

Towards Evaluating Quality, Access and Productivity – The Creation of a pan-Canadian Electronic Health Record Evaluation Framework

Authors: Gavin Giles, Simon Hagens, Nancy Kraetschmer, Catherine Hunter and Sarah Muttitt

Institutional Affiliation for all: Canada Health Infoway (www.infoway-inforoute.ca)

Primary contact: Gavin Giles (ggiles@infoway-inforoute.ca)

Abstract

An evaluation framework was created for Canada Health Infoway's investments in the pan-Canadian Electronic Health Record (EHR) to support the evaluation of the impact of the EHR on healthcare processes and care outcomes. A panel of experts from the eHealth research community was assembled and subject matter experts were identified for each of Infoway's investment programs. The updated Delone and McLean IS Success model was chosen as the foundation for the framework, and valid indicators and measurement methodologies which were relevant to the framework were added by subject matter experts. The resulting framework is comprised of dimensions of quality, system usage and net benefits. The three dimensions of net benefits (quality, access and productivity) include indicators of patient safety, appropriateness and effectiveness of care (linked with quality); access to services, patient and caregiver participation (linked with access); and efficiency, care coordination, and net costs (linked with productivity). The dimensions of quality are focused on system, information and service quality and the dimensions of system usage are use and user satisfaction. The expansion of the Delone and McLean model has resulted in a robust framework which provides structure for measuring the effect of introducing an EHR at the pan-Canadian level. Evaluation initiatives based upon the results of this work are ongoing across Canadian jurisdictions.

Canada Health Infoway

Canada Health Infoway (*Infoway*) is a federally funded, independent, not-for-profit organization created in 2001 by the Federal government in agreement with the jurisdictions

(i.e. provinces and territories) of Canada. At that time there was growing recognition that Canada lacked health information systems that could facilitate the provision of high quality and efficient care. It became clear that a coordinated approach to this vital and very expensive transformation was needed to avoid risk of wasteful duplication and failed implementations. Through the creation of *Infoway*, significant new funding was provided to develop a pan-Canadian electronic health record (EHR), with the goal of improving healthcare quality, accessibility and productivity.

An electronic health record (EHR) provides each individual with a secure and private lifetime record of their key health history and care within the health system. The record is available electronically to authorized health providers and the individual anywhere, anytime to support high quality care. The EHR is a tool which is not specific to any one clinical domain; it has the potential to link all specialties and professions at work in health care across Canada. The ability to collect information, process, and share it, as appropriate, across the continuum of care has tremendous implications for the health care system. *Infoway's* blueprint for the EHR in Canada requires the implementation of a number of core components of the EHR, such as diagnostic imaging, drug information systems, lab information systems, interoperable electronic health records, telehealth and public health surveillance systems. As a strategic investor, *Infoway*, in partnership with the jurisdictions of Canada, invests in EHR projects in each of these areas, while monitoring its investments and providing advice where needed. To-date, *Infoway* has invested in over 227 projects. Each of these projects is expected to save time and money and improve the overall access to, and efficiency and quality of, the Canadian health care system.

Benefits Evaluation Framework Development

Infoway recognizes that the evaluation of the impact of the EHR solutions deployed is critical and has included benefits evaluation in its business strategies within the “promote solution adoption and benefits realization” strategy (Canada Health Infoway, 2007). Benefits evaluation is important for increasing the investments in EHR solutions, advancing best-practices in the clinician adoption of EHR solutions, as well as supporting the measurement and realization of benefits. Infoway has committed to measuring the value of its investments and, to do so, developed a pan-Canadian evaluation framework (Lau, 2007). The framework was developed to provide leadership for jurisdictions with limitations in capacity and expertise related to benefits evaluation, and to allow for aggregation of evaluation results to the pan-Canadian level. Thought leaders from the academic community were engaged to ensure an evidence-based approach to the framework’s development. A scan of the available literature was performed and the DeLone and McLean IS success model was chosen as a basis for the framework because of its strong ground in related research (DeLone & McLean 2003). The six dimensions included in the 2003 version of the DeLone and McLean model were adopted and combined with the results of a review of the success model by van der Meijden et al. (2003) and selected health information technology evaluation studies such that two or more categories of measures were defined for each dimension (Fig 1).

