

# Rapid Synthesis

Examining the Effects of Using  
Telecommunications Technology to Provide  
Clinical Care at a Distance

29 March 2017



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**Rapid Synthesis:**  
**Identifying the Effects of Using Telecommunications Technology to**  
**Provide Clinical Care at a Distance**  
**10-day response**

29 March 2017

#### McMaster Health Forum

For concerned citizens and influential thinkers and doers, the McMaster Health Forum strives to be a leading hub for improving health outcomes through collective problem solving. Operating at regional/provincial levels and at national levels, the Forum harnesses information, convenes stakeholders, and prepares action-oriented leaders to meet pressing health issues creatively. The Forum acts as an agent of change by empowering stakeholders to set agendas, take well-considered actions, and communicate the rationale for actions effectively.

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#### Timeline

Rapid syntheses can be requested in a three-, 10- or 30-business-day timeframe. This synthesis was prepared over a 10-business-day timeframe. An overview of what can be provided and what cannot be provided in each of the different timelines is provided on McMaster Health Forum's Rapid Response program webpage ([www.mcmasterhealthforum.org/policymakers/rapid-response-program](http://www.mcmasterhealthforum.org/policymakers/rapid-response-program)).

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#### Conflict of interest

The authors declare that they have no professional or commercial interests relevant to the rapid synthesis. The funder played no role in the identification, selection, assessment, synthesis or presentation of the research evidence profiled in the rapid synthesis.

#### Merit review

The rapid synthesis was reviewed by a small number of policymakers, stakeholders and researchers in order to ensure its scientific rigour and system relevance.

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## KEY MESSAGES

### Question

- What are the effects of using telecommunications technology to provide clinical care at a distance on health outcomes, patient and provider satisfaction, and costs?

### Why the issue is important

- A number of current pressures on the health system (e.g., an aging population, increased prevalence of chronic and co-morbid conditions) and increased focus on supporting patient self-management and patient-centred care, are driving interest in delivering care in new ways.
- Health-system decision-makers have started to look at leveraging technology to support solutions to many of these pressures.
- Telehealth and virtual technologies, including telephone, text, video and apps for information exchange, are used across Canada, with the total number of clinical telehealth video conferencing sessions having increased from 282,529 in 2012 to 411,778 in 2014.
- While telehealth technologies are used every day in delivering care, there remains many more opportunities for these technologies to be used in the diagnosis, treatment and management of both chronic and acute conditions.
- Therefore, it is important to take stock of what is known about these technologies, and their capacity to impact patient satisfaction, health outcomes and the cost of care.

### What we found

- From our searches, we identified 52 systematic reviews and two economic evaluations as being relevant to the question.
- Telehealth interventions were generally found to be equally effective on clinical and health-related outcomes as comparative face-to-face treatments across a wide range of patient populations, interventions, comparators and settings.
- However, while findings from many meta-analyses appeared positive, they were often based on a limited number of studies, and this is particularly important for findings related to heart failure where recent large randomized controlled trials report significantly different findings for rates of readmission and mortality than systematic reviews (which have not yet included these trials).
- Patients report high levels of satisfaction with telehealth services, one of its most important strengths, however when they did report dissatisfaction it was primarily related to glitches that occurred with the use of technology, increased severity of symptoms related to the patient's health conditions (e.g., increased frequency of exacerbations in chronic obstructive pulmonary disease), difficulty of using the technology, or concerns regarding the privacy of data.
- The majority of studies included did not or were unable to provide findings on the cost of care, but those that did reported cost-savings most frequently being attributable to a reduction in the use of resources, including emergency department visits and hospitalizations, reduction in travel costs, and increased efficiency by reducing time between consultations.

## **QUESTION**

What are the effects of using telecommunications technology to provide clinical care at a distance on health outcomes, patient and provider satisfaction, and cost?

## **WHY THE ISSUE IS IMPORTANT**

A number of current pressures on the health system, including an aging population, increased prevalence of chronic and co-morbid conditions, and increasing focus on patient self-management and patient-centred care, are driving interest in delivering care in new ways.

With technology playing an increasingly important role in all aspects of our lives, it is no surprise that health-system decision-makers are looking to leverage technology to contend with these and many other challenges.

Telehealth technologies are used across Canada, with the total number of clinical telehealth videoconferencing sessions having increased from 282,529 in 2012 to 411,778 in 2014, representing a 120% aggregate increase over the two years.<sup>(1)</sup> Telehealth services can be used to help providers collaborate, to extend the geographic reach of services, to improve accessibility and convenience for patients, and to increase provider efficiencies. While telehealth technologies are used every day across the country, there remains many more opportunities for these technologies to be used in the diagnosis, treatment and management of conditions.

Prior to expanding their use in the health system, it is important to take stock of what is known about these technologies today, and their capacity to have an impact on patient satisfaction, health outcomes and the cost of care.

## **WHAT WE FOUND**

From our searches we identified a total of 54 documents as being relevant to the question, including 52 high- or medium-quality systematic reviews (assessed using AMSTAR) and two Canadian economic and costing studies. We provide more detail on each systematic review and the single studies in Appendix 1 and 2, respectively.

Our aim was to be as comprehensive as possible in reviewing the available research evidence from systematic reviews and economic evaluations/costing studies identified from our search strategy (see Box 2 for a description of the searches conducted). However, given the timeframe for conducting the synthesis (10 business days) and the large volume of literature that has been published on telehealth and virtual care, we had to exclude a number of systematic reviews and single studies. Given this, we prioritized the inclusion of

### **Box 1: Background to the rapid synthesis**

This rapid synthesis mobilizes both global and local research evidence about a question submitted to the McMaster Health Forum's Rapid Response program. Whenever possible, the rapid synthesis summarizes research evidence drawn from systematic reviews of the research literature and occasionally from single research studies. A systematic review is a summary of studies addressing a clearly formulated question that uses systematic and explicit methods to identify, select and appraise research studies, and to synthesize data from the included studies. The rapid synthesis does not contain recommendations, which would have required the authors to make judgments based on their personal values and preferences.

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This rapid synthesis was prepared over a 10-business-day timeframe and involved five steps:

- 1) submission of a question from a health system policymaker or stakeholder (in this case, the British Columbia Ministry of Health);
- 2) identifying, selecting, appraising and synthesizing relevant research evidence about the question;
- 3) drafting the rapid synthesis in such a way as to present concisely and in accessible language the research evidence; and
- 4) finalizing the rapid synthesis based on the input of at least two merit reviewers.

systematic reviews of high and medium methodological quality that address the use of telehealth, telephone, virtual or web-based technology in clinical encounters between a health professional and a client. Therefore, literature on the use of telehealth or telemedicine in public health, self-management and in sectors that are not typically publicly financed (e.g., dental and optometry services) have been excluded. In addition, we only included economic and costing studies that focused on clinical encounters and that were conducted in Canada.

We identified a variety of telehealth technologies from our searches, including telephone, video-conferencing, telemonitoring systems, mobile phones and tablets, web-based interventions and complex interventions that employed multiple forms of technology. The included reviews also focused on the effects of telehealth technology and virtual care for a variety of conditions, with the most common being mental health and/or substance use (n=8), heart failure (n=7), diabetes (n=6) and chronic obstructive pulmonary disease (n=6).

We have summarized the findings from the included reviews and studies in Table 1 according to their relevance to the triple aim of improving health outcomes, patient or provider experience, as well as reducing the per capita cost of healthcare.

Telehealth interventions were generally found to be equally effective on clinical and health-related outcomes as comparative face-to-face treatments across a wide range of patient populations, interventions, comparators and settings. However, a number of the included reviews reported that while findings from meta-analyses appeared positive, they were often based on a limited number of studies.(2-11) This is particularly important for findings related to heart failure, for which a number of large randomized controlled trials have recently been undertaken and report significantly different findings for rates of readmission and mortality than systematic reviews, which for the most part have not taken these new studies in account. To represent this new evidence, we have chosen to also include two of these studies in this synthesis.(12)

Patients frequently reported high levels of satisfaction with telehealth services, notably among patients with long-term conditions who reported feeling more secure when their condition was being actively monitored by a health professional. Younger patients, particularly in the delivery of mental healthcare, favoured the use of videoconferencing with professionals over usual models of care. Additionally, patients remarked on the convenience in reducing travel time to appointments. One review identified that instances of patient dissatisfaction with telehealth services were primarily related to glitches that occurred with the use of technology, having to stop the use of telehealth services due to increased severity of symptoms (e.g., increased frequency of exacerbations in chronic obstructive pulmonary disease), difficulty of using the technology or concerns regarding the privacy of data.(13) One study reported that the extent of integration between the telehealth intervention and a professional's practice is a large determinant of effectiveness of disease management.(12; 14)

**Box 2: Identification, selection and synthesis of research evidence**

We identified research evidence for this synthesis by searching for systematic reviews of effects, systematic reviews addressing other types of questions, and costing or evaluation studies in Health Systems Evidence ([www.healthsystemsevidence.org](http://www.healthsystemsevidence.org)). Using the search filter for reviews relevant to information, communication technology that supports individuals who provide care, we used the following combination of search terms to identify relevant reviews: (tele\* OR virtual OR internet-based OR web-based OR mobile OR video) AND care.

The results from the searches were assessed by one reviewer for inclusion. A document was included if it fit within the scope of the question posed for the rapid synthesis.

For each review we included in the synthesis, we documented the focus of the review, key findings, last year the literature was searched (as an indicator of how recently it was conducted), methodological quality using the AMSTAR quality appraisal tool (see the Appendix for more detail), and the proportion of the included studies that were conducted in Canada. We then used this extracted information to develop a synthesis of the key findings from the included reviews and primary studies.

The majority of studies included did not or were unable to provide findings on the cost of care. Those that did reported cost-savings most frequently being attributable to a reduction in the use of resources, including emergency department visits and hospitalizations, reduction in travel costs, and increased efficiency by reducing time between consultations.(8; 15-24) Systematic reviews and economic evaluations reporting cost data generally found telehealth services to cost less than their face-to-face alternative, but no cost-effectiveness or cost-utility analyses were included in the reviews.

