Understanding and Optimizing the Value of Digital Health

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Overview

At the 2013 World Health Assembly, countries around the world concluded that:

> "it is essential to make appropriate use of information and communication technologies in order to improve care, to increase the level of engagement of patients in their own care, as appropriate, to offer high quality health services, to support sustainable financing of health care systems, and to promote universal access."

Ontarians share this perspective. Almost all (97%) say that it is important that the healthcare system take full advantage of digital health tools and capabilities right now (2016 Nielsen survey).

Realizing value with health IT is not only – or even mostly – about technology. It is about the new models of care, new workflows, new ways of connecting patients and care providers, and indeed new cultures that digital tools can enable.

This brief paper begins with an overview of the use of health IT in Ontario. As comparative data – including a recent OECD benchmarking effort involving 38 countries – show, the province's adoption of health IT is on par with high income jurisdictions around the world, leading in some areas and lagging in others. The paper then addresses how digital health can deliver benefits, as well as what we know about the value of benefits currently being realized. It concludes with a discussion of lessons learned – from Ontario and beyond – about how to optimize value to the health system and those it serves.

Digital Health in Ontario

While there is room to continue to grow, clinical use of digital health in Ontario has increased significantly over the last decade. For instance:

- Use of electronic medical records (EMRs) by physicians has tripled. Spreading beyond early adopters (24% in 2004), EMRs have become mainstream (81% in 2014 according to the National Physician Survey);
- In Ontario's hospitals, basic and advanced use of clinical systems has grown in recent years;
- Most X-rays, CT scans, other images in the province's hospitals are now digital and shared electronically with regional hospital networks. A recent study showed that the intensity of use of these and other elements of the province's interoperable electronic health records more than doubled between 2014 and 2015 alone and the number of users continues to grow (see figure); and

How Many Use Ontario's Electronic Health Records
(# active users with monthly access to 2+ clinical domains)

34,637

Source: Canada Health Infoway

- Canadian Telehealth Forum statistics show that telehealth was used 2.5 times more in Ontario in 2014 than in 2010. Growth continues in this regard too.
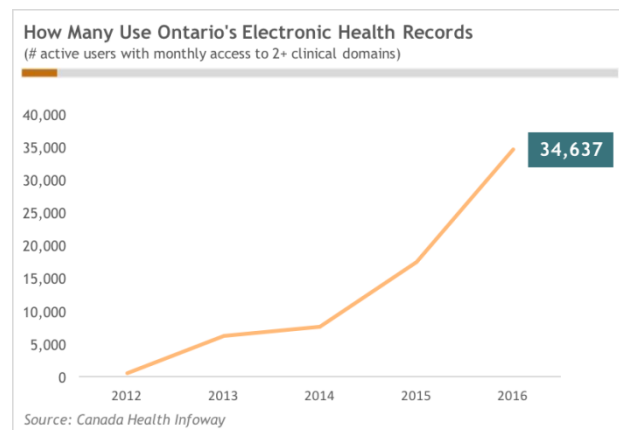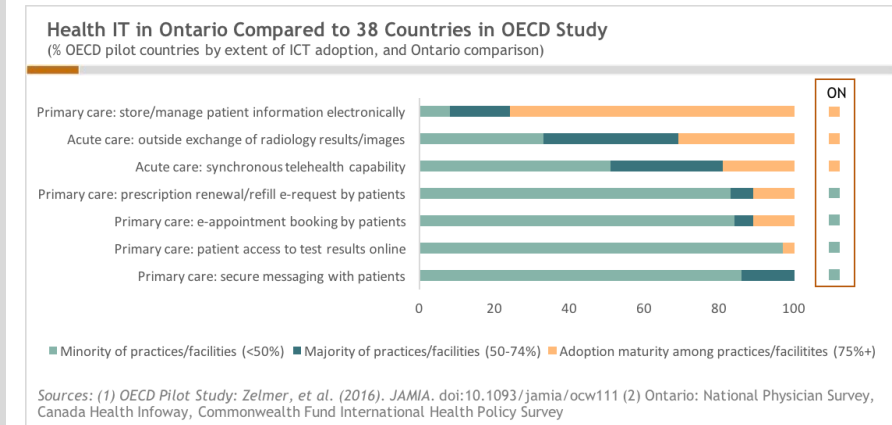
How Ontario Compares

