Connecting Patients with Providers

A Pan-Canadian Study on Remote Patient Monitoring
Executive Summary

Canada Health Infoway
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Acknowledgments

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About this Study

In October 2013, Canada Health Infoway (Infoway) commissioned Ernst & Young LLP (EY) to conduct a pan-Canadian study of Remote Patient Monitoring (RPM) to inform the potential for RPM implementation across Canada.

This study is comprised of four parts:

1. **Current State**: a discussion of available literature, current deployment in Canada, as well as lessons learned from previous implementations of RPM in Canada and internationally;
2. **Case Study Review**: an assessment of four RPM programs in Canada including a review of health system benefits of implementing these programs;
3. **Emerging Solutions**: a review of emerging, innovative RPM programs in Canada; and
4. **Critical Success Factors**: a synthesis of the key factors emerging from the selected case studies and emerging solutions necessary to design and implement RPM programs, and to support further growth and uptake across Canada.

Methodology

In collaboration with Infoway’s Expert Advisory Panel the following steps were undertaken to understand the RPM evidence base, the state of existing programs, lessons learned from international implementations and critical success factors to inform future program planning, development and implementation across Canada.

1. Detailed program information, including utilization data, funding applications, pilot results, satisfaction surveys and evaluation findings;
2. A literature review of RPM activity in Canada and internationally, complemented by a pan-Canadian scan of Telehealth and RPM activity in Canada completed by Infoway;
3. Key interviews with over 20 key informants including policymakers, clinicians, scientists and vendors with extensive RPM and Telehealth experience;
4. A synthesis and review of available Canadian evidence from RPM program and pilot evaluations; and
5. Detailed provider and consumer surveys distributed to featured programs to gather detailed cost and benefit information.
Evidence suggests that RPM activity is growing in Canada. A recent national survey found that one per cent of Canadians used medical devices that captured and transmitted data electronically (e.g., via Internet or SMS) to their health care providers for chronic disease or post-surgical discharge monitoring.¹ The 2013 Canadian Telehealth Report showed that Home Telehealth endpoints across the country have grown since 2010.² Our study identified approximately 5,000 patients enrolled in 19 RPM programs across seven provinces and territories, supporting continued growth of 15-20% annually. These programs provide care for patients along different stages of the care continuum using technologies with varying degrees of complexity. As such, the growth in RPM activity has been met with both technological innovation and the targeting of patients across different stages of illness.

Many of the large-scale, established programs are designed for patients with chronic conditions, such as Congestive Heart Failure (CHF), Chronic Obstructive Pulmonary Disorder (COPD) and Diabetes. Such patients are the ‘traditional’ candidates for RPM as appropriate ongoing management in the community, such as in the home, can reduce the need for acute care and improve wellness. Many of these programs involve the use of complex medical devices and installed technologies that automate a patient’s connection with their provider.

The smaller-scale programs reviewed are utilizing less complex and costly technologies designed to either mimic formalized monitoring programs or facilitate patient self-monitoring. While these programs have focused on providing patients with the information to self-manage their condition, rather than consistent monitoring by a healthcare provider, they intend to ensure that patients do not progress to a stage of illness requiring more intensive care and/or monitoring. Such programs have the potential to avoid the utilization of costly healthcare resources downstream.

Many programs initiated as pilot projects have been formally adopted by regional planning bodies or health service providers, such as the Ontario Telehomecare Expansion Project developed by the Ontario Telemedicine Network (OTN). The success of pilot implementations has also translated into the integration of programs as the standard of care for certain sub-sets of patients, such as the University of Ottawa Heart Institute’s (UOHI) Regional Home Monitoring Program.

¹ Annual Tracking Survey conducted by Harris/Decima and commissioned by Canada Health Infoway, 2014
As interest in RPM in Canada grows, a number of promising examples of RPM programs have emerged. While chronic disease patients remain the primary candidates for these programs, a growing number of programs are focusing on lower acuity patients. This is coupled with a shift towards less complex technology, enabling patients to self-manage their condition through the use of readily available tools.

For the purpose of this study, RPM was defined as the delivery of health care to patients outside of conventional settings enabled by a technological application or device. RPM hinges on the electronic transmission of patient data to a provider as a series of integrated services and processes, ranging from health coaching to the alteration of a patient’s course of care.