**Table 1: Summary of findings from included reviews and economic evaluations according to the Triple Aim**

Technology	Improve the health of the population	Improve patient or provider experience of care	Reduce the per capita cost of healthcare
Telephone	<ul style="list-style-type: none"> <li>• One recent high-quality review and one older medium-quality review found structured telephone support for people with heart failure was effective at reducing all-cause mortality.(15; 16)</li> <li>• One recent medium-quality review found telephone follow-up for patients after receiving myocardial revascularization improved pain management and anxiety levels.(25)</li> <li>• One older medium-quality review found telehealth-delivered cognitive-behavioural therapy significantly improved the physical health conditions of participants with chronic illness including heart disease, rheumatoid arthritis and multiple sclerosis.(26)</li> <li>• One recent high-quality review and one recent medium-quality review found that telerehabilitation using the telephone is effective in improving physical function and disability in the management of musculoskeletal conditions.(9; 27)</li> <li>• The same review reported that telehealth rehabilitation is not inferior to standard face-to-face therapy following total knee arthroplasty.(27)</li> </ul>	<ul style="list-style-type: none"> <li>• One recent high-quality review reported acceptance rates of between 76-97% among people receiving structured telephone support following hospitalization for heart failure.(16)</li> <li>• One recent medium-quality review found follow-up for patients recovering from a prostatectomy resulted in a small improvement in patients' quality of life.(28)</li> </ul>	<ul style="list-style-type: none"> <li>• One recent high-quality review and two older medium-quality reviews found structured telephone support for people with heart failure reduced the number of heart-failure-related hospitalizations, however one of the medium-quality reviews found no significant difference in cost. (15-17)</li> <li>• One older medium-quality review found regular telephone calls with a health professional to discuss healthy behaviours for diabetes management results in a cost-benefit.(29)</li> </ul>
Telemonitoring platform (web-enabled or cable phoneline)	<ul style="list-style-type: none"> <li>• Two recent studies found telemonitoring for patients hospitalized with heart failure did not produce statistically significant results for 180-day readmission rates or 180-day mortality rates when compared to usual care.(12; 14)</li> <li>• One older medium-quality review found that when paired with treatment instructions, self-management training and a web-based messaging platform, telemonitoring of diabetes resulted in a reduction in HbA1c levels compared to regular visits at home by a</li> </ul>	<ul style="list-style-type: none"> <li>• One medium-quality review found telemonitoring assisted in detecting and treating cardiovascular events earlier than conventional hospital monitoring among individuals that have recently had a pacemaker fitted.(18)</li> </ul>	<ul style="list-style-type: none"> <li>• One medium-quality review found using telemonitoring to monitor patients with pacemakers who were recovering from atrioventricular blocks were lower cost than hospital monitoring, largely as a result of reduced hospitalizations and routine hospital visits.(18)</li> <li>• One recent medium-quality review found that remote telemonitoring</li> </ul>

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	<p>primary-care provider.(30)</p> <ul style="list-style-type: none"> <li>• One recent medium-quality review found that remote telemonitoring of patients with a heart-failure diagnosis following acute discharge significantly reduced all-cause mortality.(17)</li> </ul>		<p>of patients with a heart-failure diagnosis following acute discharge reduced all-cause hospitalizations by 19-25%.(17)</p> <ul style="list-style-type: none"> <li>• One older medium-quality and one recent high-quality review observed a reduction in the mean number of hospital admissions among chronic obstructive pulmonary disease patients participating in a telehealth monitoring intervention as compared to treatment as usual.(8; 23)</li> </ul>
<p>Videoconference and synchronous teleconsultation (including telemetry of physiological indicators and vital signs)</p>	<ul style="list-style-type: none"> <li>• One older medium-quality review found that using videoconferencing to deliver therapy for post-traumatic stress disorder produced better depression outcomes than wait-list comparison conditions and equivalent outcomes for trauma survivors, as compared to face-to-face cognitive behavioural therapy.(31)</li> <li>• Two medium quality-reviews found that webcam or online counselling telepsychiatry did not result in significant improvements in physical outcomes or depression ratings, while another review found that it improved health outcomes when compared to baseline measurements.(32; 33)</li> <li>• One high-quality review found no significant difference in clinical outcomes for the use of videoconference among individuals diagnosed with post-traumatic stress disorder.(4)</li> <li>• One recent medium-quality review reported that providing patients with telerehabilitation at home via audio-video technology improved physical functioning following surgery, as compared to usual care.(3)</li> <li>• One recent high-quality review found the connection of audio-visual communication between a hospital and remote critical care unit</li> </ul>	<ul style="list-style-type: none"> <li>• One older medium-quality review found that both synchronous and asynchronous (e.g., mobile messaging and reminders) teleconsultation improved patient-provider interactions.(21)</li> <li>• In two medium-quality reviews, patients receiving counselling or psychotherapy reported having a strong therapeutic relationship with their provider through videoconferencing, and reported being generally satisfied with the service.(4; 32)</li> <li>• Younger participants diagnosed with post-traumatic stress disorder expressed a preference for psychiatry delivered over videoconference as compared to usual care in one high-quality review.(4)</li> <li>• One older medium-quality review compared telephone and videoconferencing for acute stroke management and found improved diagnostic accuracy and treatment decisions among videoconferencing participants.(19)</li> <li>• Patients reported greater satisfaction with videoconferencing for telestroke treatment than for telephone or calls with audio alone in one recent medium-quality review.(34)</li> <li>• Patients reported high levels of satisfaction in</li> </ul>	<ul style="list-style-type: none"> <li>• One recent high-quality review reported a 20% reduction in length of stay in the critical care unit and a 15% reduction in hospital stay among telemedicine patients in critical care units.(36)</li> <li>• One recent medium-quality review suggested that eConsultation services for specialty care had the potential to be cost-effective, with significant savings from reduced travel time and from time saved between consultation and the initial intervention.(22)</li> <li>• One costing analysis on providing telerehabilitation found that when a patient's home was more than 30 km round trip away from the institution providing care, telerehabilitation showed a significant advantage. However when less than 30 km round trip, the cost of the technology did not outweigh the cost of travel.(24)</li> </ul>

	<p>available 24/7 resulted in a 60% reduction in mortality, with a greater influence on patients admitted after 8 p.m. than those admitted before 8 a.m.(19)</p> <ul style="list-style-type: none"> <li>• One recent medium-quality review found similar clinical outcomes at three months for patients receiving videoconferencing in telestroke interventions as those receiving face-to-face treatment.(34)</li> </ul>	<p>one recent medium-quality study for the use of videoconferencing in emergency rooms.(35)</p> <ul style="list-style-type: none"> <li>• One recent high-quality review found the implementation of telemedicine in critical care units resulted in higher rates of adherence to best practice guidelines for deep vein thrombosis, prophylaxis and stress ulcer prophylaxis.(19)</li> <li>• One recent medium-quality review reported a reduction in wait times for specialist services from 88.6 days to 12.3 days on average when using an eConsultation platform rather than face-to-face services.(22)</li> </ul>	
<p>Mobile phone, tablet device and asynchronous teleconsultation (and additional “add on” technologies)</p>	<ul style="list-style-type: none"> <li>• One recent medium-quality review found mixed evidence with regards to the effectiveness of using text messages to help control HbA1c levels in either Type 1 or Type 2 diabetes.(37)</li> <li>• One recent medium-quality review reported a large reduction in chronic obstructive pulmonary disease exacerbation as compared to baseline through the use of a smartphone monitoring application.(7)</li> <li>• One medium-quality review found that text messages could effectively be used to remind patients of adherence to HIV medication, and resulted in a corresponding reduction in viral load.(10)</li> <li>• One recent medium-quality review found mixed evidence on the effects on patient mortality of using mobile devices to monitor heart failure.(38)</li> </ul>	<ul style="list-style-type: none"> <li>• One recent medium-quality review reported that patients receiving tele-homecare mediated by a home health nurse, perceived an increased sense of security and felt they had better access to clinicians as a result of the service.(39)</li> <li>• The same review indicated that negative experiences with telehomecare technologies were related to poor installation of devices, insufficient training of patients and technical difficulties.(39)</li> <li>• In one older and one recent medium-quality review, diabetic patients reported finding cellphone messaging and feedback to be particularly helpful in managing their diabetes.(21; 40)</li> <li>• One recent medium-quality review that examined the use of mobile phones to monitor patients with chronic obstructive pulmonary disease reported high levels of satisfaction, a better understanding of the disease, and a greater sense of security knowing their health condition was being closely monitored.(13)</li> <li>• In the same review, patients who did report concerns did so largely on account of problems or glitches in the system, the size of the device being too small, or concerns about the privacy of their data.(13)</li> </ul>	<ul style="list-style-type: none"> <li>• One costing study found the use of mobile tablets for data entry by a visiting telecare nurse reduced the number of patients visiting the emergency department, the number of visits to the emergency department, and days spent in hospital, but found a rise in the number of home visits and in the demand for nursing staff.(20)</li> <li>• The same review undertook a cost-analysis and found a \$1,557 reduction in the cost of care in favour of the intervention.(20)</li> </ul>

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<p>Web-based intervention</p>	<ul style="list-style-type: none"> <li>• One recent medium-quality review found providing post-operative patients recovering from cardiac or orthopedic surgery with access to an educational and supportive website in addition to regular physiotherapy resulted in significant improvements in physical functioning, with a specific increase observed in rates of physical self-efficacy.(3)</li> <li>• One recent medium-quality review examined the use of electronic imaging and information exchange for diabetic foot ulcers and found that a greater number of ulcers were healed among the care as usual group than among the intervention group, but the intervention group was found to have on average a faster per week healing rate.(41)</li> <li>• One recent high-quality review found telerehabilitation delivered via the internet was more effective for regaining motor functions than care as usual among patients recovering from cardiac operations and total knee arthroplasty.(42)</li> </ul>	<ul style="list-style-type: none"> <li>• One recent medium-quality review found high agreement between diagnosis and suggested treatment of foot ulcers with electronic imaging as usual care.(41)</li> </ul>	
<p>Multiple telemedicine devices</p>	<ul style="list-style-type: none"> <li>• One recent high-quality review and one older medium-quality review found that telemedicine strategies including computerized systems for information exchange, videoconferencing, short message services and the use of mobile devices to exchange information, resulted in an absolute reduction in HbA1c levels and in low-density lipoprotein as compared to usual care, as well as an improvement in depression outcomes as compared to baseline levels.(2; 43)</li> <li>• One older medium-quality review found insufficient evidence on the use of telemedicine technologies (telephone group discussions, telephone cognitive behavioural therapy, online group discussions and integrated computer telephone systems) on depression symptoms or outcomes.(5)</li> <li>• One recent medium-quality review and one</li> </ul>	<ul style="list-style-type: none"> <li>• One recent medium-quality review reported high rates of satisfaction among patients using educational and supportive websites, telemonitoring and videoconferencing for rehabilitation following cardiac and orthopedic operations.(3)</li> <li>• One older medium-quality review found insufficient evidence on patient satisfaction for the use of telemedicine technologies (telephone group discussions, telephone cognitive behavioural therapy, online group discussions and integrated computer telephone systems) in the treatment of depression.(5)</li> <li>• One older medium-quality review found that telemedicine strategies including computerized systems for information exchange, videoconferencing, short message services and the use of mobile devices improved adherence</li> </ul>	<ul style="list-style-type: none"> <li>• A reduction in costs for both asynchronous and synchronous teleconsultation for diabetic patients was reported in one older medium-quality review, with savings being attributed largely to a reduction in consultation time and decreased number of hospital admissions(21).</li> <li>• One older high-quality review found telehealth interventions including telephone, internet-based with video, and audio capability to provide breath sounds effectively reduced emergency department visits and hospital admissions among patients with chronic obstructive pulmonary disease.(23)</li> </ul>

	<p>older high-quality review found mixed evidence for the effectiveness of telehealth interventions including internet, telephone, and video and audio recordings, on disease-specific outcomes for asthma, but found similar positive effects for use with high-risk patients over the long-term (i.e., more than 12 months).(6; 44)</p> <ul style="list-style-type: none"> <li>• One medium-quality review reported improvements in depression and anxiety symptoms from telecounselling interventions for minority ethnic communities using telephone, videoconferencing and internet-mediated services.(32)</li> <li>• One medium-quality review reported no significant difference between the intervention and control groups in active knee extension, knee flexion, hamstring strength, swelling or measures of pain for osteoarthritis patients receiving telerehabilitation through telephone and videoconferencing.(45)</li> <li>• One recent high-quality review pooled findings from a broad range of telemedicine interventions and found no significant difference between telehealth interventions and usual care on all-cause mortality.(46)</li> <li>• One recent high-quality review assessed the use of both active (e.g., audio-video monitoring of clinical indicators) and passive monitoring (e.g., audio-video calls) for critically ill patients and found both interventions to reduce intensive care unit and hospital mortality.(47)</li> <li>• One recent high-quality review found that using telerehabilitation with a variety of technologies for individuals with multiple sclerosis improved balance capacity and postural control compared to baseline levels.(48)</li> </ul>	<p>to best practice guidelines in diabetes care, and high levels of satisfaction among patients receiving this type of care.(43)</p>	
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## APPENDICES

The following tables provide detailed information about the systematic reviews in the rapid synthesis. From each included systematic review, we extracted the focus of the review, key findings, last year the literature was searched and the proportion of studies conducted in Canada.

