Canadian Agency for Drugs and Technologies in Health

RAPID RESPONSE REPORT: SUMMARY WITH CRITICAL APPRAISAL

TITLE: Telehealth for the Assessment and Follow-up of Patients Requiring Cardiac Care: A Review of the Clinical Effectiveness, Cost-Effectiveness, and Guidelines

DATE: 29 June 2015

CONTEXT AND POLICY ISSUES

Chronic cardiovascular disease and the sequelae of acute coronary or cerebrovascular events affect a significant proportion of the Canadian population. According to the Public Health Agency of Canada's 2009 report on Tracking Heart Disease and Stroke in Canada, the 2007 prevalence of heart disease was Canada is 1.32 million people, and of stroke and its effects, 317,000 people.[1] In this review, heart disease encompasses heart attack, angina and congestive heart failure; the Heart and Stroke foundation estimate 0.5 million people have congestive heart failure alone.[2] The 2007 prevalence of diagnosed/treated hypertension was 4.7 million people.[1] These patients require specialist as well as primary physician care.

Telehealth is the provision of all forms of healthcare when patient and physician are geographically separated from each other.[3,4] It is being explored as a potential means of overcoming the challenges of distance and the mismatch between need and supply in delivering specialist healthcare services, such as cardiology and cardiovascular surgery, to patients living in underserved areas,[3,4] including rural and remote parts of Canada.[5] Potential benefits include more timely access to specialist care with more rapid and accurate diagnosis, and more expeditious and appropriate treatment, while avoiding unnecessary patient travel or transfers that can be deleterious to patients' health, disruptive to their relationships and costly to patients and the healthcare system.

Telehealth can feature the electronic transfer of patient records, diagnostic images and other investigative findings, from a remote site to a central site for review by a consultant physician; oversight or direction of a diagnostic exam or procedure occurring at a remote site by a central physician, including procedures involving robotics; education of patients or healthcare providers; or live, bidirectional audio or videoconference consultation (teleconsultation) between patients and healthcare providers, or between healthcare providers themselves.[3,4]

This report considers the use of teleconsultation to reduce the need for patients with cardiovascular diseases (stroke, heart failure, hypertension, or angina) to travel or transfer for cardiologist consultations.

RESEARCH QUESTIONS

1. What is the clinical effectiveness of telehealth for the assessment and follow-up of patients requiring cardiac care?
2. What is the cost-effectiveness of telehealth for the assessment and follow-up of patients requiring cardiac care?
3. What are the evidence-based guidelines regarding the use of telecardiology for the assessment and follow-up of patients requiring cardiac care?

KEY FINDINGS

One HTA and one open label RCT with an endpoint of time to diagnosis in patients with heart failure were included. There is no information on the effect of teleconsultation on clinical outcomes or harms arising for any of the four indications. There are no cost-effectiveness studies for angina, hypertension and stroke, and no studies based on clinical data for heart failure. No evidence-based guidelines were identified.

METHODS

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, and guidelines. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2010 and May 28, 2015.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria	
Population	Adults with: stroke, heart failure, hypertension, angina
Intervention	Telehealth: videoconference consultation with a cardiologist, internist, GP, or surgeon.
Comparator	Standard care (in-person consultation) (no comparator necessary)
Outcomes	Q1: clinical benefit, harm, accuracy/proper care as a result of using telehealth, avoidance of transfer, shorter wait times, patient satisfaction. Q2: cost-effectiveness, economic impact on families and patients as well as the health system Q3: evidence-based guidelines, optimal use or type of patient for whom telehealth is ideal or not recommended.
Study Designs	Health technology assessments (HTAs)/systematic reviews/meta-analyses, randomized controlled trials, non-randomized studies, economic evaluations, evidence-based guidelines.

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, they were adequately summarized in an included HTA/systematic review or they were published prior to 2010. Systematic reviews of multiple telehealth modalities were excluded if they did not assess videoconferencing as a separate modality.

Critical Appraisal of Individual Studies

The systematic review in the HTA was critically appraised using AMSTAR[6], and the randomized study was critically appraised using the SIGN-50 checklist[7]. Summary scores were not calculated for the included studies; rather, a review of the strengths and limitations of each included study were described.

SUMMARY OF EVIDENCE

Rapid Response reports are organized so that the evidence for each research question is presented separately.

Quantity of Research Available

A total of 735 citations were identified in the literature search. Following screening of titles and abstracts, 712 citations were excluded and 23 potentially relevant reports from the electronic search were retrieved for full-text review. Three potentially relevant publications were retrieved from the grey literature search. Of these potentially relevant articles, twenty-four publications were excluded for various reasons, while two publications met the inclusion criteria and were included in this report. Appendix 1 describes the PRISMA flowchart of the study selection.

