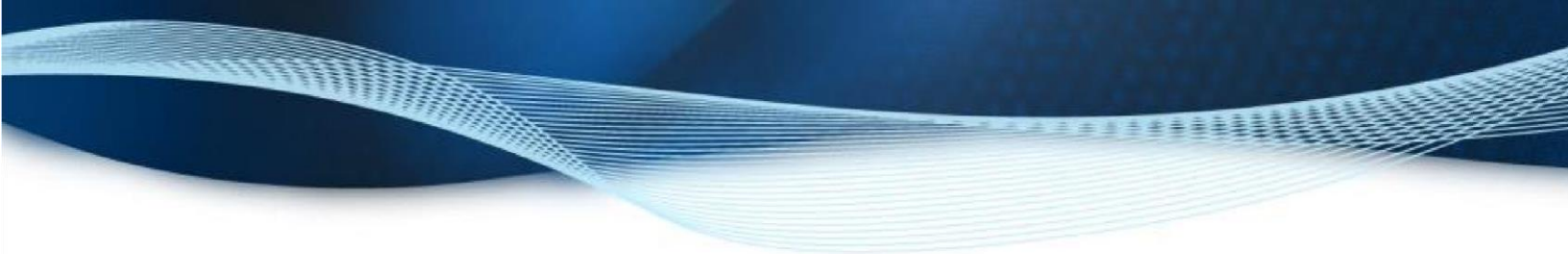


Enhancing Remote Patient Monitoring – Strategies for Widespread Canadian Adoption

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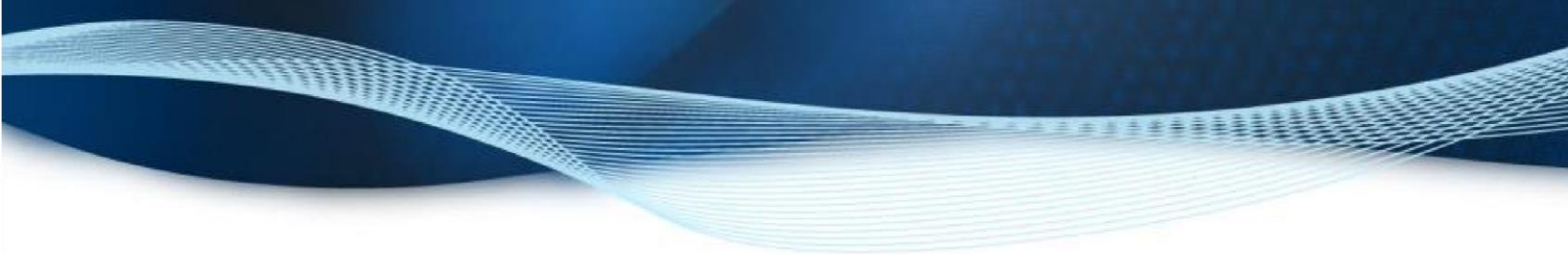


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Executive Summary

Remote Patient Monitoring (RPM) is a promising solution to improve patient outcomes while alleviating the strain that the Canadian healthcare system experiences due to on-going sustainability issues. To expand the adoption of RPM in Canada, the following four strategic considerations are recommended. 1) RPM programs must **define their patient population** based on existing evidence and best practices. RPM programs should begin with the congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) patient populations, where most of the current evidence lies. To further comply with the available, most up-to-date evidence, it is recommended that internationally recognized standards be adopted to develop inclusion and exclusion criteria. 2) Implementation of RPM programs requires careful planning which in turn will **optimize the transition process** for all stakeholders. Referral processes should be

streamlined to eliminate barriers to referral and to increase the adoption. The referral process must be refined to encourage clinicians to select RPM programs which can lessen the risk of unnecessary hospital stays. To further optimize the transition, incentivizing the referral of patients to RPM programs is recommended by incorporating RPM into newly emerging funding mechanisms. 3) **Awareness** of RPM programs must be enhanced; promotional strategies should look to involve all stakeholders including patients, clinicians, and healthcare organization management. Establishing feedback mechanisms and program monitoring is recommended for timely and adequate program assessment. 4) Lastly, **future opportunities** of RPM programs must be explored including other morbidities and use of newly emerging innovative technologies to further stimulate the growth of RPM in Canada.