For the appendix table providing details about the systematic reviews, the fourth column presents a rating of the overall quality of each review. The quality of each review has been assessed using AMSTAR (A MeaSurement Tool to Assess Reviews), which rates overall quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. It is important to note that the AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to systematic reviews pertaining to delivery, financial or governance arrangements within health systems. Where the denominator is not 11, an aspect of the tool was considered not relevant by the raters. In comparing ratings, it is therefore important to keep both parts of the score (i.e., the numerator and denominator) in mind. For example, a review that scores 8/8 is generally of comparable quality to a review scoring 11/11; both ratings are considered “high scores.” A high score signals that readers of the review can have a high level of confidence in its findings. A low score, on the other hand, does not mean that the review should be discarded, merely that less confidence can be placed in its findings and that the review needs to be examined closely to identify its limitations. (Lewin S, Oxman AD, Lavis JN, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP): 8. Deciding how much confidence to place in a systematic review. *Health Research Policy and Systems* 2009; 7 (Suppl1):S8).

All of the information provided in the appendix tables was taken into account by the authors in describing the findings in the rapid synthesis.

**Appendix 1: Summary of findings from systematic reviews about the effects of telehealth and virtual care**

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
What are the effects of using telecommunications technology to provide clinical care at a distance on health outcomes, patient and provider satisfaction, and costs?	Effectiveness of structured telephone support or non-invasive home telemonitoring compared to standard practice for people with heart failure (16)	The review included 41 studies exploring the use of structured telephone support or home telemonitoring for people with heart failure. It was found that when compared to usual care, both structured telephone support and non-invasive telemonitoring were effective in reducing all-cause mortality in people with heart failure and heart failure-related hospitalizations. Furthermore, there was evidence that both these interventions may improve participants' knowledge of their heart failure and improve health-related quality-of-life measures. For reducing all-cause hospitalizations, the study found no difference for non-invasive telemonitoring when compared to usual care, while the effect of structured telephone support was barely significant.	2015	10/11 (AMSTAR rating from McMaster Health Forum)	3/45
	Analyze available evidence on resource use and health outcomes for pacemaker telemonitoring and conventional monitoring (18)	<p>The review included seven studies that aimed to evaluate the effectiveness of pacemaker telemonitoring (TM) compared to hospital monitoring (HM). One study reported a 34% shorter hospital stay in the TM group, but found no significant difference in the quality of life or number of cardiovascular events between the two groups. All seven studies included in the review reported that TM costs were lower than HM follow-up costs, and many studies found TM to be four to eight times cheaper than the conventional option. There was also evidence that TM detected and treated cardiovascular events earlier, which reduced the number of hospitalizations and routine and emergency hospital visits.</p> <p>The author noted several limitations of this review, including the low number of selected studies, methodological heterogeneity of the studies, lack of clinical trials measuring mid- and long-term outcomes, and large time differences between studies.</p>	2014	No rating tool available for this type of document	Not reported in detail
	Effectiveness of telehealth on chronically ill patients compared with or as an addition to usual face-to-face care (30)	<p>The review included 12 studies evaluating the effects of telehealth interventions.</p> <p>Seven studies examined the use of e-health interventions in addition to usual care. Interventions included monitoring, treatment instructions, self-management training (coaching), and general information and web-based messaging. It was found that the e-health program resulted in improvements in some physical health outcomes with small-to-moderate effect sizes on primary health outcomes of individuals with diabetes.</p> <p>Five studies evaluated e-health interventions in place of usual face-to-face care for diabetes. The interventions consisted of four components, including monitoring, treatment instructions, self-management, training and general information. In these studies, usual care consisted of regular hospital visits or regular visits at home by primary-care providers, or visits to the family physician. Four of the five studies</p>	2009	6/10 (AMSTAR rating from McMaster Health Forum)	0/12

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		included patients with diabetes, and found that the intervention group demonstrated improved health outcomes, especially a reduction in HbA1c, when compared with the control group. One study included patients with cardiovascular diseases and showed greater improvements in some clinical outcomes in patients with cardiac diseases.			
	Efficacy of telehealth interventions for post-traumatic stress disorder-related symptoms (31)	<p>The review included 13 articles that examined the effects of telehealth interventions. The review found telehealth interventions to be more efficacious than wait-list conditions in reducing post-traumatic stress disorder (PTSD) symptoms, but less efficacious than face-to-face interventions. Furthermore, telehealth interventions produced a large reduction in PTSD symptoms from pre- to post-treatment.</p> <p>The review further investigated depression symptom outcomes, and found that telehealth interventions also produced better depression severity outcomes relative to wait-list comparison conditions. However, contrary to the findings for PTSD outcomes, telehealth cognitive behavioural treatment for trauma survivors may produce equivalent depression outcomes when compared with face-to-face cognitive behavioural treatment. Similar to PTSD symptoms, telehealth interventions produced a large reduction in depression symptoms from pre- to post-treatment.</p> <p>Findings from both PTSD and depression symptom severity outcomes support the use of telehealth treatments for individuals with PTSD-related symptoms.</p>	2010	5/11 (AMSTAR rating from McMaster Health Forum)	1/13
	Identify barriers and facilitators for the sustainability of telehomecare programs for chronic disease management (39)	<p>The review included 16 studies examining the barriers and facilitators for the sustainability of telehomecare programs. The review found that the healthcare providers' uncertainty about the clinical effectiveness of telehomecare programs, the implementation of telehomecare programs without a clear aim to a patient's specific situation, and the use of telehomecare technologies that did not incorporate innovative technological advances, may adversely impact the sustainability of telehomecare programs.</p> <p>Furthermore, the review found that patients generally perceived an increased sense of security along with improved access to clinicians as benefits of telehomecare services. The continuity of care telehomecare facilitates can improve relationships between patients and providers, and enhance providers' understanding of patients' situations regarding their condition.</p> <p>Another key factor identified affecting sustainability outlined in the review was interprofessional communication and collaboration. The review emphasized that the interactions between healthcare professionals involved in telehomecare delivery</p>	2013	7/10 (AMSTAR rating from McMaster Health Forum)	1/16

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>may be problematic if clinical roles and responsibilities, as well as expectations about patient outcomes, are not delineated.</p> <p>Additionally, the implementation of telehomecare programs changed home health nursing work arrangements, due to the work involved in monitoring and responding to telehomecare data, installing devices and training patients, and resolving technical difficulties. Poor home health workflow adaptability to telehomecare programs often resulted in an increased perception of workload by home health nurses, which had an adverse impact on the sustainability of telehomecare programs.</p>			
	Impact of telemedicine interventions on hemoglobin A1c (HbA1C) levels, blood pressure, LDL cholesterol (LDL-c) levels and body mass index (BMI) in diabetes patients (2)	<p>The review included 15 articles with 13 studies that investigated the effect of telemedicine on various outcomes including HbA1C levels, blood pressure, LDL-c levels and BMI in patients with diabetes. The telemedicine strategies that were included in this review included computerized systems for information exchange, videoconferencing, and exchange of information via mobile devices, short message services, or through the internet.</p> <p>Telemedicine strategies were associated with a significant absolute HbA1c reduction of -0.44%, or approximately -4.8 mmol/mol. Furthermore, five studies that evaluated the effects of telemedicine strategies on LDL-c found a significant reduction of 6.6 mg/dL, but it was not a clinically relevant impact. The studies that assessed the impact of telemedicine on systolic blood pressure and diastolic blood pressure found no significant effect when compared to usual care.</p> <p>There were only two studies that investigated the effects on BMI, and thus a meta-analysis could not be performed. However, both studies demonstrated a non-significant reduction on BMI.</p>	Not reported in detail	8/11 (AMSTAR rating from McMaster Health Forum)	0/15
	Effectiveness of perioperative e-health interventions on the postoperative course (3)	<p>The review included 27 studies that evaluated the effect of complementing or substituting care by peri-operative telehealth interventions on the post-operative course. There were four categories of interventions used in the included studies: an educational or supportive website or device; telemonitoring; telerehabilitation; and teleconsultations.</p> <p>It was found that peri-operative e-health interventions may improve physical functioning, pain scores and interference, fatigue scores, psychosocial functioning, anxiety regarding recovery, treatment satisfaction, and length of recovery. There were mixed results regarding the impact of the intervention on direct and indirect healthcare costs.</p> <p>Overall, 25 studies (92.6%) reported at least an equal (n = 8) or positive effect (n =</p>	2015	7/10 (AMSTAR rating from McMaster Health Forum)	4/26

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>17) of the e-health intervention compared to regular care. Only two studies (7.4%) reported greater positive effects for all outcomes in favour of the control group.</p> <p>The author noted that due to the several low- or moderate-quality studies the results should be interpreted with caution.</p>			
	Effects of teleconsultation on clinical, behavioural and care coordination outcomes of diabetes compared to usual care (21)	<p>The review included 90 publications and investigated two types of teleconsultation: 1) asynchronous teleconsultation for monitoring and delivering feedback via email and cellphone, automated messaging systems, or other equipment without face-to-face contact; and 2) synchronous involves face-to-face contact via videoconferencing equipment to connect caregivers and one or more patients simultaneously.</p> <p>There were 15 studies in the review that included hemoglobin A1c (HbA1c) data and was suitable for meta-analysis. The pooled reduction in HbA1c was found to be not statistically significant. Other clinical outcomes that may be improved through teleconsultation interventions include body mass index, body weight, cholesterol levels, fasting blood glucose levels, mean blood glucose levels, postprandial glucose levels, and glycemic control. There were also a few studies that reported improvements in the quality of life.</p> <p>There were 29 studies that evaluated effects on patient-caregiver interactions, and 26 of these studies reported improvements. Both asynchronous and synchronous interventions generated identical interactional benefits, including increased intensity of contact, more effective communication, and patients perceiving providers as more supportive.</p> <p>Improved self-care was observed in 42 studies. For example, there was evidence that the technology enabled patients to better manage their disease, improved their knowledge of the disease, and increased the frequency with which patients monitored their blood glucose or blood pressure, or monitored their meals.</p> <p>Participants expressed high satisfaction with the technology, and the usability of the technology was mainly assessed positively, where asynchronous interaction interventions were particularly reviewed as helpful, whereas synchronous interactions were mainly seen as user-friendly.</p> <p>Lastly, in the 33 studies that evaluated costs, 27 reported decreased costs as a result of teleconsultation. Cost savings were particularly achieved due to a reduction in healthcare-utilization costs, including a decrease in consultation time and decreased number of hospital admissions.</p>	2009	5/11 (AMSTAR rating from McMaster Health Forum)	Not reported in detail

