Under embargo until April 22, 2013

The emerging benefits of electronic medical record use in community-based care

April 2013

A study commissioned by:

Canada Health Infoway / Inforoute Santé du Canada

pwc

Acknowledgements

The evaluation team acknowledges and thanks those organizations and individuals who contributed their time, knowledge and expertise to this Study. A particular mention goes to the Advisory Panel members, jurisdictional contributors, and Canada Health Infoway's internal project team.

Advisory panel

- Neeraj Bector, Family Physician, Alberta
- Sandra Cascadden, Nova Scotia Department of Health & Wellness
- Tom Fogg, Manitoba Health
- Diane Gutiw, Saskatchewan Health
- Jerry Hurley, McMaster University
- Claudia Mariano, Nurse Practitioners' Association of Ontario
- Steve McLaren, Family Physician, Ontario
- Gary Teare, Saskatchewan Health Quality Council
- Jim Thorsteinson, College of Family Physicians of Canada

Jurisdictional contributors

- Thomas P. Alteen, Newfoundland and Labrador Centre for Health Information
- Wilma Arsenault, Manitoba eHealth
- Davin Church, Saskatchewan EMR Program
- Lisa Napier, Nova Scotia Department of Health & Wellness
- Craig Pelley, Newfoundland and Labrador Centre for Health Information
- Wei Qiu, eHealth Ontario
- Carol Rimmer, British Columbia Physician Information Technology Office
- Dan Sheplawy, Alberta Physician Office System Program
- Jessica Young, Northwest Territories Department of Health and Social Services

PwC Consulting team

- Genevieve Bonin
- Lauren Ettin
- Will Falk
- Maureen Hazel
- Catherine Hunter
- Lynn Nagle
- Erika Norris
- Jesse Smith

Canada Health Infoway

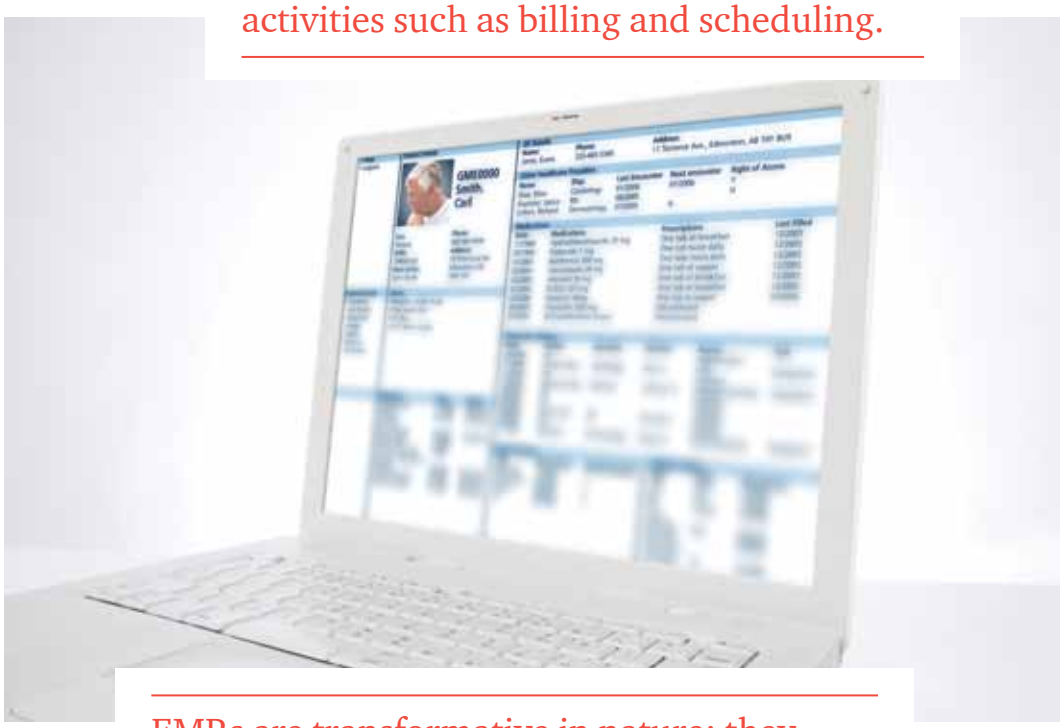
- Louise Beauchesne
- Rashaad Bhyat
- Maureen Charlebois
- Jeff Green
- Simon Hagens
- Jane Holden
- Chad Leaver
- Shelagh Maloney
- Brent McGaw
- Terry Moore
- Colleen Rogers
- Don Sweete
- Keren Taylor-Hughes
- Christina Wong
- Jennifer Zelmer
- Lynne Zucker

