

CADTH Health Technology Review

Remote Monitoring Programs for Cardiac Conditions in Canada: An Environmental Scan

Authors: Shannon Hill, Ke Xin Li, Danielle MacDougall

Acknowledgement: Jeff Mason, Andrea Smith, Jonathan Harris

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Abbreviations

AHRQ	Agency for Healthcare Research and Quality
COPD	chronic obstructive pulmonary disease
ED	emergency department
EMRs	electronic medical records
HF	heart failure
HHM	home health monitoring
HQO	Health Quality Ontario
NLCAHR	Newfoundland and Labrador Centre for Applied Health Research
PEI	Prince Edward Island
PHIPA	<i>Personal Health Information Protection Act</i>
QoL	quality of life
RM	remote monitoring
RN	Registered Nurse

Key Messages

- This Environmental Scan aimed to provide an overview of the current remote monitoring landscape for chronic cardiac conditions in Canada and was informed through a limited literature search and a survey completed by key stakeholders across Canada.
- Based on the results from the limited literature search and survey responses, remote monitoring programs are currently offered in British Columbia, Ontario, New Brunswick, Prince Edward Island, and Newfoundland and Labrador for patients with chronic cardiac conditions such as heart failure and hypertension, and for patients eligible for cardiac rehabilitation. These remote monitoring programs share common components and are intended to allow for greater patient autonomy and engagement, improved quality of life, and fewer hospital visits and admissions.
- There are many operational considerations that inform the implementation of remote monitoring programs in Canada. These operational considerations can act as barriers or facilitators to establishing and developing new remote monitoring programs. The most common identified barriers to program implementation are resourcing and funding limitations, whereas the most common facilitators to program implementation are patient engagement and a recent uptake in remote care in the wake of COVID-19.
- There are also many operational considerations that impact the maintenance of established remote monitoring programs in Canada. Similar to the barriers that affect program implementation, resourcing and funding limitations are the most commonly identified barriers to the maintenance of established remote monitoring programs. Positive patient experiences and the application of a teams-based approach to care are common facilitators to program maintenance.
- There is a gap in the jurisdictional representation from some provinces and territories in remote monitoring programs for patients with chronic cardiac conditions in Canada.
- Evidence-based guidelines for Canadian remote monitoring programs for chronic cardiac conditions or cardiac rehabilitation in Canada were sought but did not yield any results.

Context

Cardiac conditions such as atrial fibrillation, heart failure (HF), and hypertension (high blood pressure) affect millions of Canadians and are a leading cause of death and hospitalization.¹⁻⁵ Many patients who could benefit from cardiac rehabilitation programs do not or cannot access them.^{6,7} Remote monitoring (RM) — also known as remote patient monitoring, telemonitoring, or remote patient management — is a type of telehealth whereby health care is delivered to patients outside traditional settings by allowing health data to be exchanged between patients and health care providers using telecommunication technologies (e.g., video conferencing) or stand-alone devices (e.g., portable heart rate monitors).^{8,9} RM for people living with cardiac conditions has been proposed as a means of detecting health issues earlier, while also reducing the need for routine office visits, emergency room visits, and hospital admissions.^{10,11} RM also aims to help people living with cardiac conditions maintain independence and remain in the home or community, which may be particularly relevant for those living in rural or remote communities.^{7,10,12,13} For conditions like hypertension, dozens of direct-to-consumer home monitors are readily available.¹⁴ Several manufacturers of RM technologies have recently begun marketing low-cost, direct-to-consumer devices capable of monitoring heart rate, heart rhythm, and blood pressure at home that have drawn media and

health care provider attention.¹⁵⁻¹⁸ Large telehealth providers have also emerged to support care for cardiac patients.^{19,20} However, there remains uncertainty and gaps in the evidence surrounding the use of RM.²¹ In addition to questions about clinical and cost-effectiveness, because of its reliance on data and internet connections, RM raises concerns about patient privacy and data security.^{7,13}

In Canada, RM of cardiac conditions has been, or is being, used and studied in a number of projects and jurisdictions.^{7,8,12,13,20,22,23} In 2018, the Newfoundland and Labrador Centre for Applied Health Research (NLCAHR) completed an environmental scan that identified RM programs in place across Canada and selected international jurisdictions for chronic conditions to “inform the implementation and evaluation of [RM] for those living with chronic disease in remote and rural [Newfoundland and Labrador].”²⁴ The authors identified 22 RM programs (or initiatives) active in the previous 5 years, 11 of which were in Canada and enrolled people with cardiac conditions. Of these 11 Canadian RM programs, some of which enrol more than 1 type of patient group:

- 8 were available to people with HF
- 2 were for people with hypertension and one for pulmonary hypertension
- 1 was for cardiac rehabilitation
- 2 were available to all people with chronic diseases
- 1 was open to all people in the province with a provincial health card.

These 11 RM programs were available to residents of British Columbia, Newfoundland and Labrador, New Brunswick, Ontario, Prince Edward Island (PEI), and Quebec. The scan also identified an additional 10 pilot RM programs or ongoing research studies from Canada. The NLCAHR environmental scan did not discuss barriers or facilitators to implementation, nor did it evaluate the RM programs identified.

CADTH has previously conducted rapid reviews of telehealth for HF, hypertension, coronary artery disease requiring cardiac rehabilitation, and implantable cardiac devices.^{25,26} Additional health technology assessments and systematic reviews have been published in this area by the Alberta Heritage Foundation for Medical Research (2004),²⁷ the US Agency for Healthcare Research and Quality (AHRQ) (2007),²⁸ Canada Health Infoway (2014),⁸ the Cochrane Collaboration (2015),²⁹ and Health Quality Ontario (HQO) (2018).¹⁰ This Environmental Scan is part of a larger CADTH Optimal Use report that is meant to address decision problems that surround the current landscape of RM programs for cardiac conditions within Canada.³⁰ The NLCAHR environmental scan was used to identify potential contacts to help inform this Environmental Scan.

The stage of diffusion of RM programs varies across the country and, while there is broad interest in the topic, the needs of each jurisdiction vary greatly depending on the level of adoption of RM technologies. To help inform decision-making, CADTH conducted an Environmental Scan to identify and summarize active RM programs and the components that make up these programs for chronic cardiac conditions. In addition, to help inform decision-making surrounding the implementation of new RM within Canada, this Environmental Scan also sought to provide information regarding operational considerations for RM programs at the system or site level.

Objectives

The key objectives of this Environmental Scan are, as follows:

1. Describe the RM programs and their components for chronic cardiac conditions and cardiac rehabilitation that are currently available in Canada.
2. Describe operational considerations for implementation or maintenance that contribute to the establishment or lack of RM programs for chronic cardiac conditions and cardiac rehabilitation at the system or site level in Canada.

This Environmental Scan does not include the intervention of implantable cardiac devices, such as pacemakers or implantable cardioverter defibrillators, which have been covered via existing health technology assessment work in Canada.¹⁰

Methods

The findings of this Environmental Scan are based on a limited review of the literature and responses received from a survey. A description of these components is subsequently below. Table 1 outlines the criteria for information gathering and selection.