Introduction

With the Canadian healthcare system facing increasing demands due to an aging population and limited resources, Remote Patient Monitoring (RPM) resides as a promising approach to manage chronic diseases, increase quality of care and improve cost effectiveness. Nations at the forefront of implementing RPM programs have begun to realize benefits. In Scotland for example, out of 44,000 patients who received remote monitoring services from 2006 to 2011, upwards of 2,500 cases were accelerated discharges from hospital and 8,700 patients avoided emergency visits (The Scottish Government, 2015). The Danish government also showcases success with RPM projects where there is a cost savings associated in healthcare among their aging population taking part in these programs (Healthcare Denmark, n.d.). With these nations' exemplary successes, Canada should set the adoption of RPM programs as a priority.

To stimulate the growth of the RPM programs in Canada, the following four strategies have been developed based on their potential for positive impact on patients, providers, and the Canadian healthcare system. The strategies are: i. Refining the patient population for RPM programs, ii. Optimizing transition into RPM programs, iii. Enhancing awareness of RPM programs, and iv. Future expansion. There is no silver bullet for improving the adoption but these four strategies will provide Canada with a direction to enhance and expand RPM programs.

Refining the Patient Population for RPM Programs

Congestive Heart Failure (CHF) and Chronic Obstructive Pulmonary Disease (COPD) are major health concerns within Canada and are highly prevalent among Canadians. According to Statistics Canada, the second leading cause of death in Canada is heart disease, accounting for 20% of all mortalities in 2011. In addition, in recent years the number of inpatient hospitalizations due to CHF and COPD was 59,428 and 77,808, respectively, with CHF patients remaining in hospital for an average of 9.2 days, and COPD patients remaining in hospital for an average of 7.7 days (Canadian Institute for Health Information, 2005). Once admitted, 25% of CHF and COPD patients are readmitted in one month and 50% of CHF patients are readmitted in six months (Bhimaraj, A., 2013), which can create major strains on provincial health budgets.

For example, the cost of hospital stays for all CHF patients totaled approximately \$425.6 million in 2005 (Canadian Institute for Health Information, 2005), and in Ontario alone, COPD patients require an average of \$1,000 for each day of their hospital stay (Ministry of Health and Long Term Care, 2012). Globally, research and small-scale studies have proven the validity of RPM programs for CHF and COPD at reducing hospitalisation, rehospitalisation, and mortality compared to conventional post-discharge care (Kotb, Cameron, Hsieh, & Wells, 2015). Although RPM will bring many benefits to the Canadian healthcare landscape, there is much to be learned; therefore Canadian RPM program solutions should first focus on refining solutions for CHF and COPD patients. Once

these programs have been deemed successful, expansion to multiple morbidities should be explored.

To adopt CHF and COPD RPM programs in the Canadian context, program developers should identify a patient population that will reap the most benefit from these programs. The following refined inclusion criteria must be considered. First, patients must be stable with symptoms that are well controlled by medication. They should not require frequent follow-ups, and they should be physically and mentally capable. Program developers should also consider excluding low-risk patients with no symptoms, or those who are highly unstable, or suffer from cognitive dysfunctions. To define a specific set of inclusion and exclusion criteria for patients, program developers should look to internationally recognized standards, such as the New York Heart Association for CHF patients (see Appendix A and B), as guides. Based on these refined criteria, providers will be able to accurately match patients with the suitable program.

To enhance patient outcomes, patients should be monitored for at least six to twelve months; based on one study, patients take approximately three months to be comfortable with new technology and 12 months allows enough time to prove the clinical value of RPM (Udsen, Lilholt, Hejlesen, & Ehlers, 2014). With this in mind, it is recommended that RPM programs offered in Canada should be no shorter than 12 months.

Well-established CHF and COPD specific RPM programs, with clearly defined as well as refined inclusion and exclusion criteria, and proper treatment duration will contribute to improved patient outcomes, and a decreased strain on health care facility resources. To ensure these benefits are seen, patient transitions from hospital to RPM programs must be optimized.