1.0 Introduction

Canada Health Infoway (*Infoway*) commissioned PwC to conduct a Benefits Evaluation Study ("the Study") to determine the current and emerging effects of implementing Electronic Medical Records (EMRs) in community-based practices in Canada. Within scope for this Study was an assessment of the effects of EMR use by family physicians and specialists (medical or surgical) who work in private offices or clinics, community clinics and community health centres, and free-standing walk-in clinics.

Adoption of EMRs by primary care physicians in Canada has more than doubled between 2006 and 2012 from 23% to 56% (Commonwealth Fund Survey, 2012). The adoption of EMRs by community-based specialists has also increased from 28% of physicians in 2007 to 41% in 2010 (National Physician Survey, 2010). This increase in adoption has been supported to a large extent through investments by the provinces and territories in EMR programs, physician practices, and *Infoway*. As expected, there is variability in EMR adoption across the country, and those jurisdictions with defined EMR programs have experienced the most significant gains. Despite these gains, the use of EMRs in primary care in Canada lags behind that of many other countries – Australia, New Zealand, the United Kingdom and the Netherlands all report use of EMRs by over 90% of their primary care physicians.

EMRs are computer-based patient records which detail patient demographics, medical and drug history, and diagnostic information. They are often integrated with other software that manages activities such as billing and scheduling.



EMRs are transformative in nature; they fundamentally change the work, productivity and processes in community-based practices, and facilitate enhanced delivery of care.

2.0 Approach to this Study

The purpose of this Study was to develop a model that estimated current and emerging benefits of EMR use in Canada and to provide recommendations in support of further adoption and advanced use of EMRs. PwC also completed a scan of provinces' and territories' progress and activities related to the use of EMRs to inform the Study's development.

The approach taken to estimate the benefits is represented in the following graphic.

Figure 1: Approach to developing the EMR benefit estimates

Literature Review and Hypotheses

The benefits articulated in this Study are a reflection of the available research and evidence and are intended to be illustrative of the current and emerging impacts of EMR use in community-based practices in Canada. The following data sources were included in this review:

- Over 250 research articles (published, unpublished and grey);
- *Infoway* funded research and evaluations (e.g., Physician Value Study, The Population Health Management Challenge, National Impacts of Generation 2 Drug Information Systems, EMR Integrated Labs Workflow Evaluation);
- Surveys (e.g., Commonwealth Fund Survey (2006, 2009, 2012), National Physician Survey (2007, 2010), and provincial surveys); and
- Over 20 key informants from across Canada.

Using this foundation of evidence, hypotheses regarding the effects of EMR use were developed and validated with the Advisory Panel and stakeholders, including provincial EMR programs, clinicians and researchers.

Aggregation and extrapolation of effects

Each benefit area was quantified based on the findings in the literature. However, there was limited Canadian evidence available to inform the analysis, and much of the international research was several years old with significant variation in findings and scope of study. To address this, the Study team:

- focused on benefit areas where the most evidence was available;
- used Canadian findings to the extent possible;
- prioritized higher quality studies;
- prioritized recent studies and excluded dated studies to the extent possible;
- established EMR adoption and usage rates of specific functionalities from physician self-reported survey data;
- calculated benefit estimates from research evidence and Canadian source data;
- used ranges and conservative assumptions to increase the reliability of estimates; and
- cross-referenced and validated with multiple sources of data and reviewed with experts from the clinical and research communities.

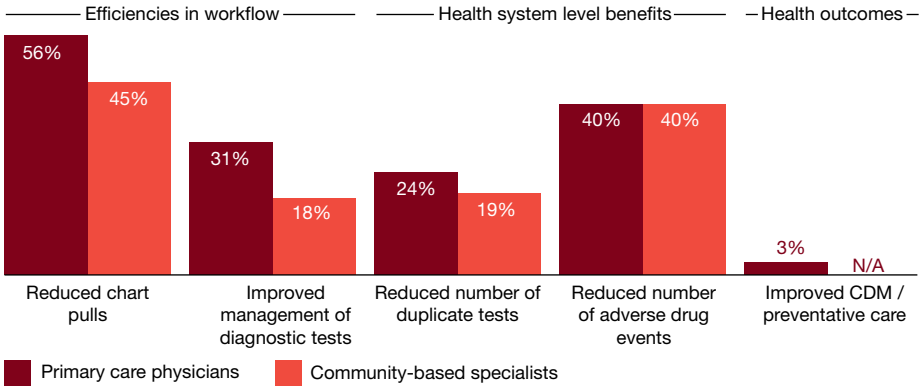
Considering these parameters, Canadian context data (e.g., number of physicians in Canada, number of tests ordered in Canada) was applied to each of the benefit areas.