Research Questions

The literature review and survey aimed to address the following questions:

1. What RM programs are currently offered for patients with chronic cardiac conditions or cardiac rehabilitation in Canada and what are their components?
2. What are facilitators and barriers to establishing, delivering, and/or expanding RM programs for chronic cardiac conditions or cardiac rehabilitation in Canada?
3. What are current evidence-based guidelines for RM programs for chronic cardiac conditions or cardiac rehabilitation in Canada?

Literature Search

A limited literature search was conducted by an information specialist on key resources including MEDLINE (1946[®]) via Ovid, Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Cochrane Library, the University of York Centre for Reviews and Dissemination (CRD) databases, the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search strategy comprised both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were RM and chronic cardiac conditions. Search filters were applied to limit retrieval to guidelines. Where possible, retrieval was limited to the human population. The original search was also limited to English- and French-language documents published until April 13, 2020. Regular alerts updated the search until project completion; only citations retrieved before December 1, 2020, were incorporated into the analysis. A supplemental grey literature search was completed on October 07, 2020. This search was completed to identify RM programs for cardiac conditions and was not limited by study type.³¹

Screening and Study Selection

One author screened the title and abstracts of citations retrieved from the literature searches for articles that met the inclusion criteria (Table 1). Potentially eligible citations were retrieved for full-text review. For the literature describing programs for RM for chronic cardiac conditions or cardiac rehabilitation in Canada, reference lists of eligible reports were scanned to identify further relevant information. When several relevant reports for a particular intervention or RM program were identified, the most recent report and/or the report judged to be most relevant was selected. Evidence-based guidelines for RM programs for chronic cardiac conditions or cardiac rehabilitation in Canada were sought but did not yield any results

Survey

A survey was conducted to identify remote monitoring programs currently available in Canada and the facilitators and barriers to establishing, delivering, and/or expanding RM programs for chronic cardiac conditions or cardiac rehabilitation in Canada and to complement the literature review. The survey comprised 22 questions and was distributed using the SurveyMonkey platform (www.surveymonkey.com). The questions were reviewed and piloted within SurveyMonkey by independent CADTH researchers who were not involved with the project. The questions consisted of a combination of dichotomous, categorical, and open-ended questions (Appendix 1). The questions were designed to capture:

Table 1: Components for Literature Screening and Information Gathering

Criteria	Description
Population	People living with a chronic cardiac condition, specifically: <ul style="list-style-type: none"> • heart failure • atrial fibrillation • hypertension • or who were otherwise eligible for cardiac rehabilitation for an acute or chronic cardiac condition
Intervention	Remote monitoring programs for chronic cardiac conditions or rehabilitation post-cardiac event ^a (or remote patient monitoring, telemonitoring, tor remote patient management), specifically those that are: <ul style="list-style-type: none"> • formal remote monitoring offered by a health care organization • telecommunication technologies (e.g., video conferencing) • programs offering stand-alone devices used for gathering remote monitoring information (e.g., portable heart rate monitors)
Settings	Primary, tertiary, community, or long-term care facilities and in the home in rural, remote, and urban areas
Types of information	<ul style="list-style-type: none"> • Descriptions of components of remote monitoring programs (e.g., staff, monitoring devices, duration) • Description of operation considerations for the implementation of remote monitoring programs (e.g., barriers and facilitators) • Evidence-based guidelines with recommendations regarding remote monitoring for the management of heart failure, atrial fibrillation, hypertension, or for patients eligible for cardiac rehabilitation

^aFor the management of patients with the included cardiac conditions, not diagnosis or detection of the cardiovascular conditions.

- the RM programs available in Canada, and their components, for chronic cardiac conditions and cardiac rehabilitation
- the factors that contribute to the establishment or lack of RM programs for chronic cardiac conditions and cardiac rehabilitation at the system or site level in Canada.

The survey opened on July 8, 2020 and responses were received until September 15, 2020. One email reminder was sent to non-responders and partial responders. The survey was distributed electronically to key jurisdictional informants and stakeholders. Survey respondents were identified through CADTH's Implementation Support and Knowledge Mobilization team networks; publications and agencies identified while reviewing the literature, with the intention of getting representation from each jurisdiction; as well as rural, remote, and urban settings. Participants were also asked to provide the names and contact information to any colleagues or existing RM programs who should be contacted as additional potential survey respondents. Any new contacts were then invited to participate in the survey. The following categories of respondents were eligible:

- coordinators, managers, or administrators of provincial or territorial telehealth or RM services or programs
- coordinators, managers, or administrators of regional telehealth or RM services or programs
- coordinators, managers, or administrators of hospital-based telehealth or RM services or programs.

Contacts involved in RM services or program delivery through a private practice were not eligible to respond to the survey. All respondents gave explicit permission to use the information they provided in this report. Survey respondent information from eligible respondents is outlined in Appendix 2.

Synthesis Approach

The findings from the literature search and survey results are summarized narratively, grouped by objective, and reported based on common findings across jurisdictions. Findings from the literature search are presented separately from survey results. Feedback from respondents who gave consent to use their survey information were included in the report. Survey responses were excluded if they were deemed incomplete or provided information on RM programs that are out of scope, as highlighted by the Environmental Scan objectives. Survey responses were deemed incomplete if answers to questions were blank, despite the respondent providing demographical information. All responses were included when there were multiple eligible responses from 1 organization.

Findings

The findings are based on the literature search and survey results, and are presented by the objectives of this report. The literature search identified a total of 222 citations. Of these, 5 were selected for full-text screening. One non-randomized study³² was selected for inclusion to provide information for Objective 1. Additionally, 1 randomized controlled trial³³ was

identified through an updated literature search and was also selected for inclusion to provide information for Objective 1. An updated search of the grey literature was conducted and the search yielded 4 documents that provided information regarding additional RM programs for cardiac conditions in Northern British Columbia and Ontario. One additional document was identified through stakeholder feedback, which provided an overview of telehomecare programs for patients with chronic HF and hypertension among various other conditions not related to this Environmental Scan.³⁴ Initially no relevant literature was identified for Objective 2; however, 1 article was identified in a literature search update that provided information related to RM program implementation. No evidence-based guidelines regarding RM programs for chronic cardiac conditions or cardiac rehabilitation in Canada were identified in the literature search.

The survey results are presented by jurisdiction based on respondent information. Sixty-one individuals were invited to participate in the survey. The survey yielded 21 responses, of which 17 were marked as complete and 4 as incomplete; however, not all questions needed to be answered in order to be marked as complete. Fourteen survey respondents from British Columbia, Manitoba, Ontario, New Brunswick, PEI, and Newfoundland and Labrador were eligible to be included in the findings. Of the 14 respondents, 2 survey respondents from British Columbia indicated that RM was being used in their jurisdiction, but no additional information was provided regarding the RM programs. Survey respondents were deemed eligible for inclusion in the findings if respondents provided information that was complete and offered relevant information within the scope of the Environmental Scan outlined in Table 1. A full outline of the survey respondent information and response characteristics from eligible respondents is available in Appendix 4, Table 4.

