

CADTH Health Technology Review

# Enablers for Remote Monitoring Programs for Cardiac Conditions: Lessons From the COVID-19 Pandemic

**Authors:** Aaron Naor

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## Key Messages

- Throughout the COVID-19 pandemic, Canada's health care system has experienced a dramatic shift toward virtual care. Patients with cardiac conditions are at an increased risk of adverse outcomes from COVID-19 infections, and for many, remote monitoring has been viewed as a safer form of health care delivery.
- This Policy Insight summarizes key facilitators and barriers to the implementation and expansion of remote monitoring programs for patients with cardiac conditions based on lessons learned during the COVID-19 pandemic. These include:
  - **Technology adoption** – Health care decision-makers should be aware of barriers to technology adoption, including both patient and clinician hesitation and varying levels of health and digital literacy. Developing an effective education program to train staff and patients can help overcome technological barriers to adoption.
  - **Program adaptation** – Transitioning programs to remote monitoring requires the consideration of a programs' operational elements, such as eligibility requirements, onboarding and assessments, appointment logistics, program equipment, roles and responsibilities of clinicians and staff, health human resource planning, and data infrastructure and management.
  - **Regulatory and legislative changes** – Policies that support enhanced interprovincial licensure and reimbursement for remote monitoring services are examples of policy changes that would foster a regulatory environment conducive to remote monitoring programs.
- While significant government investment has enabled the transition to virtual care (including remote monitoring), continued coordination between governments is needed to enhance the adoption of virtual care within Canadian health systems.
- Further research is needed on the cost-effectiveness and clinical appropriateness of remote monitoring across cardiac conditions. This analysis can support health system decision-makers in determining when and how to apply remote monitoring services safely and effectively.

## Introduction

The emergence of the COVID-19 pandemic has created an opportunity for health systems in Canada to re-evaluate virtual services like remote monitoring. During the pandemic, Canada's governing bodies implemented stringent restrictions to limit the spread of COVID-19. These included lockdown measures, stay-at-home orders, physical distancing measures, and maximum capacity limits. These restrictions also resulted in the cancellation and delay of non-urgent medical activities and operations to increase health care capacity for COVID-19-related care. Many patients and caregivers with COVID-19 were forced to self-isolate at home, in the community, or in cohort settings, which greatly disturbed their access to health care.

Throughout the pandemic, the health care system experienced a dramatic shift toward virtual care as an alternative for in-person health care delivery and management for patients with acute and chronic cardiac conditions. These patients are at an increased risk of adverse outcomes from COVID-19 infections, and for many, remote monitoring was seen as a safer alternative to traditional health care delivery.<sup>1,2</sup> Since the onset of the pandemic, interest and demand for remote monitoring and remote management of patients with cardiac conditions

has increased, and research into the pandemic's impact on the delivery of cardiac care is beginning to emerge.

Remote monitoring 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 techniques (e.g., video conferencing) or stand-alone devices (e.g., portable heart rate monitors). The goals of remote monitoring centre around promoting home-based self-management to improve patient outcomes and/or reduce health system usage.

In September 2021, CADTH completed a [Health Technology Assessment](#) on remote monitoring programs for the management of chronic heart failure, atrial fibrillation, hypertension, and cardiac rehabilitation for acute and chronic conditions.<sup>3</sup> Based on the findings of this report, in December 2021, the CADTH Health Technology Expert Review Panel (HTERP) developed [recommendations](#) to address the design and implementation of remote monitoring programs.<sup>4</sup> The report and recommendations highlighted various barriers to the accelerated uptake of remote monitoring for cardiac conditions in Canada, including concerns regarding patient data and privacy, digital equity and accessibility, cross-jurisdictional licensure, and clinician reimbursement.

## Policy Issue

As Canada emerges from the COVID-19 pandemic, the health care landscape for virtual care has significantly shifted. There is now substantial interest in telehealth and virtual care, which includes remote monitoring, with many seeing it as a core component of the future of health care. Decision-makers are looking to identify ways to incorporate remote monitoring as a component of health care delivery for patients with cardiac conditions, when appropriate. Insights from the experiences of remote monitoring programs for cardiac conditions during the COVID-19 pandemic can shed light on their enablers and barriers to inform better program design, implementation, and expansion of remote monitoring services.