Additional references of potential interest are provided in Appendix 5.

Summary of Study Characteristics

Study characteristics are tabulated in Appendix 2.

Study Design

One 2010 HTA was retrieved,[8] as well as a more recent Evidence in Context summary based on it.[5] Since the HTA described the findings in greater detail, it was preferentially included. One 2014 RCT was found that compared teleconsultation in conjunction with remote echocardiograph for patients with suspected heart failure, with referral to the nearest specialty centre.[9]

No relevant economic evaluations or evidence-based guidelines were found.

Country of Origin

The HTA was conducted in Canada and included studies in adult cardiovascular diseases from Canada, Italy and Sweden.[8] The RCT was conducted in Sweden.[9]

Patient Population

The HTA included adult and pediatric patients with any cardiovascular condition requiring consultation but without immediate access to a local cardiologist. Two clinical studies and four economic studies involved the pediatric population, and two clinical studies and one economic study involved the adult population, the subject of this review.[8]

The RCT included 38 patients with suspected congestive heart failure from a single centre. Their mean age was 69.6 years, and 61% were female.[9]

Interventions and Comparators

The HTA reviewed studies in which telecardiology consultation, with or without an associated diagnostic procedure, was compared with standard care.[8]

The RCT compared remote echocardiography followed by videoconsultation with a remote cardiologist with standard of care, which involved referral for echocardiography and cardiologist consultation.[9]

Outcomes

Clinical outcomes reported in the HTA included accuracy of interpretation of remote auscultation and appropriateness of prescribed treatment. Economic outcomes were cost savings to the healthcare system and society.[8]

The RCT measured time to diagnosis (i.e., time from initial patient visit to the time the specialist's report was signed off) and patient satisfaction.[9]

Summary of Critical Appraisal

Details of critical appraisal are tabulated in Appendix 3.

The HTA[8] was a rapid review, including a comprehensive search and the study selection limited to English-language studies of the previous 5 years. The quality of studies was appraised and found to be generally low. The studies were summarized narratively as they were heterogeneous in design, patient population, and intervention. Given the quality and quantity of studies, the interpretation of findings was appropriate.

The RCT[9] had well-defined timepoints for determining the endpoint of time to diagnosis, thereby minimizing measurement bias. One patient declined to be randomized to the standard pathway of care, involving referral, and was excluded from the analysis, but the others were followed the endpoint of time of diagnosis. The randomization method and method of allocation concealment were not described. The blinding of patients and physicians to the assigned pathway of care was not possible, a potentially important source of bias through preferential treatment of one group or the other. The groups were not equivalent at baseline. For example, the teleconsultation group included more women and more patients with symptoms of fatigue (68% versus 5%) and edema (58% versus 16%). More severe symptomatology may have prompted expedited healthcare for these patients, biasing the difference in favour of teleconsultation. Conversely, teleconsultation only occurred on a biweekly schedule, which might have introduced an offsetting delay. The sample size was 38 patients, but the effect size was large (median 27 days versus 114 days).

Summary of Findings

Study findings are tabulated in Appendix 4.

1. What is the clinical effectiveness of telehealth for the assessment and follow-up of patients requiring cardiac care?

One non-blinded RCT (n=38)[9] measured the effectiveness of remote echocardiography examination followed by cardiologist teleconsultation in time to diagnosis in patients with suspected heart failure, compared with referral to the nearest specialist centre site after the initial visit. Time to diagnosis was measured from the date of the initial patient visit to the date the specialist's report was signed off.

For teleconsultation, the median was 27 days (minimum of 1 day, maximum of 169 days) compared with standard care (referral after initial visit) of 114 days (minimum 7 days, maximum 212 days; $P<0.001$). Most of this difference was due to the difference in times between randomization to echocardiography (median 12 days versus 86 days). Patient satisfaction was reported as good, but the method of measurement was not specified. The study did not report harms.[9]

The HTA identified two studies in adults.[8] One (2008) was a feasibility study of the use of multidisciplinary teleconferencing in cardiovascular risk reduction for patients in rural Saskatchewan, involving nine patients in the telehealth intervention and 15 retrospective controls who had attended a cardiovascular risk reduction clinic outside the community. Both groups had a 2% reduction in the Framingham risk score, and the telehealth patients considered the videoconsultations a positive experience.[8]

The second study (2007) assessed the feasibility and accuracy of auscultation of heart and lung sounds by a remote cardiologist compared with in-person examination in 50 patients with heart

failure. The findings for remote and in-person examinations agreed in 92% of patients, while remote lung sounds were incorrectly interpreted in 3 patients, with implications for treatment. The errors involved the first few patients examined, so accuracy seemed to improve with training and experience.[8]

2. What is the cost-effectiveness of telehealth for the assessment and follow-up of patients requiring cardiac care?

One economic study was included in the 2010 HTA,[8] a cost-minimization modeling study within the Swedish healthcare context. The findings suggested an increased cost to the healthcare system from teleconsultation, associated with purchase and maintenance of equipment, but a cost-savings to patients and society.