Optimizing Transition into an RPM Program

Streamlining the transition or referral process from hospital discharge to RPM program will differ between provinces, but this strategy is adaptable and should be considered to enhance adoption of RPM programs across the country. Firstly, Canada Health Infoway should work with Canada's leading national health organizations, to ensure that the potential benefits of RPM programs are communicated, and integrated into their short-term and long-term strategy initiatives. Teaming with the nationally established groups will extend the lobbying capacity to allow translation of research and knowledge of the benefits of implementing RPM into national recommendations. These organizations can collaborate with Canada Health Infoway and their internal lobbying teams to encourage the provincial governments to adopt strategies that will optimize RPM referral process.

Once national recommendations are in place, referrals upon hospital discharges must be driven by provincial governments to direct hospitals and providers, to refer patients to RPM programs. Additionally, RPM referrals should follow existing provincial protocols relating to rehabilitation, for example the Cardiac Care Network's Standards for Provision of Cardiovascular Rehabilitation in Ontario. Provincial protocols such as these will specify how discharged patients can transition from hospital stays to various therapies, which should include RPM programs (Cardiac Cancer Network, 2014).

For patient transition into RPM programs to be successful, healthcare providers must be onboard, and performance-based incentives can play a vital role. Studies conducted in the U.S.A. and the U.K. suggest that such incentives

have a positive effect on quality of care, particularly in preventative medicine (Health Quality Ontario & Ministry of Health and Long-Term Care, 2013).

A similar example can be found locally in Canada; while the most common funding method for Canadian hospitals is the global budget funding, the provincial government of British Columbia has implemented a pay-for-performance program, which resulted in decreased emergency department wait times (Wranik & Durier-Copp, n.d.; Sutherland et al., 2012). As such, the use of performance-based incentives should be incorporated as part of adoption of RPM programs with the focus on prevention of hospital readmission, leading to healthier and happier patients.

RPM programs should be incorporated as a requirement in the new funding models, such as Quality Based Procedures (QBPs) in Ontario, to reward hospitals that refer the appropriate patients to programs. The incentives will encourage hospitals to actively establish the previously mentioned organizational protocols specifying how patients will make transitions from hospital to RPM programs. Hospitals will be rewarded when patients successfully avoid hospital readmission due to the same morbidities. Overall, the restructured funding mechanism may lead to decreased wait times and reduction in readmission which represents approximately \$7,000 in savings per patient (Canadian Thoracic Society, 2012). Furthermore, incentives should be given to healthcare providers referring suitable patients to RPM programs. Allotting providers with a fee-based incentive will improve referral rates to RPM programs and increase RPM adoption.

With proper national recommendations in place, provincial governments can then implement specific referral strategies and protocols. Additionally, provincial consideration

of performance-based and fee-based incentives will ensure compliance to the referral process; but to warrant interest, compliance, and success, promotional strategies should be considered.

Enhancing Awareness of RPM Programs

To promote awareness of RPM programs in Canada, health organizations need to consider the following framework that encompasses a diverse ecosystem with various needs of stakeholders. Firstly, organizations should evaluate existing internal practices to identify key factors that must be customized to implement RPM programs. Healthcare providers should be involved in the evaluation process to review and modify clinical pathways. Having the key stakeholders, especially the clinical staffs in the evaluation process will improve acceptance and adherence to RPM programs (KT Clearinghouse, n.d.). Acceptance by clinical staff is the key success factor to increase the uptake of RPM.

Barriers to RPM implementation should be assessed and mitigated early on. Some barriers could include lack of awareness of benefits of RPM programs, lack of motivation to implement or lack of utilization of the program among health providers, and resistance to workflow changes. Also, disruptions from external entities can be another major barrier, such as conflicting interest from policymakers or reluctance from the impacted body of knowledge like College of Nurses to accept changes to role of Nurses (KT Clearinghouse, n.d.). There should be a mitigation plan in place to avoid or address these barriers.

Patients must then be made aware of RPM programs and their benefits. Healthcare organizations should provide patient directed

interventions to increase adherence, engagement, and reduce drop-outs by encouraging patients to communicate their stories regarding benefits from the program. Also, the feedback from patients and family members must be considered and implemented to improve the patient experience and to optimize the program.

Lastly, patient outcomes from RPM programs must be monitored and evaluated throughout development, implementation, and improvement cycles. These outcomes will provide information to make decisions to improve the adoption of the RPM program to ensure future sustainability and effectiveness in a healthcare organization.