In addition, the expanded use of remote monitoring programs and technologies to monitor and manage clinical symptoms has brought to light existing equity issues among patients with cardiac conditions. For example, some patients may belong to communities that lack access to technology or reliable internet, while others may lack access to personal communication devices, have limited digital or health literacy, or suffer from physical or cognitive impairments. Various patient populations have been identified as particularly disadvantaged; this includes older adults, those of low socioeconomic status, and patients who are Indigenous.<sup>5,6</sup> These equity-related considerations have been previously discussed as part of CADTH's Health Technology Assessment on remote monitoring; however, further attention should be given to these issues that continue to act as barriers to remote monitoring for some, and which have been exacerbated during the pandemic.

This Policy Insight provides an overview of key trends for remote monitoring during the COVID-19 pandemic, an analysis of enablers and barriers for remote monitoring based on lessons learned during the pandemic, as well as reflections on the future of remote monitoring in Canada. Additional insights into patient and provider experiences with remote

monitoring programs for cardiac conditions during the COVID-19 pandemic are provided in [Appendix 1](#).

## Remote Monitoring Trends During the COVID-19 Pandemic

The onset of the COVID-19 pandemic resulted in rapid changes to the delivery of health care for patients with cardiac conditions in Canada. Many existing programs for patients with acute and chronic cardiac conditions were immediately discontinued due to staff redeployment, facility closures, reuse of facilities for COVID-19, or lack of resources. For example, nearly half of all cardiac rehabilitation programs in Canada closed, and staffing resources were reduced to almost 60% across Canada.<sup>7,8</sup> Some cardiac programs were able to rapidly transition from face-to-face to virtual modes of delivery;<sup>2,9-11</sup> and in other instances, new remote monitoring programs were implemented during the COVID-19 pandemic (e.g., the Alberta Central Zone PCN Home Health Monitoring Project, which was first trialed in July 2020).<sup>12</sup> Virtual care use in Canada increased from between 10% and 20% of all health care visits across provider categories before the pandemic to 60% in April 2020, before falling back to 40% in 2021.<sup>13,14</sup> This represents a substantial and sustained transition to virtual care.

The COVID-19 pandemic also resulted in an increase in remote monitoring because of program expansion and scale-up. In 2019, nearly 15,000 patients (in total) were enrolled in remote monitoring programs in Canada, whereas in 2020, nearly 16,000 patients with chronic diseases and a further 23,000 patients with COVID-19 were enrolled in remote monitoring programs.<sup>15</sup> While this represented a substantial expansion in the use of remote monitoring overall, the majority of this expansion was attributed to the monitoring of those with COVID-19.

In a 2021 survey of more than 12,000 Canadians, only 6% of respondents reported ever taking part in a remote monitoring program to manage a chronic health condition.<sup>16</sup> A 2021 national survey of more than 2,000 physicians working in Canada found that while 94% of physicians have been providing virtual care since March 2020, only 5% have been providing remote monitoring.<sup>17</sup> Use of remote monitoring by physicians as a form of virtual care remains highest in Ontario (7%), lowest in Manitoba and Quebec (2%), and is equal in both hospital and community settings (4%).<sup>17</sup> Since March 2020, all forms of virtual care use have increased among physicians (e.g., telephone, video conferencing, secure email) with the exception of remote monitoring, which has remained roughly the same.<sup>17</sup>

## Facilitators and Barriers for Remote Monitoring

There are a number of factors identified in the literature that have acted as facilitators and barriers to the expansion and implementation of remote monitoring programs for patients with cardiac conditions during the COVID-19 pandemic. These factors can be grouped into 3 areas: technology adoption, program adaptation, and legislative and regulatory changes.

