# Canada Health Infoway Benefits Evaluation Indicators

## TECHNICAL REPORT

VERSION 2.0

APRIL 2012


Produced in collaboration with:
eHealth Observatory
School of Health Information Science,
University of Victoria

Canada Health Infoway
Inforoute Santé du Canada

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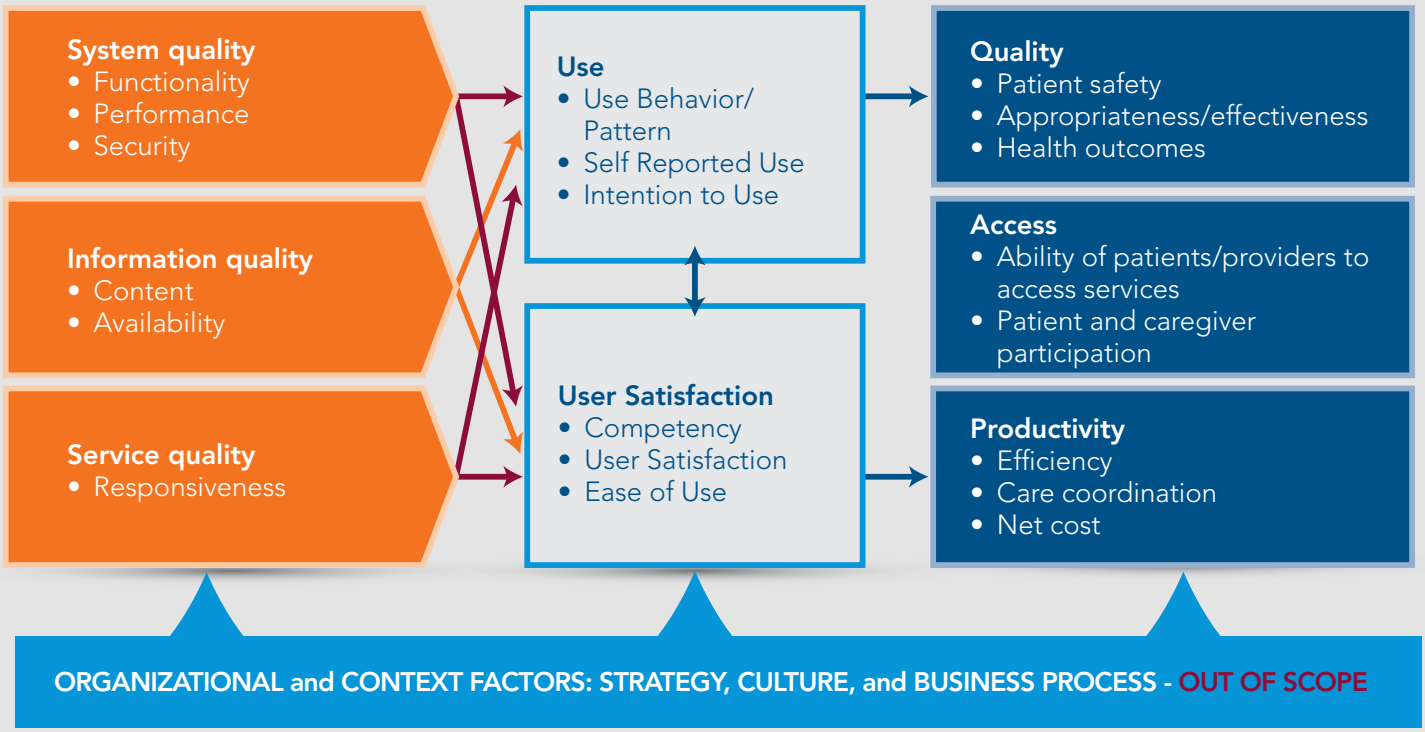
# 1. INTRODUCTION TO CANADA HEALTH INFOWAY BENEFITS EVALUATION

## 1.1 PURPOSE OF THIS DOCUMENT

In 2006, Canada Health Infoway produced the first version of the Benefits Evaluation (BE) Indicators Technical Report. This version 2.0 of the technical report is an evolved version of the original report, incorporating updated indicators for each original program area as well as new indicators and guidance for planning benefits evaluation related to an Information & Communications Technology (ICT) for health solution.

The approach taken in this report is to provide summaries of indicators and then refer the reader to more detailed original sources. In cases where the original indicator from v1.0 has been retained, this document provides references to the v1.0 report wherein more detailed methodology examples are available rather than reproducing them here.

## 1.2 INFOWAY BENEFITS EVALUATION FRAMEWORK




Based on the Delone & McLean IS Success Model

## 1.3 PROCESS FOR UPDATING THE BENEFITS EVALUATION INDICATORS

Indicators in the following ICT for health domain areas were included in the review: diagnostic imaging, drug information system, interoperable electronic health record/laboratory information system, telehealth, and public health surveillance program. The process to review and update the original set of indicators in the technical report v1.0 was as follows:

1. Compilation of Existing Indicators: All indicators from v1.0 of the Technical Manual were compiled into a spreadsheet, organized by ICT for health domain or program areas and re-mapped to the Benefits Evaluation Framework (or categories of the Clinical Adoption Framework where appropriate).

2. Documentation Review: Documentation gathered by Canada Health Infoway from various jurisdictional initiatives was reviewed and relevant indicators were extracted. These were added to the spreadsheet.

3. Benefits Evaluation Face-to-Face Meeting: Jurisdictional representatives were invited to participate in a 1-day session where updates on current BE activities were shared and participants provided feedback on existing indicators. Indicators from the presentations and notes regarding existing indicators were added to the spreadsheet.

4. Indicator Review Sessions: All candidate indicators were amalgamated across program specific spreadsheets and independently reviewed for each program area by the core working group from Canada Health Infoway and the eHealth Observatory research team members. Decisions were made regarding the merging of similar indicators to one benefit area/sub-area of measurement, inclusion of new indicators, and deletion of indicators based on feasibility of evaluation and alignment with jurisdictional priority areas.

5. Creation, review and validation of Summary Tables: The resulting indicator sets were collated across ICT for health domain or program areas and reviewed by a sub-committee of provincial representatives for input and validation.

In addition to reviewing the ICT for health domain areas covered in the first version of the Technical Manual, the domain of telehealth was expanded and one new area, electronic medical record systems (EMRs) was added. Indicators for EMRs were initially developed during a day-long working session with jurisdictional representatives and derived from early evaluations across priority focus areas.

# 2. GETTING STARTED

This report is intended to help jurisdictions plan and execute benefits evaluation projects in several ICT for health domain areas by providing foundational pieces which can be modified and applied as needed.

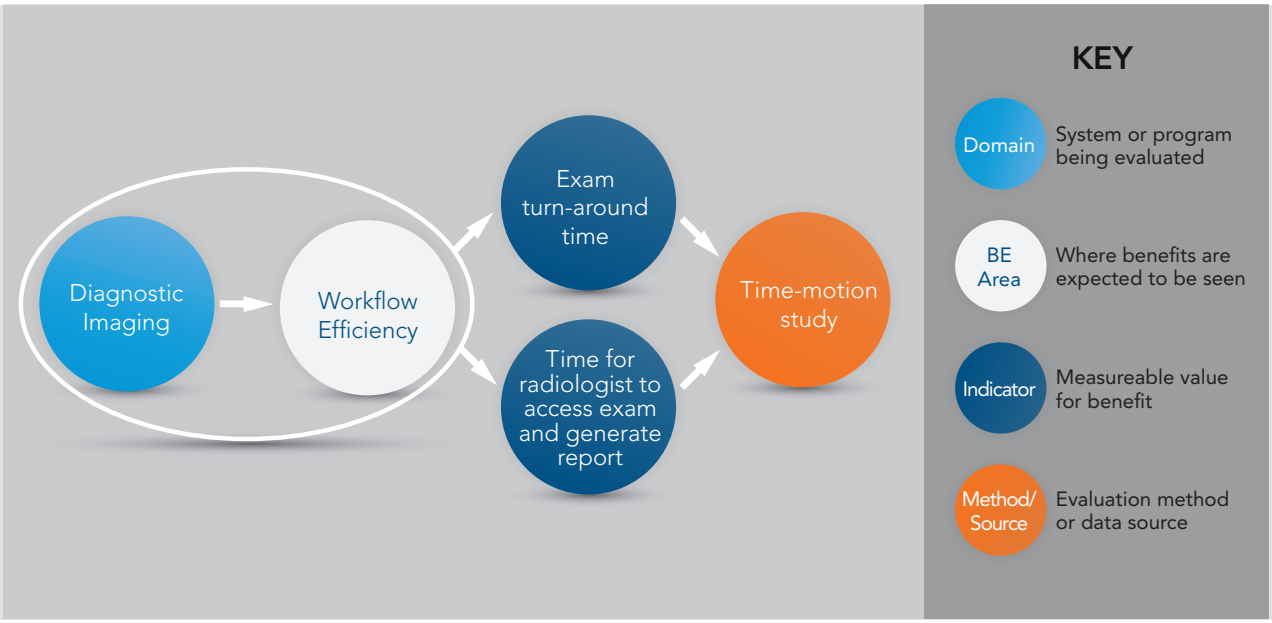
## 2.1 PLANNING A BENEFITS EVALUATION PROJECT

A benefits evaluation can be a significant undertaking requiring careful planning and consideration. Like any other project, the team must consider the purpose of the evaluation, scope, stakeholders, resources required, timelines, and deliverables. Please see Appendix A for a benefits evaluation plan structured template, wherein 'Key Lessons Learned' are included to help support and guide efforts in the development, coordination and successful execution of a benefits evaluation study.

## 2.2 CONCEPTUAL VIEW OF INDICATORS

As part of the benefits evaluation planning step above, the team will need to decide what to evaluate. Each ICT for health domain area (system or program being evaluated) in this document has a table containing categories of the BE Framework (Access, Quality, Productivity), benefit areas and sub-areas (the defined area where benefits outcomes are expected to be seen), associated indicators (the measureable value), and proposed methods/data sources. Figure 1 illustrates the inter-related connections between these constructs as illustrated in the proceeding summary tables.

### Figure 1. Conceptual Model



## 2.3 HOW TO USE THE SUMMARY TABLES

The summary tables for each ICT for health domain area follow the conceptual model above and should generally be read from left to right. Looking at the benefits evaluation framework, we see that the net benefits dimension has several areas that can be examined for benefits such as quality (patient safety, appropriateness and effectiveness, health outcomes), access (ability of patients and providers to access services, patient and caregiver participation), and productivity (efficiency, care coordination, net cost). Therefore this is one of the first decisions to be made with respect to the system or program to be evaluated. Next, the evaluation team will need to decide what benefit area the evaluation will address and/or what sub-area. The team can then select which indicators they would like to look at and consider development and specification of their indicators relevant to their local solution or clinical context. Indicators are formatted as specific measures that will need to be calculated or synthesized from information collected, often across a variety of measures and calculated using defined numerator and denominator specifications. The methods/data sources column provides some suggestions for where or how the required data can be obtained for the indicators. Where available, the examples column provides references to applied studies or methodologies for evaluation with formal study questions and designs available by accessing the complete report/citation. Key details from each example are included in abstracts to provide a quick overview. These include the title, question/purpose, context, methods/design, measures, limitations reported, and the source reference. Specific page references from the source are also provided using the notation "(p. x)".

## 2.4 FUTURE DEVELOPMENT

Some cells in the summary tables are blank. These indicate gaps where the benefit area is of importance with respect to the ICT for health domain under study, however, applied indicators and methods have yet to be developed and/or applied. Jurisdictions who conduct benefits evaluation activities addressing these gaps are encouraged to provide examples for inclusion in future versions of this document.

# 3. SYSTEM, INFORMATION, SERVICE, USE AND SATISFACTION INDICATORS

This technical report focuses on indicators for evaluating the net benefits of an ICT system for health. For the other dimensions of the BE framework (i.e. system, information, service, use, and satisfaction), there are common indicators than can be applied across all domain areas. Infoway has developed a survey tool that specifically addresses these dimensions which is presented in section 3.1. Additional indicators for these dimensions from specific domain areas are included in section 3.2.