Maturity of use

For each of the benefit areas, maturity of use was determined to reflect the percentage of physicians expected to realize the stated benefits as a result of their self-reported use of specific EMR functionalities and/or reported conduct of practice management using EMR data. The maturity of use was then applied to the benefit estimates to adjust for variation in physician use of these EMR functionalities and/or reported conduct of practice management with use of EMR data. The percentage of physicians realizing specific benefits are presented in Figure 2 below.

For example, as described in Figure 2, all primary care physicians who use an EMR (56%) are expected to realize the benefit of "reduced chart pulls" (i.e., the time it takes for staff members to pull and re-file paper charts). In contrast, as few as 3% of physicians are expected to realize the benefit of "improved chronic disease management (CDM)/preventive care" as few physicians report using EMR data in practice based population health management activities and/or use of a specific bundle of EMR functionalities.

Figure 2: Maturity of use for benefit estimates



Benefit estimates

Due to the limited available research on which the model is predicated, the benefit estimates are not comprehensive but rather represent a segment of the full benefit that is likely being realized by EMR users in community-based settings. For example, only two specific administrative tasks are modelled out of the full potential range of tasks completed by administrative staff. In addition, both current and emerging benefits are described. Current benefits are those for which strong and comprehensive evidence was available to quantify the benefit in the model. Emerging benefits are intended to reflect those currently being realized, but for which quantitative evidence is limited. Benefit estimates for 2012 are presented, as well as cumulative benefits for the period 2006-2012 based on changes in EMR adoption and maturity of use.

3.0 Benefits

Estimating benefits at the pan-Canadian level has been feasible for some benefit areas and Study findings indicate that there is compelling evidence to continue to advance EMR adoption and maturity of use across Canada. A significant finding is the need for substantially more research to generate Canadian evidence and further validate and measure the realization of benefits.

A summary of the current and emerging benefits of EMR use are as follows:

Current and emerging benefits of EMR use in Canada

Community-based practices experience efficiencies in workflow as staff time is redeployed.

EMR use results in health system level benefits, such as reduced numbers of duplicate tests and adverse drug events.

Advanced use of EMRs can improve health outcomes and patient safety through preventive care and chronic disease management.

EMR use supports improved interactions and communications among care team members and between providers and patients.

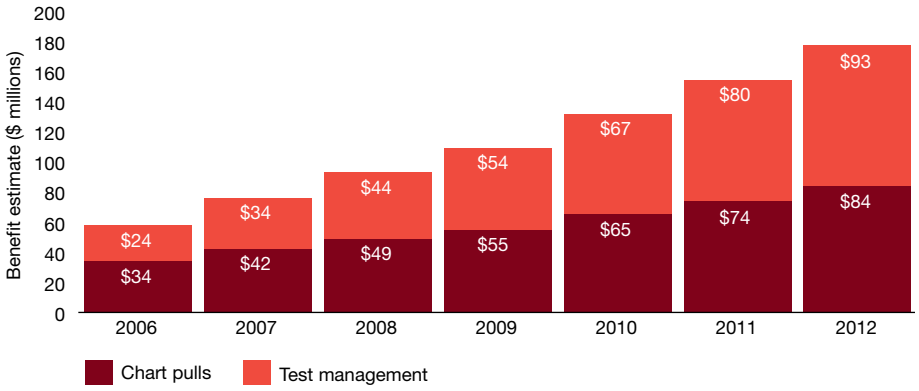
3.1 Community-based practices experience efficiencies in workflow as staff time is redeployed.