## Technology Adoption

### Availability of Technology

The availability of new technologies and innovations has helped enable the transition to remote monitoring. There are a wide variety of technologies for remotely monitoring cardiac conditions that are available in Canada now. For example, innovative technologies for monitoring patients in cardiac rehabilitation include new cardiac monitors (e.g., auscultatory devices integrated into garments), wearable devices (e.g., watches), and continuous blood sugar monitors that do not require a fingerstick.<sup>18</sup> These options offer health care providers with a variety of technologies that can be tailored to the needs of their patients.

### Familiarity With Technology and Digital Literacy

Technology challenges associated with remote monitoring can include both patient and clinician hesitation, as well as varying levels of health and digital literacy. During the pandemic, the shift to remote monitoring for patients with cardiac conditions necessitated the use of technologies that were, in many instances, new to patients, caregivers, and health care providers. Before the pandemic, many patients and providers were unfamiliar and lacked experience with telehealth and remote monitoring technologies,<sup>19,20</sup> as a result, a number of programs reported a steep learning curve for program staff and patients when it came to new technologies and modes of delivery.<sup>9</sup> This could be considered a knowledge barrier, with some patients and practitioners lacking adequate knowledge of the clinical usefulness of telemedicine, or the capacity to adopt new health behaviours and models of care.<sup>21</sup> Patient and provider lack of familiarity with virtual care technologies was likely an initial barrier to patient enrolment. For example, 1 European study found that at the onset of the pandemic, countries that had greater prior experience and integration of mobile health technologies in their health care systems had the fastest rates of enrolment into remote monitoring programs for patients with atrial fibrillation.<sup>10</sup>

Programs can best overcome technological barriers to adoption by providing education and training components on the use of remote monitoring technologies, platforms, and assessments, and by maintaining open channels for communication and feedback.<sup>7,9</sup> Some programs employed mandatory courses on the use of new digital platforms and included interactive components such as provider-to-provider mock video calls.<sup>9</sup> Other programs offered training for patients in one-on-one sessions or through less labour-intensive group sessions.<sup>8</sup> Many programs reported the time requirements for patient onboarding into remote programs as a significant barrier, and in some instances noted that misconceptions among patients about the purpose and objectives of telemonitoring led to hesitation to enrol.<sup>11</sup> Programs reported that it was important to clearly explain program objectives to patients during onboarding and to provide continuous opportunities for training and education following onboarding and assessment.<sup>11,22</sup> Low patient adherence to data transmission was also overcome through more frequent, automated reminders for patients to transmit data.<sup>23</sup>

On a broader level, health education institutions can address technology challenges with increased training on virtual care, digital health embedded into curricula, and continuing professional development, which can help equip current and future health professionals with the knowledge and skills to deliver virtual care effectively and safely. Furthermore, as health care becomes increasingly virtualized, it is expected that patients and providers will become more familiar with new modalities and technologies in health care services.

## Specific Patient Populations

Technology adoption remains a particular challenge for certain patient populations that may incur additional barriers to accessing remote monitoring programs. For example, some older adult patients suffer from visual, auditory, or cognitive impairments, and have limited digital and health literacy, which impedes their ability to navigate and use digital platforms and mobile devices.<sup>23</sup> While virtual services may increase access to older adults during times of isolation, remote monitoring programs should consider options to enhance platform design, readability, comprehension, navigation, and ease of adoption and engagement, with specific adaptations for the needs of older adults. Some examples of program modifications that have reduced barriers for older adults include enhanced font size and large displays with clear colour contrasts, the use of short texts that use plain language, formats that combine a visual and an audio message, and the inclusion of structured training and support to increase user confidence.<sup>6</sup>

Patients who are First Nations, Inuit, and Métis are also vulnerable to technological inequities. A 2018 report found that only 24% of households in Indigenous communities have access to quality, high-speed internet, compared with 97% of urban households and 37% of rural households in Canada.<sup>24</sup> According to a 2021 study, access to remote patient monitoring for Indigenous peoples decreased by 5% during the pandemic, compared to a decrease of 1% by Canadians who do not identify as Indigenous.<sup>25</sup> Expanding broadband infrastructure in Indigenous communities is an important step toward enabling access to virtual technologies and services like remote monitoring. However, further research is needed to understand how remote monitoring programs can best complement other health care strategies in Indigenous communities, as are strategies that address the various barriers that may be preventing patients who are Indigenous from accessing these technologies.