The relationship between technological complexity and acuity can be conceptualized as a spectrum of programs consisting of four streams.

1. **Enabling Information**: The provision of information relating to a patient’s condition through websites, patient portals and mobile applications. Enabling information may exist as a component of RPM programs, but is limited to the provision of information about a patient’s condition, such as their care plan and medication regime.

2. **Self-Monitoring**: Programs in which patients report their health information through an enabling technology at regular intervals to a care provider. Interventions are triggered when thresholds aligned to a patient’s health status are surpassed.

3. **Assisted Monitoring**: Programs involving patient monitoring or coaching at prescribed intervals, through the direct use of community care professionals, when complex patients are discharged into the community.

4. **Environmental Monitoring**: Programs designed for highly complex patients (e.g., those with a functional disability and/or multiple, complex comorbidities) involving the use of installed devices that monitor their ability to live independently. Self-monitoring is not typically a component of these programs.

The following framework was constructed to categorize RPM programs in Canada reviewed in this study and to illustrate the relationship between technological complexity and patient acuity. The framework also demonstrates the associated impact on the utilization of health system resources as programs attract highly complex, acute patients.
Ensuring alignment between patient acuity and technological complexity is critical to maximize patient and system level benefits of any RPM program. Using a risk stratification framework enables managers to structure their programs around groups of patients that are at varying levels of risk of being admitted to a hospital (levels 1-5 above). The framework below was applied to the programs reviewed in this study to identify the patient groups that would be associated with the greatest benefit from being included in an RPM program.

Figure 2. Risk Stratification Framework:

<table>
<thead>
<tr>
<th>Resource Requirements</th>
<th>Risk of Hospitalization</th>
<th>Patient Profile</th>
<th>RPM Solution(s)</th>
</tr>
</thead>
</table>
| High Risk of Hospitalization | High Risk of Hospitalization | • Known to multiple services and prioritised  
• Active multi-disciplinary case management | Proportion of patients may benefit from intensive remote monitoring (e.g., daily recording of bio signs linked to clinical support as part of case management) |
| Medium Risk of Hospitalization | Medium Risk of Hospitalization | • Known to one or more services  
• Risk managed through core support | Proportion of patients may benefit from intensive remote monitoring (e.g., daily recording of bio signs linked to clinical support as part of case management) |
| Low Risk of Hospitalization | Low Risk of Hospitalization | • Not necessarily known to any service  
• Risk managed through public health primarily | Not target population for RPM solutions – use of mobile applications to support self-managed lifestyle changes |

Evidence of Benefits

Using Infoway’s Benefits Evaluation Framework, a series of benefit hypotheses were constructed to evaluate programs based on quality, access and productivity benefits realized. The hypotheses were constructed in collaboration with Infoway and members of the Expert Advisory Panel based on a literature review and supported by key informant interviews with academics, program administrators, subject matter experts and industry representatives.

Overall, the literature review relied on meta-analyses, systematic reviews of peer reviewed RPM programs, program evaluations, evidence from large-scale Randomized Controlled Trials, such as the UK’s Whole System Demonstrator project and a separate literature review conducted by Infoway. Although definitions, patient populations, outcome measures and evaluation quality vary widely in the literature, the cumulative benefits story of RPM programs for chronic disease patients is encouraging.

The following table provides a summary of the benefits against each of the hypotheses identified. Hypotheses that were validated with a moderate-to-high evidence base are displayed in bold, green text. The strength of the evidence was assessed with members of Infoway’s Advisory Panel based on the availability of published evidence and discussion with key informants.