Since implementing EMRs, 67% of Saskatchewan's family physicians, office managers and specialists report that their medical practices are more or significantly more productive

Saskatchewan Physician EMR Satisfaction Survey Results Report, 2012

The decision to adopt an EMR system has significant financial implications for individual practices and funding organizations. Financial considerations beyond start-up costs include those related to ongoing maintenance and system upgrades, as well as changes in productivity during and after the transition. A detailed study of practice finances found that primary care physicians recoup their investment in 10 months on average. 14 of 17 primary care clinics had a positive return on their investments in EMRs and for those, time to break-even ranged from 1–37 months (Lortie et al., 2013). Furthermore, efficiencies in workflow can be expected as administrative staff gain increased capacity to focus on value-added tasks as staff time is redeployed. These practice efficiencies include reduced or eliminated chart-pulls (i.e., the time intensive task of retrieving and refiling a patient chart for a visit) and improved efficiencies in laboratory and diagnostic test management (i.e., the time to sort, archive and retrieve reports). While quantitative evidence is not available, it is also anticipated that emerging benefits are being realized related to other clinical and administrative tasks such as enhanced patient scheduling and billing practices. The use of EMRs is believed to fundamentally change the mix and nature of tasks undertaken by physicians. However, there is insufficient research to date to determine the net productivity impact.

Figure 3: Annual benefits from reduced chart pulls and improved test management, 2006–2012



Study Finding:

Benefits related to reductions in "chart pulls" and efficiencies in laboratory and diagnostic test management are estimated at $177M in 2012.

Summary of estimated and emerging benefits

	Estimated benefits	Emerging benefits
Description of benefit	Efficiencies realized in community-based practices by reduced or eliminated chart pulls **$84M ($56 – $112M) in 2012**	Administrative task efficiencies realized through enhanced patient scheduling and billing practices
	Efficiencies in community-based practices by improved laboratory and diagnostic test management **$93M ($41M – $103M) in 2012**	Clinical task efficiencies realized through changes in clinical processes, including documentation, order entry, and patient encounter management
2012 total benefit	**$177M in 2012 ($97M – $215M)**	Evidence not available
2006–2012 cumulative benefit	**$800M**	

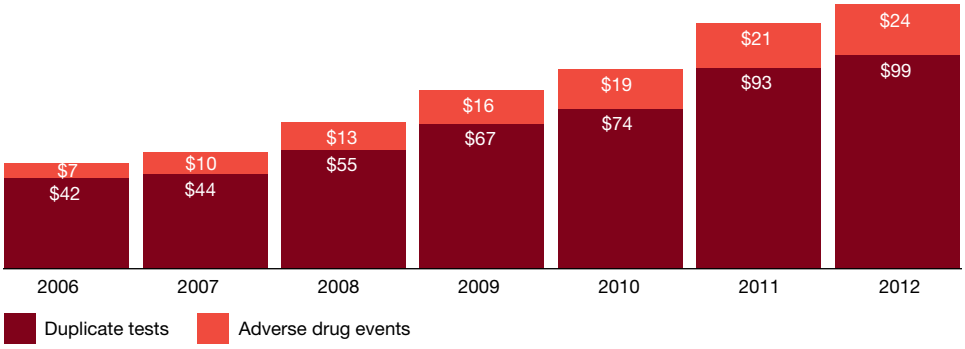
Physician billings remain stable from the date of EMR implementation over the 18-month follow-up period. No decline in overall physician office billings was observed from the date of EMR implementation (Jaakkimainen et al., 2012).

3.2 EMR use results in health system level benefits, such as reduced numbers of duplicate tests and adverse drug events.

While EMRs support transformational initiatives to enhance patient care, their use may also result in reduced health system utilization. With the use of EMRs, there are demonstrated quantifiable impacts in reducing the number of duplicate tests ordered and adverse drug events (ADEs) resulting in benefits at the system level.

The use of EMRs can reduce test duplication by displaying past test results, highlighting redundancy of ordering through alerts, and decreasing the number of test results that are lost or misplaced through electronic filing. This benefit is likely to be substantially enhanced as decision support is optimized and focussed, and when there is more integration between EMRs, Electronic Health Records (EHRs), and other systems external to the community-based care setting.

Figure 4: Annual benefits from reduced ADEs and reduced duplicate tests, 2006–2012



Study Finding:

Benefits related to fewer duplicate tests and ADEs are estimated at $123M in 2012.