Objective 1: Remote monitoring programs and their components in Canada

Literature Results

One pretest–post-test study was identified that provided a description of an active RM program currently available in Canada. The pretest–post-test pragmatic study³² described the intervention – the Medly Program in Ontario – including a patient-facing telemonitoring app that provides self-care feedback messages and suggests when to contact care providers. The Medly Program contains a telemonitoring system in the form of a patient-facing app on a smartphone, with an algorithm to provide patients with personalized self-care messages and to alert members of their core HF care team when clinical intervention may be required.³² With the app, patients self-record weight, blood pressure, and heart rate using weight scales and blood pressure monitors.³² Patients also report symptoms by answering a series of questions.³² The data are processed by the algorithm embedded within the app that classifies a patient's current health status into 1 of 9 states based on whether a value is above or below target thresholds set by the clinical team.³² The app then displays self-care messages to patients, confirms when everything is normal, instructs patients to take their prescribed diuretic medication, and suggests that patients contact care providers or visit the emergency department (ED).³² The study³² showed benefits for RM outcomes in health service utilization, clinical measurements, quality of life (QoL), and patient self-care outcomes, as summarized in Appendix 3, Table 1. One randomized controlled trial³³ was identified in an updated literature search that compared remote medication titration delivered using data from the Medly Program telemonitoring system versus standard titration performed during in-person visits for patients with HF. This study was conducted through the University of Toronto and the University Health Network, where patients were recruited and patient data were

stored.³³ The Medly Program was used to monitor patient data in both patient groups. The intervention group received remote titration, whereby participants were provided feedback over the telephone every 2 weeks in order to perform medication changes based on the Medly Program data.³³ The control group received regular titration, whereby participants attended regular in-person visits and medication changes were performed based on Medly data.³³ This study found that through telemonitored remote titration, more HF patients were able to achieve the target medication dose in a shorter time and with fewer remote visits compared to usual care.³³ The results of this study suggest that telemonitored remote titration for HF patients may contribute to more optimal clinical resource use by allowing remote therapy for more stable patients, at the same time freeing up resources for patients that require in-person treatment.³³ A detailed summary of this study is provided in Appendix 3, Table 1.

Additional RM programs were identified through a limited grey literature search. The NLCAHR environmental scan was identified in the limited grey literature search and, as previously mentioned, this Environmental Scan identified 11 active RM programs or initiatives in Canada.²⁴ These programs are available to individuals with HF, hypertension, for cardiac rehabilitation purposes, and for additional chronic diseases.²⁴ The active RM programs outlined in this Environmental Scan are available in British Columbia, Ontario, Quebec, New Brunswick, PEI, and Newfoundland and Labrador.²⁴ The Network of Regional to Tertiary Healthcare (NORTH) heart function clinic is a telehealth program that is part of a cardiac care program offered through Northern Health in British Columbia.³⁵ The NORTH heart function clinic offers HF medical management and education.³⁵ Referred patients are connected to a cardiac specialist and are able to access group education sessions through videoconferencing.³⁵ The Heart Function Clinic offered through the Scarborough Health Network provides telehealth support to HF patients and caregivers.³⁶ The purpose of the program is to help manage patient's heart function through physical assessments, ongoing education, and symptom and condition monitoring to reduce ED visits and hospital admissions.³⁶ Another Heart Function Clinic offered through Niagara Health provides an outpatient service for HF patients that includes telephone counselling and home monitoring with Community Care Access Centre involvement.³⁷ The goal of the program is to improve patient stability, avoid hospital admissions, and improve QoL through monitoring and managing patient conditions and symptoms.³⁷ The St. Mary's General Hospital in Kitchener, Ontario is offering its cardiac rehabilitation program remotely in response to the recent COVID-19 pandemic.³⁸ The home-based program offered telephone and virtual care access to cardiac specialists and nurse practitioners to help manage and educate patients during their cardiac rehabilitation process.³⁸

Canada Health Infoway has also published an overview of various telehomecare programs within the Canadian and international context. This overview provided a look at the effectiveness of telehomecare and remote patient monitoring for health outcomes related to chronic HF and hypertension.³⁴ Other various health conditions were also included in the overview; however, chronic HF and hypertension were the only conditions listed that are within the scope of this Environmental Scan. The overview regarding patients' chronic HF included various telehealth technologies focusing on telephone-based monitoring, automated monitoring of patient symptoms, and automated physiologic monitoring.³⁴ The overview mainly reported on home telemonitoring effects related to all-cause mortality, cardiovascular or HF-related mortality, hospitalizations and ED visits, and QoL.³⁴ Evidence from this report suggested that various telehealth technologies may be more beneficial for reducing all-cause mortality, HF-related mortality, and HF-related hospitalizations.³⁴ Additionally, telehealth interventions that monitored patient's symptoms and physiologic findings suggested a

reduction in mortality risk, while QoL were reported to be similar to, or better than, usual care.³⁴ The overview regarding patients with hypertension included telehealth services provided by telephone, mobile phone, modem, internet, or email.³⁴ This overview mainly focused on outcomes related to change in blood pressure, proportion of patients with controlled blood pressure, and QoL.³⁴ Despite the low quality of evidence reported, studies did indicate that telehealth technologies may improve blood pressure control in patients with hypertension.³⁴ It should be noted that this overview did not provide specific details of telehomecare and remote patient monitoring programs within Canada, but evidence for the effectiveness of telehomecare technologies was supported in this report.

Survey Results

Nine survey respondents from British Columbia, Ontario, New Brunswick, PEI, and Newfoundland and Labrador provided a description and details regarding the components of the RM program that is active within their jurisdiction. Two additional survey respondents from British Columbia indicated that there is an active RM program within their jurisdiction; however, additional survey questions were not answered and limited details of the program were provided. A full outline of the description and component details of the RM programs identified from the survey responses is provided in Appendix 4, Table 4.

Heart failure was identified as the most common condition among RM programs across each jurisdiction. One identified RM program from New Brunswick indicated that, in addition to HF, the RM program also offered cardiac rehabilitation for acute and chronic cardiac conditions. Many of the identified RM programs had similar objectives related to patient management, cardiac surveillance, general health education and self-care, and delivery of early interventions based on cardiac feedback. These objectives are intended to allow for greater patient autonomy, greater patient engagement in their own care, improved QoL, and a reduction in health care burden, with fewer hospital visits and admissions. Programs are offered in both urban and rural settings across all jurisdictions identified in the survey, which would indicate an increase in access to care for people living with chronic cardiac conditions. The RM programs also provide patients with cardiac feedback related to the management or recommended change in patient care. The frequency of monitoring feedback varies between daily or weekly feedback across jurisdictions and is typically delivered via telephone or email from a health care or cardiac professional. Some RM programs, like the Medly Program in Ontario, use designated software from a smartphone app to monitor and provide feedback to patients. This indicates the variety in technology used to deliver RM programs across Canada.