## 3.1 Infoway System and Use Survey Summary

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Survey Question Type** |
|---|---|---|---|
| System | | | |
| Functionality | Overall quality of the system | | Likert scale |
| Functionality | Ease of use | | Likert scale |
| Functionality | Impact on work performance | | Likert scale |
| Performance | Response time | | Likert scale |
| Performance | Integration into workflow | | Likert scale |
| Performance | Reliability | | Likert scale |
| Security | Security | | Likert scale |
| Information | | | |
| Content | Completeness | | Likert scale |
| Content | Accuracy | | Likert scale |
| Content | Relevance | | Likert scale |
| Availability | Speed at which information is provided | | Likert scale |
| Availability | Availability when needed | | Likert scale |
| Availability | Format and layout of information | | Likert scale |
| Service | | | |
| Responsiveness | Overall quality of the service provided for the system | | Likert scale |
| Responsiveness | Implementation process | | Likert scale |
| Responsiveness | Level of training | | Likert scale |
| Responsiveness | Level of on-going support | | Likert scale |
| Self-reported Use | Use per day | 1. Number of times per day<br>2. Always or rarely | 1. Specified value<br>2. Checkbox |

(continued)

## 3.1 Infoway System and Use Survey Summary (continued)

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Survey Question Type** |
|---|---|---|---|
| Service (Continued) | | | |
| Self-reported Use | Use per week | 1. Number of days per week | 1. Specified value |
| Self-reported Use | Use for patients | 1. % of patients | 1. Specified value or don't know |
| Intention to Use | Likelihood to recommend | | Likert scale |
| Intention to Use | Future use of system | | Likert scale |
| Satisfaction | | | |
| User Satisfaction | Overall satisfaction | | Likert scale |
| User Satisfaction | Productivity | | Likert scale |
| User Satisfaction | Quality of care | | Likert scale |
| User Satisfaction | Impact on job | | Likert scale |
| User Satisfaction | Ability to coordinate continuity of care | | Likert scale |
| User Satisfaction | Sharing of patient information | | Likert scale |
| User Satisfaction | Efficiency of ordering<br>Sub Area<br>Lab tests<br>X-rays<br>Prescriptions | | Likert scale |
| User Satisfaction | Impact of support tools on quality of decision making | | Likert scale |
| User Satisfaction | Aspects of system to change | | Free text comment |
| User Satisfaction | System support to provision of care | | Free text comment |

### 3.1.1 Infoway System and Use Survey Tool

| | |
|---|---|
| **Title** | Methodology for System & Use Assessment Survey |
| **Question/ Purpose** | Intended to be administered after a project has gone live to (p. 1):<br>• Provide benefits statements to drive adoption in later implementations<br>• Assist in identifying barriers to adoption so that remedial action may be initiated<br>• Identify additional functionality which could be provided in future releases<br>• Provide analysis of the viability of communication and training strategies<br>• Provide stakeholders with the assurance that their adoption of the solution is important |
| **Context** | Use to assess quality and use components of health IT systems (p.1) |
| **Methods/ Design** | • Anonymous survey with four-phase process: plan and adapt survey, data collection, analysis and report, and data storage<br>• Possible methods of survey distribution (p. 4): attaching survey to employees' pay stubs, organizing sessions for employees to complete in groups, project evaluation team handing out survey to individuals or departments |
| **Measures** | Survey instrument contains specific measures in the following areas:<br>• Overall user satisfaction<br>• System quality<br>• Information quality<br>• Service quality<br>• Public health surveillance specific questions<br>• System usage<br>• Demographic information |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway (n.d.). *Methodology for system & use assessment survey.* |

## 3.2 Additional System, Information, Service, Use and Satisfaction Indicators Summary

| Domain | Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|---|
| System | | | | | |
| Tele-pathology | Performance | Quality and Reliability of the System | 1. Ease of use of the system and equipment<br>2. Resolution and luminance of the viewing screens<br>3. Quality of video link<br>4. Quality of fixed or dynamic images<br>Image quality and consistency<br>Time to access image<br>5. System reliability<br>(breakdowns, failures)<br>Downtime and system maintenance (hours)<br>Number of scanning retakes as a result of system issues<br>6. System Performance<br>Response time (transmission rates)<br>Time to complete scan [based on industry standard (20x) settings]<br>7. Interoperability among the different components (administrative and clinical) of the system<br>8. Confidence in security and confidentiality of system/data | 1. Clinician and technologist survey<br>2. IT department statistics<br>3. Privacy and security (key informant interview and/or reports) | |
| Information | | | | | |
| DIS | Content | Accuracy of patient profile Sub-Area<br>1. Medication history/drug profile<br>2. Patient assessment | 1. Percentage accuracy of profile<br>2. Baseline percent of profile being completely verified | 1. Pre- and post-baseline measures<br>2. Chart review<br>3. History taking | |
| DIS | Content | Completeness of patient profile | 1. Percentage or proportion coded vs. free text<br>2. Number of drugs (%) & Number of drugs/daily doses (%) documented in chart that exist in drug profile (gold standard) | | |
| EMR | Content | Complete Patient Profile | 1. Data completeness of CPP: Blood Pressure, Weight, e-referral, e-referral follow-up consult letter, Integrated Lab data feed to EMR, prescriptions | 1. EMR-data extract | See 8.2.1 |

(continued)

## 3.2 Additional System, Information, Service, Use and Satisfaction Indicators Summary (continued)

| Domain | Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|---|
| Information (Continued) | | | | | |
| DIS | Content | Completeness and legibility of scripts with e-prescribing | 1. Percentage of missing fields (e.g. quantity, directives) per prescription in hand-written vs. computer generated printed prescriptions<br>2. Percentage of prescriptions where any required field for a legal prescription is judged illegible<br>3. Percentage requiring follow-up | | See 5.2.8 |
| EMR | Content | Completeness and validity | 1. Sensitivity: % of data reflecting reality<br>2. PPV: % of patient with data having the condition<br>3. Proportion of patients with a documented CVD risk | 1. Quasi-experimental before and after | |
| EMR | Content | High quality data structure and completeness | 1. % free text and coded structured data elements: i) used and ii) complete<br>2. % records with lab requisition/results where ordered (within practice)<br>3. % of PHC providers (stratified by EMR and non-EMR/paper-based practices) who had complete information (essential demographic and clinical information, including medication, Lab and/or Diagnostic profile from system-wide patient encounters) at the point of care, most of the time, over the past 12 months<br>4. % using EMR to support monitoring of treatment adherence, renewal frequency, allergic interactions and associated side-effect/symptom tracking<br>5. Proportion of hypertensives with BP recorded<br>6. Number of consultations recorded<br>7. Number of symptom codes recorded | 1. EMR data extract<br>2. Cluster randomized controlled trial<br>2. Observational cohort | See 8.2.1 |
| EMR | Content | Completeness: Active patients on EMR | 1. Patients with a valid HCN Active Patients Cumulative Rostered Cohort | 1. EMR data extract | See 8.2.1 |
| EMR | Content | Duration of EMR use | 1. Start date = at least 5 progress notes with a bill; end-date = most recent 'data extraction date'. | 1. EMR-data extract | See 8.2.1 |
| EMR | Content | Comprehen-siveness | 1. % coverage of intended population | | |
| Service | | | | | |
| Tele-pathology | Responsiveness | Quality of technical support | 1. Quality of technical support<br>system administrator (super-user)<br>regional technical centre<br>2. Quality of vendor support<br>• User training<br>• Responsiveness<br>• Implementation support | 1. Clinician and technologist survey | |

(continued)

## 3.2 Additional System, Information, Service, Use and Satisfaction Indicators Summary (continued)

| Domain | Category & Sub-category | Benefit Area<br>*Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|---|
| Use | | | | | |
| DI | Use behaviour and pattern | PACS Adoption | 1. Total number of unique clinician accounts<br>2. Total number of remote (VPN) clinician accounts<br>3. Number of CD burns requested to the IT department | 1. Post-implementation study with repeated measures at 6, 12 and 24 months | |
| DIS | Use behaviour and pattern | Actual use of system<br>*Sub-Area*<br>Physician and Pharmacist use of the DIS | 1. Proportion of patients seen for whom physician or pharmacist used DIS<br>2. Proportion of patients seen for whom physician prescribing using DIS, out of all patients for whom physician wrote a prescription<br>3. Portion of prescriptions which are electronic | 1. Audit trails + denominator = visits scheduled, dispensed Rx or billings<br>2. Analysis of audit trails for all functionalities, health system billing records for all patients seen (for physician billing by the act), or practice records for salaried physicians<br>3. Survey | |
| EMR | Use behaviour and pattern | Level of usage | 1. Actual usage pattern<br>2. Self-reported use of EMR interfaces/reports<br>3. % using EMR to inform quality improvement reviews/best practice initiatives or audits<br>4. % using EMR to profile patient groups and manage practice (practice reflection/ practice population management)<br>5. % using EMR to monitor patient immunization status/ data completeness of immunization status field in EMR; % at risk population immunized for current period | 1. Pre-post assessment using Adoption Models[1]<br>2.Commonwealth Fund 2012 Survey measures | |
| Telehealth | Use behaviour and pattern | Utilization of telehealth service – utilization patterns | Clinical Use:<br>Total number of health facility based telehealth endpoints (sites)<br>Total number of community based telehealth endpoints (sites)<br>Total number of telehomecare monitoring endpoints (sites)<br>Total number of clinical telehealth sessions conducted in the last 12 months<br>Total number of educational telehealth sessions conducted in the last 12 months<br>Total number of administrative telehealth sessions conducted in the last 12 months<br>Percentage of clinicians within a health region, health authority, using telehealth per year<br>Number of emergent, urgent, and routine clinical telehealth sessions' per year | 1. Utilization Analysis using Telehealth Utilization Database<br>2. Compare to benchmarks.<br>Study Design (for virtual critical care):<br>1. Identify eligibility criteria for critical care telemedicine consultation<br>2. Count number of above cases transferred from local to tertiary critical care facilities<br>3. Count number treated in local critical care facility through telemedicine<br>Data Sources:<br>1. Analysis of administrative / network/system data<br>2. DAD | |

(continued)

## 3.2 Additional System, Information, Service, Use and Satisfaction Indicators Summary (continued)

| Domain | Category & Sub-category | Benefit Area<br>*Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|---|
| Use (continued) | | | | | |
| Tele-pathology | Use behaviour and pattern | Utilization of Telepathology | 1. Frequency of use in clinical and anatomical pathology<br>• second opinion/expert consulting<br>• frozen sections<br>• immunohistochemistry<br>• tumor board rounds<br>• teaching<br>• quality assurance<br>• clinical assistance/ grossing station | 1. Clinician and technologist survey<br>2. Requesting pathologists<br>3. Other clinicians (surgeons, oncologists, radiologists, etc)<br>4. Telepathology system<br>5. LIS (for denominator)<br>6. Image databases | |
| EMR | Use behaviour and pattern | Conducting e-scheduling, e-consultations | 1. % of physicians providing e-mail contact information to patients for:<br>a. consultation and/or<br>b. scheduling/booking<br>2. Volume of appointments booked via e-scheduling<br>3. # of weekly/monthly/ annual e-consultations | 1. Cross-sectional survey<br>2. Case studies/series<br>3. Interviews<br>4. EMR data/ scheduling extract review | |
| EMR | Use behaviour and pattern | Patient participation | 1. % of clinicians/providers using EMR to facilitate communication of information (labs, DI, medication summary, discharge summary, referral summaries) during patient visit/encounter. | 1. Cross-sectional survey<br>2. Case studies/series<br>3. Interviews<br>4. EMR data/ scheduling extract review | |
| EMR | Use behaviour and pattern | Utilization of EMR at time of prescribing / Prescribing practice/process | 1. % who access EMR at time of prescribing to consult medication summary (inclusive of prescriptions across providers)<br>2. % of scripts printed vs. written<br>3. % using decision support tools at time of prescribing<br>4. % satisfaction and confidence with EMR for prescribing (having comprehensive, accurate, legible medication list) speed, elegance, ease of use and printing, managing refills, dosing) | | |
| User Satisfaction | | | | | |
| DI | User satisfaction | User satisfaction with PACS (radiologists, technologists, referring physicians)<br>*Sub-Area*<br>1. User friendliness<br>2. Usability<br>3. Productivity | | 1. Post-implementation study with repeated measures at 6, 12 and 24 months<br>2. User Survey<br>3. Interviews<br>4. Focus groups | See 4.2.6 |

(continued)

## 3.2 Additional System, Information, Service, Use and Satisfaction Indicators Summary (continued)

| Domain | Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|---|
| User Satisfaction (continued) | | | | | |
| DIS | User satisfaction | User satisfaction with the system | 1. Behavioural Intention re: continued use<br>2. Perceived ease of use<br>3. Perceived usefulness; overall and of specific functions | 1. TAM Questionnaire<br>2. User satisfaction survey | |
| Tele-pathology | User Satisfaction | | 1. Overall satisfaction with telepathology<br>2. Satisfaction with quality of image<br>3. Confidence level of the pathologist<br>4. User learning curve | 1. Clinician and technologist survey | |
| EMR | Ease of use | Usefulness and ease of use | 1. Perceived usefulness and value of the EMR | 1. Usability inspection with test scenarios | |
| EMR | Ease of use | Usability – improved billing practices | 1. Change / variation in billing errors, average billings/rates | 1. Administrative data / billing analysis pre-post-implementation | |

BP: Blood Pressure
CD: Compact Disc
CPP: Complete Patient Profile
CVD: Cardiovascular Disease
DAD: Discharge Abstract Database
DI: Diagnostic Imaging
DIS: Drug Information System
HCN: Health Card Number
LIS: Lab Information System
PACS: Picture Archiving and Communication System
PHC: Primary Health Care
PPV: Positive Predictive Value
TAM: Technology Acceptance Model
1Examples: Price et al. (2011), Newsham et al. (2012)

## Sources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12. Price M, Lau F, Lai J. (2011). *Measuring EMR adoption: A framework and case study. ElectronicHealthcare,* 10(1):e25-e30.