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>In conclusion, the included studies in this review suggest that both synchronous and asynchronous teleconsultations for diabetes may be feasible, cost-effective and reliable. However, it is important to note that many of the included studies showed no significant difference between the intervention group and control group (usual care).</p>			
	<p>Effectiveness of mobile health technologies interventions in diabetes management on glycosylated hemoglobin (37)</p>	<p>The review included 24 papers that examined the effectiveness of mobile health interventions for individuals with diabetes. The mobile health interventions evaluated were similar across Type 1 and Type 2 diabetes. However, there were dietary interventions, such as carbohydrate daily intake automated texts, which only occurred in Type 1 diabetes.</p> <p>There was mixed evidence in the studies evaluating a diet-focused intervention for Type 1 diabetes. Similarly, the use of non-dietary interventions, such as healthcare professional feedback, were inconclusive with two of the four studies supporting the effectiveness of mobile health.</p> <p>Although the evidence of effectiveness is mixed for Type 2 diabetes as well, there is more consistent positive findings compared to Type 1 diabetes. Seven studies found mhealth to be significantly more effective than other telehealth interventions and standard care. Two single-group studies reported significant improvements in HbA1c at three and six months, three randomized control trials found significant reductions in HbA1c for the mhealth group, and one RCT found greater reductions in HbA1c levels at 12 months compared with the control group after controlling for baseline HbA1c. Three RCT studies failed to find mhealth to be more effective than other telehealth interventions and standard care.</p>	2012	5/10 (AMSTAR rating from McMaster Health Forum)	0/24
	<p>Examining the use of videoconferencing to deliver psychotherapy (4)</p>	<p>The review included 66 studies examining the use of videoconferencing to deliver psychotherapy.</p> <p>The review found that the most frequently used terms to describe the modes of treatment were videoconferencing, telepsychiatry and telemedicine. The majority of the studies reported an individual therapy format, while a minority included described group therapy, discussed family therapy and combined individual and group therapy. The largest portion of samples identified cognitive behavioural therapy as the primary treatment type.</p> <p>Feasibility of implementing videoconferencing for psychotherapy was found to be a feasible means to deliver psychotherapy. Studies reported the successful expression and interpretation of emotions via videoconferencing, with a few studies referencing decreased costs for patients as a result of saved time and travel.</p>	Not reported in detail	4/10 (AMSTAR rating from McMaster Health Forum)	4/66

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>Fourteen of the 16 studies examining the patient-provider relationship reported that patients and providers perceive a strong therapeutic alliance through videoconferencing.</p> <p>Twenty-six of the articles examined patient and provider satisfaction and found that both groups were generally satisfied when engaging in psychotherapy or telemedicine. Complaints that did arise were largely as a result of technical difficulties.</p> <p>Two-thirds of the studies examined clinical outcomes and found that results differed by diagnosis, but that the number of studies remain too small for each of the diagnoses to conclude clinical effectiveness.</p>			
	Effectiveness of telecounselling for delivering healthcare to linguistic minority communities (32)	<p>Eight studies were included in the review. Telecounselling programs were designed as 12-month support for adult caregivers. Telecounselling provided cognitive behavioural therapy, family therapy and supportive counselling.</p> <p>Participants were consistently satisfied with the programs and believed that they were valuable, reporting compliance rates of 75-97%.</p> <p>Significant short-term treatment effects were associated with telephone and internet-mediated services for physical health and depression ratings. Webcam telepsychiatry was not associated with a significant improvement in outcomes among participants. Long-term follow-ups were not widely assessed across included studies.</p>	Not reported in detail	6/10 (AMSTAR rating from McMaster Health Forum)	1/8
	Examining mental health outcomes of individual synchronous online chat counselling and therapy (33)	<p>Six studies were included in this review examining the effects of synchronous chat interventions on mental health. Participants differed across studies in the conditions being treated, including anxiety, depression and feelings of burden.</p> <p>Online counselling can be divided into four primary interventions: online counselling and therapy; web-based interventions; internet-operated therapeutic software; and personal publications, online support groups and online assessments.</p> <p>All studies reported significant benefits from online chat compared to baseline measurements. Two studies found that online chat counselling was equivalent to face-to-face services while another found it resulted in better outcomes than telephone-delivered care.</p>	2012	3/9 (AMSTAR rating from McMaster Health Forum)	1/6

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Examining the use of telemedicine for recovery from stroke (19)	<p>The review included 18 studies examining the use of telemedicine for recovery from stroke. The studies included a variety of different interventions. Ten of the studies used two-way real-time audio-videoconferencing, three studies compared telephone consultation with video consultation, and five interventions used telephones to support community hospitals in acute stroke management.</p> <p>All of the telemedicine networks reported a positive experience and improved quality of care. Three studies reported on levels of satisfaction and found patients and healthcare providers reported high levels of satisfaction and acceptance. Across studies, the number of patients who had to be transferred to a hospital or to an acute stroke centre varied significantly. Studies that compared videoconferencing to telephone alone reported better outcomes among videoconferencing patients in terms of diagnostic accuracy and treatment decisions.</p> <p>Only one study examined the cost-effectiveness and found that a telestroke service is only cost-effective when screening candidates by means of video-consultation.</p>	2008	3/10 (AMSTAR rating from McMaster Health Forum)	1/15
	Assessing the impact of critical care telemedicine on intensive care unit (ICU) and hospital mortality in adults and children (36)	<p>Telemedicine has been proposed as a solution to address structural inadequacies in critical care resources and variability across clinical settings. Critical care telemedicine uses a remotely located support centre housing a critical care team and patients via audio-visual communication and computer systems over a 24-hour period.</p> <p>The review included two studies in a qualitative synthesis. The findings from one study show a 60% reduction in mortality odds in the hospital in the telemedicine group. A subgroup analysis showed that the telemedicine intervention had greater effect on hospital mortality for patients admitted after 8 p.m., than those admitted after 8 a.m. Similarly, the study reported a shorter length of stay for the telemedicine group among patients who stayed at least one week. ICU length of stay in the telemedicine group was 20% shorter and 15% shorter for hospital length of stay.</p> <p>Telemedicine was also found to have higher rates of adherence to best practice guidelines for deep vein thrombosis, prophylaxis, stress ulcer prophylaxis, and cardiovascular protection.</p> <p>The following individual components were found to be associated with lower mortality: 1) intensive case review within one hour of admission; 2) timely use of performance data; 3) adherence to ICU best practices; and 4) quicker alert response times.</p>	2015	8/9 (AMSTAR rating from McMaster Health Forum)	0/2

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Assess home telemonitoring interventions for chronic obstructive pulmonary disease and explore patient's adherence and satisfaction (13)	<p>The review found that telemonitoring interventions could be separated into five categories: 1) duration; 2) type of technology; 3) patients training on the system; 4) data collection and transmission; and 5) use of prompt reminders and/or feedback and detection of health deterioration.</p> <p>The review included 12 studies (17 articles). The length of telemonitoring differed substantially between interventions, varying from two to 12 months. Similarly, technology also differed, employing a range of devices including oximeters, spirometers, blood pressure monitors, electrocardiographs, and respiratory rate sensors. The most frequent piece of technology used, however, was a mobile/web telephone with an integrated touch-screen computer that allowed for data recordings.</p> <p>Five studies reported relatively high drop-out rates, however the review found that compliance rates were higher when data was transmitted once per day, and increased when the frequency increased to three times per day. Overall, drop-outs were frequently related to technological problems with the system or symptom exacerbations.</p> <p>Patients reported finding the technology easy to learn and useful, and most patients reported that the system improved self-management of their health condition as they had a better understanding of their disease. Patients reported a greater sense of security knowing their health condition was being monitored, and improved their ability to communicate with their providers.</p> <p>In some studies patients reported dissatisfaction with the size of the device, often thinking the screen was too small. Additionally, the patients had concerns regarding the transmission and privacy of data.</p>	2012	5/10 (AMSTAR rating from McMaster Health Forum)	2/17
	Assessing the application of telemedicine for use in general emergency rooms (35)	<p>The review included 38 studies that were divided into three groups: 1) general emergency department use; 2) minor treatments in clinics; and 3) telemedicine for special patient populations.</p> <p>Nearly half of the studies reported information related to technical qualities and generally found that physicians and nurses indicated good image and teleconference quality with the exception of a few reported instances.</p> <p>While not all studies included reported on patient satisfaction, the studies that did found largely positive reports. Patient satisfaction was consistently high among general emergency use patients. Patients in the special patient population were also generally satisfied with the consultation across medical conditions. Not enough data was reported for conclusions to be made for the group in the minor treatment</p>	2013	5/9 (AMSTAR rating from McMaster Health Forum)	1/36

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>clinic.</p> <p>General emergency telemedicine was found to be useful for remote context or for communicating sensitive information to patients. Among the special patient population, telemedicine was found to be clinically effective across a diverse set of conditions.</p> <p>Not enough economic or cost data was provided to be able to complete a cost-benefit analysis.</p>			
	Evaluating the effectiveness of telemedicine for the treatment of depression (5)	<p>The review included 10 studies that utilized a variety of interventions for treating depression, including cognitive behavioural therapy self-help programs, telephone post card or online group discussion, and integrated computer telephone systems.</p> <p>Nine studies evaluated depression symptoms, with four finding statistically significant improvement in the intervention group, while the remaining five showed no difference between the telemedicine group and the control (face-to-face) group. Four studies evaluated quality of life rating and showed no significant difference between the control and intervention groups.</p> <p>Four studies assessed treatment adherence and satisfaction and showed no statistical difference between telemedicine and the control group. Similarly, no significant difference was found during the 12-month follow-up for the use of resources between the two groups.</p> <p>Overall the review concluded that insufficient evidence was available on the effectiveness of telemedicine in the management of depression. There was, however, a strong hypothesis that telemedicine obtains largely similar results to face-to-face therapy.</p>	2008	7/11 (AMSTAR rating from McMaster Health Forum)	2/10
	Evaluating the effectiveness of telehealth to help diabetic patients manage foot ulcers (41)	<p>The review included 11 studies that varied in their interventions and outcomes. Two studies evaluated telehealth against clinical outcomes, which found that in 12 weeks a greater percentage of ulcers were healed in the control group than the intervention group, but the per week healing rate was significantly higher in the intervention group than the control group.</p> <p>Four studies conducted reproductability assessments of telehealth tools. The foot-imaging device was found to have excellent intra-observer reproductability and generally high agreement with live assessments. The use of infrared thermometer technology had only moderate to good reproductability and agreement with live assessments when detecting signs of foot infection.</p>	2015	4/10 (AMSTAR rating from McMaster Health Forum)	0/11