With the proper steps taken to ensure RPM programs are properly promoted towards stakeholders such as providers and patients, CHF and COPD specific RPM programs will realize success, and future expansion of RPM programs in Canada can then be considered.

Future Expansion

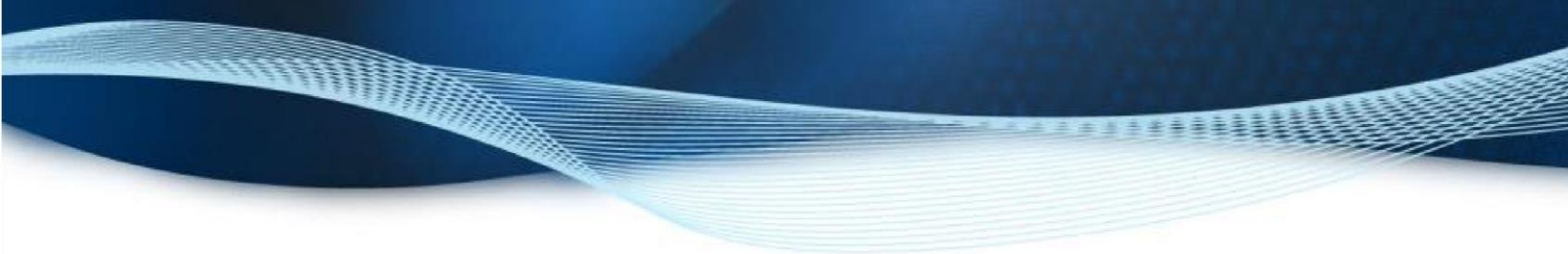
Future expansion of RPM programs within Canada should look to include new technologies and additional morbidities. There is ample room for growth of RPM programs, including embracing mobile health (mHealth) technologies. The Global Observatory for eHealth (GOe) defined mHealth as “medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices” (WHO, 2011). As smartphone adoption grows exponentially, coverage to mobile networks expands, along with the development of new health-related applications, and opportunities for mHealth continue to grow. High acceptance, familiarity of devices, cost effectiveness, and improved comfort level are the major reasons

for greater adoption of RPM such as mHealth (Aranda-Jan, Mohutsiwa-Dibe, & Loukanova, 2014). Furthermore, patients can benefit from new technology and eConsult their physicians via secured email and Short Message Service (SMS) medication reminders while physicians can receive reimbursement for the eConsultation (Arjanna Van Der Plas, 2013). Therefore, provincial governments should eventually consider incorporating the use of patients’ personal devices as a key strategy to improve patient enrolment and lower healthcare costs.

In addition to mHealth, RPM programs in Canada should also look to catering to other morbidities with an increased likelihood of complex health issues such as Diabetes, Chronic Kidney Disease, Alzheimer’s and Parkinson’s disease. RPM programs will help individuals live healthier in their own homes while reducing the burden on caregivers and on health care system; moreover, RPM can decrease the need for older adults to move to costly care settings. Better access to healthcare services and better cost efficiencies driven by available technologies will improve patient experience while helping create a sustainable and optimized healthcare system.

Conclusion

Moving forward, implementing RPM programs can help to alleviate the challenges that Canada faces, - namely an aging population and limited resources. These four proposed strategies to enhance RPM adoption will benefit patients, providers, and the Canadian healthcare system in both the short-term and long-term. These strategies are practical and actionable with strong emphasis on the need for consistent long-term efforts to re-shape the landscape of the Canadian healthcare system. The proposed strategies will assist in fulfilling the goal of improving the sustainability of Canadian



healthcare systems and most importantly

improve the health of Canadians.