3. What are the evidence-based guidelines regarding the use of telecardiology for the assessment and follow-up of patients requiring cardiac care?

No evidence-based guidelines were identified concerning the use of telecardiology for the assessment and follow-up of patients requiring cardiac care.

Limitations

The recent literature specifically addressing the use of videoconference consultation with a physician for cardiovascular disease in adults is limited to an unblinded RCT which reported considerable savings in time to diagnosis, and two older feasibility studies included in an HTA, which do not report clinical outcomes. The RCT is not blinded, therefore there was potential for significant bias by preferential tracking of patients in the interventional arm. The economic study identified in the HTA was based in Sweden, so may have limited applicability to the Canadian context. Our selection criteria excluded papers that did not sufficiently describe the intervention or identify indications, which has been identified as a deficit of literature in the related monitoring literature.[10]

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

There was no information identified on the effect of teleconsultation on clinical outcomes or harms arising for any of the four indications. There are no cost-effectiveness studies for angina, hypertension and stroke, and no studies based on clinical data for heart failure. At present, we cannot conclude benefit, harm or cost-effectiveness from teleconsultation in these indications and populations.

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6. Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Med Res Methodol [Internet]. 2007 [cited 2015 Jun 25];7:10. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1810543/pdf/1471-2288-7-10.pdf

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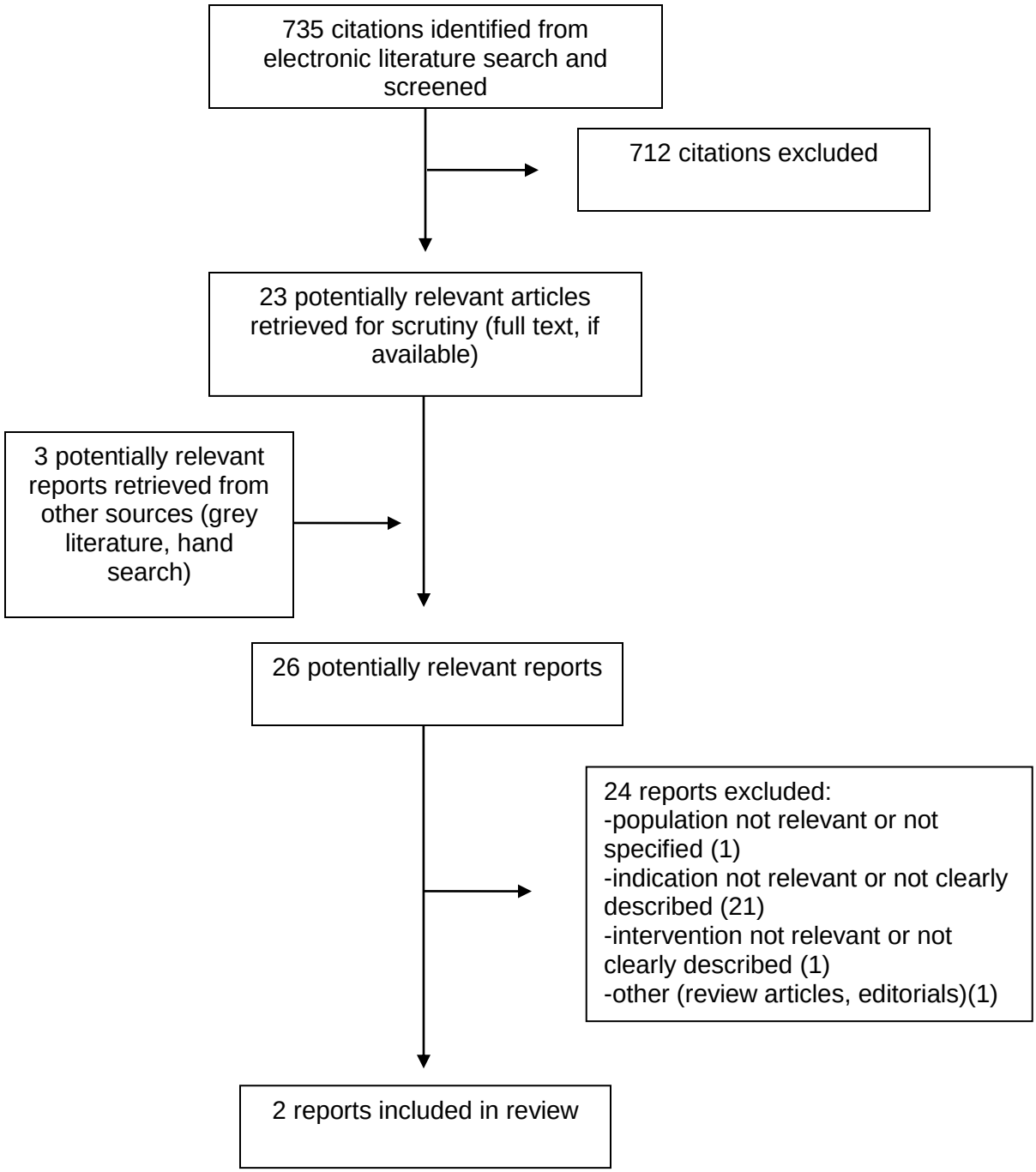
11. Daily currency converter [Internet]. Ottawa: Bank of Canada; 2015. [cited 2015 Jun 24]. Available from: http://www.bankofcanada.ca/rates/exchange/daily-converter/