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>Four studies included cost data and found that the costs associated with the telehealth system varied from \$2,500 to \$4,500 US dollars. One study used a clinical costing model, which found that the control group incurred greater experience than the intervention group due to treatment, travel and amputation costs.</p> <p>Three studies examined behavioural aspects of telehealth and found that the majority of clinicians found the telehealth system easy to use, improved staff skills and improved patient outcomes. Another study found that both clinicians and patients found the equipment easy to use, and patients reported saving time on not having to travel.</p> <p>Overall, while the review found positive effects from telehealth for diabetic foot ulcers, particularly among reported costs and for the per week healing rate, additional research is required before firm conclusions can be made.</p>			
	Assessing the effect of remote home telemonitoring on patients with a heart failure diagnosis (17)	<p>The review included 21 studies in its analysis. The studies assessed remote home telemonitoring (using patient-initiated external electronic devices or cardiovascular implanted monitoring devices, with transfer of physiological data from patient to healthcare provider using telecommunications technology) or structured telephone support programs (including regular telephone contact between patients and healthcare providers and reporting of symptoms and/or physiological data) in adults (<math>\geq 18</math> years of age) with a heart failure diagnosis and discharged from acute care (within 28 days) to home. More specifically, the remote monitoring interventions included structured telephone support delivered via human-to-machine interface, structured telephone support delivered via human-to-human contact, and telemonitoring during office hours.</p> <p>For adults recently discharged from an acute care setting after a recent heart failure, remote monitoring was beneficial in reducing all-cause mortality. No beneficial effect on mortality was observed with structured telephone support via human-to-machine interface. Telemonitoring with medical support during office hours or 24/7 was associated with 25% or 19% reduction in all-cause hospitalizations, respectively, whereas there was no major effect of structured telephone support by itself or with human-to-human contact. Although there were no major effects on heart failure-related hospitalization for structured telephone support via human-to-machine interface, and telemonitoring with medical support during office hours, structured telephone support via human-to-human interaction was associated with a 23% reduction in heart-failure-related hospitalizations.</p> <p>In terms of cost, telemonitoring during office hours was the most cost-effective strategy compared to all the other strategies.</p>	2013	10/11 (AMSTAR rating from McMaster Health Forum)	2/21

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Assessing the effectiveness of telerehabilitation practices in children and adolescents (6)	<p>The review included nine studies, which examined telerehabilitation practices in children and adolescents. The intervention utilized the internet, telephones, and video and audio recordings. The main condition explored was asthma.</p> <p>In general, the included studies demonstrated that telerehabilitation provided improved results compared to traditional methods of rehabilitation. This included decreased occurrence of symptoms, improvement in quality of life, greater control of disease, greater treatment adherence, and greater practice of physical activity. However, the authors express caution with interpreting the results due to methodological constraints.</p> <p>There was no evidence regarding the cost or cost benefits regarding telerehabilitation in youth populations.</p>	2012	5/10 (AMSTAR rating from McMaster Health Forum)	0/7
	Review the use of telecommunications technology in delivery of mental health and substance abuse treatment services within rural areas (49)	<p>The review included 38 studies that placed emphasis on telemental health, telepsychiatry, or telehealth to provide services for substance abuse disorder. The authors organized the findings into four major themes: advantages of telehealth and applications to rural practice; barriers to implementation in rural practice; utilization in rural areas; and areas for further research.</p> <p>In terms of advantages, there were several ways in which telehealth technology could relieve shortage of healthcare providers in rural areas. The technology could provide ease in clinical data transmission, monitor patients' conditions in home settings, enhance staff training, supply immediate technical assistance during surgeries and other medical procedures, and serve individuals who are incarcerated or institutionalized. There is also an advantage with reduced travel time and cost, reduced separation of families, and reduced number of missed appointments. For patients, there is increased satisfaction with services and willingness to reuse services.</p> <p>In terms of barriers to implementation, financial sustainability has been a primary barrier. Other barriers include the space needed for technological equipment, providers feeling undertrained, technical aspects of equipment, variability in technology, licensure requirements and time zone differences.</p> <p>For the utilization within rural areas, collaboration increases and staff response is overall positive. It has practicality within adult psychiatric care, pediatric telemental health and psychiatric care, substance abuse treatment, post-traumatic stress disorder, and cross-cultural applications.</p>	2012	3/9 (AMSTAR rating from McMaster Health Forum)	Not reported in detail

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Assess the effectiveness of smartphone interventions on reducing COPD exacerbations (7)	<p>The review included six studies in the qualitative analysis, and three studies in the quantitative meta-analysis. Most of the studies had fairly small sample sizes (less than 100 participants), follow-up ranged from four to nine months, mean age was 70.5 years, and 74% were male. The studies varied in the types of smartphone interventions.</p> <p>The quantitative analysis found a reduction in exacerbation by 80% in patients using a smartphone intervention. However, due to methodological constraints the results should be interpreted with caution.</p>	2015	7/10 (AMSTAR rating from McMaster Health Forum)	0/6
	Evaluate the effectiveness of home blood pressure telemonitoring compared to usual care (50)	<p>The review included 12 studies, which assessed home blood pressure telemonitoring versus usual care. The outcomes were office and/or ambulatory blood pressure before and at the end of the study follow-up. The telemonitoring intervention was delivered via telephone or the internet and often incorporated nurse visits, pamphlets or education.</p> <p>The review found that telemonitoring significantly reduced systolic and diastolic blood pressure when taken at the doctor's office. There were also increases in office blood pressure normalization and use of blood pressure medications. The review concluded that home blood pressure telemonitoring may represent a useful tool to improve blood pressure control, but well-designed large-scale trials were needed to demonstrate its clinical usefulness. However, caution is warranted due to the quality of the current evidence base.</p>	2010	8/11 (AMSTAR rating from McMaster Health Forum)	0/12
	Evaluate the effectiveness of telephone-delivered cognitive behavioural therapy on physical health of people with chronic illness (51)	<p>The review included eight studies that assessed the use of telehealth to monitor symptoms, assess adherence to prescribed therapies or provide therapy via a user interface (e.g., telephone, videoconferencing, or electronic diary). The patients within the studies included children, adolescents, adults or a mixture of all. The interventions were telemedicine assessments at home, downloading of data on adherence and medication re-orders, assessment of equipment usability in hospital, provision of behavioural and nutritional interventions for toddlers, and automated downloads of spirometry and symptoms. The patient outcomes included calorie intake, healthcare use, respiratory exacerbation rate, antibiotic use, adherence to interventions and psychological outcomes.</p> <p>Of the eight studies, one study found no differences with length of hospital stay, number of clinic visits, and anxiety and depression scores in adolescent and adult patients. In four studies, adherence ranged from 52% to 80% of possible occasions for data recording. Overall, the authors concluded that there was insufficient evidence, with most current studies having poor methodological quality. This made it difficult to make definitive conclusions on the benefits of telehealth interventions for patients with cystic fibrosis.</p>	2011	8/10 (AMSTAR rating from McMaster Health Forum)	0/8

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Evaluate the effectiveness of telephone-delivered cognitive behavioural therapy on physical health of people with chronic illness (26)	<p>The review included eight studies, which assessed telephone-delivered cognitive behavioural therapy. The illnesses included systemic lupus erythematosus, heart disease, end stage respiratory disease, rheumatoid arthritis or osteoarthritis, multiple sclerosis and breast cancer.</p> <p>The review found that telephone-delivered cognitive behavioural therapy significantly improved physical health in patients with chronic illnesses. Furthermore, studies that included less than five hours of therapist contact had a greater impact on health outcomes than those with just five hours of therapist contact. There were no differences between interventions focusing mainly on emotions, those which focused mainly on physical illness and those aimed at improving life-threatening illnesses. However, for studies focusing on less serious illnesses, the effect was significant.</p>	2010	6/11 (AMSTAR rating from McMaster Health Forum)	0/8
	Evaluate the effectiveness of telemonitoring on patients with congestive heart failure (15)	<p>The review included 13 studies and pooled the findings from each. The telemonitoring intervention was typically comprised of patient follow-up, education and counselling delivery via telephone call made by a specialist nurse.</p> <p>The results identified an overall reduction in all-cause mortality and congestive heart failure specific hospital admission, but no reduction was observed for all-cause hospital admission. As well, there were no differences in length of stay in hospital, medication adherence or cost.</p>	2009	6/11 (AMSTAR rating from McMaster Health Forum)	1/14
	Evaluating the effectiveness of one-to-one telephone coaching for people with long-term conditions (29)	<p>The review included 34 studies reporting on telephone coaching, which involves regular telephone calls from a health professional to provide support and encouragement to the patient with the aim of promoting healthy behaviours (e.g., medication control, healthy diet, physical activity/mobility, rehabilitation and good mental health).</p> <p>Of the 34 studies, 17 focused on diabetes management and 17 focused on managing chronic cardiovascular conditions. A total of 32 studies reported outcomes in favour of telephone coaching, with the most notable benefits being improved self-care compliance, increased self-confidence towards disease management, improved mental health, and reductions in hospital readmissions. Of the studies that evaluated patient satisfaction, most demonstrated that patients have positive perceptions of the telephone services provided.</p> <p>There were five studies that assessed cost-effectiveness or cost benefits, and four of these reported that telephone coaching interventions resulted in a cost benefit.</p>	2010	5/10 (AMSTAR rating from McMaster Health Forum)	1/30
	Examining the effects of telestroke, teleoncology and teledialysis services	The review included 14 articles, nine of which concerned telestroke, two related to teleoncology and three related to teledialysis.	2013	4/10 (AMSTAR rating)	2/14

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	on patients' clinical outcomes (34)	<p>Studies examining telestroke found similar clinical outcomes for patients receiving videoconferencing at three months to those receiving face-to-face treatment. No significant difference was found for the number of adverse events (e.g., intracranial bleeds) between the two groups. In terms of patient satisfaction, real time videoconferencing was preferable to telephone, though one limitation in widespread adoption of telestroke is the dependence on available CT machines.</p> <p>Further reviews are required before conclusions can be drawn for teledialysis services.</p> <p>High levels of patient satisfaction was recorded with the supervision of chemotherapy through teleoncology services, however only two studies were included, which limits the ability to draw firm conclusions. One challenge in implementation that was noted for this model of care is the requirement for a sufficient health workforce trained to deliver and supervise chemotherapy.</p>		from McMaster Health Forum)	
	Identifying the effectiveness of telecounselling to treat and manage depression for minority ethnic groups (27)	<p>The review included eight studies which included individuals of Asian, African-American and Spanish origin. The authors defined telecounselling as utilizing telephone, videoconferencing or internet media to assist with managing depression for these ethnic groups.</p> <p>The review found that there were significant short-term treatment effects associated with telephone and internet-mediated services. These included moderate to large improvements in depression, anxiety, quality of life and psychosocial functioning. Two studies also identified similar findings and effects in physical health and depression ratings with telephone services.</p> <p>Only three studies assessed the long-term treatment effects of telecounselling, but found mixed results regarding the relapse in symptoms of depression over time.</p>	Not reported in detail	6/10 (AMSTAR rating from McMaster Health Forum)	1/9
	Identify the successful elements of telephone communication by nurses for older people with long-term conditions (52)	<p>The review included five studies, which did not look at routine telephone communication between nurse and patient, but most did show that telephone-based interventions were successful in improving pre-determined disease-specific health indicators for long-term conditions (e.g., blood pressure, physical activity, smoking cessation). Furthermore, the interventions in the study only focused on individual needs and self-management behaviours for one specific long-term condition.</p> <p>It was unclear whether aspects of telephone communication contributed to the success of the intervention. Barriers found included the multiple tasks nurses had that interrupted their calls and resulted in them being lower priority than face-to-face consultations.</p>	2015	5/9 (AMSTAR rating from McMaster Health Forum)	0/5