Respondents from British Columbia, PEI, and Newfoundland and Labrador referenced additional documents that provided overviews and evaluations of the RM programs identified in the survey. Respondents from the Vancouver Island Health Authority (Island Health) and the University of British Columbia provided an additional document that was completed in 2018 regarding the evaluation of the RM program.³⁹ The purpose of this document was to provide an overview and evaluation for the Home Health Monitoring (HHM) initiative to assess the implementation and intended outcomes of the program. The HHM initiative is a free service that aims to provide clients with the ability to manage their own health from home and improve their understanding of their conditions.³⁹ The HHM initiative was captured in the NLCAHR environmental scan, which provides a more detailed scope of the program.²⁴ Island Health partnered with British Columbia's HHM initiative to implement a standardized service for its clients living with HF and has since undergone an expansion project to provide the HHM service to all the HF patients within the Island Health jurisdiction.³⁹ The respondent from Health PEI indicated an additional document for the evaluation of the RM program that was

completed in 2017.²² The purpose of the document was to fulfill the Canada Health Infoway project requirement to provide a benefits evaluation report for the Health PEI Remote Patient Monitoring Program.²² The Remote Patient Monitoring Program was captured in the NLCAHR environment scan and a detailed description of the Program is provided in the report.²⁴ This identified document evaluated and reported on acute care resource use, clinical efficacy, and quality and access to care outcomes.²² The respondent from Eastern Health in Newfoundland and Labrador also indicated an additional document for the evaluation of the RM program conducted by Eastern Health.⁴⁰ This document is an evaluation of the Eastern Health Remote Patient Monitoring program and examines patient perceptions of the program and the impact of the program on hospital use.⁴⁰ The Eastern Health Remote Patient Monitoring program was captured in the NLCAHR environment scan.²⁴

Objective 2: Operational considerations for remote monitoring program implementation or maintenance

Literature Results

One article was found from an updated literature search that provided information regarding the operational considerations for the implementation of an RM program for cardiac rehabilitation in Canada. The article provided guidance on the implementation of virtual cardiac rehabilitation in the wake of the COVID-19 pandemic in Canada. Virtual cardiac rehabilitation refers to remote interactions between patients and care providers, and can offer an alternate delivery of in-person, centre-based cardiac rehabilitation.⁴¹ Common virtual cardiac rehabilitation delivery methods include telephone, videoconferencing, various messaging solutions, smartphone applications, online platforms, and wearable devices.⁴¹ Reported challenges and obstacles for the implementation of virtual cardiac rehabilitation programs include resource limitations, preference for in-person interactions, supervision and risk stratification difficulties, and lack of delivery standards for virtual cardiac rehabilitation programs.⁴¹ Additionally, the potential for limited access to technology and a lack of technology literacy may promote gaps in care delivery to vulnerable populations.⁴¹ The aim of implementing virtual cardiac rehabilitation programs was to focus on the use of existing resources, equipment, and technology – rather than a restructuring of the program – to allow for rapid delivery of the program.⁴¹ The suggested goals of implementing a virtual cardiac rehabilitation program are to prioritize basic, safe, and timely care, particularly if there is no previously established virtual cardiac rehabilitation program.⁴¹ It is suggested that all patients who would be eligible for in-person cardiac rehabilitation services be considered to participate in virtual cardiac rehabilitation programs and that a plan for the development and sustainability of a virtual cardiac rehabilitation program be considered for future planning.⁴¹

Survey Results

The respondents of the survey were asked to provide information related to the barriers and facilitators that contribute to the establishment or lack of RM programs within their jurisdiction. These barriers and facilitators were meant to inform the operational considerations for the implementation of RM programs that have not yet been established or the maintenance of RM programs that are already active in different jurisdictions. Respondents were also asked to distinguish any identified barriers or facilitators at the micro, meso, and macro operational levels. These levels were defined in the survey as staff or patient factors for the micro level, facility or regional factors for the meso level, and health system factors for the macro level.⁴² A full outline of the operational considerations for the

implementation or maintenance of RM programs provided by the survey respondents is available in Appendix 4, Table 4.

Implementation Considerations

Three survey respondents in Manitoba indicated that an RM program was in development at the time of the survey. These survey respondents were able to offer operational considerations for the implementation of an RM program within their jurisdiction. The respondents representing Manitoba's development of an RM program identified many barriers and facilitators at each operational level. The common barriers to implementation reported by the Manitoba respondents were mostly represented in the meso and macro operational level. These barriers included general funding implications from the federal and provincial level, program approval, connectivity and infrastructure considerations, program dissemination considerations at the regional level, concerns surrounding *The Personal Health Information Act*, and considerations for the development of a remuneration model for remote activities. There were also shared barriers in the micro operational level, which include the general preference for in-person health care, adequate patient management strategies, lack of proficiency with technology, and access to program essentials (e.g., internet access). Furthermore, the respondents indicated that there are cultural barriers to be mindful of when implementing an RM program. These additional barriers include language and a general awareness for cultural sensitivity. Similar to the identified barriers, the respondents also indicated common facilitators that would contribute to the implementation of an RM program. Many of the reported facilitators were aimed at the micro operational level and included themes like the adoption of a patient-centred approach to care, development of culturally sensitive program tools, and consideration for the development of resources for caregivers. Larger considerations that were suggested to facilitate the implementation of RM programs include access to funding for staff to improve patient support, widespread availability of high-speed internet, and the use of electronic medical record metrics for tracking and evaluation purposes. One of the respondents also noted that with the recent adoption of remote care caused by COVID-19, there has been a change in the alignment of the health system to implement more remote care across the jurisdiction.

Maintenance Considerations

Respondents from British Columbia, Ontario, New Brunswick, PEI, and Newfoundland and Labrador provided information related to the operational considerations for maintaining established RM programs within their jurisdictions. Many of the respondents across different jurisdictions provided common barriers and facilitators to maintain active RM programs. The most commonly reported barrier to maintaining RM programs across each jurisdiction was the lack of available resources needed for optimal program execution. The lack of available resources spans across the micro, meso, and macro operational levels. These resources include general funding from regional and provincial bodies, and adequate health professional staffing to operate and review monitoring information. Additionally, lack of patient engagement and clinician buy-in was commonly reported as a barrier across jurisdictions. Respondents from British Columbia, Ontario, and Newfoundland and Labrador acknowledge challenges to integrating an RM program in the existing health care system. For example, the respondent from Ontario reported the RM systems lack interoperability and integration with electronic medical records across organizations. Similar micro operational level barriers to implementation were also reported with the maintenance of RM programs. A commonly reported micro operational level barrier to maintaining RM programs was the lack of technological literacy that impedes the success of remote programs. Many of the facilitators to maintaining the RM programs across jurisdictions were related to patient experience

and the application of a team-based approach to care. Respondents from British Columbia, Ontario, and Newfoundland and Labrador reported that RM programs were perceived to provide a positive patient experience. Newfoundland and Labrador report patient experience surveys that indicate an extremely high rate of satisfaction with program elements related to goal setting, coaching support, and QoL. Additionally, respondents across jurisdictions report better patient support through a team-based approach used by RM programs. Respondents from British Columbia and Newfoundland and Labrador also reported that they observed that RM programs reduce hospital admission rates, which would be considered a sound macro level facilitator to maintaining RM programs within their jurisdictions.

Limitations

This Environmental Scan aims to provide an overview of current Canadian RM programs and operational considerations and is not intended to be a comprehensive review on the topic of RM. Due to the extensive body of literature relating to the topic of RM, the literature review was restricted to evidence from Canada and subsequently no evidence-based guidelines were identified in the literature search. Since this Environmental Scan is primarily focused on RM within the Canadian context, evidence and topics discussed lack generalizability to the international RM community. The information from the survey results is based on the personal opinions, experiences, and perspectives of the respondents regarding RM from their own organization. Because of the nature of the survey responses, this may not be completely representative of RM within the respondent's jurisdiction. The survey results are informed by a small sample size of eligible respondents and does not represent all jurisdictions across Canada. As the RM landscape for chronic cardiac conditions is broad, it may be challenging to compare program effectiveness across organizations or Canadian jurisdictions. Additionally, inter-jurisdictional access to RM may be covered or funded differently depending on the province or territory; therefore, operational considerations for an RM program cannot be generalized across Canada. This is evident from the responses received regarding the operational considerations for the implementation of an RM program that was informed by survey responses from stakeholders from 1 jurisdiction.