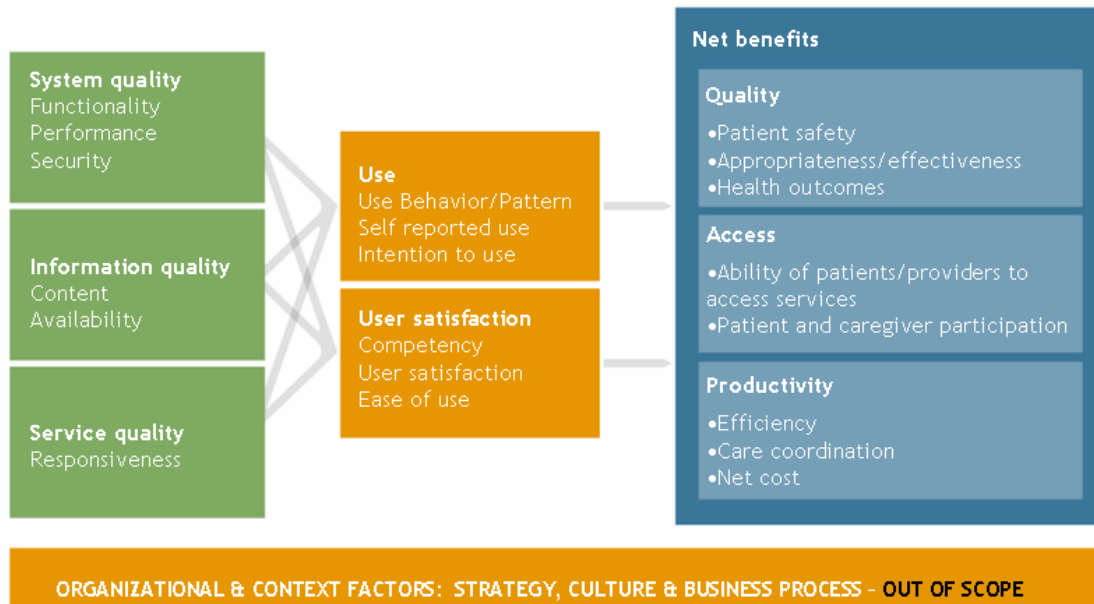


Figure 1. Benefits Evaluation Framework

The resulting framework has dimensions which relate to the System and Use of the System (i.e. System, Information, Service, Use, and User Satisfaction). It is expected that assessment of these dimensions will primarily flag obstacles to evaluation efforts and return these issues to Infoway for resolution, as well as provide early evidence of benefits. The framework also includes dimensions which can be regarded as Net Benefits. These Net Benefits are categorized as health care quality, productivity and access. Evaluations of Net Benefits will demonstrate the value of Infoway investments and generate reusable methodologies and tools. Further details regarding categories and sub-categories for each dimension have been previously published (Lau, 2007).

Indicator Identification

Following the development of the framework, 27 initial indicators were identified and defined through the review of relevant literature by Subject Matter Expert teams from across the country. Each team was asked to define appropriate measures for a specific Infoway investment program based on the available literature and their own field experiences. Each measure was also mapped back to show its relation to the dimensions of the framework. Detailed descriptions of these measures can be found in a previously released report. Table 1 describes the current indicators for each investment program.

Table 1: Indicators of interest by investment program

Program or Domain	Indicators
Diagnostic Imaging	Efficiency improvements for staff (radiologists and technologists)
	Quality benefits of timely service delivery (with improved turnaround time (TAT))
	Availability of previous DI results decreasing duplicate orders
	Sharing test results with offsite specialists to reduce patient transfers
Drug Information Systems	Efficiency improvement for patient assessment and medication history taking
	Efficiency improvement for pharmacists and prescribing physicians
	Medication error avoidance through identification of drug duplications/interactions
	Medication error avoidance through completeness/legibility of scripts with e-prescribing
	Medication error avoidance through physician alerts at time of e-prescribing
	Reduction in medication errors leading to adverse drug events
Lab Information Systems	Quality benefits of timely of service delivery (with improved turnaround time (TAT))
	Efficiency improvement for laboratories and referring physicians
	Completeness of lab profile
	Availability of previous lab results decreasing duplicate orders
	Impact on clinician workflow and patient safety
	Improved coordination of care
Public Health Surveillance	Improved outbreak detection and intervention
	Reduction in time spent managing cases
	Improved vaccination rates
	Avoidance of vaccine wastage and unnecessary duplicate vaccinations
Telehealth	Access to previously unavailable services with telemedicine
	Provider sharing of patient information with telemedicine
	Efficiency of recovery with telehomecare
	Change in work practices with telehealth
	Change in caregiver or patient participation
Interoperable EHR	Improved provider efficiency and effectiveness in emergency departments
	Reduction in readmission rates with shared health record in use in the community
	Improved management of chronic disease

Early Results

Infoway is committed to evaluating the impacts of its investments in all of its core clinical programs and has demonstrated some early benefits in programs such as Diagnostic Imaging and Drug Information Systems. The evaluation approaches for specific investments are developed with provincial partners, who are responsible for executing the evaluations across multiple investment programs. These evaluations are often conducted by third parties (e.g. academics, consultants, etc.) or by the province's internal resources.

A recent evaluation was conducted on the Ontario Drug Profile Viewer System which has been implemented in Emergency Departments across Ontario and aims to provide health care providers with secure access to the provincial drug claims information of Ontario Drug Benefit (ODB) recipients seeking care in Emergency Departments. A survey was developed to capture the opinions of the system users. According to the results 85% of those that used the Drug History Report produced by the system found the reports were useful, and over 70% said it saved time, made their job easier, provided relevant and up-to-date information and improved drug reconciliation. Approximately three-quarters agreed that it helped streamline therapy, prevent duplication, ensure patients' medication is continued upon admission to hospital and promote patient safety. Authorized End Users of the ON DPV system generally agreed that the system was easy to operate, and navigation and finding information was easy and clear. Three-quarters reported that it had the features required to do their work and two-thirds reported that it was integrated into their work flow. This evaluation has shown that the DPV System is beneficial for both health care providers and patients. Timely access to a patients' drug history helps promote patient safety by helping to identify potential adverse events, improves coordination and quality of care and information sharing amongst providers (OMOHLTC, 2006).