Summary of estimated and emerging benefits

	Estimated benefits	Emerging benefits
Description of benefit	Reduced laboratory and imaging test duplicates: **$99M ($29M – $145M) in 2012**, 6.5M fewer duplicate tests in 2012	Reduced duplicates with increased system connectivity to Electronic Health Records, interoperability and access to data repositories
	Reduced ADEs due to prescription legibility: **$24M in 2012**	Reduced inappropriate imaging tests with decision support: e.g., Sinus CTs and head and lumbar MRIs: $5.7M in 2012, 6,000 fewer inappropriate CTs and MRIs*
2012 total benefit	**$123M in 2012 ($53M – $169M)**	Evidence not available
2006–2012 cumulative benefit	**$584M**	

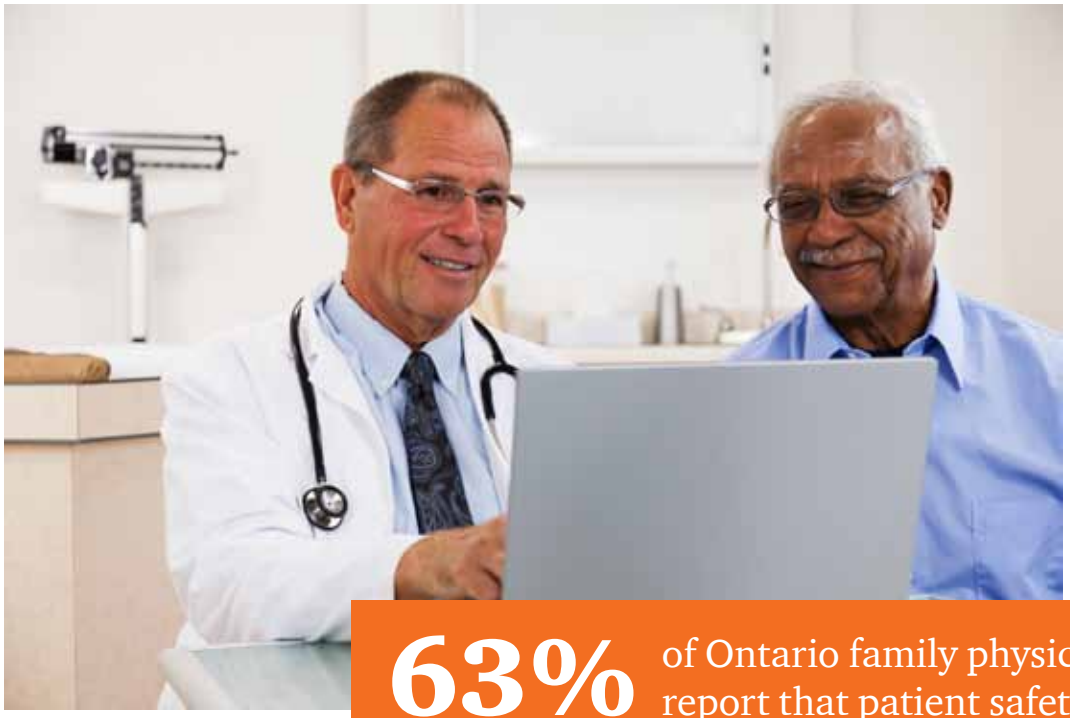
**CT - Computed Tomography, MRI - Magnetic Resonance Imaging*

With electronic prescription entry, EMRs can: alert the physician to potential prescribing errors and potential ADEs due to interactions with other medications; flag patient allergies; and improve prescription legibility and completeness. Avoidable ADEs are just one of the many medication management benefits which EMRs have the potential to facilitate. Availability of a current and accurate list of medications within the EMR has substantial value as a trusted source of clinically relevant data. When full medication profiles and e-prescribing functionality become widely available to community-based clinicians, the benefits may include the ability to counsel patients on appropriate use of medications in order to reduce ADEs and achieve better patient outcomes.

It is also expected that the use of EMRs may improve the appropriateness of diagnostic tests ordered through the availability of decision support features that can reduce the misuse or overuse of certain diagnostic tests.

Since implementing the EMR, 94% of physicians enrolled in Alberta's EMR program report that patients receive their test results faster, and 97% report that tests and investigations are no longer needlessly repeated.

Alberta Physician Office System Program (POSP) Benefits Survey, 2012



63% of Ontario family physicians and specialists report that patient safety has improved within the first year of implementing their EMR (OntarioMD Physicians EMR Usage and Satisfaction Survey, 2013).

3.3 Advanced use of EMRs can improve health outcomes and patient safety through preventive care and chronic disease management.