Conclusions and Implications for Decision- or Policy-Making

This Environmental Scan aims to provide an overview of the RM landscape in Canada for chronic cardiac conditions by describing active remote monitoring programs and identifying operational considerations for RM development. Information was provided by a survey and a limited literature search, including grey literature. The survey was completed by targeted stakeholders and offered information and experiences from individuals who are closely involved in RM programs across Canada. This Environmental Scan was meant to add to the existing knowledge of RM programs within Canada that were outlined in the NLCAHR environment scan completed in 2018.²⁴

The identified non-randomized study from the limited literature search described the RM program characteristics of the Medly Program based in Ontario. According to the information

presented in the study, the Medly Program was developed for HF patients, with personalized care messages and alerts for when to contact a care provider. The study provided outcomes related to health care utilization, various clinical outcomes, QoL, and self-care measurements, and concluded that the Medly Program reduced health service utilization and improved clinical, QoL, and patient self-care outcomes.³² An additional randomized controlled trial described the use of telemonitored remote titration for the medical therapy of patients with HF. This study found that remote titration is more efficient in providing adequate medication dosages to HF patients compared to usual in-person care.³³ Neither study was critically appraised as part of this Environmental Scan. Additional RM programs in British Columbia and Ontario were identified from a limited grey literature scan and the main components and objectives were highlighted. A literature overview conducted by Canada Health Infoway, which focused on the effectiveness of telehomecare and remote patient monitoring, was also provided in the findings.³⁴

Based on the results from the survey, there are active RM programs working in multiple jurisdictions across Canada. Many of these identified RM programs have been captured by the NLCAHR environmental scan; however, the eligible survey respondents provided perspectives and experiences from within the organization. Respondents from each jurisdiction reported that RM programs were developed for HF patients, with some programs from British Columbia and Newfoundland and Labrador reporting hypertension as an additional cardiac condition. Many of these programs share common components related to the targeted chronic cardiac conditions, program objectives, monitored data, and feedback delivery. The RM programs across jurisdictions share program components that aim to provide cardiac patient management, symptom monitoring to reduce hospital utilization, and engage clients in their care pathway.

The operational considerations that contribute to implementing an RM program were highlighted by 1 identified article from an updated literature search and through the survey responses from individuals from Manitoba. The article provided challenges and guidance suggestions for the implementation of virtual cardiac rehabilitation programs in Canada in the wake of COVID-19. The survey respondents from Manitoba indicated that there was no established RM program at the time of the survey, but that a program was in development. These respondents provided operational level barriers and facilitators that contribute to the implementation of an RM program. Common barriers that were identified were resourcing and funding limitations, cultural and language barriers, and complications from a current health systems transformation perspective. Facilitators that were highlighted among respondents include a recent push for RM programs, patient engagement, and physician buy-in. Operational considerations that contribute to the maintenance of established RM programs were highlighted from the survey results from respondents in British Columbia, Ontario, New Brunswick, PEI, and Newfoundland and Labrador. Resourcing and funding were common barrier themes, while patient engagement and utility of a teams-based approach to care were common facilitators to maintaining RM programs. It was also reported that maintaining established RM programs was observed to lead to a reduction in hospital admission rates.

Although many of the highlighted RM programs in this Environmental Scan share common components, it should be mentioned that operational considerations vary between jurisdictions in Canada. RM programs should be developed in a way that meets the needs of the patients who will be directly benefiting from the programs. Additionally, the findings only report on the RM programs from some jurisdictions across Canada. The aim of this Environmental Scan was to provide an overview of current RM programs in operation and

to highlight key factors for implementing future programs in Canada. However, it should be noted that there is a lack of complete jurisdictional representation across the provinces and territories. This Environmental Scan is 1 part of a larger CADTH Optimal Use project that aims to provide information regarding the appropriate use of RM programs within Canada.³⁰

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Appendix 1: Survey

General

Are you currently involved in any capacity with delivering remote monitoring programs or considering providing these programs for patients with cardiac conditions?

- Yes
- No

In which jurisdiction do you work?

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Nunavut
- Ontario
- Prince Edward Island
- Quebec
- Saskatchewan
- Yukon
- Federal

Do you work in one or more of these settings? (Select all that apply.)

- Primary care clinic
- Hospital or specialist clinic
- Cardiac rehabilitation centre
- Long-term care facility
- Health authority
- Provincial ministry of health
- Other (please specify):

Remote Monitoring Program Components

Do you have remote monitoring program(s)?

- Yes, established program
- Yes, currently being expanded
- Not currently, but in development
- No

Do you provide care to patients in one or more of these geographical settings? (Select all that apply.)

Note: Health Canada defines various levels of remote, ranging from remote isolated (i.e., no scheduled flights or road access and minimal telephone or radio service) through to non-isolated remote (i.e., road access and less than 90 km away from physician service).

- Urban (i.e., area with a population of at least 1,000 and no fewer than 400 persons per square kilometre)
- Rural (i.e., not fitting the definition of “urban” or “remote”)
- Remote (Please self-identify based on your local understanding of the aforementioned criteria.)

For which conditions do you have programs? (Select all that apply.)

- Heart failure
- Atrial fibrillation
- Hypertension
- Cardiac rehabilitation (for chronic or acute conditions)
- Other (please specify)

Please describe the objectives of your remote monitoring program(s).

Who is eligible for your remote monitoring program(s)?

What is monitored? (Select all that apply.)

- Blood pressure
- Pulse
- Blood glucose
- Weight
- Blood oxygen
- Electrocardiogram (ECG or EKG)
- Pulmonary artery (PA) pressure
- Diet
- Exercise
- Other (please specify)

What is the frequency of monitoring data?

- Daily
- Weekly
- Every two weeks
- Monthly
- Other (please specify)

What types of feedback are offered when the monitoring data are received? (Select all that apply.)

- Medication adjustment
- Change in frequency of monitoring
- Advice for in-person follow-up with a health care professional

- Health education (e.g., diet, exercise information, and recommendations)
- No changes needed; continue with original instructions
- Other (please specify)

Who reviews monitoring data? (Select all that apply.)

- Nurse
- Nurse educator
- Exercise specialist
- Cardiac specialist
- Non-clinical program staff (please specify)
- Other (please specify)

How is feedback based on monitored data delivered? (Select all that apply.)

- Telephone
- Email
- Fax
- Designated software
- Other (please specify)

Barriers and Facilitators

Yes Arm (Question 5)

What are the barriers to maintaining the remote monitoring programs that you currently face in your jurisdiction? Please discuss barriers at the micro level (staff or patient level, including perceptions of remote monitoring, technology literacy, implementation challenges, etc.), meso level (clinic, facility, or regional level, including lack of technical infrastructure and expertise, lack of medical resources, data access challenges, etc.), and macro level (health system level, including lack of public funding, existing remuneration policies, lack of access to specialist care, etc.).

What are the facilitators to maintaining the remote monitoring programs that you currently face in your jurisdiction? Please discuss facilitators at the micro level (staff or patient level, including training and patient education, etc.), meso level (clinic, facility, or regional level, including access to tools, strategies, or guidelines, multidisciplinary teams, and availability of care platforms, etc.), and macro level (health system level, including policy change, etc.).