## Program Adaptation

The transition to remote monitoring should include consideration of all of a program's operational elements; for example, eligibility requirements, onboarding and assessments, appointment logistics, program equipment, roles and responsibilities of clinicians and staff, and data infrastructure and management. To assist health care leaders in designing, implementing, and evaluating remote monitoring programs, the American Medical Association has developed a [Remote Patient Monitoring Playbook](#).<sup>26</sup> This playbook offers a step-by-step guide for remote monitoring program development from objective setting and contracting to workflow design, implementation, evaluation, and scale-up.

## Eligibility and Onboarding

The rapid transition to telemonitoring necessitated structural changes within programs to provide continuity of care for patients. Some of the more immediate changes to programs that helped enable the transition were the loosening of eligibility requirements to maximize inclusion and the virtualization of onboarding and assessment processes.<sup>11,27</sup> Some programs developed a triaging protocol to remotely assess and review disease severity, and to categorize patients into risk categories.<sup>28</sup> Safety remained a primary concern, particularly for those patients at highest risk of infection from COVID-19, such as patients who were older and frail and those with comorbidities.<sup>8,18</sup>

Strong management support, including consistent communication from management to program staff, was cited as an important facilitator for remote monitoring.<sup>27,29</sup> One program for patients with heart failure attributed its successful transition to virtual care to the rapid



development of a leadership council to operationalize and oversee program changes, as well as to consistent communication with faculty, staff, and patients, and open channels for feedback.<sup>29</sup>

The Peter Munk Cardiac Centre Heart Function Clinic at the Toronto General Hospital rapidly expanded its telemonitoring program for patients with heart failure (the Medly Program) at the onset of the pandemic.<sup>11</sup> The Medly Program offers a mobile phone-based telemonitoring program to remotely support patients with heart failure. Within the first 2 months of the pandemic, the program rapidly expanded its eligibility requirements and seconded 2 new nurses to oversee patient enrolment. Cardiologists became much less selective in patient referrals (for example, the ability for patients to adhere to daily weights was previously considered a more strict clinical criteria). Many in-person components of the program were quickly virtualized, including onboarding by telephone, and the program began offering to mail patients a kit of equipment to their home.

## Team Member Roles and Responsibilities

Successful programming involves additional consideration of clinician workload, staff capacity, and health human resource planning. Health care worker burnout and exhaustion has remained a significant issue in Canada throughout the COVID-19 pandemic and this is likely to impede health care service delivery in the future.<sup>30</sup> During the pandemic, staff shortages, facility closures, staff redeployment, and staff in isolation resulted in an overburdened health care workforce.<sup>7,20</sup>

Short-staffed programs were able to compensate by having available staff perform multiple tasks outside of their usual scope of duties.<sup>20</sup> For example, the role of nurses and nurse practitioners was highlighted as a key enabler for the transition to virtual care for patients with heart failure.<sup>2,9,28,29</sup> Heart failure programs that were transitioning to virtual care assigned specific roles to nurse practitioners and medical assistants who would contact patients in advance of virtual visits to conduct certain tasks, such as medication reconciliation, assessments, and obtaining vital signs. This helped alleviate physicians' workloads in advance of telehealth visits.<sup>29</sup> With health care increasingly being delivered by multidisciplinary teams, the components of remote monitoring programs may be best delivered by various health care professionals within a team, with each team member having clearly delineated roles and responsibilities. This flexible team dynamic can improve workload distribution among team members and may strengthen program resilience against potential future health system shocks. Programs may also consider hiring additional staff members to support continuous monitoring activities and to promote program scale-up.