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Evaluate the effectiveness of home telerehabilitation in patients who underwent total knee arthroplasty (45)	<p>The review included six studies using two primary interventions: telephone and videoconferencing-based telerehabilitation; and virtual software that supports wireless sensors to record movement and includes a web portal for therapists' evaluation.</p> <p>In terms of effectiveness outcomes, two studies reported improvements in quality of life in osteoarthritis scores (WOMAC). Studies found no significant difference in active knee extension, active knee flexion, hamstring muscle strength, swelling of the knee joint, or on measures from the visual analogue scale for pain between the intervention and control groups. However, a significant difference was however found for quadriceps muscle strength in favour of telerehabilitation.</p> <p>One study reported high level of satisfaction by participants enrolled in telerehabilitation.</p>	2014	7/10 (AMSTAR rating from McMaster Health Forum)	3/6
	Evaluating the effect of eConsultations on wait times for specialist care (22)	<p>The review included 36 studies evaluating the impact of eConsultation systems on wait times for specialist care. The majority of studies included single-specialty services, with seven studies describing multi-specialty services. eConsultation services were implemented on a variety of different platforms, including private networks within closed systems or as part of larger regional networks.</p> <p>Thirteen of the studies examined provider satisfaction and found that the majority of studies reported positive reviews of eConsultation. Downsides of the system included deficiencies in technology and information communication technology support, medico-legal concerns, and increased workload. In most cases this was outweighed by additional advantages including education.</p> <p>In terms of patient experience, the majority of studies that evaluated access to care found positive results. Reported wait times were significantly shorter through eConsultation (12.3 days compared to 88.6 days). On levels of effectiveness, nearly all reported outcomes were comparable between usual care and eConsultation. Similarly, patients were consistently satisfied with the service, with average ratings ranging from 78% to 93%.</p> <p>Outcomes for cost-effectiveness varied significantly, in part because of differences in calculation. However most agreed that the intervention had the potential to be cost-effective, with savings from travel and from time to initial intervention.</p>	2014	7/10 (AMSTAR rating from McMaster Health Forum)	0/36

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Examining the effectiveness of home telehealth interventions on individuals with COPD (8)	<p>The review included six studies that examined the effectiveness of home telehealth monitoring for patients with COPD. To be included in the review telehealth interventions were required to periodically measure physiological indicators, use telecommunication technologies, lead to the automated or manual review of a patient's health status, and begin a response when the patient's health status crossed a threshold.</p> <p>Four of the six studies included had an educational component to the intervention program. Among these complex studies, the review could not determine whether the educational strategies, increased contact with health professionals or the close patient monitoring had the most effect on improving clinical outcomes.</p> <p>Across the included studies, the frequency of monitoring varied significantly. In four studies patient status was monitored daily while in the remaining two it was monitored twice weekly.</p> <p>Four of the six studies evaluated the number of COPD exacerbations; two of these studies found a statistically significant result. Only two of six studies evaluated quality of life, and only one study found a significant improvement.</p> <p>All six studies reported hospital admissions, of which four observed a reduction in the number of hospital admissions among participants in the intervention group.</p> <p>Two studies included cost data and reported savings of between 15% and 50% per patient. These studies reported that a reduction in hospital visits was the source of the greatest economic gain.</p> <p>The review calls for increased research into this area noting that few studies were included in the review, and the six studies included had relatively small samples.</p>	2009	6/10 (AMSTAR rating from McMaster Health Forum)	1/6
	Evaluating the effectiveness of treatment delivered via real-time telerehabilitation for the management of musculoskeletal conditions (9)	<p>The review included 14 studies that examined the effects of delivering telerehabilitation for the treatment of musculoskeletal conditions, including arthritis, spinal pain conditions, and rehabilitation following elective orthopedic surgeries.</p> <p>The interventions varied in time and intensity, lasting from four weeks to one year and used two primary technologies, a videoconferencing platform or telephone.</p> <p>Ten trials assessed physical function following telerehabilitation (only eight of which were pooled) and generally found that both telerehabilitation and usual care significantly improved physical function. A moderate effect size was found in favour of telerehabilitation. A sub-analysis found that neither intervention was</p>	2015	8/10 (AMSTAR rating from McMaster Health Forum)	2/14

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>favourable for knee arthroplasty, however a significant effect was found in favour of telerehabilitation in hip arthroplasty.</p> <p>Studies that used telephone as the telerehabilitation medium showed a moderate to large effect favouring telerehabilitation, whereas videoconferencing showed a small effect in favour of care as usual. on its own.</p> <p>In terms of pain outcomes, six trials examined pain as a primary outcome and found that while telerehabilitation improved pain more at the outset than care as usual, over time neither group appeared to be more favourable. Neither telephone nor videoconferencing were found to be more favourable for pain reduction.</p> <p>A non-inferiority analysis found that for total knee arthroplasty telerehabilitation was not inferior to standard face-to-face management.</p> <p>One study examined self-efficacy and found no significant improvements in levels of self-efficacy from telerehabilitation for the management of arthritis. However, another study examined quality of life and found that the provision of physiotherapy management of individuals with knee osteoarthritis significantly improved physical and psychological quality of life, but not social domains. The study also showed that neither telerehabilitation nor face-to-face care was more favourable.</p> <p>The review found evidence that the management of musculoskeletal conditions via real-time telerehabilitation is effective in improving physical function and disability and pain. When compared to a control cohort a small but significant effect can be seen in favour of telerehabilitation for both physical function and disability as compared to usual care.</p>			
	Evaluating the efficacy of telecounselling on spinal rehabilitation (27)	<p>The review included seven studies examining telecounselling for spinal cord injuries. In particular, the review evaluated the clinical characteristics of telephone-, video- and internet-based counselling. The interventions included were required to involve a healthcare professional directly interacting with a participant to facilitate psychological recovery.</p> <p>All seven studies used the telephone - six used it as the primary technology for intervention while the seventh compared telephone and audio-video. Delivered treatments included supportive counselling, cognitive behavioural therapy and motivational interviewing.</p> <p>Only one study reported statistically significant treatment effects immediately following telephone counselling. This study found an improvement in individual</p>	2013	5/11 (AMSTAR rating from McMaster Health Forum)	2/7

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>ability to manage physical health symptoms related to spinal injuries. The remaining studies found moderate but non-significant effect sizes. The telecounselling program produced the only significant positive change in quality of life ratings that was maintained in the medium term (i.e., 12 months) following the intervention.</p> <p>Clinical outcomes, however, were generally favourable. One study provided cost data and found telephone counselling to be cost efficient, estimated at AUD \$150 per patient. A sub-analysis on particular diverse cultural groups found that telephone counselling provided much needed support to individuals when peer mentors a mentees were matched from the same cultural background. The review warns that this qualitative data is based on small samples and therefore should be interpreted with caution.</p> <p>For video-counselling, short-term efficacy could not be determined from the single study, however at the medium term efficacy values show that participants in the program report more depression symptoms than telephone counselling participants. These participants, however, reported the lowest rates of rehospitalization.</p> <p>For internet-based counselling, clinical efficacy was found to not be statistically significant on levels of depression, anxiety and stress. Qualitative findings from this study indicate that patients considered internet counselling to be acceptable and convenient.</p> <p>Overall, the review found that telecounselling can contribute to short-term improvements in health symptoms for individuals with spinal cord injuries, but the longer term impact of telecounselling was not adequately evaluated. Clinical outcomes suggest that telecounselling can improve psychological outcomes when delivered within the first three months post-discharge from primary rehabilitation.</p>			
	Examining the effectiveness and acceptability of using mobile phone messaging in the treatment of HIV (10)	<p>The review included 21 studies examining the use of short message service and multimedia messaging from mobile phones for the treatment and prevention of HIV.</p> <p>In terms of prevention, one study used SMS messages to bring awareness to HIV and 81% of the target population reported having increased their knowledge. Another three studies sent quiz questions and reported high response rates within targeted populations, but much lower rates when scaled up to the general population.</p> <p>One study examined the use of SMS messaging for appointment reminders for HIV treatment and found an overall 10% increase in adherence to appointment</p>	Not reported in detail	5/10 (AMSTAR rating from McMaster Health Forum)	0/21

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>times before and after the intervention. An additional study examined the use of SMS to remind patients to pick up test results and found that patients were four times more likely to adhere to planned date and time of pick-up when the intervention was employed, than compared to the control.</p> <p>Three studies examined the effect of messaging on medication adherence and found improved adherence and a corresponding reduction in viral load.</p> <p>Additionally, one study equipped peer health workers with mobile phones and found improvements in communication across health professionals.</p> <p>Most studies did not report cost data, however the initial set-up cost was found to vary across studies, ranging from US\$215 to US\$20,000 depending on the extent of infrastructure needing to be purchased, and any marketing and awareness campaigns.</p> <p>Qualitative findings from the studies include challenges patients had in using messages to communicate information, however notification to patients was accepted for the purpose of appointment or medication reminders.</p> <p>A lack of formal assessments or evaluations from these studies limits the extent to which firm conclusions can be drawn.</p>			
	Examining the effect of telehealth for palliative care on patients and their caregivers (11)	<p>The review included nine studies that examined the effect of telehealth for palliative care on patients and their caregivers. A variety of technology was used to deliver the intervention: four used videophones to simulate face-to-face communication, two used regular telephones for counselling, two used internet-based interventions and the remaining study did not report the details of the telehealth device.</p> <p>Five studies showed no significant difference between the experiment and control groups in measuring caregiver quality of life. The anxiety score, however, was found to significantly improve in the intervention group. Two studies examined caregiver burden and found mixed results, with one reporting reduced levels of caregiver burden while the other showed no significant difference.</p> <p>While there is some evidence to support the use of telehealth to deliver palliative care interventions and it having a positive impact on caregivers, evidence on outcomes was derived from relatively small samples and should therefore be treated with some level of caution.</p>	2015	5/10 (AMSTAR rating from McMaster Health Forum)	1/9