The costs of managing chronic diseases currently account for 58% of all health care spending in Canada and are estimated at $68 billion annually and growing; in addition, the indirect costs associated with income and productivity loss are estimated at $122 billion, or double the costs of managing chronic diseases (Public Health Agency of Canada, 2011). As such, with advanced use of EMRs (i.e., use of a broader range of available functionalities) there is a significant opportunity to support improved CDM and preventive care and potentially reduce the associated costs to the health care system. However, self-reported survey responses revealed that only 3%–18% of primary care physicians in Canada were estimated to effectively use EMRs for this purpose.

Research has indicated that with advanced EMR use, positive impacts can be expected such as:

- improved identification of at-risk or in need of follow-up patients/ populations;
- improved screening rates and testing frequency;
- enhanced adherence and responsiveness to guidelines and changes in guidelines;
- improved physiological outcomes; and
- improved immunization rates.

86% of physicians enrolled in Alberta's EMR program report that their ability to manage patients' chronic diseases is improved through the use of such EMR tools as alerts, flow sheets, reminders and goals.

Alberta POSP Benefits Survey, 2012

Study Finding:

When clinicians use the EMR functionalities that support prevention and CDM (e.g., population-based reminders, decision support), there are significant benefits to be realized.

Examples of emerging benefits

10% increase in mammogram screening rates and 12% increase in cholesterol screening rates (Johnston et al., 2003).

51% of patients with diabetes in EMR-enabled practices received necessary care compared to 7% in paper-based practices (Better Health Greater Cleveland, n.d.).

10.9% more patients in EMR-enabled practices achieved target hemoglobin A1c levels, 11.1% more achieved target blood pressure levels, and 18.1% more achieved target cholesterol levels (Cebul et al., 2011).

49% increase in pneumococcal vaccination rates and a 20.7% increase in influenza vaccination rates with EMR reminders (Loo et al., 2011).

Primary care practices with EMRs conducted reviews of all patients (e.g., for medication recall) approximately 30 times more quickly than paper-based clinics (Lapointe et al., 2012).

3.4 EMR use supports improved interactions and communications among care team members and between providers and patients.

EMRs can improve interactions between care teams, providers and patients when used as a communication tool.

The use of EMRs may support improvement in the quality of care by fostering a collaborative environment with inter-professional teams. Anecdotally and through surveys, physicians have indicated that they are better able to share patient information with members of their team, whether onsite or remotely when comprehensive, legible and accurate patient histories are available.

The patient-provider relationship may also improve through additional opportunities for patient education (e.g., trending of test results over time, access to the internet in the examining room), availability of information in real time so decisions can be made more promptly, and options for the patient and physician to communicate without having to schedule an office appointment. However, the use of EMRs may introduce challenges critical in building rapport between patients and providers (e.g., due to the placement of the computer in the examination room).

93% of physicians enrolled in Alberta's EMR program report that access to a summarized patient history means that patients spend less time repeating the same information to care providers; and 97% report that they and their clinic associates and care team have more complete patient information.

Alberta POSP Benefits Survey, 2012

Canadian adults whose regular doctors look up information about their health using computers or mobile devices are more likely to say that their regular doctor always knows important information about their medical history than those using paper records alone.

Harris Decima User Experience Survey, 2012

63% of Ontario family physicians and specialists report that continuity of care has improved within the first year of implementing their EMR.

OntarioMD Physicians EMR Usage and Satisfaction Survey, 2013

96% of physicians enrolled in Alberta's EMR program report that access to a summarized patient history has improved continuity of care.

Alberta POSP Benefits Survey, 2012

4.0 Recommendations

This Study has demonstrated some of the benefits that have been realized with the implementation of EMRs in community-based care practices. In practices demonstrating advanced EMR use, further emerging benefits at the practice and health system level are being realized. The evidence indicates that there is a compelling reason to continue to advance EMR adoption and maturity of use across Canada.

With the implementation of a number of focused recommendations and with the ongoing engagement and involvement of clinicians, the potential for wide ranging and transformative benefits can be further realized by providers, patients and the health care system as a whole.

The following recommendations are presented to policy-makers, governing agencies, funders, researchers, implementers and adopters of EMRs in support of continued realization of benefits associated with the mature use of EMRs.

1. **Continue to increase EMR adoption and maturity of use in community-based settings to realize benefits** – As essential enablers of transformation in community-based care, continued investments in EMRs should be pursued to encourage increased adoption and maturity of use. By doing so, it can be expected that further benefits will be realized at the pan-Canadian level.