# 4. DIAGNOSTIC IMAGING PROGRAM

## 4.1 Diagnostic Imaging Program Indicators Summary

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Methods/Data Sources** | **Examples** |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Quality: Appropriateness/ Effectiveness | Timeliness<br>*Sub Area*<br>1. Service delivery<br>2. Access to test results<br>3. Referring physician capacity to make clinical care decisions in a timely manner | 1. Report TAT: Time elapsed from the point of the exam completion to the availability of the radiologist report to the referring physician:<br>2. Time spent by the referring physician retrieving images and reports | 1. Perceived benefits survey<br>2. Report TAT from RIS systems<br>(Objective measure) | See 3.1.1<br>See 4.2.1<br>See 4.2.2<br>See 4.2.6 |
| Access: Patient and caregiver participation | Patient transfers | 1. Rate of patient transfers for DI services pre and post PACS<br>2. Patient travel required to access DI services | 1. Objective measure<br>2. Survey of recent cases | See 4.2.3<br>See 4.2.4<br>See 4.2.6 |
| Productivity: Efficiency | Workflow efficiency<br>*Sub Area*<br>1. Technologist efficiency<br>2. Radiologist efficiency | 1. Exam TAT: Time elapsed from patient registration to exam available to radiologist for interpretation<br>2. Time required by the radiologist to access an exam and generate the report | 1. Time-motion study<br>2. Workflow collection sheet<br>3. Interviews or focus groups<br>4. Survey | See 3.1.1<br>See 4.2.6 |
| Productivity: Net cost | Duplicate tests | 1. Number of redundant exams ordered: number of exams re-ordered pre-PACS because original was missing or unknown to ordering physician | 1. Administrative data duplicates study<br>2. Survey | See 4.2.4<br>See 4.2.5<br>See 4.2.6<br>See 3.1.1 |

CD: Compact Disc
DI: Diagnostic Imaging
PACS: Picture Archiving and Communication System
RIS: Radiology Information System
TAT: Turn-Around Time
VPN: Virtual Private Network

### Sources


1. Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0.*
2. Canada Health Infoway. (n.d.) *Infoway Benefits Evaluation Indicators Summary.*

## 4.2 Diagnostic Imaging Benefits Evaluation – Example Details

### 4.2.1 Timeliness #1

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Timeliness of access to test results #1 |
| **Question/ Purpose** | "Does PACS support more timely access to information by referring physicians?" (p. 18) |
| **Context** | • "The setting for this indicator will be a defined catchment area (e.g., health region, enterprise, hospital)." (p. 18)<br>• "The population will be imaging modalities and patient exams within scope; sampling to be used where appropriate." (p. 18) |
| **Methods/ Design** | • "Study Design #1: Report TAT determined through recorded time checks, pre and post PACS" (p. 19)<br>• "Study Design #2: Report TAT determined through a Time Motion Study (TMS), pre and post" PACS (p. 19) |
| **Measures** | "Report turn-around time (TAT) measured as the average time (hours) by modality, from when the technologist completes the exam to when the report (verified or unverified) is available to the referring physician." (p. 18) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 - Section 2.3.* |

### 4.2.2 Timeliness #2

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Timeliness of access to test results #2 |
| **Question/ Purpose** | "Does PACS support more timely access to information by referring physicians?" (p. 21) |
| **Context** | • "The setting for this indicator will be a defined catchment area (e.g. a health region)." (p. 21)<br>• "The population will include all referring physicians within a catchment area. Referring physicians would include all physicians who would normally refer patients for diagnostic imaging services." (p. 21) |
| **Methods/ Design** | • "It is recommended that a survey questionnaire (mailed or web-based) be administered 3-months pre-PACS implementation and 6 and/or 12-months post PACS implementation. Time series analyses are used to investigate changes in perceived benefit over time." (p. 22)<br>• "Key informant interviews of a sample of referring physicians (approx. 5) following the analysis of the 12-month post PACS survey are also recommended. The purpose of the interviews would be to solicit more detailed information on the benefits of PACS to referring physicians." (p. 22) |
| **Measures** | Perceived improvements in the time required by referring physicians to access radiology images and reports. The survey, primarily utilizing Likert scales, would focus on (p. 21):<br>• Accessibility – ability to access images and reports<br>• Efficiency and Time Management – time spent retrieving images and reports<br>• Patient Care – more timely treatment; access to previous exams |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 - Section 2.3.* |

### 4.2.3 Patient transfers #1

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Change in patient transfers for DI services |
| **Question/ Purpose** | "Is patient travel (i.e., transfers) for radiology services reduced as a result of implementing PACS?" (p. 25) |
| **Context** | • "The setting for this indicator will be selected sites that provide diagnostic imaging services." (p. 25)<br>• "The population will be all patients transferred for any reason to these sites prior to the implementation of PACS" (p. 25) |
| **Methods/ Design** | "A pre/post comparative analysis using a retrospective chart review as the data collection method." (p. 25) |
| **Measures** | "Total average number (annually) of patient transfers for DI services five (5) year pre-PACS as a proportion of all patient transfers for the same period, compared to the total number of patient transfers for DI services one (1) year post-PACS as a proportion of all patient transfers for the same period." (p. 25) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 - Section 2.4.* |

### 4.2.4 Patient transfers #2 and duplicate tests #1

| | |
|---|---|
| **Title** | The impact of PACS on neurosurgical diagnoses in the emergency department of a community hospital and neurosurgeon satisfaction with the system |
| **Question/ Purpose** | "To demonstrate how the use of PACS in the Emergency Department of a community hospital affects Emergency Room doctors, neurosurgeons, patients and health care budgets." (p. 1) |
| **Context** | Conducted at the end of April 2005 in the Emergency Department of a community hospital located in the Fraser Valley of British Columbia. |
| **Methods/ Design** | • Phase I: "Quantitative analysis of CT Head scans done on an emergency basis during a representative 30-day period" (p. 1-2)<br>• Phase II: "Six question follow up survey conducted with the neurosurgeons who provide services within the Fraser Health Authority" (p. 2) |
| **Measures** | • Number of emergency CT Head scans performed, reviewed for neurosurgical and neurological diagnoses<br>• Number of transfers to an urban hospital for follow-up<br>• Estimate of cost-savings to the health care system<br>• Neurosurgeon satisfaction levels with PACS and benefits of implementing the system in a multi-site organization with limited physician resources |
| **Limitations** | N/A |
| **Source** | Burns, J. (n.d.) *The impact of PACS on neurosurgical diagnoses in the emergency department of a community hospital and neurosurgeon satisfaction with the system.* |

### 4.2.5 Duplicate tests #2 and resource utilization

| | |
|---|---|
| **Title** | Impact of picture archiving communication systems (PACS) on rates of duplicate imaging in the Thames Valley region of Ontario |
| **Question/ Purpose** | To determine if a regional PACS system in the Thames Valley region of Ontario reduced the frequency of duplicate imaging examinations (p. 3). |
| **Context** | 10 hospital sites in the Thames Valley Imaging Network, 36 months before PACS to 12 months after PACS |
| **Methods/ Design** | A before-after study to examine changes in frequencies of duplicate diagnostic imaging examinations using administrative claims data from the Ontario Health Insurance Plan (OHIP). |
| **Measures** | • "Frequency of duplicate imaging within institutions before and after PACS" (p. 6)<br>• "Frequency of duplicate imaging throughout the Thames Valley Imaging Network before and after shared-PACS" (p. 7) |
| **Limitations** | N/A |
| **Source** | You, J. J., Yun, L., & Tu, J. V. (2007). *Impact of picture archiving communication systems (PACS) on rates of duplicate imaging in the Thames Valley region of Ontario*. |

## 4.2.6 Various diagnostic imaging indicators

| | |
|---|---|
| **Title** | Evaluating the benefits of picture archiving and communications system (PACS) in Newfoundland and Labrador |
| **Question/ Purpose** | Study done to (p. i):<br>• Validate and measure the benefits arising from the implementation of the provincial PACS<br>• Compare PACS benefit measures in Newfoundland with PACS evaluations carried out in Nova Scotia, British Columbia, and Ontario<br>• Describe the implementation of the provincial PACS within the context of other key strategies in the province<br>• Document the total cost of ownership of the provincial PACS and estimate the time to achieve a return on investment<br>• Identify and describe the key facilitators and barriers to the successful implementation of PACS<br>• Document the lessons learned from implementing the provincial PACS<br>• Report on the challenges encountered in carrying out the evaluation |
| **Context** | Conducted from June 2005 to November 2007 on the "island portion of the province with a focus on the Eastern and Western Health Authorities" (p. i). |
| **Methods/ Design** | "Pre/post comparative study utilizing project documentation, administrative data, surveys and key informant interviews." (p. i)<br>• Administrative data: "collected each month for at least three months pre implementation and at least nine months post implementation" (p. i)<br>• Questionnaires: "administered post PACS to radiologists, radiology technologists and referring physicians" (p. i)<br>• Key informant interviews: carried out at least twelve months post-implementation (p. i) |
| **Measures** | • Perceived benefits and challenges with PACS<br>• Degree of filmlessness (p. 15)<br>• Percent digitally stored exams (p. 15)<br>• Proportion of unique clinician user accounts (p. 16)<br>• Proportion of active users (p. 16)<br>• Proportion of remote users (p. 16)<br>• Unnecessary duplicate exams (p. 17)<br>• Exams dictated per radiologist scheduled hours (p. 17)<br>• Worked productivity percent (p. 18)<br>• Exam end to dictation end turn-around-times (p. 18)<br>• Total turn-around-time (p. 19)<br>• Patient transfers (p. 19)<br>• Cost per exam in film vs in PACS (p. 20)<br>• Estimated total cost of ownership (p. 21) |
| **Limitations** | Limitations reported (p. 182-183):<br>• Low response rate to the post PACS physician surveys suggesting a non-random sample<br>• Loss of detailed information due to collapsing the four-point Likert scale to two categories<br>• Small sample sizes for the surveys<br>• PACS being only one component of the hospital information system<br>• Questionnaire wording<br>• Lack of administrative data to support objective benefits measures<br>• Absence of study data from PACS evaluations done in Nova Scotia, Ontario and British Columbia for inter-provincial comparisons |
| **Source** | MacDonald, D. (n.d.) *Evaluating the benefits of picture archiving and communications systems (PACS) in Newfoundland and Labrador.* Available: http://www.nlchi.nf.ca/pdf/FINAL_PACS_Report.pdf |

# 5. DRUG INFORMATION SYSTEM PROGRAM

## 5.1 Drug Information System Program Indicators Summary

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Methods/Data Sources** | **Examples** |
|---|---|---|---|---|
| Net Benefits | | | | |
| Quality: Patient Safety | Medication discrepancies | 1. Number of surgical patients with at least one unintentional BPMH medication discrepancy (at time of pre-admission assessment)<br>2. Types of unintentional BPMH medication discrepancies according to a standardized system<br>3. Number of patients with at least one unique discrepancy prevented upon obtaining a BPMH linked to the DPV system<br>4. The number of surgical patients with at least one unintentional medication discrepancy related to home medications<br>5. The types of medication discrepancies related to home medications | 1. Prospective, dual-centre, RCT | See 5.2.1 |
| Quality: Patient Safety | Response to target alerts at time of e-prescribing or dispensing<br>*Benefit Sub-Area*<br>1. MD response to alerts<br>2. Pharmacist response to alerts | 1. Percent of alerts that are over-ridden, overall, and broken down by reason for over-ride<br>2. Percent of alerts that result in a change of prescription<br>3. Most common alerts and the drugs, allergies, or diagnoses that are involved<br>4. Frequency of physician use of changes of settings to suppress alerts (if available) | 1. Audit trails + reasons (desirable not essential) | See 5.2.2 |
| Quality: Patient Safety | ADEs: senior, adult, pediatric<br>*Benefit Sub-Area*<br>1. Rates of Adverse Drug Events pre and post DIS, by age group | 1. Number of medications taken by seniors<br>2. Number of ER visits by seniors resulting from an ADE<br>3. Numbers of inappropriate, maybe inappropriate, drug-drug interaction, one of the above<br>4. Prevalence of ADEs/PADEs<br>5. Significance of ADEs (fatal, life-threatening, serious)<br>6. Percentage of ADEs considered to be preventable<br>7. Number treated for ADEs/PADEs<br>8. Number requiring hospitalization | 1. Focus groups<br>2. Interviews<br>3. Chart reviews (addiction centre & ER records)<br>4. Surveys | See 5.2.3<br>See 5.2.4<br>See 5.2.5<br>See 3.1.1 |
| Quality: Patient Safety | Inappropriate use of prescription drugs<br>*Benefit Sub-Area*<br>1. Legitimate channels used to obtain Rx drugs for abuse<br>2. Substitution of drugs | 1. Most frequently abused drugs<br>2. Number of inappropriate medication requests (double dosing) | 1. Focus groups<br>2. Interviews<br>3. Chart reviews (addiction centre & ER records)<br>4. Surveys<br>5. Anecdotal vignettes<br>6. Pre and post measures | See 3.1.1<br>See 5.2.6 |

(continued)

## 5.1 Drug Information System Program Indicators Summary (continued)

| Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Net Benefits (continued) | | | | |
| Productivity: Efficiency | Pharmacist efficiency | 1. Time to read, retrieve, enter, etc. the prescription for e-Rx<br>2. Efficiency rating of prescriptions for new/ repeat single/multiple medication<br>3. Percentage of e-Rx, computer printed, and hand written prescriptions requiring a change or addition<br>4. Percentage of therapeutic substitutions by the pharmacist | 1. Survey<br>2. Time and Motion study | See 5.2.7 |
| Productivity: Efficiency | Pharmacist to physician call backs | 1. Physician and pharmacist self-reported assessment of time-saving<br>2. Call-back frequency. | 1. Time-motion analysis of call-backs for written and electronic Rx and time per script<br>2. Anecdotal evidence<br>3. Pre/post design | See 5.2.8<br>See 5.2.9 |
| Productivity: Efficiency | Medication review | 1. The mean overall time required to obtain and complete a BPMH (including pre-interview, patient interview and post-interview clinician time) | 1. Prospective, dual-centre, RCT<br>2. Time-motion study | See 5.2.1<br>See 5.2.10 |