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Evaluating the effects of telehome monitoring-based telenursing on health outcomes and resource use for patients with severe chronic obstructive pulmonary disease (23)	<p>The review included seven studies that examined the impact of telenursing on health outcomes and resource use for patients with severe chronic obstructive pulmonary disease.</p> <p>Telenursing interventions were found to have no significant difference between the telenursing group and the control group at three, six or 12 months, but were effective at reducing the mean number of hospitalization among severe and very severe COPD patients. The intervention was not found to significantly reduce mortality in patients with moderate to severe COPD.</p> <p>Significantly fewer patients receiving the telenursing intervention visited the emergency department compared to treatment-as-usual groups. Two studies reported shorter durations of bed days per patient in the telenursing group than in the control group, however one additional study reported longer durations.</p>	2011	9/11 (AMSTAR rating from McMaster Health Forum)	0/9
	To assess the effectiveness of telehealth interventions in people with asthma (44)	<p>Interventions included in the study had to focus on the proactive use of ICT, which included: 1) video or telephone links between patients and professionals; 2) systems of care using internet-based telecommunication (these could be synchronous or asynchronous with professionals); 3) systems of care using both wired and wireless telemetry for monitoring expiratory flow and vital signs; and 4) other systems of remote healthcare incorporating patient self-reporting of symptoms on questionnaires and information exchange with a professional.</p> <p>The review included 21 studies that used a variety of technologies including the telephone, videoconferencing, text messaging and other networked systems.</p> <p>In terms of clinical outcomes, telehealth interventions were not found to have a significant improvement on disease-specific quality of life, emergency room visits, or hospitalization for asthma in the short term. Telehealth may, however, have a significant effect on high-risk patients when examined over a longer term (e.g., 12 months). Mixed results were found for symptoms with some studies indicating improvements in symptoms while others found no significant differences. Across all the studies a few adverse events were reported, with some studies reporting patients abandoning the technology and cease self-monitoring when they felt well enough.</p>	2010	10/11 (AMSTAR rating from McMaster Health Forum)	0/25
	Review the effectiveness of telehealthcare for chronic obstructive pulmonary disease compared with face-to-face care	For the purpose of this review telehealth has three requirements: 1) that information from the patient, whether voice, video, other audio, oxygen saturation or breath sounds, are available; 2) electronic transfer of this information over a distance; and 3) personalized feedback from a professional. The review identified 10 randomized controlled trials. Two of these papers, however featured telehealth prominently one part of a complex intervention.	2010	10/10 (AMSTAR rating from McMaster Health)	1/12

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>Interventions included: telephone, internet use with video, and videoconferencing. The review found that telehealth has the capacity to reduce the total number of exacerbations, may increase quality of life, reduces emergency department visits, and reduces hospital admissions, without resulting in increased morbidity. No meta-analysis was possible for either patient satisfaction or for cost and cost-effectiveness.</p>		Forum)	
	<p>To assess the effectiveness, acceptability and cost of interactive telemedicine (46)</p>	<p>Interactive telemedicine provides patients and clinicians the ability to exchange information and communicate in real time. The review included 93 randomized controlled trials evaluating the effectiveness of interactive telemedicine.</p> <p>Recruited patients had a variety of different illnesses including cardiovascular disease, heart failure, recovering from cardiac surgery, hypertension, diabetes, respiratory diseases and others.</p> <p>Six categories were identified that described the function of telemedicine: 1) monitoring of a chronic condition to detect early signs of deterioration and prompt treatment and advice; 2) provision of treatment or rehabilitation; 3) education, advice for self-management, and support; 4) specialist consultations for diagnosis and treatment decisions; 5) real-time assessment of clinical status; and 6) screening.</p> <p>Pooled data found no significant difference between telemonitoring and usual care on all-cause mortality however, a greater improvement in quality of life compared with usual care was observed. Some evidence was found that LDL cholesterol and blood pressure improved in patients with diabetes who received telemedicine care. Similarly, studies that examined the use of telemedicine for mental health reported no difference in mental health or substance use, but reported cost savings related to travel.</p> <p>Outcomes relating to cost were limited in many cases by the wide range of interventions and conditions included in the review. Twenty-three studies reported cost data, nine of which reported lower costs for telemedicine than for usual care. Six of these studies reported lower follow-up costs, while the remaining three reported lower hospital admissions charges. Ten studies reported no difference in costs while five reported increased cost for telemedicine when compared with usual care.</p> <p>No evidence was found for increased frequency of hospital admissions for patients with either heart failure or diabetes. In patients with asthma, substitution of usual care with telemedicine resulted in similar numbers of exacerbations, use of resources and use of medicines.</p>	2013	11/11 (AMSTAR rating from McMaster Health Forum)	2/93

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Review the evidence on the effects of structured telephone support or non-invasive home telemonitoring on patients with heart failure (16)	<p>The review included 41 studies, 24 of which have been previously reviewed in an earlier iteration of the review conducted in 2010.</p> <p>The review focused on structured interventions as being either structured telephone support if both the monitoring and self-care management were delivered using a telephone, or categorized as telemonitoring if people were using more advanced technologies.</p> <p>Most of the studies examined participants with symptomatic health failure. The review found small reductions on all-cause hospitalization rates for both telephone and telemonitoring patients, and significant reduction in health failure-related hospitalizations among both groups. Tests for heterogeneity strongly suggested differences in the technology's effectiveness for health failure-related hospitalization, suggesting effective technology included telephone and complex non-invasive telemonitoring.</p> <p>As for secondary outcomes, only one of seven studies found statistically significant reductions in length of stay, while five of 11 reported improvements in health-related quality of life. Fifteen studies reported cost data, with those finding reductions primarily from fewer hospitalizations or cost of care per admission. Studies reported a cost reduction range between 14-86%. Two telemonitoring studies reported increases in cost due to the intervention and to increased medical management. Compliance rates were reported as between 55.1-65.8% for structured telephone support, and from 75-98.5% for telemonitoring. Similarly, acceptance levels of the interventions were highly rated, with people receiving healthcare via technology rating them between 76% and 97%.</p>	2015	10/11 (AMSTAR rating from McMaster Health Forum)	3/45
	Evaluating the impact of mobile devices via phone calls and SMS in patient-doctor communication on health outcomes (40)	<p>The review found that mobile health technologies focused on cellphones and personal digital assistants were typically used in four contexts: appointment reminders and improvements in attendance or cancellations; medication adherence and adherence to a regime; disease control and improvement in patients' parameters; and test-result and notifications, and improvement in patients' understanding of their results.</p> <p>The review included 63 studies, 23 of which evaluated the effect of mobile appointment reminders, 19 investigated medication adherence, 20 examined disease-control interventions, and two examined test result reporting.</p> <p>Outcomes amenable to meta-analysis included appointment reminders, medication adherence and disease-specific outcomes. The review found mobile communication had a small improvement on attendance at appointments, improved adherence to medication when compared to usual care, and improved</p>	2015	6/11 (AMSTAR rating from McMaster Health Forum)	0/32

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	Assessing the outcomes for telephone follow-up for patients following myocardial revascularization surgery (25)	<p>both asthma and diabetes outcomes. Results were found to be largely similar to previous systematic reviews.</p> <p>The review included seven studies that assessed the impact of telephone and email follow-up for patients after receiving myocardial revascularization. Across all studies telephone follow-up was used to improve patients' ability to manage their pain, to encourage exercise and to participate in rehabilitation programs, as well as to provide an opportunity to review the patient's history and provide education about depression and cardiac disease.</p> <p>Content of the telephone calls was grouped into four themes: 1) discussions on cardiovascular illness; 2) concerns about post-operative complications; 3) self-care, including behavioural lifestyle change education and support; and 4) psychosocial evaluation and emotional support and counselling. In all studies telephone interventions were started within two weeks of hospital discharge.</p> <p>In assessing outcomes, telephone follow-up was found to result in statistically significant improvements in health-related quality of life, pain management, anxiety levels and mood, and knowledge about self-care measures. No difference was observed in rates of compliance between the intervention and the control groups.</p> <p>Findings from this review should be used with caution as many of the outcomes are based on findings from a very small number of studies (one to three) and therefore make generalization challenging.</p>	2016	4/9 (AMSTAR rating from McMaster Health Forum)	6/14
	Evaluating the impact of telemedicine on critically ill patients' outcomes (47)	<p>The review included 11 studies which evaluated the impact of telemedicine on outcomes for critically ill patients. All studies included a before-after observational design. Studies varied in their inclusion of patients, with one study including only those with neurologic diseases, while another specifically excluded these patients and a third restricted the intervention to patients with a medical diagnosis.</p> <p>There was significant variability in the interventions that were implemented, with three studies using a low-intensity passive system, for example employing videoconferencing for clinical consultation, using a robotic telepresence program or a clinical information system, while five other studies employed more active interventions including ongoing audio-video monitoring and data monitoring that alerted providers to abnormal signs or results of radiologic and laboratory tests. The remaining studies did not provide enough detail to classify them into either the passive or active telemedicine groups.</p> <p>Pooled results from nine studies found a reduction in both intensive care unit (ICU) and hospital mortality. Similarly, pooled results from seven studies found a reduction in the length of stay in the ICU and in hospital from telemedicine. A sub-</p>	2012	8/11 (AMSTAR rating from McMaster Health Forum)	0/11

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		group analysis demonstrated that both active and passive interventions reduced ICU mortality rates, but no statistically significant difference was found when comparing the two.			
	Examining the effects of telerehabilitation on improving physical or functional outcomes in patients with cardiopulmonary diseases (53)	<p>The review included 11 studies, five of which involved patients with chronic heart disease, five with chronic heart failure, and two with respiratory diseases. Telerehabilitation programs ranged from eight to 36 weeks, with a varied frequency between one and five times per week. Studies used a variety of interventions. Six studies used aerobic training while the remaining five combined aerobic training and strength training.</p> <p>The primary measure was the six-minute walk test, which showed no significant difference in post-program scores between telerehabilitation and the control group for patients with chronic heart failure. When comparing baseline scores, there was a significant difference between the telerehabilitation and control group of 21 metres. Similar results were reported for the chronic heart failure group, however no difference was observed for patients with chronic obstructive pulmonary disease.</p> <p>Inconsistent results were also observed for VO<sub>2</sub> Peak tests, with two studies finding significant improvements while the remaining showed no decline. For studies that reported on quality of life, the telerehabilitation group improved significantly from baseline measures among patients with cardiac and respiratory conditions. In general, adherence to exercise was better at the beginning of the study as compared to later in time, regardless of the time of measurement used.</p> <p>Small differences were reported in the number of adverse events with fewer events experienced among the intervention group. It is hypothesized that this could be the result of increased monitoring at home as compared to centre-based rehabilitation. Information on costs was only reported by one study, which found that the cost-per-patient for delivering telemedicine electrocardiogram monitoring in Brazil was \$502.71 U.S. dollars for three months.</p>	2013	6/9 (AMSTAR rating from McMaster Health Forum)	2/11
	Examining the effectiveness of mobile technology on heart failure outcomes (38)	<p>The review included 10 studies examining the effectiveness of mobile technology on heart failure outcomes. The majority of the studies used mobile devices as part of larger monitoring systems, which included a blood pressure-measuring device, weighing scale, electrocardiogram and an implantable defibrillator. Only one study used mHealth as a stand-alone intervention.</p> <p>Mixed evidence was found on the impact of mobile health interventions on mortality. One study reported a lower mortality rate while the remaining studies found no difference in mortality rates. Neither invasive nor non-invasive</p>	2015	6/10 (AMSTAR rating from McMaster Health Forum)	Not reported in detail