Health policy and priorities vary across countries, but many see digital health as key to delivering better health, better care, and a more sustainable health system. A recent OECD project benchmarked digital health availability and use across 38 nations. The study focused on 4 areas: electronic records at the point of care, health information exchange, telehealth, and patient online solutions.

Use of electronic records to store and manage patient information at the point of care was relatively common. Thirty-six countries reported that at least half of primary care physicians were using this functionality. Most had rates above 75%. There were, however, differences within and across countries in the types of data available, the functionality of the solutions used, and their frequency of use. Patient information exchange across care settings was less frequent than use of health IT within a given practice or organization. The availability and use of telehealth and patient online solutions also varied greatly.

Health IT in Ontario Compared to 38 Countries in OECD Study
(% OECD pilot countries by extent of ICT adoption, and Ontario comparison)

Legend: Minority of practices/facilities (<50%) ■ Majority of practices/facilities (50-74%) ■ Adoption maturity among practices/facilitites (75%+)

Sources: (1) OECD Pilot Study: Zelmer, et al. (2016). JAMIA. doi:10.1093/jamia/ocw111 (2) Ontario: National Physician Survey, Canada Health Infoway, Commonwealth Fund International Health Policy Survey

The graph shows how Ontario would compare with the countries in the OECD study. The province ranks among high adopters on the study's three measures of clinician health IT, but is a low adopter on the four measures of patient online solution use.

Today, Ontario is home to a number of global leaders in the use of digital health. For instance, Ontario Shores was the first behavioural health facility world-wide to receive a top international recognition for its efforts to use IT to improve the quality of patient care. Likewise, the province's telemedicine network is one of the most active in the world. In Ontario, telehealth has moved beyond being a pilot project. It is now a normal way of delivering health services in many parts of the province.

Progress is not, however, evenly distributed. Some Ontario hospitals are fully paperless and/or make extensive use of clinical decision support. For instance, North York General Hospital has documented a 45% reduction in mortality for pneumonia and chronic obstructive pulmonary disease patients when using computerized order sets. However, clinicians in a number of other hospitals have limited access to digital health or are using only basic levels of functionality. Overall, international comparisons suggest that use of advanced clinical systems in Ontario hospitals is behind that in Austria, Denmark, Italy, the Netherlands, Singapore, Spain, and the US but ahead of Australia, Germany, Malaysia, New Zealand, the Philippines, and Thailand.[1]

A similar situation exists in primary care. The 2015 Commonwealth Fund survey of primary care physicians found that use of electronic medical records (EMRs) in Ontario was slightly above the

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[1] Based on the percent of hospitals with a HIMSS EMRAM level of 4 (computerized provider order entry and clinical decision support) or higher in Quarter 2 of 2015, as reported by HIMSS Europe. Note: data may be based on a partial sample of hospitals in each country.

Canadian rate but lagged the 11-country average (78%, 73%, and 88% respectively). How family doctors use EMRs also varies. For instance, Ontario EMR users were more likely than their international counterparts to use population health management functions (e.g. listing patients by diagnosis or identifying patients who are due or overdue for tests or preventive care) but less likely to use patient care functions, such as preparing a clinical visit summary to give to the patient or listing all a patient's medications or laboratory test results.

Likewise, the National Survey of Canadian Nurses found that only 1 in 5 of those providing direct care used electronic records exclusively. 56% were using a combination of electronic and paper records. The remaining 25% continued to practice in a paper record environment. This matters because nurses that used a richer range of electronic functions were more likely to report improvements in quality of care and productivity – and less likely to report drops. The barrier to achieving full value from the use of health IT nurses cited most often was the use of a combination of paper charts and electronic records.