BPMH: Best-Possible Medication History
DIS: Drug Information System
DPV: Drug Profile Viewer
ER: Emergency Room
e-Rx: Electronic Prescription
MD: Medical Doctor
(P)ADE: (Potential) Adverse Drug Event
RCT: Randomized Controlled Trial
TAM: Technology Acceptance Model

### Sources


1. BE Jurisdictional Collaboration Group. (2011, February 8). *BE Forum Meeting Notes. Toronto, Ontario.*
2. Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0.*
3. Canada Health Infoway. (n.d.) *Infoway Benefits Evaluation Indicators Summary.*
4. Elliot, P. (2011). Evaluating the Implementation of a Pharmacy Network (NL). *Presentation at BE Forum.*
5. Fernandes, O.A. & Etchells, E.E. (2010). *Final Report: Impact of a Centralized Provincial Drug Profile Viewer on the Quality and Efficiency of Patient Admission Medication Reconciliation (The Evaluation of the Ontario Drug Profile Viewer as part of an Inter-professional Medication Reconciliation Practice Model in a Surgical Pre-Admission Clinic).*
6. Ontario MOHLTC and University Health Network. (2009). *Evaluation Project for Ontario Drug Profile Viewer Impact on Medication Reconciliation - Project Charter/SOW.*

## 5.2 Drug Information System Benefits Evaluation – Example Details

### 5.2.1 Medication discrepancies and medication review #1

| | |
|---|---|
| **Title** | Impact of a Centralized Provincial Drug Profile View on the Quality and Efficiency of Patient Admission Medication Reconciliation |
| **Question/ Purpose** | "Does a centralized provincial drug profile viewer reduce patient admission best possible medication history discrepancies and potential adverse drug events?" (p. 5) |
| **Context** | Surgical pre-admission clinics of two tertiary care teaching hospitals in Ontario. |
| **Methods/ Design** | • "Prospective, dual-centre, randomized control trial with blinded independent observer assessments" (p. 15)<br>• Time motion study |
| **Measures** | • Number of patients with at least one unintentional best possible medication history (BPMH) discrepancy at the time of pre-admission clinic assessment (p. 19)<br>• Discrepancy characteristics (p. 20)<br>• Time required to complete the BPMH (p. 20)<br>• Unique discrepancies prevented by the drug profile viewer (DPV) (p. 20)<br>• Clinical significance assessment for potential adverse drug events (PADEs) (p. 20) |
| **Limitations** | • "Intervention arm involving the DPV could not be blinded from clinicians and patients" (p. 45)<br>• "Only the potential of medication discrepancies to cause harm was assessed rather than actual harm from adverse drug events" (p. 45)<br>• Limitations of the clinician time estimation: variance and inaccuracy, insensitivity of the 5 minute block to discern time differences, variances in number of medications per patient, mixed and overlapping activity (p. 45-46) |
| **Source** | Fernandes, O. A. & Etchells, E. E. (2010). *Impact of a centralized provincial drug profile viewer on the quality and efficiency of patient admission medication reconciliation.* |

### 5.2.2 Response to target alerts at time of e-prescribing or dispensing and impact of alerts

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Physician response to target alerts at time of e-prescribing |
| **Question/ Purpose** | "Do alerts for prescribing errors at the time of electronic prescribing reduce potentially serious prescribing errors?" (p. 47) |
| **Context** | Indicator setting and population (p. 47):<br>• Community-based primary care physicians and specialists<br>• High-risk patients in general practice (those with >3 co-morbidities, >1 score on the Charlson Index, and/or >4 active drugs<br>• Pre- and post-implementation assessments should be undertaken within the same province to serve as a control population<br>• To increase physician acceptability, there may be a staggered implementation (one location receives a system with lab information system, one receives a basic drug information system) to allow benefits to all physicians, with different benefits at different times |
| **Methods/ Design** | • "Intervention and contemporaneous control group within the same province, ideally randomized to early or late intervention with comparison of pre-post differences in the two groups" (p. 48)<br>• "Audit trail analysis of physician response to alerts, and control group prescribing extracted from prescribing system and prescription dispensed provincial databases" (p. 48) |
| **Measures** | Measures (p. 47):<br>• Percent of alerts in high risk patients that are over-ridden, overall, and broken down by reason for over-ride, for drug interactions/duplications/excess dose from the target list<br>• Percent of alerts in high risk patients from target list that result in a change of prescription<br>• Number of prescriptions written for drug combinations from the target list, preimplementation<br>• (no alerts available), for high-risk patients |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 3.5.* |

### 5.2.3 ADEs: adult

| | |
|---|---|
| **Title** | Serious Adverse Drug Events in Adult Patients Leading to Emergency Department Visits: A Baseline Study to Investigate Benefits of a Provincial Pharmacy Network |
| **Question/ Purpose** | • "Estimate the prevalence of ADEs presenting at EDs in the two adult care hospitals in St. John's over a one year period" (p. 12)<br>• "Classify these ADEs by age and gender, and with respect to severity and preventability" (p. 12)<br>• Use the findings of the study as a baseline to compare to the results of a repeat of the study (p. 12) |
| **Context** | Adult population presenting to two adult EDs in St. John's, Newfoundland over one year. |
| **Methods/ Design** | Study conducted in 3 phases:<br>• Phase 1: narrowed the sampling frame to "avoid using limited resources on reviewing patient records when the reason for the visit was highly unlikely to be drug-related" (p. 20); random sample of ED charts selected for review<br>• Phase 2: initial chart review by a physician and a nurse using a trigger assessment tool in order to classify the charts according to their likelihood of being drug-related<br>• Phase 3: "full chart review of all high and moderate probability ADE charts, and a random sample of the low/very low probable charts" (p. 20) |
| **Measures** | • Descriptive statistics for probable ADEs and screening criteria (p. 24)<br>• Prevalence of ADEs (p. 25)<br>• Rate of severity and preventability of ADE (p. 25) |
| **Limitations** | • "Lack of a "gold standard" approach for accurately determining prevalence of ADEs in the community setting" (p. 36)<br>• Using a retrospective chart review design limited the accuracy in determining whether a patient emergency visit was caused by an ADE (p. 36)<br>• "Only considered one visit per patient (randomly) in the final sample" (p. 36)<br>• The trigger assessment tool may have underestimated the true prevalence of ADE in the community (p. 36-37)<br>• Did not extrapolate data to the entire province (p. 37)<br>• Reviewer bias in detecting an ADE (p. 37) |
| **Source** | Research and Evaluation Department, Newfoundland and Labrador Centre for Health Information. (2009). *Serious adverse drug events in adult patients leading to emergency department visits: a baseline study to investigate benefits of a provincial pharmacy network.* |

### 5.2.4 ADEs: pediatric

| | |
|---|---|
| **Title** | Serious Adverse Drug Events in Pediatric Patients Leading to Emergency Department Visits: A Baseline Study to Investigate Benefits of a Provincial Pharmacy Network |
| **Question/ Purpose** | • Estimate the prevalence of ADEs presenting to the ED at the Janeway Children's Health Care Centre in St. John's over a one year period (p. 11)<br>• "Classify ADEs by age and sex, and with respect to severity and preventability" (p. 11) |
| **Context** | Janeway Children's Health Care Centre in St. John's, Newfoundland, a tertiary care centre which specializes in pediatric health care |
| **Methods/ Design** | Study conducted in 3 phases:<br>• Phase 1: narrowed the sampling frame to avoid using limited resources for reviewing patient records were the reason for the ED visit was high unlikely to be drug-related (p. 22)<br>• Phase 2: initial chart review to classify the charts according to their likelihood of being drug-related (p. 22)<br>• Phase 3: full ED chart review of all high, moderate, low, and very low probability ADEs (p. 22) |
| **Measures** | • Descriptive statistics generated for probable ADEs and screen criteria (p. 26)<br>• Estimated prevalence rate of ADEs (p. 26)<br>• Rate of severity and preventability of ADEs (p. 26) |
| **Limitations** | • Lack of a "gold standard" approach for accurately determining prevalence of ADEs in the community setting (p. 35)<br>• Using a retrospective chart review design limited the accuracy in determining whether a patient emergency visit was caused by an ADE (p. 36)<br>• Attempted to identify ADEs treated in EDs and did not capture ADEs treated in outpatient clinics, physician offices, or those who did not seek medical care (p. 36)<br>• "Only considered one visit per patient (randomly) in the final sample" (p. 36)<br>• The trigger assessment tool may have underestimated the true prevalence of ADE in the community (p. 36)<br>• Did not extrapolate data to the entire province (p. 36)<br>• Reviewer bias in detecting an ADE (p. 36) |
| **Source** | Research and Evaluation Department, Newfoundland and Labrador Centre for Health Information. (2009). *Serious adverse drug events in pediatric patients leading to emergency department visits: a baseline study to investigate benefits of a provincial pharmacy network.* |

### 5.2.5 ADEs: senior

| | |
|---|---|
| **Title** | Trends in Prescribing Potentially Harmful Medications Among Seniors: A Baseline Study to Investigate Benefits of a Provincial Pharmacy Network |
| **Question/ Purpose** | • "Examine and characterize the prevalence of potentially inappropriate medication use among the senior population (age 65 years and older) residing in the community" (p. 13)<br>• "Identify factors contributing to inappropriate medication use among the senior population" (p. 13)<br>• "Investigate the expected impact of the Pharmacy Network on inappropriate medication use among the senior population" (p. 13) |
| **Context** | Senior population residing in the community |
| **Methods/ Design** | • Focus groups: "to obtain an in-depth understanding of inappropriate medication use among seniors in Newfoundland and Labrador and the potential impact of the Pharmacy Network" (p. 14); participants included members of the Pharmacy Network Clinical Advisory Committee (physicians, community pharmacists, nurses) (p. 14)<br>• Secondary analysis of the Community Pharmacist Survey (p. 14): one relevant item analyzed<br>• In-home interviews with seniors living in the community (p. 14): conducted by one of seven pharmacists<br>• Emergency room chart review to identify adverse drug events (p. 14): obtained summary data for individuals over age 65 from the Adult ADE study described in 5.2.3 |
| **Measures** | • Concerns regarding drug utilization among seniors (p. 19)<br>• Compliance, confusion and forgetting (p. 20)<br>• Costs of medications (p. 20)<br>• Benefits and limitations of the Pharmacy Network (p. 21-22)<br>• Number of medications used by seniors (p. 25)<br>• Medication appropriateness, duplication of therapy, and potential drug interactions (p. 25)<br>• Distribution of inappropriate medications per patient (p. 26)<br>• Mean number of medications with and without inappropriate medication use (p. 26)<br>• Seniors sense of medication indication (p. 26)<br>• Number and prevalence of ADEs among seniors (p. 27)<br>• Number and rates of preventability of adverse drug events by severity (p. 27) |
| **Limitations** | • Focus group questions were sometimes closed ended and in sometimes leading in their wording (p. 33)<br>• Use of closed ended questions without follow-up may have impacted the richness of data (p. 33)<br>• Study designed to only detect medications that were outlined in the list of inappropriate medications for seniors developed for this study, were a duplication of therapy, or were involved in drug-drug interactions (p. 33)<br>• Only seniors living in the greater St. John's area were recruited for the in-home interview (p. 33)<br>• Each in-home interview conducted by one of seven pharmacists which may have resulted in some differences in how it was conducted (p. 33)<br>• Include results for only a sub-sample of seniors to be included in the full study (p. 33) |
| **Source** | Research and Evaluation Department, Newfoundland and Labrador Centre for Health Information. (2009). *Trends in prescribing potentially harmful medications among seniors: a baseline study to investigate benefits of a provincial pharmacy network.* |

## 5.2.6 Inappropriate use of prescription drugs

| | |
|---|---|
| **Title** | Illegal Use of Prescription Drugs in Newfoundland and Labrador: A Baseline Study to Investigate Benefits of a Provincial Pharmacy Network |
| **Question/ Purpose** | • "Examine and characterize the prevalence of prescription drug abuse in Newfoundland and Labrador" (p. 13)<br>• "Identify factors contributing to prescription drug abuse in Newfoundland and Labrador" (p. 13)<br>• "Establish the expected impact of the Pharmacy Network on prescription drug abuse" (p. 13) |
| **Context** | Prescription drug abuse in Newfoundland and Labrador |
| **Methods/ Design** | • Focus groups and key informant interviews with persons identified as having experience in the issues surrounding illegal drug use (policy, health, social, and law-enforcement professionals) (p. 14)<br>• Survey of physicians and pharmacists (p. 15)<br>• Secondary analysis of Community Pharmacist Survey (p. 15)<br>• Chart review at addictions centres (p. 15)<br>• Hospital separation data (p. 15) |
| **Measures** | • Focus groups and interviews: magnitude of the problem, common prescription and over-the-counter medications abused, obtaining prescription drugs for illicit use, professional and public safety concerns, stigmatization of legitimate medication users, prevention and reducing abuse, expected impact of the Pharmacy Network (p. 17)<br>• Pharmacist and physician survey: perceived extent of the drug abuse problem in Newfoundland and Labrador, commonly abused prescription drugs, commonly abused OTC drugs, methods of obtaining prescription drugs, expected impact of the Pharmacy Network on prescription drug abuse, drug abuse interventions (p. 30-33)<br>• Secondary analysis of community pharmacists survey: perceived extent to which pharmacists agree that the Pharmacy Network will reduce the amount of prescription drugs in the illegal drug trade (p. 34)<br>• Addictions centre chart review: drugs contributing to addiction centre admissions, documented drugs per admission; presence of other addictive disorders (p. 36-37)<br>• Hospitalizations: drugs with abuse potential contributing to hospitalization (p. 37) |
| **Limitations** | • Inpatient addiction centre chart review: not necessarily a representative sample of drug abusers in the province as only severe cases are admitted (p. 46)<br>• Inpatient addiction centre chart review: may not be the best source of information for describing OTC abuse (p. 46)<br>• Focus group and interview questions were sometimes closed ended without follow-up and may have impacted richness of the data (p. 46)<br>• Very few key informants interviewed from rural settings (p. 46) |
| **Source** | Research and Evaluation Department, Newfoundland and Labrador Centre for Health Information. (2009). *Illegal use of prescription drugs in Newfoundland and Labrador: a baseline study to investigate benefits of a provincial pharmacy network.* |