Table 1. Evidence of Benefits Summary

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Strength of evidence</th>
</tr>
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<tbody>
<tr>
<td><strong>Quality</strong></td>
<td></td>
</tr>
<tr>
<td>▶ ↑ Patient satisfaction</td>
<td>● ○ ○ ●</td>
</tr>
<tr>
<td>▶ ↑ Patient compliance</td>
<td></td>
</tr>
<tr>
<td>▶ ↑ Quality of life</td>
<td></td>
</tr>
<tr>
<td>▶ Promote integrated care</td>
<td></td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td></td>
</tr>
<tr>
<td>▶ ↓ Caregiver burden</td>
<td>● ○ ● ●</td>
</tr>
<tr>
<td>▶ ↑ Access to specialists</td>
<td></td>
</tr>
<tr>
<td>▶ ↑ Dissemination of health data</td>
<td></td>
</tr>
<tr>
<td><strong>Productivity</strong></td>
<td></td>
</tr>
<tr>
<td>▶ ↓ ED visits/hospitalizations</td>
<td>● ○ ○ ●</td>
</tr>
<tr>
<td>▶ ↓ Per client health $</td>
<td></td>
</tr>
<tr>
<td>▶ ↓ Per client care time</td>
<td></td>
</tr>
</tbody>
</table>

*● = High availability of evidence (> = 10 published studies), ○ = Moderate availability of evidence supporting hypotheses, * = Low availability of evidence supporting hypotheses (< = 2 published studies).
As illustrated in the table above, the strongest evidence supports reductions in emergency room visits, hospital admissions and bed days, patient satisfaction, and quality of life given appropriate patient selection into a program.⁴,⁵,⁶,⁷

It is important to note that many of the existing evaluations have focused on smaller scale projects which have featured variability in the use of technologies, patient populations, chronic diseases and locations.⁸ Nearly all the reviews and studies examined here, which collectively involve thousands of patients, span multiple years, cover multiple countries and include various RPM technologies and delivery models, consistently argue that additional research is needed to optimize the benefits of RPM, identify the right technology mix, and uncover the key drivers of sustainable RPM initiatives.

⁶ Home Telemonitoring for Chronic Disease Management: An Economic Assessment, HEC Montreal, August 2012
Case Study Review

An in-depth review of four established RPM programs in Canada demonstrated strong evidence for quality, access and system benefits, including decreased ED utilization and fewer hospitalizations.

Table 2. Case Studies

<table>
<thead>
<tr>
<th></th>
<th>Ontario Telehomecare Expansion Program - OTN</th>
<th>University of Ottawa Heart Institute (UOHI) Regional Home Monitoring Program</th>
<th>BreatheWELL at Home Program</th>
<th>Jardins Roussillon (JRHC) Telehomecare Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year established</td>
<td>2007</td>
<td>2006</td>
<td>2012</td>
<td>2010</td>
</tr>
<tr>
<td>Province</td>
<td>Ontario</td>
<td>Ontario</td>
<td>British Columbia</td>
<td>Quebec</td>
</tr>
<tr>
<td>Condition(s)</td>
<td>COPD, CHF</td>
<td>Cardiac (including CHF)</td>
<td>COPD</td>
<td>CHF, COPD, Diabetes</td>
</tr>
<tr>
<td>Annual patients</td>
<td>1,400</td>
<td>300</td>
<td>300</td>
<td>180</td>
</tr>
</tbody>
</table>

Although there is considerable variation in the design and structure of these programs, they each target chronic disease patients with a medium-to-high risk of being hospitalized. Such patients remain the focus of RPM programs as they have demonstrated the ability to effectively manage a patient’s clinical condition before deteriorating to a more resource-intensive course of care.

The case studies looked at the value of these benefits to the health system and compared them to the costs to establish and operate the respective programs. While these programs consistently realized system-level benefits, inconsistencies in how these benefits are measured present barriers in forecasting the benefits of growing these programs across Canada. The diverse methods by which benefits are analyzed and monitored create difficulties in assessing the minimum number of patients a program should support to remain viable and the design factors that will realize access, quality and productivity benefits.
As the Canadian RPM market continues to expand and new programs emerge, understanding and assessing the ability of an RPM program to recruit and retain a critical mass of patients will be critical to facilitating larger-scale implementations.

The following figure illustrates the number of patients required for larger-scale RPM programs to ‘break-even.’ The patient “break-even” or “point of sustainability” calculation and the percentage of current maximum capacity takes into account the patient threshold required for the program benefits to outweigh the costs.