While the situation is changing, most Ontarians have little access to digital health that connects them with their care team. Across the province, most Ontarians say they want to be able to book appointments, access their records, consult with care providers, and request prescription renewals electronically, but fewer than 1 in 4 said that they could do so in a 2016 survey. That said, early adopters of patient online solutions – such as Sunnybrook, the Group Health Centre in Sault Ste Marie, the Wise Elephant Family Health Team, and LifeLabs – have moved ahead. Their experiences offer insights to drive further progress.

The Health IT Ecosystem in Ontario
Many organizations are involved in advancing the use of digital health in Ontario, and their relationships and functions have evolved over time. The Ministry of Health and Long-Term Care has policy and operational responsibilities. A number of independent agencies have taken on important strategy, operational, and/or research roles. Examples include eHealth Ontario, Cancer Care Ontario, the Ontario Telemedicine Network, and the Institute for Clinical Evaluative Sciences.

Public and regulatory bodies also have a role in the digital health landscape. For instance, the Office of the Information and Privacy Commissioner is involved with the protection of personal health information. Likewise, colleges regulate the practice of the province's health professionals, including providing guidance in areas such as medical records and telemedicine. Core digital health competencies have also been agreed nationally. They are being integrated into education for physicians, nurses, and pharmacists.

In addition, clinicians and health care organizations are key participants in the health IT ecosystem, individually and collectively. Decisions about adoption of digital health, as well as how it is used, are often made locally. At a provincial level, organizations such as Ontario MD and the Registered Nurses Association of Ontario have led efforts in areas such as electronic medical records adoption and peer support for advancing the effective use of digital health in clinical practice.

As use of patient online solutions expands and the popularity of health apps grows, the involvement of individual Ontarians is also rising. We are increasingly influencing our own digital health footprints, as well as how we interact with health care teams electronically.

Understanding the Value of Digital Health

Modern healthcare doesn't work well on paper. With thousands of new studies published each year, it is difficult – perhaps impossible – to keep up without online tools. Care too has become more complex for many people. For example, a 2014 Commonwealth Fund survey found that nearly two-thirds (61%) of Ontarians aged 55 and older saw two or more doctors in the past year, and more than half (59%) said that they saw or needed to see a specialist in the past two years. Likewise, the numbers of people who have many prescriptions is rising.
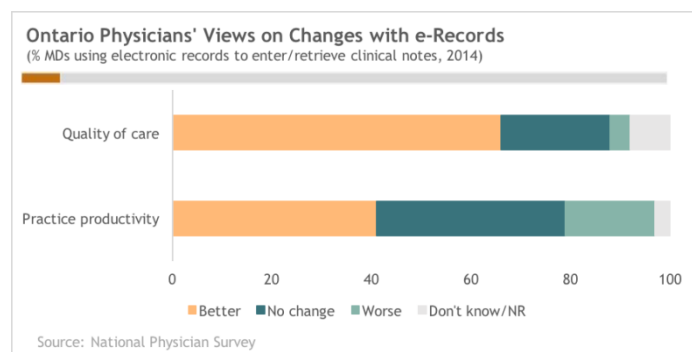
Opportunities to improve care in the digital age include the ability to:

- **Read information**: Digitization can reduce handwriting errors and improve the efficiency of claims processing.

- **Find information**: The ability to access information digitally, even on a local basis, makes it easier to find important information for patient care and reduces time spent on information retrieval (e.g. chart pulls). It also makes it possible to analyze de-identified information in a privacy-sensitive way to inform management and policy decisions, as well as to enable research.

- **Share information**: The ability to share information with patients and between health care providers has become increasingly important as team-based care becomes more common and care complexity grows. Digital solutions allow authorized care providers to access patient health history, test results, and other information to enable safer, more seamless care.