## 5.2.7 Pharmacist efficiency

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Pharmacist efficiency |
| **Question/ Purpose** | "Does the use of computer generated and printed prescriptions reduce the time required to process prescriptions, including call-backs from pharmacists to physicians?" (p. 53) |
| **Context** | "Community pharmacists receiving handwritten, computer printed, and electronic prescriptions" (p. 53) |
| **Methods/ Design** | "Survey of community-based pharmacists with access to both electronic and hand-written prescriptions" (p. 54) |
| **Measures** | Measures (p. 53-54):<br>• Time to read the prescription for e-Rx, printed Rx, and handwritten Rx<br>• Time to retrieve patient profile for e-Rx, printed Rx, and handwritten Rx<br>• Time for entry or checking of prescription information (for submission to adjudication) for e-Rx, printed Rx, and handwritten Rx<br>• Time for checking process prescription for accuracy for e-Rx, printed Rx, and handwritten Rx<br>• Time for resolving illegible prescriptions for e-Rx, printed Rx, and handwritten Rx<br>• Time for resolving incomplete prescriptions for e-Rx, printed Rx, and handwritten Rx<br>• Efficiency rating of prescriptions for new single medication for e-Rx, printed Rx, and handwritten Rx<br>• Efficiency rating of prescriptions for multiple new medications for e-Rx, printed Rx, and handwritten Rx<br>• Efficiency rating of prescriptions for repeat single medication for e-Rx, printed Rx, and handwritten Rx<br>• Efficiency rating of prescriptions for repeat multiple medications for e-Rx, printed Rx, and handwritten Rx<br>• Percentage of e-Rx, printed Rx, and handwritten Rx requiring callback to physician to clarify prescription<br>• Percentage of e-Rx, printed Rx, and handwritten Rx requiring change in posology based on professional judgment<br>• Percentage of e-Rx, printed Rx, and handwritten Rx requiring addition of supplemental information based on professional judgment<br>• Percentage of e-Rx, printed Rx, and handwritten Rx requiring change in DIN |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 - Section 3.7.* |

### 5.2.8 Pharmacist to physician call backs #1 and completeness and legibility of scripts with e-prescribing

| | |
|---|---|
| **Title** | The Effect of Handwritten Prescription Orders on Pharmacists Clarification Calls |
| **Question/ Purpose** | 1. To determine the prevalence of pharmacist seeking clarification for four (4) small, medium and large volume pharmacies in the St. John's area<br>2. To document and categorize the reasons for seeking clarification<br>3. To compare volume and types of clarification calls of hand written scripts to printed scripts<br>4. Estimate time taken to clarify prescriptions |
| **Context** | Prospective community-based pharmacist review of handwritten vs. EMR-generated/printed prescriptions |
| **Methods/ Design** | • Each pharmacy was asked to complete an anonymous data collection sheet for clarification calls undertaken for new prescriptions for a total of approximately 17 weeks. Three of the pharmacies collected clarification from Monday – Saturday and the fourth collected 3 days a week on alternating days.<br>• Pharmacists also collected total number of new prescriptions daily for the duration of the study period<br>• Data collection sheets were entered into SPSS and analysed |
| **Measures** | • Type of prescription<br>• Name of drug(s) prescribed<br>• Name of drug(s) requiring clarification<br>• Reason for clarification<br>• Time taken to confirm prescription via call<br>• Type of pharmacist (relief/staff)<br>• Age of pharmacist<br>• Years of experience as pharmacist |
| **Limitations** | • Collecting only errors that require a clarification call<br>• Experience of pharmacist and familiarity with patients may lead to fewer clarification calls. Experience of pharmacists in the study varies. |
| **Source** | Centre for Health Information Newfoundland & Labrador. (2012). *The Effect of Handwritten Prescription Orders on Pharmacists Clarification Calls.* |

### 5.2.9 Pharmacist to physician call backs #2

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Number of pharmacist to physician callbacks |
| **Question/ Purpose** | "Does the availability of 2-way communication for prescription refill reminders reduce the number of call for prescription refills between physicians and pharmacists?" (p. 56) |
| **Context** | "General practices and community pharmacies" (p. 56) |
| **Methods/ Design** | "Pre- and post-implementation assessments should be undertaken in a DIS intervention and control group within the same province and time period. To increase physician acceptability of being in the control group, there may be a staggered implementation to allow benefits to all physicians, with different benefits at different times." (p. 56) |
| **Measures** | Measures (p. 56):<br>• Number of calls per day from pharmacists to physicians for refills<br>• Time spent per day by pharmacists to call physicians for refills<br>• Number of calls per day received by physicians for refills<br>• Time spent per day by physicians responding to pharmacist calls for refills |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 3.8.* |

### 5.2.10 Medication review #2

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Time to take medication history/patient assessment |
| **Question/ Purpose** | "Does access to the complete drug profile reduce the time required to take a medication history?" (p. 50) |
| **Context** | • "Emergency rooms, general practices" (p. 50)<br>• "Analysis for all patients, and also a separate analysis for vulnerable patients taking 5 or more medications" (p. 50) |
| **Methods/ Design** | • "Time and motion study of a patient consultation, both for physicians with a DIS, and a control group of physicians without a DIS, as well as pre- and post- DIS implementation periods for each physician" (p. 51)<br>• "Intervention and contemporaneous control group within the same province ideally randomized to early or late intervention" (p. 51)<br>• "Pre-post implementation comparison" (p. 51) |
| **Measures** | • Measures (p. 50-51):<br>• Total time for consultation (ER nurse + MD components)<br>• Subcomponent times for: introduction, history taking, consent (for use of DIS), examining drug profiler (using DIS), history of current medications including calls to pharmacies, physical examination, prescription writing, test ordering, determining plan of action, closing of patient consultation, other activities-not patient related, refills requests for other patient by telephone/by receptionist (not for the patient under examination) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 3.6.* |

# 6. INTEROPERABLE ELECTRONIC HEALTH RECORD/LABORATORY PROGRAM

## 6.1 Interoperable Electronic Health Record/Laboratory Program Indicators Summary

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Methods/Data Sources** | **Examples** |
|---|---|---|---|---|
| Net Benefits | | | | |
| Quality: Patient safety | Impact of LIS on patient safety | | 1. Post-implementation: Case study required designed to answer the question "Did the LIS result in increased patient safety?" | See 6.2.1 |
| Quality: Patient safety | Impact of alerts | Post-implementation:<br>1. Number of alerts triggered and acted upon | 1. Audit trails + reasons (desirable not essential) | See 5.2.2 |
| Quality: Appropriateness/ effectiveness | Informed clinical decisions | 1. Perception of informed decision making pre/post EHR implementation | 1. Physician survey<br>2. Key informant interview<br>3. Focus group | |
| Quality: Appropriateness/ effectiveness | Duplication of immunizations | 1. Percentage of patients who received unnecessary repeat tetanus shots = Number of patients who received an unnecessary repeat tetanus shot / all ER patients who have a prior tetanus shot that is still effective and that is in the immunization record | Design (over one-week period in ER):<br>1. Observe or tally the number of tetanus shots, or conduct a chart review and find all the tetanus shots given in the ER in the study period<br>2. Check the immunization record to find all patients who already had a tetanus shot<br>3. Check the date of the last shot in the record to determine whether the shot is still effective/valid<br>4. Calculate the number of repeat tetanus shots<br><br>Data sources:<br>1. Immunization record | |
| Quality: Appropriateness/ effectiveness | Length of stay in ER and ER throughput | 1. Average ER LOS for ER trend patients = Total ER LOS (hours) for eligible patients/Number of eligible patients<br>2. Overall ED LOS (EDIS)<br>3. ED LOS for ED trend patients? (Chart Review + EDIS)<br>4. Provider perception (survey/interviews)<br>5. Length of stay for specific patients (e.g. kidney disease, chest pain, or anemia) | 1. Chart Review + EDIS<br>2. Survey<br>3. Interviews<br>1. Pre-implementation: calculate baseline by determining the average ER LOS<br>2. Post-implementation: repeat the calculation<br>3. Compare post-implementation LOS to baseline LOS<br><br>Data Sources:<br>1. From EDIS: time of entry into ER, time of discharge | |

(continued)

## 6.1 Interoperable Electronic Health Record/Laboratory Program Indicators Summary

**(continued)**

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Methods/Data Sources** | **Examples** |
|---|---|---|---|---|
| Net Benefits (Continued) | | | | |
| Quality: Appropriateness/ effectiveness | Blood tests and immunizations in primary care or ER | 1. Average number of blood tests and/ or immunizations received by abnormal trend patients and immunization patients = sum of all blood tests/immunizations / total number of trend patients & immunization patients | Blood tests:<br>1. Calculate baseline for number of blood tests/patient<br>2. Post-implementation - repeat calculation<br>3. Compare pre- and post-implementation<br><br>Immunizations:<br>1. Calculate baseline for number of immunizations/patient<br>2. Post-implementation - repeat calculation<br>3. Compare pre- and post-implementation<br><br>May also conduct physician survey | |
| Quality: Appropriateness/ effectiveness | Timeliness of ER care | 1. Number of ER hours saved from ER lab trend patients = Total post-implementation LOS - Total pre-implementation (baseline) LOS<br>2. Average ER LOS for all patients = number of hours for all ER trend patients / number of patients<br>3. Timely comparative review of prior identical and usable lab test result(s) avoiding time lapse for lab-series testing in ED. (e.g. Creatinine and Troponin T) | Design:<br>1. Prior to implementation, complete baseline by calculating total LOS for ER lab trend patients<br>2. Post-implementation: repeat the calculation<br>3. Calculate difference = hours saved<br>4. Calculate post-implementation ER average LOS<br><br>Data sources:<br>1. From EDIS: time of entry into ER, time of discharge | See 6.2.2 |
| Quality: Appropriateness/ effectiveness | Resource utilization | 1. Type and number of tests ordered<br>2. Number of tests before and after iEHR<br>3. Number of patients seen | 1. Infoway System & Use Survey<br>2. Admin data<br>3. Administrative data duplicates study | See 4.2.5 |
| Quality: Health outcomes | Readmission rate | 1. Hospital readmission rates within 30 days after discharge | 1. Objective measure: data from Discharge Abstract Database | See 6.2.3 |
| Access: Ability of patients and providers to access services | Patient satisfaction | 1. Discomfort of repeated tests<br>2. Inconvenience of waiting for lab test results | 1. Conduct survey/focus group of ER trend patients<br>2. Conduct exit survey for non-local ER patients<br>3. Conduct survey and focus group of PC new patients<br>4. Conduct focus group of physicians of PC new patients<br>5. NRC Picker (measures) | |

**(continued)**

## 6.1 Interoperable Electronic Health Record/Laboratory Program Indicators Summary

**(continued)**

| Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Net Benefits (Continued) | | | | |
| Productivity: Efficiency | Timeliness of access to test results | 1. Pre and post-implementation: average turnaround times by lab, region and sector for specified tests.<br>2. Provider perception | 1. Post implementation provider perception<br>2. Pre/port implementation time study<br>3. Survey<br>4. Interview<br>5. Self-report log | See 6.2.4 |
| Productivity: Efficiency | Lab technician call-backs | 1. Pre and post-implementation: Number of call-backs from ordering provider to lab technologist | | See 6.2.5<br>See 5.2.8<br>See 5.2.9 |
| Productivity: Efficiency | Administrative effort in primary care settings for managing lab results | 1. Percentage of administrative time that can be saved finding lab test results = total time spent finding lab results – total time for work day<br>2. impact of LIS integrated into EMR on administrative time | Design: Conduct time study of administrative staff in a clinic<br>1. Pre-implementation: conduct baseline calculation of average time spent finding lab test history for eligible patients<br>2. Post-implementation: repeat calculation<br>3. Compare pre- and post-implementation averages<br><br>Data Sources:<br>1. Lab repository | |
| Productivity: Efficiency | Duplication of lab and imaging tests | Pre and post-implementation:<br>1. Number of times a best practice duplicate test rule was invoked by month and action taken stratified by LIS user practitioners and non-LIS user practitioners<br>2. Count of redundant laboratory tests<br>3. Overall count of laboratory tests<br>4. Count of redundant imaging tests<br>5. Overall count of imaging tests | 1. Qualitative data from interviews<br>2. Qualitative data from focus group sessions<br>4. Key informant interviews<br>5. Pre-evaluation stakeholder engagement<br>6. Pre/post design<br>7. Administrative data<br>8. Surveys (e.g. Infoway System and Use Survey) | See 3.1 |

ED/ER Emergency Department / Emergency Room
EDIS: Emergency Department Information System
LIS: Lab Information System
LOS: Length of Stay
NRC: National Research Corporation
PC: Primary Care

### Sources


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## 6.2 Interoperable Electronic Health Record/Laboratory Benefits Evaluation – Example Details