## Data Management and Infrastructure

Data management remains a challenge for remote monitoring programs for cardiac conditions. The tracking, recording, transmission, and storage of data are all important components of a data management system for remote monitoring programs. Currently, there are no clear standards for the collection of data through remote monitoring programs in Canada, though there are data security concerns related to data and internet connections.

To be successful, remote monitoring programs require software, a data infrastructure for hardware (e.g., computers, smartphones, laptops), a secure means for data storage and transmission (e.g., antiviral software, firewalls, anti-ransomware tools, regular data backups), and the availability of technical support. It has been noted that many cardiac clinics do not currently have sufficient infrastructure to support remote monitoring.<sup>31</sup> More research

is needed to identify the costs of remote monitoring programs across cardiac conditions, including both the capital and operational costs associated with data infrastructure and management.

The lack of interoperability between remote monitoring systems and other data systems continued to act as a barrier during the COVID-19 pandemic. Clinicians reported challenges with accessing and navigating between multiple electronic systems (e.g., electronic health records (EHR), remote monitoring platforms, video conferencing) to fill patient information gaps, leading to significant workflow inefficiencies.<sup>11</sup> Some reported benefits of EHR-integrated remote monitoring include better patient-provider communication, detection of unrecognized or hidden problems, and changes to clinical management and decision-making. However, there remains limited evidence regarding the benefits of EHR-integrated remote monitoring on clinical workflow efficiency.<sup>32</sup> While the interoperability of data systems remains an ongoing objective for health systems, further research is needed regarding the benefits of EHR-integrated remote monitoring to inform the development of these systems.

### Language

Language is an additional barrier to accessing remote monitoring programs, particularly for many people in Canada who do not speak English, including new Canadians.<sup>5</sup> Not speaking English has been found to be independently associated with a 50% lower use of virtual care services.<sup>33</sup> Some provinces offer services to minimize language barriers and improve access of virtual care services to those who do not speak English; for example, the British Columbia Provincial Health Services Authority provides virtual interpretation and translation services in more than 150 languages for patients with limited English proficiency.<sup>34</sup> In other provinces, these services are coordinated locally or regionally; for example, in Saskatchewan, where the Saskatoon Health Authority offers virtual interpretation services for the region.<sup>35</sup> To reduce language barriers for patients for whom English is not a first language, remote monitoring programs could be offered in various languages and could consider using available interpretation and translation services to facilitate virtual clinician-patient interactions.

## Legislative and Regulatory Changes

In response to the pandemic, a number of legislative and regulatory policy changes in Canada have been described as enablers to the scale-up of remote monitoring programs. These include changes to professional licensing requirements and reimbursement billing codes.

### Clinician Reimbursement

In Canada, lack of reimbursement has been a significant barrier to the expansion of virtual care. In response to the COVID-19 pandemic, provincial and territorial governments and medical associations adapted telehealth billing codes to improve patient access to telehealth services. In Ontario, for example, temporary Ontario Health Insurance Plan billing codes were agreed upon in March 2020 by the Ontario Ministry of Health and Ontario Medical Association for assessments, counselling, and specialist consultations by phone or video.<sup>36</sup> The Canadian Institute for Health Information has compiled a full list of physician billing codes for virtual care for all provinces and territories.<sup>37</sup> These codes were developed to meet temporary needs, and, to date, Alberta is the only jurisdiction that has indicated that changes to its fee schedule for virtual visits will be made permanent.<sup>14</sup>

Furthermore, the virtual care billing codes that were introduced are not necessarily applicable to remote monitoring, which may be impeding the feasibility of remote monitoring compared

to other forms of virtual care. The US, on the other hand, has developed billing codes for both general and condition-specific remote patient monitoring.<sup>38,39</sup> Various national health professional organizations in Canada have supported the inclusion of remote patient monitoring in fee schedules,<sup>40</sup> and jurisdictions should evaluate the feasibility of these temporary billing codes and consider what further refinements would be needed to support the uptake of remote monitoring.

