyer R, Denman D, Wilkes-Gillan S, Chen YW, Bogaardt H, Kim JH, et al. Effects of telehealth by allied health professionals and nurses in rural and remote areas: A systematic review and meta-analysis. Journal of rehabilitation medicine. 2018;50(3):225-35.
164. Strnad K, Shoulders BR, Smithburger PL, Kane-Gill SL. A Systematic Review of ICU and Non-ICU Clinical Pharmacy Services Using Telepharmacy. The Annals of pharmacotherapy. 2018;52(12):1250-8.
165. Su D, McBride C, Zhou J, Kelley MS. Does nutritional counseling in telemedicine improve treatment outcomes for diabetes? A systematic review and meta-analysis of results from 92 studies. Journal of telemedicine and telecare. 2016;22(6):333-47.
166. Suksomboon N, Poolsup N, Nge YL. Impact of phone call intervention on glycemic control in diabetes patients: a systematic review and meta-analysis of randomized, controlled trials. PloS one. 2014;9(2):e89207.
167. Sutherland R, Trembath D, Roberts J. Telehealth and autism: A systematic search and review of the literature. International journal of speech-language pathology. 2018;20(3):324-36.
168. Tan IJ, Dobson LP, Bartnik S, Muir J, Turner AW. Real-time teleophthalmology versus face-to-face consultation: A systematic review. Journal of telemedicine and telecare. 2017;23(7):629-38.
169. Tao KFM, Brennan-Jones CG, Capobianco-Fava DM, Jayakody DMP, Friedland PL, Swanepoel W, et al. Teleaudiology Services for Rehabilitation With Hearing Aids in Adults: A Systematic Review. Journal of speech, language, and hearing research : JSLHR. 2018;61(7):1831-49.
170. Tchero H, Noubou L, Becsangele B, Mukisi-Mukaza M, Retali GR, Rusch E. Telemedicine in Diabetic Foot Care: A Systematic Literature Review of Interventions and Meta-analysis of Controlled Trials. The international journal of lower extremity wounds. 2017;16(4):274-83.
171. Tchero H, Tabue Teguo M, Lannuzel A, Rusch E. Telerehabilitation for Stroke Survivors: Systematic Review and Meta-Analysis. Journal of medical Internet research. 2018;20(10):e10867.
172. Thomas SM, Jeyaraman MM, Hodge WG, Hutnik C, Costella J, Malvankar-Mehta MS. The effectiveness of teleglaucoma versus in-patient examination for glaucoma screening: a systematic review and meta-analysis. PloS one. 2014;9(12):e113779.
173. Trettel A, Eissing L, Augustin M. Telemedicine in dermatology: findings and experiences worldwide - a systematic literature review. Journal of the European Academy of Dermatology and Venereology : JEADV. 2018;32(2):215-24.
174. van den Berg N, Schumann M, Kraft K, Hoffmann W. Telemedicine and telecare for older patients--a systematic review. Maturitas. 2012;73(2):94-114.
175. van Egmond MA, van der Schaaf M, Vredeveld T, Vollenbroek-Hutten MMR, van Berge Henegouwen MI, Klinkenbijl JHG, et al. Effectiveness of physiotherapy with telerehabilitation in surgical patients: a systematic review and meta-analysis. Physiotherapy. 2018;104(3):277-98.
176. Verberk WJ, Kessels AG, Thien T. Telecare is a valuable tool for hypertension management, a systematic review and meta-analysis. Blood pressure monitoring. 2011;16(3):149-55.
177. Vyas KS, Hambrick HR, Shakir A, Morrison SD, Tran DC, Pearson K, et al. A Systematic Review of the Use of Telemedicine in Plastic and Reconstructive Surgery and Dermatology. Annals of plastic surgery. 2017;78(6):736-68.
178. Wade VA, Karnon J, Elshaug AG, Hiller JE. A systematic review of economic analyses of telehealth services using real time video communication. BMC Health Serv Res. 2010;10:233.
179. Wallace DL, Hussain A, Khan N, Wilson YT. A systematic review of the evidence for telemedicine in burn care: with a UK perspective. Burns : journal of the International Society for Burn Injuries. 2012;38(4):465-80.
180. Ward MM, Jaana M, Natafgi N. Systematic review of telemedicine applications in emergency rooms. International journal of medical informatics. 2015;84(9):601-16.
181. Warshaw EM, Hillman YJ, Greer NL, Hagel EM, MacDonald R, Rutks IR, et al. Teledermatology for diagnosis and management of skin conditions: a systematic review. Journal of the American Academy of Dermatology. 2011;64(4):759-72.
182. Wickramasinghe SI, Caffery LJ, Bradford NK, Smith AC. Enablers and barriers in providing telediabetes services for Indigenous communities: A systematic review. Journal of telemedicine and telecare. 2016;22(8):465-71.
183. Wilcox ME, Adhikari NK. The effect of telemedicine in critically ill patients: systematic review and meta-analysis. Critical care (London, England). 2012;16(4):R127.
184. Winburn AS, Brixey JJ, Langabeer J, 2nd, Champagne-Langabeer T. A systematic review of prehospital telehealth utilization. Journal of telemedicine and telecare. 2018;24(7):473-81.
185. Wootton R, Bahaadinbeigy K, Hailey D. Estimating travel reduction associated with the use of telemedicine by patients and healthcare professionals: proposal for quantitative synthesis in a systematic review. BMC Health Serv Res. 2011;11:185.
186. Young LB, Chan PS, Cram P. Staff acceptance of tele-ICU coverage: a systematic review. Chest. 2011;139(2):279-88.
187. Young LB, Chan PS, Lu X, Nallamothu BK, Sasson C, Cram PM. Impact of telemedicine intensive care unit coverage on patient outcomes: a systematic review and meta-analysis. Archives of internal medicine. 2011;171(6):498-506.
188. Yun JE, Park JE, Park HY, Lee HY, Park DA. Comparative Effectiveness of Telemonitoring Versus Usual Care for Heart Failure: A Systematic Review and Meta-analysis. Journal of cardiac failure. 2018;24(1):19-28.
189. Zhai YK, Zhu WJ, Cai YL, Sun DX, Zhao J. Clinical- and cost-effectiveness of telemedicine in type 2 diabetes mellitus: a systematic review and meta-analysis. Medicine. 2014;93(28):e312.
190. Zhao J, Zhai YK, Zhu WJ, Sun DX. Effectiveness of Telemedicine for Controlling Asthma Symptoms: A Systematic Review and Meta-analysis. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2015;21(6):484-92.
191. Zheng Y, Head BA, Schapmire TJ. A Systematic Review of Telehealth in Palliative Care: Caregiver Outcomes. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2016;22(4):288-94.

[DOI: 10.47176/mjiri.35.184]