### 6.2.1 Impact of LIS on patient safety

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Impact of LIS on patient safety |
| **Question/ Purpose** | "Does the JLIS result in anecdotal evidence of improvement in patient safety?" (p. 62) |
| **Context** | JLIS leads to identify an example of where they believe the JLIS has improved patient safety (p. 62) |
| **Methods/ Design** | "Qualitative case study conducted using semi-structured interviews & observation" (p. 62) |
| **Measures** | Grounded theory analysis of qualitative data (p. 63) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 4.3.* |

### 6.2.2 Timeliness of ER care

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Provider efficiency and effectiveness in emergency departments |
| **Question/ Purpose** | "Does the iEHR improve the productivity and efficiency of the doctors and nurses providing care for patients in the emergency department (ED)?" (p. 96) |
| **Context** | • "Emergency departments that have implemented the iEHR" (p. 96)<br>• "Patients being seen in the ED during the specified study period" (p. 96) |
| **Methods/ Design** | Several different study designs can be used to assess this study question (p. 97-98):<br>• Select sample of approximately 4-6 EDs if possible and perform a comparison of data collected 12 months pre- and post- iEHR implementation<br>• Select sample of patients in the ED and give them timers and/or other recording devices on their arrival to track time and specific aspects of care while in the ED<br>• Time motion studies with direct observation of physicians, nurses, and other ED staff to assess the time providers spend trying to track down lab, imaging and medication information<br>• Focus groups conducted with ED personnel before and after iEHR implementation<br>• Measure the number and types of lab and imaging tests ordered as well as costs in the 12 months pre- and post-iEHR implementation to assess impact of the iEHR on ordering |
| **Measures** | Measures (p. 97):<br>• Waiting time of patients seen in the ED from arrival to discharge<br>• Time spent by ED physicians, nurses, and other staff tracking down and obtaining lab results, diagnostic imaging results, and medication information<br>• Number of lab and diagnostic imaging tests ordered by the ED<br>• Costs of lab and diagnostic imaging tests ordered by the ED |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 6.4.* |

### 6.2.3 Readmission rates

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Readmission rates |
| **Question/ Purpose** | "Do hospital readmission rates decrease after implementation of the iEHR?" (p. 90) |
| **Context** | • "Hospitals with iEHR implemented" (p. 90)<br>• "All patients in a given study population who have been admitted to the hospital, discharged, and re-admitted within 30 days" (p. 90) |
| **Methods/ Design** | • Comparisons between pre- and post-implementation: measurement 12 months pre-implementation of the iEHR and 12 months post-implementation (p. 90)<br>• Comparison between sites that have implemented the iEHR and those who have not: randomization of sites with similar demographic characteristics and implement iEHR at half of the sites (p. 90-91) |
| **Measures** | "Number of patients readmitted to acute inpatient hospitals within 30 days of being discharged from an acute inpatient hospital stay will be measured" (p. 90) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 6.2.* |

### 6.2.4 Timeliness of access to test results

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Timeliness of access to test results |
| **Question/ Purpose** | "Does the JLIS implementation improve turnaround time for results dissemination?" (p. 59) |
| **Context** | Track a representative bundle of pre-selected tests which feature the following criteria (p. 59):<br>• High volume, and shorter testing time<br>• High volume and longer testing time<br>• Complex, yet critical tests |
| **Methods/ Design** | Pre- and post-implementation: use calculated data to determine average turnaround time (p. 60) |
| **Measures** | "Average (mean, median, & mode) turnaround times by lab, region and sector for specified tests. Turnaround time (TAT) is defined as the time between when a sample is taken from a patient to the time the result is available to the ordering provider (whether viewed at that time or not)." (p. 60) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 4.2.* |

### 6.2.5 Lab technician call-backs

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Lab technician callbacks |
| **Question/ Purpose** | "Does the JLIS implementation result in reduced callbacks from lab technologist to ordering provider?" (p. 66) |
| **Context** | "All lab technologists & call-desk staff working in JLIS participating laboratories" (p. 66) |
| **Methods/ Design** | "Reports generated monthly from 12 months preceding "go-live" for the duration of the implementation period (L-12 months – L+36 months). A simple tally to be kept by the lab technician of call-backs made by date." (p. 66) |
| **Measures** | "Number of call-backs made from lab technician to ordering provider by provider role" (p. 66) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 4.5* |

# 7. TELEHEALTH PROGRAM

## 7.1 Telehealth Program Indicators Summary

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Methods/Data Sources** | **Examples** |
|---|---|---|---|---|
| Quality: Appropriateness and effectiveness | Overall patient satisfaction | Patient satisfaction with:<br>1. Ease of access to health care provider<br>2. Ease of access to follow-up care<br>3. Travel to/from telehealth site<br>4. Convenience of care | 1. Utilization analysis<br>2. Surveys: provider and patient (e.g. Canadian survey of patient healthcare experiences (Statistics Canada))<br>3. Key informant interviews<br>4. Analysis of administrative data | See 7.2.1<br>See 7.2.2 |
| Quality: Appropriateness and effectiveness | Unnecessary admissions, ER visits or other services | Number of hospital admissions, ER visits, unplanned primary care visits avoided through the use of telehomecare or other remote monitoring or disease screening technologies (e.g. telerenal, teleophthalmology) | Study Design: Pre vs Post design, or intervention and control cohorts<br>- Utilization data collected through either:<br>- administrative databases<br>Data Sources:<br>1. Analysis of administrative /network/system data<br>2. NACRS data<br>3. DAD<br>4. Patient Survey | See 7.2.3<br>See 7.2.4<br>See 7.2.5 |
| Quality: Appropriateness and effectiveness | Wait times for access to services with telemedicine | 1. Wait time to initial specialist visit (median wait time in days between patient referral date and data of visit)<br>2. Difference in wait time between telehealth and in-person visits for any year or over the three-year study period<br>3. Compare average time to diagnosis/treatment via telemedicine vs. average time to diagnosis/treatment via conventional in-person patient visits<br>4. Interdisciplinary referral rate<br><br>Clinical use:<br>1. Patient wait time for initial appointment<br>2. Patient wait time for specialist referral<br>3. Patient wait time for diagnosis and treatment | Study Design:<br>1. Administrative (network/system) Store-Forward data analysis to calculate wait times<br>2. Compare to published information about average dermatology wait times<br>3. Do analysis by postal code, if available in SF data. If not available then by geographic region<br>4. Analysis of Administrative Data from Oncology Patient Information System<br>5. Administrative database comparison of urban vs. rural encounters before and after telehealth interventions<br>6. Determine length of time from initial telemedicine assessment to telemedicine diagnosis/treatment<br>7. Determine length of time from initial in-person assessment to in-person diagnosis/treatment<br><br>Data Sources:<br>1. Analysis of administrative /network/ system Store-Forward data<br>2. Published info about average dermatology wait times<br>3. Analysis of administrative /network/system data<br>4. External reference on non-telemedicine time from referral to diagnosis/treatment | See 7.2.6 |

(continued)

## 7.1 Telehealth Program Indicators Summary (continued)

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Methods/Data Sources** | **Examples** |
|---|---|---|---|---|
| Quality: Appropriateness and effectiveness | Stroke treatment rates and time | 1. Percentage of ischemic stroke patients getting tPA in underserved areas with no Telestroke program<br>2. Percentage of ischemic stroke patients getting tPA when treated via Telestroke / ischemic stroke patients seen via Telestroke<br>3. Time from 1st presentation to tPA admin for ischemic stroke patients<br>~within Telestroke and outside of Telestroke<br>~outside stroke centre catchment areas with Telestroke and inside stroke centre catchment areas | Study Design:<br>1. Analysis of administrative /network/ system data to calculate percentage of ischemic stroke cases that receive tPA<br>2. Use NACRS data to calculate percentage of ischemic stroke cases received tPA in general population and in underserved areas without telestroke programs<br>3. Use same data to calculate time between ER triage and tPA administration for the various categories described above<br><br>Data Sources:<br>1. Administrative/ System /network tPA administration data and associated assessment and treatment times<br>2. NACRS number of cases with tPA administration CCI code by FSA / hospital<br>3. Linkage by HIN of ER episodes across the system | See 7.2.7 |
| Quality: Health outcomes | Self-reported quality of life | | 1. Generic physical and mental health well-being survey/questionnaire | |
| Access: Ability of patients and providers to access services | Access to specialists | 1. Number and rate of specialist services (e.g. mental health crisis assessments) for patients in underserved areas | Study Design:<br>1. Identify number of patients seen by an FHT in a year<br>2. Identify the number of primary care telemedicine referrals by FHT, by therapeutic areas of care<br>4. Determine number of specialist services per year in underserved areas<br>5. Determine fraction that are done through telemedicine<br>Data Sources:<br>1. Analysis of administrative /network/system data<br>2. Care provider/ care network survey | See 7.2.8 |

(continued)

## 7.1 Telehealth Program Indicators Summary (continued)

| Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Access: Ability of patients and providers to access services | Travel to access services | 1. Total travel distance to access specialized services for cancer patients living in underserved areas with and without Telemedicine<br>2. Total number of avoided travel kilometres by eligible patients as a result of accessing required eligible services using Telehealth<br>3. Total health system savings associated with avoided travel kilometres by eligible patients as a result of accessing required eligible services using Telehealth<br>4. Savings for physically-disabled patients<br>5. Savings for health care providers doing traveling clinics<br>6. Total RHA and province health savings associated with avoided travel kilometres by staff as a result of accessing required services using Telehealth | 1. Utilization analysis<br>2. Surveys: provider and patient<br>3. Key informant interviews<br>4. Analysis of administrative data<br>5. Focus groups<br>Study Design:<br>1. Determine total travel done by patients to receive cancer treatment<br>2. Determine fraction done by patients in underserved areas<br>3. Determine necessary travel by patients in underserved areas when receiving treatment via telemedicine<br>4. Identify number of eligible patients receiving services<br>5. Identify where Telehealth service was used, or could have been used<br>6. Translate number of events to avoided person trips<br>7. Calculate driving distance for each case and multiply by person visits avoided<br>8. Identify number of eligible patients receiving eligible services<br>9. Identify where Telehealth service was used, or could have been used<br>10. Translate number of events to avoided person trips<br>11. Calculate driving distance for each case and multiply by person visits avoided<br>12. Calcuate total funded cost savings by multiplying cost per km by number of avoided kms and cost per trip by number of avoided trips<br>13. Identify total staff travel time and costs.<br>14. Identify where Telehealth service was used, or could have been used<br>15. Translate number of events to avoided trips<br>16. Calculate total funded cost savings plus savings associated with reduced unproductive time (during travel)<br><br>Data Sources:<br>1. Analysis of administrative /network/system data<br>2. Regional Cancer Care (such as Cancer Care Ontario-CCO data)<br>3. Telehealth scheduled events data repository<br>4. Health billing data<br>5. Telehealth program data<br>6. Ministry of Health travel costs per kilometer and per patient trip<br>7. RHA and province travel cost data | See 7.2.1 |

(continued)

## 7.1 Telehealth Program Indicators Summary (continued)

| Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Access: Patient and caregiver participation | Caregiver burden | 1. Ability to provide adequate care<br>2. Satisfaction with role | 1. Caregiver questionnaires | |
| Productivity: Efficiency | Healthcare provider productivity | 1. Average number of 'clients' handled per week<br>2. Average clinician time spent per 'client'<br>3. Average clinician administrative staff time spent per 'client'<br>4. Average time spent with 'client'<br>5. Average time for review of 'client' past medical history<br>6. Number of return visits by 'client' to clinician for same complaint<br>7. Frequency, ease and convenience of patient follow-up<br>8. Continuity of care<br>9. Number of patients seen in period of time | 1. Key Informant Interviews | See 7.2.9 |

[1] For clinical telehealth activities, the 'delivering site' will be viewed as that site at which the specialist or referred clinician is located.
[2] For clinical telehealth activities, the 'receiving site' will be viewed as that site at which the referring clinician and/or patient is located.

CPD: Chronic Pulmonary Disorder
CPG: Clinical Practice Guidelines
CCHSA: Canadian Council on Health Services Accreditation
CCI: Controlled Cortical Impact
CCO: Cancer Care Ontario
CCR: Canadian Cancer Registry
DAD: Discharge Abstract Database
ER: Emergency Room
FHT: Family Health Team
FSA: Forward Sorting Address
HIN: Health Insurance Number
NACRS: National Ambulatory Care Reporting System
QALY: Quality-Adjusted Life Year
RHA Regional Health Authority
tPA: Tissue plasminogen activator (tPA): A substance that is sometimes given to patients within three hours of a stroke to dissolve blood clots within the brain.