12. Inflation calculator [Internet]. Ottawa: Bank of Canada; 2015. [cited 2015 Jun 24]. Available from: http://www.bankofcanada.ca/rates/related/inflation-calculator/

APPENDIX 1: Selection of Included Studies



APPENDIX 2: Characteristics of Included Publications

Table A2-1: Characteristics of Included HTAs and systematic reviews

Author, date. Types of studies included, Study objective	Patient populations, Study inclusion/exclusion criteria	Intervention Comparator(s)	Clinical Outcomes, Length of Follow-Up
CADTH, 2010[8] HTA including systematic reviews, meta-analyses, RCTs, controlled clinical trials, observational studies, economic studies. Evaluate diagnostic accuracy of telecardiology consultation compared with current practice in remote or rural areas. Evaluate benefits in patient outcomes, transfers avoided, patient satisfaction. Evaluate economic impacts for patients, families, healthcare system.	Patients in remote, rural or urban areas without access to cardiac specialists and who need non-emergency consultation for diagnosis or treatment. Excluded: Studies of case management, (home support, telemonitoring, remote medication management), discharge planning, emergency consultation. Studies of consultations not requiring face to face interaction. Technical studies. Studies without a control group. Studies that describe interventions for multiple specialties, if telecardiology-specific information could not be separated.	Telecardiology technologies (e.g., audio, video) replacing face-to-face patient and primary care physician to cardiologist consultation. Usual care in which patient or physician travels for face-to-face consultation.	Mortality, hospitalization, hospital transfer, health-related quality of life, diagnostic accuracy, patient satisfaction, wait times, costs to patient or health care payer, measures of cost-effectiveness.

CADTH = Canadian Agency for Drugs and Technologies in Health; HTA = health technology assessment; RCT = randomized controlled trial

Table A2-2: Characteristics of Included Clinical Studies			
First author, Year, Setting, Indication; Type of study	**Patient Characteristics**	**Details of the intervention and comparators**	**Main outcomes**
Boman, 2014[9] Sweden. Heart failure. Rural northern Sweden. County primary healthcare centre (PHC) 65 miles from nearest referral centre. RCT: Randomized 1:1 to intervention and comparison.	Patients with signs and symptoms suggestive of HF who in GPs opinion needed cardiology consultation with an echocardiogram. Number of patients in each arm: 19 (one additional patient declined randomization to standard pathway of care). Mean age: 70.7 versus 68.4 years. % male: 21% versus 58%. Fatigue: 68% versus 5%. Edema: 58% versus 16%.	Intervention: 1. All patient information electronically transferred to remote cardiologist. 2. Patient underwent remote echocardiogram, directed from county hospital (biweekly time-slots). 3. Teleconsultation between patient and GP (at PHC), cardiologist, sonographer (at county hospital 135 miles away). Comparator: After first visit to PHC, patient was referred to nearest specialty hospital (65 miles away).	Time to diagnosis. Patient experience and satisfaction.