### Cross-Jurisdictional Licensure Requirements

The regulatory framework for licensure requirements across interprovincial and international lines remains complex and inefficient, and may be significantly impeding the adoption of remote monitoring programs. In Canada's provinces and territories, the medical regulatory authorities (Colleges) set the standards of care for practising medicine. Each jurisdiction has its own guidelines regarding interprovincial and international licensing requirements, and these vary from jurisdiction to jurisdiction.<sup>41</sup> Typically, a regulated health professional must comply with the licensing requirements imposed both by the College where they are licensed to practice and the College of the jurisdiction where their patient is located. For example, the College of Physicians and Surgeons of Nova Scotia permits physicians licensed elsewhere in Canada to provide virtual services to patients in Nova Scotia; however, these physicians remain subject to the regulation of their home licensing body. The result has been a very complex landscape of licensure requirements across the country.

In response to the growing number of issues resulting from a segmented regulatory framework for licensure, many national health organizations have advocated for a pan-Canadian approach to medical licensure.<sup>42</sup> CADTH's policy brief on [interjurisdictional medical licensing to support telemedicine](#) provides a further analysis on interjurisdictional licensing.<sup>43</sup>

## Future of Remote Monitoring in Canada

Considerations for the expansion of remote monitoring for cardiac conditions in Canada are nestled within a larger, ongoing, policy discussion on the future of virtual care, where there is currently significant momentum among governments, health organizations, industry, and patient groups, who recognize the potential for virtual technologies to radically transform health care in Canada.

During the COVID-19 pandemic, there has been significant federal fiscal support to manage the transition to virtual care. In May 2020, the Government of Canada announced a \$240.5 million investment to accelerate the use of virtual tools and digital approaches.<sup>44</sup> A total of \$150 million of this investment was dedicated to the provinces and territories through time-limited bilateral agreements with priority areas for secure messaging and information-sharing platforms, secure video conferencing, remote patient monitoring tools, patient access to test results, and back-end supports to enable integration of these new tools into existing digital systems. Canada Health Infoway received a further \$50 million to support provincial and territorial implementation of these new initiatives. While these bilateral agreements have assisted the provinces and territories in managing the transition to virtual care during the pandemic, continued coordination between governments is needed to enhance the adoption of virtual care in Canada.

In 2020, the Federal, Provincial, Territorial Virtual Care/Digital Table, a government coordinating body on digital health, was convened to develop a framework for the long-term adoption of virtual services within Canada.<sup>44</sup> Building upon this framework, William Falk, a policy expert in digital health, was commissioned to develop recommendations to advance digital health services in Canada.<sup>15</sup> Among these recommendations is to “scale up implementation of patient monitoring programs. Provide permanent funding envelopes in a system neutral way that allows competing hardware/software/service bundles to compete with physical visit monitoring in a fair way.”

Following the release of this report, a summit meeting was held in June 2021 to identify considerations for a national action plan for virtual care.<sup>45</sup> The report indicated that based on proposals from the summit, the Federal, Provincial, Territorial Virtual Care/Digital Table would develop an action plan for the next 12 to 18 months.

A revolution in virtual care is currently under way in Canada that has largely been initiated by the COVID-19 pandemic. The adoption of virtual care and remote monitoring has resulted in a radical transformation in health care delivery and there is strong interest among health leaders to sustain this momentum. While significant investment by the federal government has helped enable this transition, continued collaboration across health systems is needed to determine the best path forward for integrating remote monitoring within Canadian health systems. Although remote monitoring can offer great value and convenience for patients with cardiac conditions, further research is needed to determine the cost-effectiveness and clinical utility of remote monitoring across cardiac conditions. Health system leaders will need to take these into consideration to maximize the safety and effectiveness of remote monitoring and determine which patients with cardiac conditions would most benefit from participation in remote monitoring programs.

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## Appendix 1: Patient and Provider Experiences

Note that this appendix has not been copy-edited.

The following section is a review of patient and provider experiences with remote monitoring programs for cardiac conditions during the COVID-19 pandemic. This section was informed by a literature and grey literature review and outlines additional benefits and challenges for remote monitoring as reported by patients and clinicians. The review outlines 3 themes related to patient and provider experiences: satisfaction with remote monitoring programs, continuity of care, and developing and maintaining the patient-provider relationship.

