

CADTH RAPID RESPONSE REPORT: REFERENCE LIST

Remote Monitoring for Chronic Cardiac Conditions: Clinical Effectiveness and Cost-Effectiveness

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About CADTH: CADTH is an independent, not-for-profit organization responsible for providing Canada's health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs, medical devices, diagnostics, and procedures in our health care system.

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Research Questions

1. What is the clinical effectiveness of remote monitoring for chronic cardiac conditions?
2. What is the cost-effectiveness of remote monitoring for chronic cardiac conditions?

Key Findings

Ten systematic reviews (six with meta-analyses), two systematic reviews of systematic reviews, and ten economic evaluations were identified regarding the clinical and cost-effectiveness of remote monitoring for chronic cardiac conditions.

Methods

A limited literature search was conducted on key resources including Ovid Medline, PubMed, the Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 01, 2014 and April 03, 2019. Internet links were provided, where available.

Selection Criteria

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	People with chronic cardiac conditions (i.e., heart failure, hypertension, arrhythmias /atrial fibrillation, syncope) or in cardiac rehabilitation
Intervention	Remote patient monitoring with a wearable
Comparator	Standard of care (e.g., doctor's appointments)
Outcomes	Q1: Clinical effectiveness (e.g., quality of life, well-being, health status, hospital admissions) and safety (e.g., mortality) Q2: Cost-effectiveness
Study Designs	Health technology assessments, systematic reviews, meta-analyses, economic evaluations

Results

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by economic evaluations.

Ten systematic reviews (six with meta-analyses), two systematic reviews of systematic reviews, and ten economic evaluations were identified regarding the clinical and cost-effectiveness of remote monitoring for chronic cardiac conditions. No relevant health technology assessments were identified.

Additional references of potential interest are provided in the appendix.

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

1. Brons M, Koudstaal S, Asselbergs FW. Algorithms used in telemonitoring programmes for patients with chronic heart failure: a systematic review. *Eur J Cardiovasc Nurs*. 2018 10;17(7):580-588.
[PubMed: PM29954184](#)
2. Clark RA. Telehealth in the elderly with chronic heart failure: what is the evidence? *Stud Health Technol Inform*. 2018;246:18-23.
[PubMed: PM29507256](#)
3. Pekmezaris R, Torte L, Williams M, et al. Home telemonitoring in heart failure: a systematic review and meta-analysis. *Health Aff (Millwood)*. 2018 12;37(12):1983-1989.
[PubMed: PM30633680](#)
4. Tse G, Chan C, Gong M, et al. Telemonitoring and hemodynamic monitoring to reduce hospitalization rates in heart failure: a systematic review and meta-analysis of randomized controlled trials and real-world studies. *J Geriatr Cardiol*. 2018 Apr;15(4):298-309.
[PubMed: PM29915620](#)
5. Yun JE, Park JE, Park HY, Lee HY, Park DA. Comparative effectiveness of telemonitoring versus usual care for heart failure: a systematic review and meta-analysis. *J Card Fail*. 2018 01;24(1):19-28.
[PubMed: PM28939459](#)
6. Baig MM, GholamHosseini H, Moqem AA, Mirza F, Linden M. A systematic review of wearable patient monitoring systems - current challenges and opportunities for clinical adoption. *J Med Syst*. 2017 Jul;41(7):115.
[PubMed: PM28631139](#)

7. Duan Y, Xie Z, Dong F, et al. Effectiveness of home blood pressure telemonitoring: a systematic review and meta-analysis of randomised controlled studies. *J Hum Hypertens*. 2017 07;31(7):427-437.
[PubMed: PM28332506](#)
8. Gorthi J, Hunter CB, Mooss AN, Alla VM, Hilleman DE. Reducing heart failure hospital readmissions: a systematic review of disease management programs. *Cardiol Res*. 2014 Oct;5(5):126-138.
[PubMed: PM28348710](#)
9. Nakamura N, Koga T, Iseki H. A meta-analysis of remote patient monitoring for chronic heart failure patients. *J Telemed Telecare*. 2014 Jan;20(1):11-17.
[PubMed: PM24352899](#)