- **Provide services**: Decision support can help clinicians in many ways, such as ensuring that the medications they prescribe or dispense are safe given other prescriptions a patient is taking. Virtual care can close distance gaps between patients and providers. And telehomecare can help patients monitor their health, connect with their care teams, and manage their chronic conditions on a daily basis.

- **Learn and evolve**: Digital solutions are at the core of learning health systems. For instance, simulation can help students learn to provide care without putting patients at risk. Likewise, big data analytics can evaluate and suggest promising approaches to therapy, as well as guide policy decisions.

Each of these functions can add value in different ways, whether by empowering patients, delivering more seamless services, or enabling more informed care.

As with any health intervention, there are a range of ways to assess that value. Each approach has strengths and weaknesses. Examples include:

- **Qualitative assessments by patients and/or health care providers**: Surveys, focus groups, interviews, and similar techniques are often used to understand the perspectives of digital health users. In a 2016 Nielsen survey, for instance, almost three-quarters of Ontarians (74%) said that digital health is having a positive impact on the Canadian healthcare system. Only 4% said there was a negative impact. Surveys have also asked health professionals for their views. For example, a summary of six surveys of Canadian users of interoperable electronic health records found that positive

Ontario Physicians' Views on Changes with e-Records
(% MDs using electronic records to enter/retrieve clinical notes, 2014)

Quality of care

Practice productivity

0   20   40   60   80   100

■ Better ■ No change ■ Worse ■ Don't know/NR

Source: National Physician Survey

outcomes were reported more often than mixed/neutral or negative ones. This was true for users' assessments of information quality, user satisfaction, quality of care, and productivity. A 2014 survey asked similar questions of physicians who fully or partly use electronic records to enter/retrieve patient clinical notes (see graph).

- **Accounting Metrics:** Researchers and evaluators have used accounting techniques, such as return on investment, to understand the value of a range of digital health solutions. For example, Yeona Jang and colleagues reviewed financial data from 17 primary clinics that used EMRs. They found that the clinics recouped their initial investments in the technology in 10 months on average. Factors driving this result included an increase in the clinic's number of active patients, active patients per clinician FTE, and net revenue. Others have also explored whether physician payments change after the implementation of EMRs. For instance, a study by ICES concluded that "while many factors need to be considered by FPs [family physicians] when implementing their EMR, a drop in their billings, FFS payments and overall government payments is not likely to occur."

- **Economic analyses** offer a broader approach to assess the value from investments in digital health. Perhaps the best known studies of this type in Canada are those commissioned by Canada Health Infoway. Earlier this year, Infoway estimated that telehealth, drug information systems, diagnostic imaging systems, and physician office and ambulatory EMRs have produced national benefits valued at about $16 billion since 2007. (See box for details.)

Beyond patient, clinical, or health system value, studies have also sought to understand the effect of digital health on the broader economy and on research. For instance, according to a report by the Information and Communications Technology Council (ICTC), 82% of Canada's domestic health ICT companies, many of which are based in Ontario, expected to increase employment in 2016. ICTC estimated year-over-year growth in this sector at 19% since 2011. Likewise, the Conference Board of Canada estimated that investments made as a result of the 2010 federal grant to Infoway ($500 million) are creating 10,700 person-years of employment across all regions of the country. With respect to research, investments in analytic capacity and data are tracked in a variety of ways. For instance, the Institute for Clinical Evaluative Sciences reports citations, media interest, and other metrics in its annual report.

In deciding which evaluative approach(es) to use, it is important to consider who will use the findings and how. This may affect choices such as the focus areas, preferred perspective (to whom gains or losses accrue), and timeframe for the analysis. In addition, it is helpful to take into account whether benefits will result in cost savings (e.g. reduced travel costs if a patient gets care closer to home with telehealth), cost avoidance (e.g. avoiding medication errors may reduce emergency department visits), or other forms of value (e.g. peace of mind for patients and caregivers).