No Arm (Question 5)

What are the barriers to implementing the remote monitoring programs that you currently face in your jurisdiction? Please discuss barriers at the micro level (staff or patient level, including perceptions of remote monitoring, technology literacy, implementation challenges, etc.), meso level (clinic, facility, or regional level, including lack of technical infrastructure and expertise, lack of medical resources, data access challenges, etc.), and macro level (health system level, including lack of public funding, existing remuneration policies, lack of access to specialist care, etc.).

What are the facilitators to implementing the remote monitoring programs that you currently face in your jurisdiction? Please discuss facilitators at the micro level (staff or patient level, including training and patient education, etc.), meso level (clinic, facility, or regional level,

including access to tools, strategies, or guidelines, multidisciplinary teams, and availability of care platforms, etc.) and macro level (health system level, including policy change, etc.).

Identifying Remote Monitoring Programs

Are you aware of documents or other sources that you can make available that evaluate the remote monitoring programs in use in Canada or internationally? Please specify the title of the document or source.

Are you aware of any colleagues who, or other groups or organizations that, should receive this survey or should be contacted directly for stakeholder feedback?

- Yes
- No
- Other (if yes, please specify)

If required, would you be open or willing to participate in a follow-up email or phone interview regarding this survey and its content?

- Yes
- No
- Other (if yes, please provide name and preferred contact information — e.g., phone, email)

In the event that clarification is required for any of your answers, please provide your contact information.

- Name:
- Organization:
- Email:
- Phone:

Appendix 2: Information on Survey Respondents^a

Table 2: Jurisdiction and Organization for Eligible Survey Respondents

Jurisdiction (number of respondents)	Organization represented by survey respondents (number of respondents)
British Columbia (4)	Vancouver Island Health Authority University of British Columbia Provisional Health Services Authority Providence Health Care British Columbia
Manitoba (3)	St. Boniface Hospital Shared Health One respondent did not specify the represented organization
Ontario (1)	University Health Network
New Brunswick (1)	Horizon Health Network
Prince Edward Island (2)	Health PEI
Newfoundland and Labrador (3)	Eastern Health (2) Labrador-Grenfell Health

^aInformation in the table is from survey respondents who provided complete and eligible information based on the inclusion criteria outlined in Table 1 of the report.

Appendix 3: Study Details of Included Studies

Table 3: Study Characteristics and Author Conclusions of Included Non-Randomized Study

First author, publication year, jurisdiction, country, and funding	Study details	Authors' conclusions
Randomized controlled trials		
<p>Artanian et al. (2020)³³ Ontario Ted Rogers Centre for Heart Research, the Peter Munk Cardiac Centre site; and National Sciences and Engineering Research Council of Canada Discovery Grant</p>	<p>Study Design(s): Randomized controlled trial</p> <p>Population: Adults older than 18 years of age diagnosed with HF and followed by a cardiologist and not yet at target dose of medical therapy (N = 42)</p> <p>Intervention(s): Participants were called on the phone every 2 weeks to perform medication changes based on Medly Program data</p> <p>Comparator(s): Participants attended regular titration visits and were provided with the current standard of care, which included the Medly Program</p> <p>Clinical Outcomes:</p> <ul style="list-style-type: none"> • Number of visits required to achieve target medical therapy dose was 20 for the intervention group and 44 for the control group • Titration was complete in 12.3 weeks for the intervention group and 19.0 weeks for the control group • 90% of patients in the intervention group completed titration and 52% of patients in the control group completed titration <p>Patient Safety Outcomes:</p> <ul style="list-style-type: none"> • Total number of adverse events: <ul style="list-style-type: none"> ◦ 13 (62%) in the intervention group ◦ 10 (48%) in the control group • Most common adverse events (total): <ul style="list-style-type: none"> ◦ Hypotension – 29% of all events ◦ Dizziness – 26% of all events ◦ Hyperkalemia (increased potassium levels) – 16% of all events ◦ Fatigue – 16% of all events 	<p>“Remote titration increased the proportion of patients that achieved target doses, decreased the median time to dose optimization, and decreased the number of visits required to achieve target doses. In addition, remote titration may contribute to optimal use of clinic resources by enabling remote therapy optimization for more stable patients while freeing up clinic space and time for patients that require in-person follow-up. Lastly, by facilitating timely optimization of vital therapy for patients with HF and eliminating delays in therapy, remote titration could help reduce preventable disease progression.” (p. 11)</p>

First author, publication year, jurisdiction, country, and funding	Study details	Authors' conclusions
Non-randomized studies		
<p>Ware et al. (2020)³² Ontario Funding Not Reported</p>	<p>Study Design(s): Pretest-post-test pragmatic quality improvement study</p> <p>Population: Adults older than 18 years of age diagnosed with HF who were enrolled in the Medly Program between August 23, 2016 and January 31, 2019 (N = 315)</p> <p>Intervention(s): The Medly Program, including a patient-facing telemonitoring app that provides self-care feedback messages and suggests when to contact care providers</p> <p>Comparator(s): Baseline before the Medly Program</p> <p>Health Service Utilization Outcomes:</p> <ul style="list-style-type: none"> • IRR comparing the number of HF-related hospitalizations between 6 months and baseline: 0.50 (P < 0.001) (interpreted as 50% reduction in the number of HF-related hospitalizations) • Reduction in all-cause hospitalizations: 24% (IRR = 0.76; P = 0.02) • Length of stay (HF-related and all-cause), ED visits (HF-related and all-cause), and outpatient clinic visits: no significant difference between baseline and 6 months <p>Clinical Outcomes:</p> <ul style="list-style-type: none"> • BNP: <ul style="list-style-type: none"> ◦ mean (minimum to maximum, SD) at baseline: 701.4 pg/mL (10.0 – 3852.1, 757.5) ◦ mean at 6 months: 540.3 pg/mL (10.0 – 3739.7, 725.2) ◦ statistically significant decrease • No significant change between baseline and 6-month values in sodium, creatinine, LVEF, predicted survival rate <p>Quality of Life Outcomes:</p> <ul style="list-style-type: none"> • mean (SD) MLHFQ total score: 53.2 (26.3) at baseline vs. 43.4 (26.0) at 6 months; statistically significant after adjusting for the control variable in the linear regressions • mean (SD) physical score: 22.9 (11.8) at baseline vs. 17.4 (11.9) at 6 months; statistically significant after adjusting for the control variable in the linear regressions 	<p>“This study presented the results of a pretest-posttest study to evaluate the impact of an HF TM program by comparing the change in outcome measures at 6-month follow-up with those at baseline. After controlling for key demographic and clinical variables, regression analyses found that enrollment in the TM program led to a 50% reduction in the number of HF-related hospitalizations, a 24% reduction in all-cause hospitalizations, and a 59% reduction in BNP values. In addition, enrollment in the TM program was associated with statistically and clinically significant improvements in HF-related QoL and self-care maintenance and management. This study suggests that a real-world HF TM program, which provides patients with self-care support and active clinical monitoring by their existing care team, can reduce health service utilization and improve clinical, QoL, and patient self-care outcomes.” (p. 11)</p>