Infoway's Diagnostic Imaging program invests in Picture Archiving and Communication Systems (PACS) which permit authorized clinicians to securely and remotely access diagnostic images. These systems have the potential to offer tangible benefits to stakeholders by improving access to, and the quality and efficiency of, Diagnostic Imaging services. To measure the benefits of these PACS investments both quantitative and qualitative evaluation approaches are being employed. A PACS Opinion Survey was developed to capture end users' opinions regarding the impact of PACS on such areas as provider efficiency, patient care, report turnaround time and communication. The survey was conducted in three provinces (Ontario, Nova Scotia and British Columbia) and administered to radiologists and referring physicians deemed to be high users of the system. The survey was completed by 78 Radiologists (43.1% response rate) and 181 Referring Physicians (17.6% response rate). The vast majority of radiologists and referring physicians indicated that PACS had improved their efficiency, with 87.2% of radiologists reporting that PACS has improved their reporting and consultation efficiency and 93.6% indicating that it reduced the time they spend locating exams for review. Almost 40% of the radiologists reported that PACS had allowed them to report to new remote sites. PACS also appears to have a positive impact on report turnaround time,

with 93.6% radiologists and the majority (70%) of referring physicians indicating so. A separate analysis of report turnaround time, defined as the time from patient registration in Diagnostic Imaging to when a draft report is available to the referring physician on the system, was conducted on data extracted for 22 sites in British Columbia. The analysis showed that report turnaround time decreased following the implementation of PACS by 41% (mean turnaround time decreased from 60.8 hours pre-PACS to 35.9 hours post-PACS). According to referring physicians, PACS has also had a positive impact on patient care, with two-thirds of respondents indicating that PACS has improved their ability to make decisions regarding patient care, 80% reporting that PACS has reduced the time they must wait to review an exam (images), 58% indicating that PACS had reduced the number of exams reordered because the exams were not available (e.g. lost or located elsewhere) when they needed them, and 43% reporting that PACS has reduced the number of patient transfers between facilities due to the new ability to share images and consult remotely. The perceived reduction in patient transfers indicated in the survey results has been further substantiated through a separate study of the impact of PACs on neurosurgical diagnoses in the ER of a British Columbia community hospital. This study found that PACS reduced the number of transfers for patients who had a neurosurgical consult in the ED of a community hospital (10 of 12 avoided transfers to an urban trauma centre).

Emerging Challenges

Challenges are beginning to emerge from the field as jurisdictional partners continue to develop and refine their evaluation plans in accordance with *Infoway's* framework. The common challenges include: stakeholder engagement, governance and accountability, costs and timelines, measurement methodology and availability of data, human resources and a lack of previous research on which to base measure development. *Infoway* and its jurisdictional partners have begun to develop strategies to help mitigate such challenges, components of which are: a) the identification and communication of strategies which have been used to overcome such challenges; and, b) the encouragement of cross-jurisdictional collaboration.

Summary

The net benefits that can be achieved from the deployment of the EHR in Canada strongly depend on commitment to change, adoption and evaluation of the end product. The development of a pan-Canadian Benefits Evaluation framework provides a platform for aligning the knowledge gained and results achieved through evaluations across Canada. The dimensions included cover many fundamental aspects of information system evaluations and it is expected that the program-related indicators will evolve as new results emerge from the field. Challenges are expected but collaboration among, and communication between, those working in the field are thought to be key components of the mitigation strategy.

References

- Canada Health Infoway. (2007). Electronic Health Records: Transforming health care, improving lives [Electronic version]. Retrieved on September 18, 2007 from http://www.infoway-inforoute.ca/Admin/Upload/Dev/Document/Business%20Plan_2007-08_EN.pdf
- DeLone, W.H. & McLean, E.R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems*, 19(4), 9-30.
- Lau, F., Hagens, S., & Muttitt, S. (2007). A Proposed Benefits Evaluation Framework for Health Information System in Canada. *Healthcare Quarterly*, 10(1), 112-118.
- Ontario Ministry of Health and Long-term Care e-Health Program. (2006). Emergency Department Access to Drug History Project - Drug Profile Viewer System. Retrieved on September 24, 2007 from http://www.health.gov.on.ca/login/moheda/pub/pres_dpv_eval.pdf
- van der Meijden, M.J., Tange, H.J., Troost, J., & Hasman, A. (2003). Determinants of Success of Inpatient Clinical Information Systems: A Literature Review. *Journal of the American Medical Informatics Association*, 10(3), 235-243.