Unpacking Infoway's estimate of $16 billion in benefits since 2007

Canada Health Infoway commissions pan-Canadian benefits evaluation studies to estimate the value of access, quality, and productivity benefits that result from use of specific types of digital health. Findings show that the balance of benefits varies. For instance, digital diagnostic imaging has improved access and radiologist productivity, while many of the benefits of drug information systems reflect improvements in quality of care and patient safety. For more information and links to the studies, please see the Appendix.

Overseen by expert groups, the pan-Canadian studies use a standard framework and approach. They typically take a health system perspective. That is, they capture benefits that accrue within the health system, regardless of who captures those benefits (e.g. clinician practices, health care organizations, or government). In most cases, the studies do not measure the value of a range of benefits to individual patients or their families (e.g. less time off work or improved quality of life). Nor do they usually measure the value of jobs created or other industrial/workforce benefits.

The benefit evaluation studies generally begin with a review of relevant academic studies, evaluation reports, and similar evidence, as well as key informant interviews. Using this information, the evaluation team develops benefits hypotheses (e.g. that telehealth videoconferencing reduces travel costs). They then evaluate whether or not there is enough evidence and data to quantify the magnitude of each hypothesized benefit. Critical success factors for achieving and growing value are also described.

Not all benefits can be included in quantitative calculations. Take comments by Sandra Wallace, mother of Camryn who is cared for at the Children's Hospital of Eastern Ontario as an example. She said "it's fantastic to be able to sit in a clinic appointment now with the doctor and see all the data and medications, everything that she's on is right there in front of us and that's just a fantastic change; makes things flow so much quicker in appointments today." Studies have captured the reduced time staff spend searching for information implied by Ms. Wallace's comment, but not the value of the peace of mind or smoother clinic flow that more coordinated care gave to her and Camryn.

For benefits that can be quantified, the team extrapolates their value at a pan-Canadian level using estimates of how often the digital solution in question is used. These estimates are then adjusted for the maturity of use of the solutions. For instance, only a subset of physicians with electronic medical records use them to identify patients who would benefit from proactive outreach for preventive or follow-up care. Those who do not use their EMRs in this way do not realize the associated value and are not included in the benefit estimates.

Note: Infoway has commissioned pan-Canadian benefits studies for several, but by no means all, types of digital health. Similar studies have not yet been undertaken in a number of areas that may well generate significant value in Ontario and beyond. Examples include laboratory information systems, public health surveillance systems, and clinical systems in hospitals.

Optimizing Value

As the examples above illustrate, significant gains are possible through the use of digital health, but optimizing value takes careful thought and hard work. In recent years, we have learned much – in Ontario and beyond – about the associated opportunities and barriers. Four common themes are described below.

Clarity of Focus is Key
Transforming care is the goal; technology is the enabler. Digital health tends to be most effective when focused on specific outcomes and integrated into broader efforts to improve health and health care. Most such efforts would benefit from being underpinned by effective use of digital health, but not all those rolling out changes in policy or practice systematically consider how to take advantage of this opportunity.

Users typically have a strong and proactive role in the most successful digital health strategies and initiatives. Their voice and perspectives can be embedded in a variety of ways, from governance and leadership to stakeholder consultations and project teams. For greatest impact, engagement must occur not just to the time of implementation but also beyond through the optimization process.

How You Implement Matters
Thoughtful implementation is key to realizing benefits from digital health use. Technical decisions – such as system architecture, standards, and user interface design – matter. A US study offers a classic illustration of this reality. Researchers asked how often hospital systems flagged 15 high priority potentially serious drug-drug interactions. On average, 69% of the interactions led to alerts, but alert rates ranged from 27% to 93%. Implementation and display of alerts varied widely across the 19 systems tested in the study, even when hospital used the same vendor solution. This led researchers to point to the important role that configuration and implementation decisions at the hospital level can play in supporting patient safety.

The scale of implementation and proactive change management can also be important. For instance, expanding beyond the pilot stage, shaping regional implementation clusters, or joining up disparate local initiatives are key decisions. Likewise, governance and leadership, policy and legislation, practice and process change, resource capacity and capability, financial models, business case and benefits realization, and similar factors all influence value achieved and to what extent it is – or isn't – realized. It's at least as much about policy, processes, and culture as about technology.