CADTH = Canadian Agency for Drugs and Technologies in Health; PHC = primary healthcare centre; RCT = randomized controlled trial

APPENDIX 3: Critical Appraisal of Included Publications

Table A3: Strengths and Limitations of Systematic Reviews and Meta-Analyses using AMSTAR[6]	
Strengths	**Limitations**
CADTH, 2010[8]	
• An 'a priori' design was provided. • Search was comprehensive, conducted by a trained librarian and including multiple databases. • Grey literature was included in the search and selection. • A list of included studies was provided. • The scientific quality of the included studies was assessed and documented by standard methods. • Narrative synthesis was appropriate, given heterogeneity in design, patient population, and intervention.	• As this was a rapid response, a single author selected authors and extracted data. • The systematic search was limited to the most recent 5 years, omitting earlier studies, although older technologies may have been less relevant. Study selection was effectively restricted to English language papers. • Only selected excluded studies were provided. • The likelihood of publication bias was not assessed.

Table A3-2: Strengths and Limitations of Randomized Controlled Trials using SIGN-50[7]	
Strengths	**Limitations**
Boman, 2014[9]	
• Assignment to pathway of care was described as randomized. • Time-points for determining primary endpoint of time to diagnosis were well-specified. • Dropouts were not significant (one patient declined to be randomized to the standard of care referral and was not included in the analysis) • Study size (n=38), but large difference in primary outcome of time to diagnosis, so sufficient power to detect a difference.	• Randomization method and method of allocation concealment were not described. • Blinding of patients and physicians to assigned pathway of care was not possible. • Teleconsultation group included more women and more patients with symptoms of fatigue and edema. This might have led healthcare for these patients to be expedited, biasing the difference in favour of the teleconsultation. It may also have led patients to prefer the remote consultation, which avoided travel. • Measures of patient satisfaction were not described.

APPENDIX 4: Main Study Findings and Author's Conclusions

Table A4-2: Summary of Findings of HTAs and systematic reviews	
Main Study Findings	**Author's Conclusions**
CADTH, 2010[8]	
Nine studies, adult and pediatric: three diagnostic, four cohort, one interrupted time-series, five included cost analyses. Two adult clinical studies: 1. Canada, 2008. Feasibility study of multidisciplinary teleconference in cardiovascular risk reduction in patients (9 telehealth, 15 historical controls) in rural Saskatchewan. Both groups had a 2% reduction in the Framingham risk score, and the telehealth patients considered the videoconsultations a positive experience. 2. Italy, 2007. Feasibility and accuracy of remote auscultation of heart and lung sounds in 50 patients with heart failure. Remote and in-person examinations in agreement in 92% of patients. Remote lung sounds incorrectly interpreted in 3 patients, with implications for treatment. Experience seemed to improve outcomes. One adult economic study: 1. Sweden, 2009. Cost minimization modeling study of societal and health care payer costs of mobile robotic echocardiography technology, involving videoconsultation with cardiologists at regional centre. Telecardiology more expensive, from health care payer perspective (€4,100), less expensive from societal perspective (-€17,000), with reduced travel costs and hospital fees. This is equivalent to $7,658.29 CAD and -$31,753.88 CAD in 2015.[11,12]	• "The literature suggests that the implementation of clinic- or hospital-based telecardiology programs is feasible in communities with limited access to cardiovascular specialists. Because of the limitations of the evidence, conclusions about diagnostic accuracy or impact on patient outcomes cannot be made." p iv[8] • "Telecardiology programs reduce the number of patients who are required to travel to access care. This may reduce the travel costs of patients or health care payers. The cost of telecardiology programs is affected by the volume of patients using the service, with higher volumes reducing the per-patient cost of acquiring and operating telemedicine equipment." p iv[8] • "None of the studies reported on wait times, and limited information was available on patient satisfaction with telecardiology programs. There is limited evidence available to guide decision-makers planning to implement telecardiology consultation services in their jurisdiction." p iv[8]

Table A4-2: Summary of Findings of Randomized Controlled Trials	
Main Study Findings	**Author's Conclusions**
Boman, 2014[9]	
Total process time, teleconsulation versus referral: median 27 days (min 1 day, max 169 days) versus median 114 days (min 7 days, max 212 days) P<0.001. Randomization to echocardiography: median 12 days versus median 86 days. "Almost all" patients satisfied with teleconsultation. Most patients with experience of standard of care preferred teleconsultation.	• "With real-time echocardiography followed by cardiologic consultation at a distance, the total diagnostic process time could be substantially reduced. Patient satisfaction with such an option has been reassuring, enabling patients to have easier access to echocardiography and specialist consultations within the precincts of a PHC." p803[9]

APPENDIX 5: Additional References of Potential Interest

Systematic reviews describing videoconferencing in telemonitoring (routine care)

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