2. **Extend leading change management support and evidence-based best practices to reflect clinician and practice needs and priorities** – While programs are in place to support physicians during initial EMR adoption, strong leadership and ongoing training and support is essential to promote advanced use of EMRs.

3. **Continue to improve the accessibility and flow of information to and from community-based EMRs through enhanced connectivity and system interoperability** – A focus should be placed on improving connectivity to electronic systems and databases outside of primary care in order to enhance continuity of care.

4. **Broadly initiate applied privacy-sensitive approaches to population management through EMR use** – EMRs are large repositories of data which clinicians and researchers are increasingly engaging with to inform analyses and decision making such as practice-based and system-level population health planning. Practice-level data are increasingly being integrated with provincial data sources and/or being used as a source of data for evaluation or comparative effectiveness research. This activity is also important within physician practices, supported by effective use of their own patient data to support proactive care and quality outcomes.

5. **Address priority research areas using rigorous health services research methodologies in Canadian community-based settings to estimate the full scope of current and emerging benefits related to the optimized use of EMRs and patient outcomes** – It is recommended that additional research questions be explored with greater coordination and prioritization of projects in order to develop a better understanding of EMR adoption and benefits in Canada. Examples of topics that warrant future research include:
   - The range of factors which impact improvements in quality and safety of care and health outcomes in practices with EMRs;
   - Opportunities for the EMR infrastructure to advance patient engagement and patient-centred care;
   - The ability of EMRs to serve as a data source for research and evaluation studies;
   - The impact of EMRs in enabling primary care transformation; and
   - Factors that enable maturity of use (e.g., with respect to opportunities for alignment with EMR vendors, connectivity, training and support, remuneration model).

The full report is available from the Resource section on Infoway's website at: **www.infoway-inforoute.ca**

5.0 References

Alberta Physician Office System Program (POSP). (2012, October). Benefits Survey First vs Second Response Analysis (Unpublished).

Better Health Greater Cleveland (n.d.). Reform in Action: Does use of EHRs help improve quality? Insights from Cleveland [Data Brief].

Cebul, R. D., Love, T. E., Jain, A. K., & Hebert, C. J. (2011). Electronic Health Records and Quality of Diabetes Care. The New England Journal of Medicine, 365(9): 825-833.

Commonwealth Fund, The (2012). 2012 Commonwealth Fund International Survey of Primary Care Doctors. http://www.commonwealthfund.org/Surveys/2012/Nov/2012-International-Survey.aspx

Harris Decima. (2012, April). Canada Health Infoway User Experience Survey.

Jaakkimainen, L., Schultz, S.E., Tu, K. (2012). Does starting an electronic medical record (EMR) affect family physicians' billings? Draft Report.

Johnston, D., Pan, E., Walker, J., Bates, D., and Middleton, B. (2003). CITL: The Value of Computerized Provider Order Entry in Ambulatory Settings. http://www.partners.org/cird/pdfs/CITL_ACPOE_Full.pdf

Lapointe, L., Hughes, J., Simkus, R., Lortie, M., Sanche, S., Law, S. (2012, January). The Population Health Management Challenge. Final Report.

Loo,T.S., Davis, R.B., Lipsitz, L.A., Irish, J., Bates, C.K., Agarwal, K., Markson, L., Hamel, M.B. (2011). Electronic Medical Record Reminders and Panel Management to Improve Primary Care of Elderly Patients. Arch Intern Med. 171(17): 1552-1558.

Lortie, M., Sanche, S., Lapointe, L., Vedel, I., Hughes, J., Simkus, R., Dyck, S., Saragosa, E., Law, S. (2013). The EMR Physician Value Study: The Impact of mature Electronic Medical Record (EMR) implementations on productivity, operational efficiencies and clinical functionalities in Canadian primary care settings.

National Physician Survey (2010). 2010 National Physician Survey. http://nationalphysiciansurvey.ca/surveys/2010-survey/

OntarioMD. (2013, January 28). Physicians EMR usage and Satisfaction Survey 2009-2012.

Public Health Agency of Canada (2011). United Nations NCD Summit 2011. http://www.phac-aspc.gc.ca/media/nr-rp/2011/2011_0919-bg-di-eng.php

Saskatchewan EMR Program (2012). 2012 Physician Satisfaction Survey Results Report (Unpublished).