### Satisfaction

Satisfaction with remote monitoring programs overall during the pandemic remains mixed among physicians. A 2021 national survey of more than 2000 Canadian physicians found that 50% of physicians were satisfied with using remote monitoring while 21% were dissatisfied.<sup>17</sup> Satisfaction with remote monitoring was roughly equal among physicians in both community and hospital settings and regionally was highest in Manitoba (72%) and lowest in Alberta (34%).<sup>17</sup> In general, physicians in Alberta had somewhat less favourable attitudes toward the use of virtual care compared to other provinces.<sup>17</sup> When asked about the potential benefits of remote monitoring to help patients manage health conditions, the majority of physicians regarded remote monitoring as having some benefits for their patients, while 33% of physicians were unsure.<sup>17</sup>

While physicians see some benefit in remote monitoring, there is high demand for these programs among the Canadian public. According to a 2021 survey of more than 12,000 Canadians, while only 6% of respondents have ever taken part in a remote monitoring program using a device to manage a chronic health condition, 47% are interested in taking part.<sup>16</sup> This is a large discrepancy and signifies that there is substantial interest for remote monitoring among the Canadian public. Further research is needed to understand both clinician and patient satisfaction with remote monitoring programs for cardiac conditions specifically.

### Continuity of Care

Continuity of care was an important theme for both patients and providers during the pandemic. Many patients experienced a heightened sense of fear of contracting COVID-19 and had increased anxieties over being able to access health care services.<sup>2</sup> For patients with cardiac conditions, continual monitoring created a sense of comfort and security during a period of great uncertainty and patients were pleased with the convenience and ease of access to health care providers.<sup>10,11</sup>

Providers described a continuous improvement and learning environment as they navigated the sudden change to their usual way of practice.<sup>22</sup> Clinicians noted a preference for continual monitoring of cardiac patients compared to virtual visits alone, as it provided a more comprehensive view of patient health and helped identify the need for follow-up for patients with worsening symptoms.<sup>11</sup> They also noted some newfound benefits and efficiencies, such as being able to optimize patient medication more rapidly, as well as the ability to deliver more individualized care.<sup>11,22</sup>

Certain components of remote monitoring programs could not be easily virtualized and this created challenges for some programs. For instance, there was concern among patients when directed to attend hospitals to obtain blood work out of fear of potential COVID-19 exposure.<sup>11</sup> Some patients felt that the risk associated with attending hospital settings outweighed the benefits of treatment optimization based on blood work.<sup>11</sup> Other programs were able to permit home blood draws to help overcome this issue.<sup>29</sup>

### Patient-Provider Relationships

The transition to a fully virtual model of care created challenges for fostering new clinician-patient relationships. Clinicians expressed difficulties in building relationships with new patients in a virtual setting, establishing rapport, a personal connection, and being able to assess a patient's condition in the absence of visual cues, body language, or caregiver support.<sup>11</sup> Clinicians also expressed concern in being able to establish meaningful relationships with their patients and that this could increase the chance of patient non-adherence to their care plan.<sup>11</sup>

There was also a challenge associated with clinician-patient interactions triggered by system alerts, which sometimes created an alert-driven patient-clinician relationship.<sup>11</sup> Patients who were not experiencing severe symptoms had fewer system alerts, and therefore fewer interactions with their clinician. As a result, many patients with non-severe symptoms felt they were not able to develop a relationship with their clinician or have other aspects of their health attended to beyond the clinical parameters measured by the remote monitoring system.<sup>11</sup>

Workload and capacity remained a key challenge for health care providers delivering remote monitoring programs throughout the pandemic.<sup>7,11,20,27</sup> Physicians described the burden of increased caseloads, which made it difficult to increase the frequency of patient interactions.<sup>11</sup> This also contributed to the alert-driven relationship issue noted by patients as providers lacked the capacity to handle patient interactions beyond those driven by system alerts.<sup>11</sup>