Question	Focus of systematic review	Key findings	Year of last search/publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>monitoring systems showed a significant difference in the number of hospitalizations.</p> <p>The impact of mobile health interventions on functional class and on health-related quality of life was also inconclusive, with three studies reporting no conclusions and two reporting significant improvements.</p> <p>No conclusions on the effectiveness of mobile health interventions could be made, largely due to differences in methodological rigour between the included studies.</p>			
	Assessing the effects of telephone follow-up on patients recovering from a radical prostatectomy (28)	<p>The review included five studies assessing the effects of telephone follow-up on patients recovering from a radical prostatectomy. Two studies reported on calls that contained information on prostate cancer, treatment symptoms, symptom management methods and skills teaching for better communication. One study reported teaching relaxation and assisted patients to develop a treatment plan. Other studies reported contents including pelvic floor muscle training, information about urinary catheter management, information on preventing urinary tract infections, and emotional counselling. Telephone calls in all studies averaged 15 minutes.</p> <p>No difference in outcomes was observed between the intervention and control group for quality of life measurements, though urinary incontinence in the control group was said to no longer interfere with quality of life after one year. Men in the intervention group were found to demonstrate better urinary flow during the first four months, and reduced use of medical resources during the post-operative period.</p>	2013	5/10 (AMSTAR rating from McMaster Health Forum)	1/5
	Examining the impact of telemedicine interventions on the quality of life for patients with chronic obstructive pulmonary disease (54)	<p>The review included 18 studies, which were subdivided between those that were considered “larger” (data on more than 100 patients at follow-up) and those that could be considered “smaller” (data on less than 100 patients at follow-up).</p> <p>Six large studies and 12 small studies were included in the review. Only three of these studies found that the intervention had a statistically significant effect on quality of life outcomes.</p> <p>The review found that telemedicine interventions can either be largely similar to the services that would be provided in hospital, or may differ by adding additional elements. It was found that only active interventions were able to produce statistically significant results. These interventions were those that delivered some kind of education by telephone or computer, or provided patients with coping skills training.</p>	2015	4/10 (AMSTAR rating from McMaster Health Forum)	1/18

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	The effectiveness of telerehabilitation programs in recovering motor function across diseases (42)	<p>The review included 12 studies in a meta-analysis, 10 of which compared telerehabilitation to usual care provided in home or in hospital, while the remaining two compared telerehabilitation to face-to-face therapy. The primary outcome examined was improvement in motor function.</p> <p>The meta-analysis found high-heterogeneity when comparing the two groups (i.e., telerehabilitation and usual care) and therefore conducted three meta-analyses, one for the group recovering from neurological conditions, one for patients recovering from total-knee arthroplasty surgery, and one for cardiac patients.</p> <p>Telerehabilitation was more effective than control treatments for regaining motor function among patients recovering from total knee arthroplasty surgeries. It is thought that these results may be skewed by one study, which reported particularly positive results. No significant difference was found between telerehabilitation and usual care for the treatment of either the cardiac or neurological disease groups.</p>	2014	10/11 (AMSTAR rating from McMaster Health Forum)	1/12
	Assessing the effect of telerehabilitation on patient outcomes for persons with multiple sclerosis (48)	<p>The review included nine studies assessing the impact of telerehabilitation on patient outcomes among adults with multiple sclerosis. Telerehabilitation interventions included more than one component and often involved physical activity, along with educational, behavioural and symptom-management programs. The duration and intensity of these interventions varied significantly depending on the nature of the intervention, with duration ranging from one to six months.</p> <p>The qualitative review indicated some evidence showing short-term benefits in improving levels of physical activity, balance capacity and postural control, compared with baseline levels, as well as short-term benefits in levels of fatigue. Long-term benefits were found for improving patients' psychological outcomes and quality of life.</p> <p>Some caution is required when interpreting this evidence due to a relatively small number of included samples and potential for bias.</p>	2014	10/11 (AMSTAR rating from McMaster Health Forum)	0/12
	Examining the impact of telecare for managing Type 2 diabetes on health outcomes, patient satisfaction and quality of care (43)	Telecare was sub-divided into two categories: simple interventions including telemonitoring, telediagnosis/consultation, and e-learning; and complex interventions, which involved the combination of more than one intervention. The review included 17 studies that focused on simple interventions and an additional 27 that used complex interventions. The simple interventions were most commonly mediated by two technologies: distant direct transmission or smart phone/personal digital assistant; and other technologies including teleconference, internet, and a pager. The more complex interventions commonly used multiple technologies in combination, most frequently employing a smart phone.	2011	6/10 (AMSTAR rating from McMaster Health Forum)	1/38

Question	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
		<p>In terms of health outcomes the majority of studies found that telecare for diabetes patients reduced HbA1c levels, with the exception of four studies which reported no improvements. These negative results were, however, explained by a lack of adherence to the intervention and to poor reliability in the reporting of blood glucose levels. Other health outcomes included improved self-perceived health (two studies), increased level of physical activity (five studies), decreased depression or improved mental health status (three studies), and improved nutrition (two studies). Mixed results were found for levels of quality of life, while telecare was found to have no effect on body mass index, weight, cholesterol or triglyceride blood levels.</p> <p>The primary outcome being assessed for quality of care was adherence to best practice guidelines, which improved in most studies with the exception of three, which did not show any result.</p> <p>Five studies reported on patient satisfaction showing relatively high levels in 14 of 16 studies, with lower rates of satisfaction observed for interventions that combined direct transmission and internet or website technologies.</p> <p>Few studies focused on health-service use, cost or productivity. However five of six studies found that health-service use decreased.</p> <p>The review showed positive results for the use of telecare technologies for individuals with Type 2 diabetes. Despite examining the impact of individual technologies, the typology suggests that no given intervention or technology is clearly superior to others. Instead, the intervention and technology needs to be designed to fit the context for each intervention.</p>			

## Appendix 2: Summary of findings from primary studies about the effects of telehealth and virtual care

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
<p>Assessing the cost implications of a telecare program for older adults with chronic conditions (20)</p>	<p><i>Publication date:</i> 2013</p> <p><i>Jurisdiction studied:</i> Montreal, Quebec</p> <p><i>Methods used:</i> Economic costing study with a pre-post cohort design</p>	<p>A total of 113 male patients with a regular physician, a demonstrable desire to manage their own care given their health condition, and a working telephone line were recruited to the study. Targeted conditions included congestive heart failure, hypertension, diabetes and chronic obstructive pulmonary disease. Patients had a mean age of 70 and primarily spoke French.</p>	<p>Home telemonitoring is the remote transmission and collection of psychological and biological data as well as behavioural data for the purpose of patient monitoring and clinical decision-making.</p> <p>The telecare program serves older adults with chronic health conditions. The technology is equipped with a tactile screen and an integrated modem. Patients were trained to use the technology and to complete a data entry table every day that documented vital signs, symptoms and medication taken.</p>	<p>Results show a decline in the number of patients who visited an emergency room (ER) from 57 to 10. During the period studied the total number of days spent in the emergency room fell from 91 (pre-intervention) to 37 (per-intervention) to 23 (post-intervention). This suggests a 34% decrease.</p> <p>The number of patients who stayed in hospital as a consequence of their primary diagnosis declined by 66% during the post-period intervention compared to the pre-intervention period. Individuals diagnosed with congestive heart failure and chronic obstructive pulmonary disease were those most often hospitalized.</p> <p>Home visits by a telecare nurse rose between pre- and post-intervention by 32%, though this number was not statistically significant. Similarly the total number of minutes spent providing direct care to patients increased by 42%. Home visits were more frequent during the post-intervention period, but often shorter than those in the pre-intervention period.</p> <p>Participants were generally satisfied with the telemonitoring system, with 80% of respondents saying they would continue to use the system beyond the trial if possible.</p> <p>The pre-intervention and post-intervention cost analysis was performed from a health system point of view and calculated in Canadian dollars. The telecare program was found to cost a total of \$171,309 per 157-day period, representing a per-patient cost of \$1,803 and a daily cost of \$11.48 per patient. The annual cost for the telecare program is \$216,903, representing a \$147,937 reduction in cost compared to usual care, and a \$1,557 reduction in cost per patient per year.</p> <p>The main source of saving stemmed from reductions in the number of hospitalizations and reductions in the average hospital stay among patients. Hospitalizations represented 90% of the costs of usual care for this population, but only 40% in the telecare program. An increase in the demand for nurses in this program was observed.</p>

<p>Compare costs of in-home telerehabilitation with conventional home visits for individuals following total knee arthroplasty (24)</p>	<p><i>Publication date:</i> 2015 <i>Jurisdiction studied:</i> Quebec, Canada <i>Methods used:</i> Randomized control trial</p>	<p>Participants were recruited from the surgical waiting list of orthopedic surgeons. Patients had to be waiting for a primary total knee arthroplasty after a diagnosis of osteoarthritis, had to be returning home after discharge, live in an area served by high-speed internet services, and live within an hour of driving from the hospital.</p> <p>A total of 205 patients took part in the trial. Participants were comparable in each group across socio-demographic variables, except for living alone, where the telerehabilitation group consisted of about twice as many individuals living alone.</p>	<p>Patients were randomized to either take part in the in-home telerehabilitation experimental group or the home-visit control group. The duration and frequency of physiotherapy sessions were two 45-minute sessions a week for eight weeks. The telerehabilitation platform included various components such as a videoconferencing system and peripheral pieces for measurements.</p>	<p>The cost analysis found a cost differential in favour of the telerehabilitation group of 18%. Cost-per-treatment analysis found that the mean cost for the home visit group was \$93.08 compared to \$80.99 for the telerehabilitation group, representing a mean difference of 13%.</p> <p>The total cost distribution revealed that total direct clinical costs were largely similar, but that the treatment duration was often longer in the visit. Indirect costs for the home visit group were higher than for the telerehabilitation group because of costs associated with travel to the patient's home. That said, technology costs for the telerehabilitation group almost counterbalanced the travel costs for the home visit group.</p> <p>A sub-group analysis was undertaken and found that when patients live less than 30 km round trip from the health centre providing care, the difference in cost between the telerehabilitation and home visit was not significant, but when the distance was over 30 km round trip the telerehabilitation showed a significant advantage.</p>
<p>Use of physician-led remote telemedical management compared with usual care on mortality and hospitalization (14)</p>	<p><i>Publication date:</i> 2011 <i>Jurisdiction studied:</i> New York <i>Methods used:</i> Randomized controlled trial</p>	<p>A total of 710 stable chronic heart failure patients were recruited from the New York Heart Association with left ventricle ejection fraction and a history of heart failure within the previous 2 years.</p> <p>Patients were randomly assigned to remote management or usual care.</p>	<p>Remote management consisted of portable devices for electrocardiogram measurements, blood pressure and body weight measurements.</p>	<p>Average follow-up time was 26-months, with a minimum of 12 months. No significant effect was reported on all-cause mortality or on cardiovascular death or heart failure hospitalization compared to care as usual.</p>
<p>Care transition intervention using remote patient monitoring to reduce readmissions and mortality among older adults hospitalized with heart failure (12)</p>	<p><i>Publication date:</i> 2016 <i>Jurisdiction studied:</i> California <i>Methods used:</i> Randomized controlled trial</p>	<p>A total of 1437 older adults were included in a randomized controlled trial.</p> <p>Enrolment criteria included all patients actively being treated for heart failure instead of just those with a principle diagnosis or heart failure.</p>	<p>The intervention consisted of three components, a pre-discharge education, regular schedule telephone coaching and home telemonitoring of weight, blood pressure, heart rate, and symptoms.</p>	<p>The intervention and usual care groups did not differ significantly in readmissions for any cause after discharge and further found no difference in mortality rates.</p>





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