Systematic Review of Systematic Reviews

10. Hanlon P, Daines L, Campbell C, McKinstry B, Weller D, Pinnock H. Telehealth interventions to support self-management of long-term conditions: a systematic metareview of diabetes, heart failure, asthma, chronic obstructive pulmonary disease, and cancer. *J Med Internet Res*. 2017 05 17;19(5):e172.
[PubMed: PM28526671](#)
11. Purcell R, McInnes S, Halcomb EJ. Telemonitoring can assist in managing cardiovascular disease in primary care: a systematic review of systematic reviews. *BMC Fam Pract*. 2014 Mar 07;15:43.
[PubMed: PM24606887](#)

Cardiac Rehabilitation

12. Chan C, Yamabayashi C, Syed N, Kirkham A, Camp PG. Exercise telemonitoring and telerehabilitation compared with traditional cardiac and pulmonary rehabilitation: a systematic review and meta-analysis. *Physiother Can*. 2016;68(3):242-251.
[PubMed: PM27909373](#)

Economic Evaluations

13. Dehmer SP, Maciosek MV, Trower NK, et al. Economic evaluation of the home Blood Pressure Telemonitoring and Pharmacist Case Management to control hypertension (Hyperlink) trial. *J Am Coll Clin Pharm*. 2018 Oct;1(1):21-30.
[PubMed: PM30320302](#)
14. Grustam AS, Severens JL, De Massari D, Buyukkaramikli N, Koymans R, Vrijhoef HJM. Cost-effectiveness analysis in telehealth: a comparison between home telemonitoring, nurse telephone support, and usual care in chronic heart failure management. *Value Health*. 2018 07;21(7):772-782.
[PubMed: PM30005749](#)

15. Herold R, Hoffmann W, van den Berg N. Telemedical monitoring of patients with chronic heart failure has a positive effect on total health costs. *BMC Health Serv Res*. 2018 04 10;18(1):271.
[PubMed: PM29636040](#)
16. Lanssens D, Vonck S, Vandenberg T, et al. A prenatal remote monitoring program in pregnancies complicated with gestational hypertensive disorders: what are the contributors to the cost savings? *Telemed J E Health*. 2018 Oct 30;30:30.
[PubMed: PM30376412](#)
17. Williams C, Wan TT. A cost analysis of remote monitoring in a heart failure program. *Home Health Care Serv Q*. 2016 Jul-Dec;35(3-4):112-122.
[PubMed: PM27552654](#)
18. Grustam AS, Severens JL, de Massari D, Koymans R, Vrijhoef H. The cost-effectiveness analysis of Philips Motiva telehealth system: a comparison between home telemonitoring, nurse telephone support and usual care in chronic heart failure. *Value Health*. 2015 Nov;18(7):A358.
[PubMed: PM26532026](#)
19. Blum K, Gottlieb SS. The effect of a randomized trial of home telemonitoring on medical costs, 30-day readmissions, mortality, and health-related quality of life in a cohort of community-dwelling heart failure patients. *J Card Fail*. 2014 Jul;20(7):513-521.
[PubMed: PM24769270](#)
20. Kaambwa B, Bryan S, Jowett S, et al. Telemonitoring and self-management in the control of hypertension (TASMINH2): a cost-effectiveness analysis. *Eur J Prev Cardiol*. 2014 Dec;21(12):1517-1530.
[PubMed: PM23990660](#)
21. Maeng DD, Starr AE, Tomcavage JF, Sciandra J, Salek D, Griffith D. Can telemonitoring reduce hospitalization and cost of care? A health plan's experience in managing patients with heart failure. *Popul Health Manag*. 2014 Dec;17(6):340-344.
[PubMed: PM24865986](#)

Cardiac Rehabilitation

22. Frederix I, Hansen D, Coninx K, et al. Effect of comprehensive cardiac telerehabilitation on one-year cardiovascular rehospitalization rate, medical costs and quality of life: a cost-effectiveness analysis. *Eur J Prev Cardiol*. 2016 May;23(7):674-682.
[PubMed: PM26289723](#)