First author, publication year, jurisdiction, country, and funding	Study details	Authors' conclusions
	<ul style="list-style-type: none"> • mean (SD) emotional score: 12.0 (7.5) at baseline vs. 10.2 (7.6), at 6 months; statistically significant after adjusting for the control variable in the linear regressions • linear regression of EQ-5D-5L scores (generic health status): no significant change <p>Self-Care</p> <ul style="list-style-type: none"> • Mean (SD) SCHFI scores for maintenance: 70.9 (16.8) to 78.5 (13.9); statistically significant (P < 0.001) after adjusting for the control variable in the linear regressions • Mean (SD) SCHFI scores for management: 64.2 (21.9) to 72.5 (19.1); statistically significant (P= 0.01) after adjusting for the control variable in the linear regressions • Mean (SD) SCHFI scores for confidence: 67.3 (20.4) to 69.7 (20.2); not statistically significant after adjusting for the control variable in the linear regressions 	

BNP = B-type natriuretic peptide; ED = emergency department; EQ-5D-5L = EuroQol 5-Dimensions 5-Levels questionnaire; HF = heart failure; IRR = incidence rate ratio; LVEF = left ventricular ejection fraction; N = number; Minnesota MLHFQ = Living With Heart Failure Questionnaire; TM = telemonitoring; QoL = quality of life; SCHFI = Self-Care of Heart Failure Index; SD = standard deviation; vs. = versus.

Appendix 4: Remote Monitoring Programs for Cardiac Conditions in Canada Based on Survey Responses^a

Table 4: Survey Respondent Characteristics and Descriptions of Remote Monitoring Programs

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
British Columbia			
<p>Vancouver Island Health Authority</p> <p>Urban, rural, and remote setting</p>	<p>Condition(s): Heart failure, hypertension, COPD, diabetes, COVID-19, and palliative care</p> <p>Objective(s)</p> <ul style="list-style-type: none"> • Self-management • Symptom management • Surveillance <p>Patient(s): Individuals who fit disease and program-specific eligibility and suitability criteria</p> <p>Monitoring and Frequency</p> <ul style="list-style-type: none"> • All daily: blood pressure, pulse, blood glucose, weight, blood oxygen, diet, exercise, symptoms <p>Feedback Offered: Health education</p> <p>Delivery of Feedback: Telephone or virtual visit by nurse</p>	<p>Barrier(s)</p> <ul style="list-style-type: none"> • Funding for more clinicians • Ability to integrate programs into clinical workflows <p>Facilitator(s): Strong support via virtual care</p>	<p>NR</p>

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
University of British Columbia Urban, rural, and remote setting	<p>Condition(s): Heart failure and Hypertension</p> <p>Objective(s): Patient support from unnecessary ED and hospitalization visits</p> <p>Patient(s): Individuals with hypertension or heart failure</p> <p>Monitoring and Frequency</p> <ul style="list-style-type: none"> • All daily: blood pressure, pulse, weight, blood oxygen <p>Feedback Offered</p> <ul style="list-style-type: none"> • Medication adjustment • Advice for in-person follow-up with a health care professional • Health education <p>Delivery of Feedback: Telephone by nurse</p>	<p>Barrier(s)</p> <ul style="list-style-type: none"> • Fit into normal workflow of health professionals and clinics • Data transmission and visualization • Demonstrate cost avoidance <p>Facilitator(s)</p> <ul style="list-style-type: none"> • Patient engagement and positive user experience • Demonstration of cost-effectiveness and hospital reduction rates • Team-based care 	NR
Manitoba			
St. Boniface Hospital	Remote monitoring program in development	NR	<p>Barrier(s)</p> <ul style="list-style-type: none"> • Funding • Approval to initiate program (health system transformations) <p>Facilitator(s): Strong staff and physician support</p>

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
<p>Shared Health (Manitoba) Urban, rural, and remote setting</p>	<p>Remote monitoring program in development</p>	<p>NR</p>	<p>Barrier(s)</p> <ul style="list-style-type: none"> • Connectivity and infrastructure for various settings • Change in practice for those delivering in-person care • Need for provincial approach service typically delivered by region <p>Facilitator(s)</p> <ul style="list-style-type: none"> • COVID-19 influencing the adoption of remote care approach • Aligns with system transformation framework • Patient-centred approach

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
Respondent organization and program setting not specified	Remote monitoring program in development	NR	<p>Micro level barrier(s):</p> <ul style="list-style-type: none"> • Preference with face-to-face care • Technology literacy • Access to program essentials (e.g., equipment, internet) • Language barriers • Multiple health issues • Interpreting advice from specialists • Access to medications • Risk of lack of support from staff • Lived experiences of urban versus remote patients <p>Meso level barrier(s)</p> <ul style="list-style-type: none"> • Geographic implications • Attracting and retaining health care staff to set up and operate equipment • Lack of Indigenous health care providers • Limited access to specialists • Urban sites lack provincial funding • Cultural bias • Lack of patient support flexibility • Lack of patient-specific care plan development

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
Respondent organization and program setting not specified (continued)	Remote monitoring program in development	NR	<p>Macro level barriers</p> <ul style="list-style-type: none"> • Limited access to specialists • Remuneration model for remote visits • Lack of evidence-based/core component practicality in rural and remote settings • Differences in federal and provincial funding • Lack of evidence-informed practice for comorbidity patient plans • PHIA versus user-friendly accessible technology • Remote and rural setting technology limitations • Cultural sensitivity • Remuneration model for specialists/PCP/ patients for virtual visits/group sessions • Remuneration across specialty areas that include counsel from other health care providers and elders • Lack of resources and supports for caregivers

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
Respondent organization and program setting not specified (continued)	Remote monitoring program in development	NR	<p>Micro-meso level facilitator(s)</p> <ul style="list-style-type: none"> • Development of culturally sensitive tools • Appropriate patient education • Food/beverages onsite for group sessions • Having a local to answer questions/clarify language • Providing resources and understanding to caregivers • Having resources within different communities to understand specific needs and access to educational programs • Having applicable educational material to the individual <p>Meso-macro level facilitator(s)</p> <ul style="list-style-type: none"> • Funding and staffing for 24-7 access to phone supports • High-speed internet • Proper remote monitoring equipment • Consistent interpretations of application of PHIA by regions • Reportable EMR metrics to facilitate tracking and evaluation of interventions

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
Ontario			
University Health Network (The Medly Program)	<p>Condition(s): Heart failure</p> <p>Objective(s)</p> <ul style="list-style-type: none"> • Developed to monitor patients at home in-between care episodes • Provides self-care messages • Alerts clinical teams if parameters fall outside of normal range • Aims to reduce health service utilization, improve clinical management of heart failure, and improve patient quality of life <p>Patient(s)</p> <ul style="list-style-type: none"> • Individuals with heart failure being followed by a cardiologist within an organization that offers the Medly Program • Patients are enrolled based on a joint decision process between patients and providers <p>Monitoring and Frequency</p> <ul style="list-style-type: none"> • All daily: blood pressure, pulse, weight, heart failure symptoms <p>Feedback offered</p> <ul style="list-style-type: none"> • Medication adjustment 	<p>Micro level barriers:</p> <ul style="list-style-type: none"> • Patients' unequal access to smartphones <p>Meso level barriers:</p> <ul style="list-style-type: none"> • Medical staff resourcing for reviewing or management of RPM data • Lack of interoperability/integration of RPM system with EMRs across organizations • Lack of convenient access to lab results obtained in the community • Lack of access to up-to-date medication list <p>Macro level barriers:</p> <ul style="list-style-type: none"> • Lack of public funding • Lack of remuneration policies for physicians involved in remote monitoring activities • RN scope of practice, which requires sign-off from MD or NP to manage certain routine adjustments to a patient's care plan in response to RPM alert <p>Micro level facilitator(s):</p> <ul style="list-style-type: none"> • Ease of use of the RPM system • BYOD model 	<p>NR</p>