Reducing Medication Misuse: Results Vary
Enabling better medication management is one of the potential benefits of digital health. Studies have explored the impact on opioid and benzodiazepine prescribing in British Columbia, Ontario, and the United States.

British Columbia launched its provincial drug information system, Pharmanet, in 1995. The study showed "large, immediate, and sustained reductions" in potentially inappropriate filled prescriptions for both opioids and benzodiazepines following the system's implementation. Likewise, researchers found a significant drop in potentially inappropriate prescriptions for both types of medications after Ontario introduced new legislation in 2011. There was a further significant reduction for benzodiazepines following the launch of a centralized prescription monitoring in mid-2012. There was no change in trend for opioids, but potentially inappropriate prescriptions continued to fall.

In contrast, a study of 19 US states found that state-level prescription drug monitoring programs had little effect on overall consumption of opioids. Unlike in Canada, most of these state programs did not encourage real-time access by health professionals to prescription data. The difference in results reinforces the importance of implementation and policy choices to benefits realization.

Experience suggests that disciplined user and stakeholder engagement, project management, change management, benefits realization, and related approaches can help focus implementation and optimization efforts. In addition, as part of the benefits realization plan, it is important to consider who is likely to incur implementation or change management costs and to whom expected benefits will accrue. Often, the two groups are not the same. Specific strategies may also be needed to realize and capture certain benefits, such as productivity gains.

Maximizing Potential Benefits, Minimizing Potential Harm
'First do no harm' applies as much to digital health as to other healthcare interventions. Outcomes that effective use of digital health can improve, poor approaches can potentially harm. For instance, well-executed privacy by design strategies can enhance health information protection. In a digital world – unlike in a paper one – audit trails can show who has accessed patient records. In addition, it is possible to implement role-based access so that staff only see the subset of patient information they need. But a failure to implement appropriate privacy and security protocols can put patient information at risk. Similarly, clinical systems can significantly improve medication safety, but some instances of harm have also been documented.
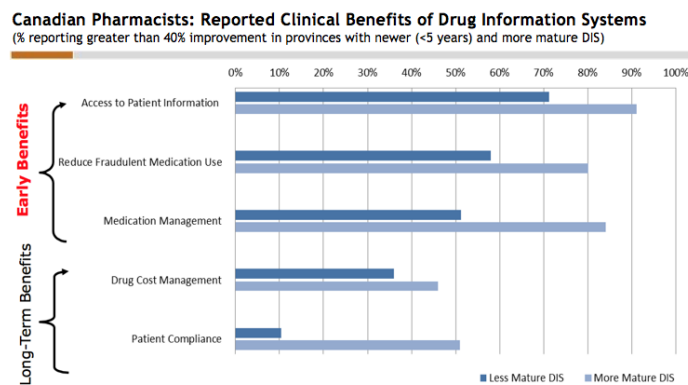
Accordingly, national eSafety guidelines highlight the need for a culture of safety that considers both technical and broader risk factors in order to maximize potential benefits and minimize potential harm.

Getting the Most out of Existing Solutions
Most digital health solutions can be used in a variety of ways. For instance, clinicians can use drug information systems (DIS) simply to view the medications a patient has received. This has value compared to paper records, including legibility and ready access to information in an emergency. DIS can also be used in more sophisticated ways. Examples include automated checks to make sure that a new medication is safe to prescribe given the others a patient is taking, identifying patients taking a recalled medication so they can be contacted quickly, and research using de-identified data that helps to pinpoint potential medication risks and benefits.

For both DIS and other types of digital health, benefits tend to rise as system use matures. This evolution can occur over a number of years, with some benefits typically being achieved sooner than others (see the graph for an example).

In part, this may reflect growth in user experience and use of more advanced functions. Updated workflows, practice patterns, and policies may also help to explain gains over time. The good news is that there tend to be many opportunities to significant advance benefits without needing to deploy new IT systems.