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## 7.2 Telehealth Benefits Evaluation – Example Details

### 7.2.1 Overall patient satisfaction #1 and travel to access services

| | |
|---|---|
| **Title** | Telehealth Benefits and Adoption: Connecting People and Providers Across Canada<br>Indicators: Patient time and travel costs |
| **Question/ Purpose** | To inform Telehealth stakeholders about the evidence of value of Telehealth activities in Canada with a focus on the quality, access, and productivity benefits being achieved (p. 1). |
| **Context** | • "Patients who received consults via a Telehealth program when they would have otherwise travelled to receive an in-person consult with a health care provider" (p. 81)<br>• "Current populations: rural patients in all regions who had Telehealth service" (p. 85)<br>• "Future state populations: outpatient health care events in the disciplines where there is Telehealth for rural residents" (p. 85) |
| **Methods/ Design** | Data sources: jurisdictional surveys, reports and studies |
| **Measures** | Category (p. 84; p. 86):<br>• Possible rural consults<br>• Kilometres driven per consult<br>• Total kilometres driven<br>• Hours of driving time<br>• Person-years of travel<br>• Gas saved<br>• Avoided CO2 emissions<br>• Estimated cost per trip<br>• Cost savings for patients in rural settings |
| **Limitations** | • Lack of standardization in medical terms, metrics and Telehealth event definitions across organizations and jurisdictions (p. 60)<br>• Assumptions behind quantitative data presented (p. 60)<br>• Causality versus correlation (p. 61)<br>• Evaluation versus research (p. 61) |
| **Source** | Praxia, Gartner. (2011). *Telehealth Benefits and Adoption – Connecting People and Providers Across Canada.* |

### 7.2.2 Overall patient satisfaction #2

| | |
|---|---|
| **Title** | Evaluating the Benefits<br>Newfoundland and Labrador Provincial Telehealth Program: Chronic Disease Management<br>Indicator: Patient satisfaction |
| **Question/ Purpose** | "Are patients/providers satisfied with Telehealth services?" (p. 8) |
| **Context** | Chronic Disease Management Provincial Telehealth Program – telehealth sites in St. John's |
| **Methods/ Design** | Patient surveys were mailed to telehealth coordinators who arranged to have surveys mailed to individual telehealth sites plus specialist sites (p. 12)<br>• Conducted immediately after the telehealth session by the nurse of other on-site staff<br>• After completion, patients were instructed to seal the survey in an envelope<br>• Administered over a four-month period<br>• Used descriptive statistics and bi-variate comparisons to compare responses among sites and provider groups<br>• Analyzed open-ended questions for emerging themes and categories |
| **Measures** | Survey items (p. 48-49):<br>• Easier to get an appointment to see the specialist/other provider<br>• Ability to see the specialist/provider more often<br>• Acceptability of time to get a telehealth appointment<br>• Appropriateness of facility space for telehealth session<br>• Ability for patient and specialist/provider to see/hear each other<br>• Videoconference equipment ready and working properly<br>• Privacy and confidentiality concerns<br>• Acceptability of process to schedule and confirm appointment<br>• Time to ask questions during session<br>• Likelihood of seeing same specialist<br>• Acceptability of travel time to telehealth site<br>• Satisfaction with overall quality of telehealth session<br>• Use of telehealth service again<br>• Recommendation of telehealth service to others<br>• Locating the telehealth session<br>• Explanation of what to expect during telehealth session<br>• Comfort seeing the specialist/provider<br>• Patient options if telehealth were not available<br>• Issues which made in-person specialist visits difficult<br>• Distance to travel if telehealth not available<br>• Approximate cost savings for current telehealth session<br>• Number of telehealth sessions attended |
| **Limitations** | Small sample sizes (p. 85) |
| **Source** | Centre for Health Information Newfoundland & Labrador. (2010). *Evaluating the Benefits Newfoundland and Labrador Provincial Telehealth Program: Chronic Disease Management.* |

### 7.2.3 Unnecessary admissions, ER visits or other services #1

| | |
|---|---|
| **Title** | Telehealth Benefits and Adoption – Connecting People and Providers Across Canada (reports on multiple studies done across Canada)<br>Indicator: Avoidable health system utilization |
| **Question/ Purpose** | To inform Telehealth stakeholders about the evidence of value of Telehealth activities in Canada with a focus on the quality, access, and productivity benefits being achieved (p. 1). |
| **Context** | Patients enrolled in Telehomecare programs in British Columbia, Ontario, Quebec, Nova Scotia, and New Brunswick. Selected conditions: diabetes, congestive heart failure (CHF), and chronic obstructive pulmonary disease (COPD) (p. 97). |
| **Methods/ Design** | Data sources: various studies and reports from Ontario, Quebec, Canada, British Columbia, New Brunswick |
| **Measures** | Category (p. 102):<br>• Number of Telehomecare patients<br>• Inpatient stays avoided per patient<br>• Cost per inpatient stay<br>• Emergency department visits<br>• Emergency visit avoidance<br>• Emergency visit cost |
| **Limitations** | • Lack of standardization in medical terms, metrics and Telehealth event definitions across organizations and jurisdictions (p. 60)<br>• Assumptions behind quantitative data presented (p. 60)<br>• Causality versus correlation (p. 61)<br>• Evaluation versus research (p. 61) |
| **Source** | Praxia, Gartner. (2011). *Telehealth Benefits and Adoption – Connecting People and Providers Across Canada*. |

### 7.2.4 Unnecessary admissions, ER visits or other services #2

| | |
|---|---|
| **Title** | Home Telehealth Business Case Report<br>Indicator: Overall impacts |
| **Question/ Purpose** | The business case is focused on home telehealth in the broadest sense: the application of information and communication technologies to bring health care to the home environment (p. 19). |
| **Context** | Telehealth interventions for Chronic Disease Prevention and Management and post-acute care (p. 3-4):<br>• Chronic Disease Management: diabetes, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD)<br>• Pose Acute Care: post-surgical discharge, wound management |
| **Methods/ Design** | • Developed a home telehealth business case around home telehealth interventions which were derived from specific Canadian examples and the literature (p. 3).<br>• The business case defines a set of qualitative impacts and quantitative impacts that are expected to be delivered (p. 4).<br>• The business case defines the operational and capital costs associated with the Pan-Canadian home telehealth solution (p. 4). |
| **Measures** | Impacts (p. 6):<br>• Hospitalizations<br>• ED visits<br>• Primary Care Physician visits<br>• Specialist physician visits<br>• Ambulatory clinic visits<br>• Home care visits<br>• Length of stay |
| **Limitations** | • Assumptions behind quantitative data presented<br>• Evaluation versus research<br>• Rate of cost allocation and impact realization is dependent on characteristics of each intervention; when the intervention is implemented; and end user adoption (p. 4-5). |
| **Source** | Canada Health Infoway. (2007). *Pan-Canadian Home Telehealth Business Case*. |

### 7.2.5 Unnecessary admissions, ER visits or other services #3

| | |
|---|---|
| **Title** | Telehomecare Phase One Program Evaluation, Final Report Summary<br>Indicator: Health system utilization |
| **Question/ Purpose** | To assess the Telehomecare Phase One Program's impact on the individual and the health care system (p. 19) |
| **Context** | Telehomecare Phase One Program in Ontario provides remote monitoring and education to patients with congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) (p. 7). |
| **Methods/ Design** | • Patient surveys (p. 20)<br>• Site data collection tools (p. 21)<br>• Stakeholder and key informant interviews (p. 22) |
| **Measures** | Health system utilization:<br>• Physician visits (p. 41)<br>• Physician utilization (p. 42)<br>• Percent of physician visits that were pre-scheduled vs. not pre-scheduled (p. 42)<br>• Percent of physician visits that were unplanned and related to the disease (p. 42)<br>• Walk-in clinic utilization (p. 44)<br>• Emergency department utilization (p. 46)<br>• How many of the emergency department visits were associated with the disease? (p. 47)<br>• Hospital utilization (p. 49)<br>• Average length of stay in hospital (p. 50)<br>• Hospital admissions associated with the disease (p. 52) |
| **Limitations** | • Selection bias (p. 25)<br>• Seasonality (p. 27)<br>• Causality versus correlation (p. 28)<br>• Evaluation versus research (p. 28) |
| **Source** | Ontario Telemedicine Network. (2009). *Telehomecare Phase One Evaluation, Final Report Summary.* |

### 7.2.6 Wait times for access to services with telemedicine

| | |
|---|---|
| **Title** | Telehealth Benefits and Adoption: Connecting People and Providers Across Canada<br>Indicator: Timeliness of care |
| **Question/ Purpose** | To inform Telehealth stakeholders about the evidence of value of Telehealth activities in Canada with a focus on the quality, access, and productivity benefits being achieved (p. 1). |
| **Context** | Patients who had a specialist consult, including other patients in Telehealth services who have a demonstrated reduction in wait times (p. 87). |
| **Methods/ Design** | Data sources: various studies and reports from Ontario, Alberta, Manitoba, British Columbia, and New Brunswick |
| **Measures** | Pre and Post-implementation wait times for Telehealth programs (p. 89):<br>• Teleophthalmology<br>• Teledermatology<br>• Tele-endocrinology<br>• Telenephrology<br>• C-Triage |
| **Limitations** | • Lack of standardization in medical terms, metrics and Telehealth event definitions across organizations and jurisdictions (p. 60)<br>• Assumptions behind quantitative data presented (p. 60)<br>• Causality versus correlation (p. 61)<br>• Evaluation versus research (p. 61) |
| **Source** | Praxia, Gartner. (2011). *Telehealth Benefits and Adoption – Connecting People and Providers Across Canada.* |

## 7.2.7 Stroke treatment rates and time

| | |
|---|---|
| **Title** | Telestroke in Northern Alberta: a two-year experience with remote hospitals |
| **Question/ Purpose** | • "Determine the number of patients who were thrombolysed and the outcome of treatment at three months" (p. 809)<br>• "Evaluate the impact of the availability of the telestroke service on the transfer of patients and cost savings from one of the 'spokes' to the 'hub'" (p. 809) |
| **Context** | • "All consecutive patients with acute ischemic stroke who were referred to the telestroke program and received thrombolysis" (p. 809)<br>• University of Alberta stroke centre (hub) and four hospital sites with two-way videoconferencing plus three other sites with telephone link only (spokes) |
| **Methods/ Design** | • Implemented the telemedicine program at the sites<br>• When possible, follow-up National Institute of Health Stroke Scale (NIHSS) scores were recorded 24 hours after treatment<br>• Gathered information about time from onset of symptoms to arrival at local emergency department, time from arrival to completion of CT scan, and door to needle time<br>• For sites without video link, the patient's history was reviewed with the referring physician and either the CT were accessed directly or relied on the local radiologist<br>• Three months modified Rankin Scale (mRS) was obtained through the telephone call from the patient or caregiver |
| **Measures** | For telestroke video consults and telestroke phone consults (p. 810):<br>• Number of patients receiving thrombolysis<br>• Mean age<br>• Number of male patients<br>• Mean time of onset to ER<br>• Mean time from CT to tPA<br>• Mean Door to Needle<br>• Mean time of onset to tPA<br>• Pre thrombolysis NIHSS (Median)<br>• 24 Post thrombolysis HIHSS Median<br>• Number of deaths within three months of thrombolytic treatment (p. 809)<br>• Average length of stay for tPA treated patients compared to patients not treated with tPA (p. 810)<br>• Reduction in days for patient care (p. 810)<br>• Cost savings (p. 810)<br>• Number of transfers to the University of Alberta Hospital pre and post telestroke service (p. 810) |
| **Limitations** | • Variability in utilization of the telestroke program at spoke sites (p. 812)<br>• Not able to determine if any thrombolysis eligible patients were missed or not considered for possible treatment (p. 812)<br>• "Not always possible to get complete NIHSS evaluations" (p. 812)<br>• 90-day information missing on four patients (p. 812)<br>• Three cases where a post thrombolysis CT scan could not be obtained (p. 812)<br>• Not able to determine the effect of the telestroke program on patient transfers from spokes to hub except one (p. 812) |
| **Source** | Khan, K; Shuaib, A; Whittaker, T; et al. (2010). *Telestroke in Northern Alberta: a two-year experience with remote hospitals.* |

### 7.2.8 Access to specialists

| | |
|---|---|
| **Title** | Telehealth Benefits and Adoption – Connecting People and Providers Across Canada<br>Indicator: Equitable access to specialized clinical services for rural or Aboriginal populations |
| **Question/ Purpose** | To inform Telehealth stakeholders about the evidence of value of Telehealth activities in Canada with a focus on the quality, access, and productivity benefits being achieved (p. 1). |
| **Context** | Indicator setting and populations (p. 72):<br>• Telehealth sites or systems in rural or Aboriginal communities<br>• Patients who are part of the rural or Aboriginal populations, who have access to Telehealth services<br>• Telehealth events in rural or Aboriginal communities |
| **Methods/ Design** | Data sources: various studies and reports from across Canada |
| **Measures** | Category (p. 77-80):<br>• # of endpoints<br>• # of communities<br>• # of systems for FN communities<br>• # of Inuit communities served by Telehealth<br>• Total # of events<br>• Top events<br>• # of Telehomecare patients<br>• Average % of rurality in Canada<br>• Estimated Telehealth events for the rural population<br>• Population<br>• % population<br>• All physician consults (input and output)<br>• Current physician Telehealth consult rate<br>• Current physician Telehealth consults<br>• Possible physician Telehealth consult rate if all achieve median rate<br>• Possible physician Telehealth consults if all achieve median use<br>• Total physician and non-physician Telehealth consults<br>• Physician to non-physician Telehealth consult rate<br>• Possible projected physician and non-physician Telehealth consults<br>• Current Telehealth services<br>• % of total Telehealth consults<br>• % rural consults (estimated)<br>• Rural consults<br>• Possible rural consults if all achieve the median rate<br>• Possible rural physician Telehealth consults if all achieve median use |
| **Limitations** | • Lack of standardization in medical terms, metrics and Telehealth event definitions across organizations and jurisdictions (p. 60)<br>• Assumptions behind quantitative data presented (p. 60)<br>• Causality versus correlation (p. 61)<br>• Evaluation versus research (p. 61) |
| **Source** | Praxia, Gartner. (2011). *Telehealth Benefits and Adoption – Connecting People and Providers Across Canada*. |