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
	<ul style="list-style-type: none"> • Advice for in-person follow-up with a health care professional • Health education • No changes needed; continue with original instruction <p>Delivery of feedback: Telephone, email, designated software delivered on the Medly smartphone app monitored by nurses and cardiac specialists</p>	<ul style="list-style-type: none"> • Dedicated staff • Detailed training plans and supporting materials • Clinical champions <p>Meso level facilitator(s):</p> <ul style="list-style-type: none"> • Engaged leaders • Team-based approach to care 	
New Brunswick			
<p>Horizon Health Network Urban and rural setting</p>	<p>Condition(s): Heart failure and cardiac rehabilitation (for chronic or acute conditions)</p> <p>Objective(s): Provides a platform to upload video, audio, pictures, and documents</p> <p>Patient(s): All heart failure patients and some cardiac rehabilitation patients</p> <p>Monitoring and Frequency</p> <ul style="list-style-type: none"> • All weekly: blood pressure, pulse, blood oxygen, electrocardiogram <p>Feedback Offered</p> <ul style="list-style-type: none"> • Medication adjustment • Advice for in-person follow-up with a health care professional <p>Delivery of Feedback: Telephone or email by a nurse or medical director</p>	<p>Barrier(s): Staffing and patient's technology literacy</p> <p>Facilitator(s)</p> <ul style="list-style-type: none"> • Telehealth department and clinical engineering • IT supports the devices 	NR

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
Prince Edward Island			
<p>Health PEI Urban and rural setting</p>	<p>Condition(s): Heart failure and COPD Objective(s): Catch deteriorating patients early to prevent hospitalization Patient(s)</p> <ul style="list-style-type: none"> • Cardiac heart failure patients • COPD patients <p>Monitoring and frequency</p> <ul style="list-style-type: none"> • All daily: blood pressure, pulse, weight, blood oxygen <p>Feedback Offered</p> <ul style="list-style-type: none"> • Medication adjustment • Change in frequency of monitoring • Advice for in-person follow-up with a health care professional • Health education <p>Delivery of Feedback: Telephone by nurse</p>	<p>Barrier(s)</p> <ul style="list-style-type: none"> • Human resources • Physician engagement and communication <p>Facilitator(s)</p> <ul style="list-style-type: none"> • Funding • Expansion to cardiac rehab 	<p>NR</p>

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
<p>Health PEI Urban and rural setting</p>	<p>Condition(s): Heart failure and COPD</p> <p>Objective(s)</p> <ul style="list-style-type: none"> • Teach self-management of their chronic disease • Patient education of their chronic disease • Assisting patients with transitioning from diagnosis in hospital to living in community (most applicable to heart failure) • Identifying changing status and early intervention resulting in fewer ED visits and hospital admissions <p>Patient(s)</p> <ul style="list-style-type: none"> • Must be resident of PEI • Cannot live in long-term facility • Able to set up equipment • Access to telephone • Cannot have a barrier with language or cognition <p>Monitoring and Frequency</p> <ul style="list-style-type: none"> • All daily: blood pressure, pulse, weight, blood oxygen • Monday to Friday, excluding stat holidays <p>Feedback offered: Data outside of predetermined parameters</p> <p>Delivery of feedback</p> <ul style="list-style-type: none"> • Telephone by nurse • Trending reports are sent to the physician 	<p>Barrier(s)</p> <ul style="list-style-type: none"> • Micro level: <ul style="list-style-type: none"> ◦ Referrals from physicians ◦ Some patients struggle with technology • Meso level: <ul style="list-style-type: none"> ◦ Dependence on primary care network to help distribute kits and some networks are not engaged <p>Facilitator(s)</p> <ul style="list-style-type: none"> • Micro level: <ul style="list-style-type: none"> ◦ Being able to maintain the RPM staff • Meso level: <ul style="list-style-type: none"> ◦ Continued engagement from PCP and primary care staff • Macro level: <ul style="list-style-type: none"> ◦ Maintain current system support 	<p>NR</p>

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
Newfoundland and Labrador			
<p>Eastern Health Urban, rural, and remote setting</p>	<p>Condition(s): Heart failure</p> <p>Objective(s)</p> <ul style="list-style-type: none"> • Education • Self-management support • Monitoring to reduce ED visits and acute care admissions • Improve access to care <p>Patient(s): Adults with confirmed diagnosis and ED visit or acute admission in previous 12 months</p> <p>Monitoring and Frequency</p> <ul style="list-style-type: none"> • All daily: blood pressure, pulse, blood glucose, weight, blood oxygen, symptoms related to heart failure <p>Feedback Offered</p> <ul style="list-style-type: none"> • Advice for in-person follow-up with a health care professional • Health education • No changes needed; continue with original instructions • Goal setting • Motivational interviews <p>Delivery of Feedback: Telephone, designated software, Zoom platform embedded in system by nurse</p>	<p>Barrier(s)</p> <ul style="list-style-type: none"> • Clinician buy-in • Low referral rates (rates have steadily increased) • Integration to existing health data systems • Relatively low rates of pay for nurses providing care to the RPM, which may lead to turnover <p>Facilitator(s)</p> <ul style="list-style-type: none"> • Executive support is paramount • Patients love this program • Positive word of mouth • Ease of access to data • Strong clinical team to monitor patients 	<p>NR</p>

Respondent organization and program setting	Program components	Barrier(s)/facilitator(s) to maintaining the programs ^b	Barrier(s)/facilitator(s) to implementing the programs ^b
Eastern Health Urban, rural, and remote setting	<p>Condition(s): Heart failure, hypertension, and COVID-19</p> <p>Objective(s): Chronic disease self-management</p> <p>Patient(s): Patients based on clinical algorithms</p> <p>Monitoring and Frequency</p> <ul style="list-style-type: none"> • All daily: blood pressure, pulse, blood glucose, weight, blood oxygen, diet, exercise <p>Feedback Offered</p> <ul style="list-style-type: none"> • Change in frequency of monitoring • Advice for in-person follow-up with a health care professional • Health education • No changes needed; continue with original instructions • Motivational interviews <p>Delivery of Feedback: Telephone, email, designated software by a nurse, nurse educator or cardiac specialist</p>	NR	NR
Labrador-Grenfell Health	Respondent was not involved in RM		

COPD = chronic obstructive pulmonary disorder; ED = emergency department; EMR = electronic medical record; MD = medical doctor; NP = nurse practitioner; NR = not reported; PCP = primary care physician; PHIA = *The Personal Health Information Act*; RN = registered nurse; RPM = remote patient monitoring.

^aInformation in the table is from survey respondents who provided complete and eligible information based on the inclusion criteria outlined in Table 1 of the report.

^bIndividual respondents who indicated barriers and facilitators using micro, meso, and macro operational levels were reported according to the survey response.