Canadian Pharmacists: Reported Clinical Benefits of Drug Information Systems
(% reporting greater than 40% improvement in provinces with newer (<5 years) and more mature DIS)

Source: Leung, et al. (2013). Healthcare Quarterly. http://www.longwoods.com/content/23409

A key challenge in growing the value of digital health is accelerating this process so as to achieve greater benefit sooner, on a broader basis. It requires a continued focus on change management and optimization, even after the initial system implementation. Creative approaches in this regard can yield

significant benefits. For instance, experience shows that tailored support can help physician practices advance their use of EMRs in a relatively short period of time. Likewise, existing digital assets may be used in new ways to deliver further value. For example, access to systems originally designed to distribute results to clinicians who ordered laboratory tests has, in some cases, been expanded to patients. A recent study found that users received their test results more quickly and were less likely to have had an in-person visit to receive/discuss test results (study). That said, they were also somewhat less likely to say they understood their test results (76% vs. 85% for non-users).

Appendix: Summary of pan-Canadian Benefits Evaluation Studies Commissioned by Canada Health Infoway

Scope	Examples of study findings	Overall estimates of value
Digital diagnostic imaging: Enables authorized care providers to access x-ray, MRI, CT, and other images and results (LINK)	- 25-30% improvement in technologists' and radiologists' productivity - 2-3% fewer unnecessary duplicate exams - Elimination of film-related cost of materials and operations - 30-40% improvement in exam turnaround times	Benefits valued at $908 million in 2015 (Canada) With full implementation, would enable radiologists to perform 11 million more exams each year
Drug information systems: Enables authorized care providers to access a patient's complete medication profile, as well as decision support tools to assist them in safe and effective medication management (LINK)	- Patients more likely to take medication as prescribed (21% of total benefit value in 2010) - Fewer drug interactions and other medication problems (20%) - Less medication abuse (16%) - Increased pharmacist and prescriber productivity (32%) - Improved management of drug costs (10%)	Benefits valued at $593 million in 2015 (Canada) Opportunity to rise to an estimated $2.3 billion with full national implementation and mature use of next-generation solutions, including seamless e-prescribing
Electronic medical records are used by clinicians at a specific point of care, such as in community settings (LINK and hospital ambulatory clinics (LINK)	- Some benefits (e.g. reduced chart pulls) experienced by almost all users; more mature use offers broader benefits, such as reductions in duplicate tests, fewer adverse drug events, and improved chronic disease management - Supports more interaction and communication among care team members, as well as between providers and patients - 57% of EMR-enabled hospital ambulatory clinics reported EMR use has been beneficial or very beneficial for improving quality of care	Benefits valued at $419 million in 2015 for use in community settings, such as physician offices (Canada) Benefits valued at $196 million in 2015 for use in hospital ambulatory care (Canada)
Telehealth and telehomecare: Links patients with the health care team, even when not in the same location, often by videoconferencing (telehealth: LINK; telehomecare: LINK)	- Tends to have high patient and provider satisfaction - Enables services that would not otherwise be possible, e.g. urgent specialist consultations in rural areas via telestroke - Telehomecare reduces emergency visits, hospitalizations, and per client costs when implemented effectively - Shortens wait times - Reduces caregiver burden	Benefits valued at $407 million in 2015 (Canada) Telehealth helped patients save nearly $240 million in personal travel costs in 2015 47 million fewer km travelled in 2010, equivalent of taking 2760 cars off the road
Consumer health solutions help individuals to access and manage their care online, including booking appointments, secure messaging with clinicians, requesting prescription renewals or refills, and viewing their own personal health information, such as test results (LINK)	If Canadians had been able to consult with their health care providers, access test results, and request prescription renewals electronically in 2011: - They could have gained nearly 70 million hours of time, including more than 18 million hours off work, boosting the country's potential output by $408 million - They could have avoided nearly 47 million in-person visits to health care providers	National benefits estimates have not been calculated.