Appendix — Further Information

Previous CADTH Reports

23. Telehealth for patients with cardiovascular disease: a review of the clinical effectiveness, cost-effectiveness and guidelines. (*CADTH Rapid response report: summary with critical appraisal*). Ottawa (ON): CADTH; 2016; <https://www.cadth.ca/sites/default/files/pdf/htis/jan-2016/RC0749%20Telehealth%20for%20cardiac%20care%20Final.pdf>. Accessed 2019 Apr 09.
24. Remote monitoring of cardiac devices. (*CADTH Top 10 new and emerging health technology watch list*). Ottawa (ON): CADTH; 2015; <https://www.cadth.ca/sites/default/files/cnesh/2015/cnesh2015-remote-monitoring-of-cardiac-devices-e.pdf>. Accessed 2019 Apr 09.
25. Telehealth for patients with heart failure: a review of the clinical effectiveness, cost-effectiveness and guidelines. (*CADTH Rapid response report: summary with critical appraisal*). Ottawa (ON): CADTH; 2015; <https://www.cadth.ca/sites/default/files/pdf/htis/dec-2015/RC0734%20Telehealth%20for%20heart%20failure%20Final.pdf>. Accessed 2019 Apr 09.
26. Telemedicine for patients with heart failure: clinical and cost-effectiveness. (*CADTH Rapid response report: reference list*). Ottawa (ON): CADTH; 2015; <https://www.cadth.ca/sites/default/files/pdf/htis/aug-2015/RA0795%20Telemedicine%20for%20Heart%20Failure%20Final.pdf>. Accessed 2019 Apr 09.
27. Telehealth for the assessment and follow-up of patients requiring cardiac care: a review of the clinical effectiveness, cost-effectiveness, and guidelines. (*CADTH Rapid response report: summary with critical appraisal*). Ottawa (ON): CADTH; 2015; <https://www.cadth.ca/sites/default/files/pdf/htis/june-2015/RC0674-Telecardiology-Final.pdf>. Accessed 2019 Apr 09.

Systematic Reviews and Meta-Analyses

Uncertain Outcome

28. Walker RC, Tong A, Howard K, Palmer SC. Patient expectations and experiences of remote monitoring for chronic diseases: systematic review and thematic synthesis of qualitative studies. *Int J Med Inf.* 2019 Apr;124:78-85. [PubMed: PM30784430](https://pubmed.ncbi.nlm.nih.gov/30784430/)

Systematic Review of Economic Evaluations – Unspecified Chronic Conditions

29. Peretz D, Arnaert A, Ponzoni NN. Determining the cost of implementing and operating a remote patient monitoring programme for the elderly with chronic conditions: a systematic review of economic evaluations. *J Telemed Telecare*. 2018 Jan;24(1):13-21.
[PubMed: PM27650163](#)

Systematic App Search

30. Jamaladin H, van de Belt TH, Luijpers LC, et al. Mobile apps for blood pressure monitoring: systematic search in app stores and content analysis. *JMIR Mhealth Uhealth*. 2018 Nov 14;6(11):e187.
[PubMed: PM30429116](#)

Overview of Systematic Reviews

31. Bashi N, Karunanithi M, Fatehi F, Ding H, Walters D. Remote monitoring of patients with heart failure: an overview of systematic reviews. *J Med Internet Res*. 2017 01 20;19(1):e18.
[PubMed: PM28108430](#)
32. Kitsiou S, Pare G, Jaana M. Effects of home telemonitoring interventions on patients with chronic heart failure: an overview of systematic reviews. *J Med Internet Res*. 2015 Mar 12;17(3):e63.
[PubMed: PM25768664](#)

Systematic Review Protocol

33. Heikkila A, Majjala V. Heart failure patients' experiences of mobile phone-based telemonitoring in self-care: a qualitative systematic review protocol. *JBI Database System Rev Implement Rep*. 2016 05;14(5):68-74.
[PubMed: PM27532464](#)