Figure 3. ROI Analysis

Despite the obvious variability in the number of patients an RPM program requires to achieve a break-even position, the findings provide a signpost for smaller, emerging programs that are considering how to structure and design their program to maximize benefits for their patients. While start-up costs for programs may be high, this analysis provides evidence to suggest that long-term sustainability is a realistic goal for a variety of RPM programs.
Emerging Solutions

In addition to the established programs described above, four additional RPM programs were identified as examples of emerging solutions based on their potential to realize sustainable and scalable benefits for patients:

1. mDAWN (British Columbia),
2. Wel-Tel (British Columbia),
3. Virtual Cardiac Rehabilitation Program (vCRP) (British Columbia),
4. MyHome Health Program (Alberta).

Many of the RPM programs reviewed demonstrated the potential to realize significant benefits for a variety of patient populations using both simple and complex technologies to connect patients and providers. Many of these programs are within the pilot phase and involve smaller sub-sets of patients and in some cases, limited evidence of measurable benefits.

Each program utilizes an innovative approach to manage a patient’s condition, often relying on technology patients have readily available, such as smartphones and/or internet connectivity. While the benefits of these programs are still early and not fully realized, the emergence of such programs represents a shift towards RPM programs with lower technological complexity and cost structure, with a broadened scope towards patients who can self-manage their condition.
Critical Success Factors

As demonstrated by the case studies, literature review, expert interviews and emerging solutions, to gain the greatest value from implementing an RPM program at-scale there must be sufficient recognition of four factors within program design:

1. **Engagement and collaboration.** As clinicians are at the forefront of understanding the clinical complexity of patients, they should assist in designing an RPM program, along with the patient and/or caregiver, including the selection of appropriate technology that aligns with a patient’s acuity and health care requirements. Clinicians are uniquely positioned to describe and deliver a compelling value proposition to potential patients, facilitating greater recruitment and retention.

2. **Patient recruitment and retention.** This is to ensure that providers identify patients that can benefit from the RPM program based on the complexity of the patient’s condition, potential benefit from using the supporting technology and the actual technology involved. Appropriate recruitment and retention of patients relies on a consistent level of communication with patients regarding both the benefits of the program and the potential to track progress towards improving their health status throughout the duration of the program. The analysis also found that achieving a critical mass of patients is necessary to maximize benefits, recover program costs and return savings to the health system for reinvestment. This minimum number of patients was found to be highly variable and dependent on the scope and design of the program.

3. **Benefits measurement.** As RPM programs remain a relatively new care delivery enabler in Canada, determining likely benefits and consistently measuring those benefits will allow patients, clinicians and policymakers to understand the patient and system-level value RPM programs provide.

4. **Integrated care and care-coordination.** RPM should be integrated into a clinician’s workflow through an assisted or environmental monitoring program, or coordinated across the care continuum through a self-management program in order to achieve the best patient benefit.
Conclusion

RPM is an emerging enabler of care delivery in Canada. The results from this study have demonstrated the growth in formalized RPM programs, evidenced by the large-scale programs featured as case studies. As the evidence base for RPM programs continues to grow, this study has highlighted a number of key points that should be considered by policymakers, technology vendors, patients and providers to facilitate widespread uptake and adoption:

► RPM programs in Canada are progressing from pilots to established solutions,

► Much of the activity in large and small-scale programs remains focused on chronic disease patients presenting a medium-to-high risk of admission to a hospital,

► Larger scale programs have demonstrated considerable economic, system-level benefits through decreased utilization of health system resources,

► Smaller scale programs are emerging that leverage enabling information and self-monitoring technologies targeted to patients with a low and medium risk of being admitted to a hospital,

► Preliminary cost analysis provides evidence to support the feasibility of RPM programs in both smaller and larger jurisdictions,

► Extrapolating benefits from established programs is limited by variations in program design, patient cohorts and outcomes measurement, and

► RPM remains an emerging enabler for health system transformation with the potential to improve outcomes and the patient experience through self-management and home-based care.

The role of information technology is a critical enabler to improving health services delivery. As decision-makers consider options for delivering high quality care at the right cost, there is a need for innovative solutions that potentially reconfigure traditional service delivery models. RPM is a critical enabler for this transformation with the potential to incentivize self-management, support the delivery of care in home settings and significantly improve the patient experience. The continued growth and sustainability of RPM programs in Canada will be dependent on consistent engagement and collaboration, recruiting and retaining the right patients, and striking an appropriate balance between integrated and coordinated care while consistently measuring and demonstrating benefits.
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