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Appendix A—Example of Inclusion and Exclusion Criteria

Table A1

General Inclusion Criteria:	General exclusion Criteria:
<p>Able to communicate both written and verbal in English or French.</p> <p>Good ability to have control over his own health.</p> <p>Good ability to use different monitoring equipment.</p> <p>Having a complete access to an active internet connection.</p> <p>Having an access to a healthcare provider.</p> <p>Fully intact to mildly impaired (caregiver needed) cognitive ability.</p>	<p>Unable to communicate in English or French.</p> <p>Unable to have good control over his own health.</p> <p>Unable to use monitoring equipment.</p> <p>Does not have an access to internet.</p> <p>Does not have an access to a healthcare provider.</p> <p>Moderate to severe cognitive dysfunction.</p>

Table A2—COPD Specific Criteria

COPD Inclusion Criteria	COPD Exclusion Criteria
<p>Well-known Diagnosis of COPD. Outpatients with GOLD* grades 2, 3.</p> <p>MRC** Dyspnea Scale grades 2,3,4.</p> <p>CTS*** COPD Classification: Mild, Moderate.</p> <p>Current or ex-smoker with a smoking history of at least 10 years.</p> <p>Spirometry shows: $FEV_1^1 < 80\%$ and $> 30\%$ of the predicted normal value within 12 months. $FEV_1/FVC^2 < 70\%$ within 12 months.</p> <p>Mild exacerbation in the last 12 months: Patient treated in emergency or outpatient. There was no need for hospitalization.</p> <p>Moderate exacerbation: Patient required admission.</p>	<p>Outpatients with GOLD grade 1, 4.</p> <p>MRC Dyspnea Scale grade 1, 5. CTS COPD Classification: severe.</p> <p>Spirometry shows: $FEV_1 \geq 80\%$ OR $\leq 30\%$</p> <p>Severe exacerbation: Patient required ventilation and/or Intensive Care Unit (ICU) admission.</p>

GOLD* = Global Initiative for Chronic Obstructive Lung Disease (Appendix B, Table B1), MRC**= Medical Research Council, CTS*** = Canadian Thoracic Society (Specific for Canada)

FEV_1 = Forced Expiratory Volume in first second, FVC^2 = Forced Vital Capacity

Table A3—CHF Specific Criteria

CHF Inclusion Criteria	CHF Exclusion Criteria
<p>Well-Known Diagnosis of CHF.</p> <p>Discharge from the hospital after acute heart failure in the last 12 months with: EF ^a < 40% and ≥ 35% or EF > 40% plus BNP ^b > 400 or plus NTproBNP ^c >1500.</p> <p>Emergency visit due to heart failure in the last 12 months.</p> <p>NYHA● classes 2, 3.</p> <p>AHA/ACC●● stages B, C.</p>	<p>. CHF with EF < 35%.</p> <p>NYHA classes 1, 4.</p> <p>AHA/ACC stages A, D.</p>

EF ^a = Ejection Fraction, BNP ^b = B-type (Brain) Natriuretic Peptide, NT-proBNP ^c = Nterminal pro B-type Natriuretic Peptide, NYHA● = New York Heart Association (Appendix B, Table B2), AHA/ACC●● = American Heart Association/ American College of Cardiology (Appendix B, Table B3).

Appendix B—International Standards Used in Developing Criteria

Table B1

GOLD Grading for COPD

GOLD 1	Mild	FEV1 ≥ 80% predicted
GOLD 2	Moderate	50% ≤ FEV1 < 80% predicted
GOLD 3	Severe	30% ≤ FEV1 < 50% predicted
GOLD 4	Very Severe	FEV1 < 30%

Table B2

NYHA Classification of CHF

Class	Functional Capacity: How a patient with cardiac disease feel during physical activity
I	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea or anginal pain.
II	Slight limitation of physical activity. Comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea or anginal pain.
III	Marked limitation of physical activity. Comfortable at rest. Less than ordinary physical activity results in fatigue, palpitation, dyspnea or anginal pain.

Class	Functional Capacity: How a patient with cardiac disease feel during physical activity
IV	Inability to carry on any physical activity without discomfort. Symptoms of heart failure / anginal symptoms are present at rest. Discomfort increases with any physical activity.

Table B3

ACC/AHA Classification of CHF

Stage	Description
A: High risk for developing heart failure	Hypertension, DM, CAD, family history of cardiomyopathy.
B: Asymptomatic heart failure	Previous MI, LV dysfunction, valvular heart disease.
C: Symptomatic heart failure	Structural heart disease, dyspnea and fatigue, impaired exercise tolerance.,
D: Refractory end stage heart failure	Marked symptoms at rest despite maximal medical therapy.

DM= Diabetes Mellitus, CAD= Coronary Artery Disease, MI= Myocardial Infarction, LV= Leftt ventricle.

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