### 7.2.9 Healthcare provider productivity

| | |
|---|---|
| **Title** | Telehealth Benefits and Adoption – Connecting People and Providers Across Canada<br>Indicator: Increased number of consultations |
| **Question/ Purpose** | To inform Telehealth stakeholders about the evidence of value of Telehealth activities in Canada with a focus on the quality, access, and productivity benefits being achieved (p. 1). |
| **Context** | • "Current populations: providers who have experienced an increased volume of consultations due to the use of Telehealth" (p. 106)<br>• "Future populations: all providers of the Telehealth programs, which has led to an increased number of consultations" (p. 106) |
| **Methods/ Design** | Data sources: data from Ontario and Manitoba |
| **Measures** | Category (p. 107):<br>• Patients per day<br>• # of patients each year<br>• # of additional consultations per year<br>• # of physician equivalents required<br>• Physician annual salary<br>• Value |
| **Limitations** | • Lack of standardization in medical terms, metrics and Telehealth event definitions across organizations and jurisdictions (p. 60)<br>• Assumptions behind quantitative data presented (p. 60)<br>• Causality versus correlation (p. 61)<br>• Evaluation versus research (p. 61) |
| **Source** | Praxia, Gartner. (2011). Telehealth Benefits and Adoption – Connecting People and Providers Across Canada. |

## 7.3 Tele-pathology Indicators Summary

| Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Quality: Appropriateness/ Effectiveness | Individual and health system | 1. Quality/timeliness of medical diagnoses (clinical decision-making)<br>2. Confidence level of surgeon<br>3. Degree of surgical conservatism (less aggressive) | 1. Key informant interview<br>2. Clinician survey (pre/post)<br>3. Surgeons<br>4. Pathologists | |
| Quality: Appropriateness/ Effectiveness | Perceived impact on patient care | 1. Perceived quality of patient care | 1. Key informant interview<br>2. Clinician survey<br>- Surgeons<br>- Pathologists | |
| Quality: Appropriateness/ Effectiveness | Change in patient transfers and delays | 1. Number of preventable patient transfers and two-stage surgeries as a result of:<br>- lost slides<br>- broken/wasted slides | 1. Manual tracking<br>2. Clinical/administrative information systems / LIS | |
| Quality: Appropriateness/ Effectiveness | Patient transfers | 1. Number of patients transferred to regional or tertiary sites | 1. Clinical/administrative information systems | |
| Productivity: Efficiency | Individual and health system | 1. Time between surgery and availability of report | 1. Clinical/administrative information systems<br>2. Clinician survey | |
| Productivity: Efficiency | Technologist efficiency | 1. Time between slide availability for reading and final diagnosis | 1. Clinical/administrative information systems<br>2. Telepathology system<br>3. Clinician survey | |
| Productivity: Efficiency | Staff availability | 1. Number of surgeries postponed due to lack of pathologists | 1. Clinical/administrative information systems<br>2. Manual tracking | |
| Productivity: Efficiency | Delayed services | 1. Number of surgeries performed in two stages | 1. Clinical/administrative information systems<br>2. Manual tracking | |
| Productivity: Efficiency | Provider communication | 1. Average number of second clinical opinions requested | 1. Clinician Survey<br>2. Telepathology system | |
| Productivity: Efficiency | Provider communication time | 1. Average time to obtain a second clinical opinion (between the request and the response) | 1. Clinician Survey<br>2. Key informant interview<br>3. Telepathology system | |
| Productivity: Efficiency | Throughput | 1. Number of frozen sections performed/total number of surgeries performed (for a given diagnosis) | 1. Clinical/administrative information systems | |

(continued)

## 7.3 Tele-pathology Indicators Summary (continued)

| **Category & Sub-category** | **Benefit Area** *Benefit Sub-Area* | **Indicators** | **Methods/Data Sources** | **Examples** |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Access: Ability of patients and providers to access services | Access to medical expertise | 1. Degree of professional isolation<br>2. Travel time for roving coverage of another site<br>3. Availability of telepathology in recruiting and retention of pathologists<br>4. Pathology coverage rate<br>5. Average number of second medical opinions requested<br>6. Impact on clinical management planning in tumor board rounds | 1. Key informant interview<br>2. Clinician Survey<br>a. Radiation/Medical Oncologists<br>b. Pathologists | |
| Productivity: Care coordination | Continuity of care | 1. Continuity of care provided to patients<br>2. Portability of images outside network (ability for patients to request images be sent outside of network) | 1. Key informant interview<br>2. Clinician Survey | |
| Productivity: Net cost | Net cost | 1. Average processing cost per specimen<br>2. Shipping costs vs scanning<br>3. Number of times patients/ providers needed to travel for treatment and education<br>- cost savings<br>- environmental impact (CO2 reduction) | 1. Clinical/administrative information systems<br>2. Administrative Survey<br>3. Key informant interview<br>4. Manual tracking (pre/post) | |

CO2: Carbon Dioxide
LIS: Laboratory Information System

## Sources

1. Canada Health Infoway. (2011). *Utilization and Benefits Evaluation Indicators for Telepathology*.

# 8. ELECTRONIC MEDICAL RECORD PROGRAM

## 8.1 Electronic Medical Record Program Indicators Summary

| Category & Sub-category | Benefit Area<br>*Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Access | Primary care patient volume | 1. % volume change in primary care patient volume | 1. Pre-Post EMR patient volume review | |
| Access | Access to specialized services | 1. % volume change in specialized services (clinical and ancillary) referrals with use of an EMR vs. non-EMR. (Ancillary examples: Diabetes education centre referrals, mental health, nutrition-obesity)<br>2. % of appropriate referrals (accurateness /completeness of information, # of rejected or repeat visits due to incomplete work-up) | 1. Pre-Post EMR patient volume review<br>2. Case studies/series<br>3. Interviews<br>4. Cluster randomized controlled trial<br>5. Observational cross-sectional study<br>6. Case-Control (EMR/ Non-EMR) referral letter content review | |
| Quality | Quality of non-routine care visits (after-hours and emergency care) | 1. (High/low) impact rating of providers in Emergency care and/ or after hours clinics to support new, non-routine visits. | 1. Cross-sectional survey<br>2. Case studies/series<br>3. Interviews | |
| Quality: Patient Safety | Medication reviews and alerts | 1. Rates of medication reviews and changes made, medication reviews/reconciliations performed at predetermined times (e.g. 1st appointment after discharge from hospital)<br>2. Frequency of alerts/reminders generated, accepted, and overridden<br>3. % change in congruence of EMR medications to pharmacy info system dispensed drugs (stratified by EMR and non-EMR/paper-based practices)<br>4. % change in congruence of EMR medications to most recent BPMH | 1. Cross-sectional survey<br>2. Case studies/series<br>3. Interviews<br>4. EMR data extract | |
| Quality: Patient Safety | Change in medication actual/ potential error rates | 1. # of callbacks and/or time responding to pharmacist requests for physician verification<br>2. Congruence of EMR generated print prescription receipts to non-EMR/paper-based prescriptions upon dispensation<br>3. Medication error rates in terms of actual/potential prescribing errors and adverse reactions/events | 1. Prospective Rx review with community pharmacies<br>2. Administrative data analysis<br>3. Cluster randomized controlled trial | See 5.2.8 |
| Quality: Patient Safety | Capacity to respond to public health priorities and medication recalls/ warnings | 1. Rate at which clinician / practice can identify at-risk patient groups for public health alert or medication recall/warning (e.g. H1N1, chronic disease management, recalled medications) | 1. Population Health Management Review | See 8.2.2 |
| Quality: Patient Safety | Inappropriate prescriptions | 1. Potentially inappropriate prescriptions per 1000 visits<br>2. Discontinuation rate of potentially inappropriate prescriptions | 1. Cluster randomized controlled trial | |

(continued)

## 8.1 Electronic Medical Record Program Indicators Summary (continued)

| Category & Sub-category | Benefit Area<br>*Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Quality: Appropriateness/ Effectiveness | Capacity for common health risk screening and prevention / support to use/adhere to practice standards and guidelines<br><br>Current prevention care and screening measures for priority clinical conditions supported by most recent guidelines/standards: CTFPHC; CIHI; Primary and acute care professional associations<br>*e.g. Screenings for Cancer: Breast: (Mammogram), Cervical: (PAP) and Colon: (FOBT, Colonoscopy); Diabetes Mellitus: Glyemic control, -Hemoglobin A1c testing (HbA1c); -Full fasting lipid profile screening; -Nephropathy screening (e.g. albumin/creatinine ratio, microalbuminuria); -BP measurement; - Foot care; Opthomologist consultation; and -Obesity/overweight screening; and Mental Health* | 1. Adherence rates for preventive care<br>2. Adherence rates for disease management<br>3. Adherence rates for follow-up visits<br>4. Proportion of prescriptions in accordance with guidelines<br>5. Variation in prescribing as measured by HHI<br>6. Prevalence of prescribing problems<br>7. Adherance to guidelines for processes of care<br>8. Adherance to guidelines for treatment<br>9. Achievement of intermediate outcomes<br>10. Percentage of patients screened<br>11. Mammography screening rates<br>12. Eligible patients screened for diabetes | 1. Cross-sectional secondary analysis<br>2. Case studies/series<br>3. Interviews<br>4. Cluster randomized controlled trial<br>5. Observational cross-sectional study<br>6. Practice review/ population health management review results | |
| Quality: Appropriateness/ Effectiveness | Agreement with system recommendations | 1. Rate of PCP agreement with the diagnosis | 1. Cluster randomized controlled trial | |
| Quality: Appropriateness/ Effectiveness | Population immunization | 1. % change in PHC clients/patients, 65 years and over, who received an influenza immunization within the past 12 months<br>2. % change in PHC clients/patients, 65 years and over, who have received a pneumococcal immunization<br>3. % change in PHC clients/ patients who received required primary childhood immunizations by 18-months and 7 years of age | 1. Cohort prospective audit<br>2. Case-Control (EMR/Non-EMR) | |
| Quality: Appropriateness/ Effectiveness | Repeat prescriptions | 1. Frequency of repeat prescription ordering (computer vs. hand-written)<br>2. Proportion of people who filled their repeat prescription (computer vs. hand-written) | 1. Cohort prospective audit | |

(continued)

## 8.1 Electronic Medical Record Program Indicators Summary (continued)

| Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Quality: Appropriateness/ Effectiveness | Chronic Disease Management (CDM) | 1. Change in clinical outcomes for chronic disease populations for priority conditions supported by most recent guidelines/standards<br>2. Percentage of patients with LDL at or below goal (LDL < 100 mg/dl)<br>3. Percentage of patients using lipid lowering drugs | 1. Detailed quality indicator review1<br>2. Quasi-experimental before and after | See 8.2.3 |
| Quality: Health Outcomes | Physiological parameters | 1. Physiological parameters within target range (e.g. Haemogobin A1C in diabetes)<br>2. Proportion of controlled hypertensives<br>3. Percentage of patients with 5 year cardiovascular risk >= 10%<br>4. Systolic BP<br>5. Diastolic BP | 1. Cluster randomized controlled trial | |
| Productivity: Efficiency | Clinical and administrative tasks | 1. Time to complete prescribing<br>2. Time to complete clinical documentation<br>3. Time to complete scheduling<br>4. Time to complete billing | 1. Cross-sectional time-motion study<br>2. Case study/series<br>3. Interviews<br>4. Observations | |
| Productivity: Efficiency | Prescribing time | 1. Time spent for e-prescribing vs. hand written prescriptions | 1. Quasi-experimental before and after<br>2. Cross-sectional time-motion study<br>3. Case study/series<br>4. Interviews<br>5. Observations | |
| Productivity: Efficiency | Management of laboratory information | 1. Time to manage laboratory results across all stages of process and including all providers | 1.Observational operational research design (workflow process review)<br>2. Time-motion study | See 8.2.4 |

(continued)

## 8.1 Electronic Medical Record Program Indicators Summary (continued)

| Category & Sub-category | Benefit Area *Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Productivity: Efficiency | Timeliness of transitions in care (wait times) | 1. Time from referral letter to consultant appointment to consultant letter in Primary Care physician's EMR.<br>2. Waiting time from GP referral until appointment booked<br>3. Waiting time from GP referral to actual clinic appointment<br>4. Patient attendance rate<br>5. Waiting time from consultant visit to note in EMR<br>6. Completeness of referral | 1. Administrative data analysis (linked to EMR data)<br>2. Quasi-experimental before and after<br>3. Observational cohort<br>4. Cross-sectional time-motion study | See 8.2.5 |
| Productivity: Efficiency | Response time | 1. Time for PCP response to the electronic message | 1. Cluster randomized controlled trial | |
| Productivity: Efficiency | Process time | 1. Patient registration time<br>2. Average clinical consultation time | 1. Quasi-experimental before and after | |
| Productivity: Efficiency | Capacities for professional planning and development | 1. Workflow benefits in time (aggregated to day/week/month) | 1. Case studies/series<br>2. Interviews<br>3. Cluster randomized controlled trial<br>4. Observational cross-sectional survey<br>5. Case-Control time-motion study | |
| Productivity: Care Coordination | Practice capacity to attract/ retain clinicians | 1. Rating of practice attractiveness to new clinicians/graduates | 1. Case studies/series<br>2. Interviews<br>3. Cross sectional survey | |
| Productivity: Care Coordination | Patient-provider communication and overall experience | 1. Change in patient satisfaction and/or patient-provider experience measures - existing-validated tools<br>2. Patient knowledge/ awareness of their clinical information to more effectively. (manage self-care, engage in treatment decision making) | 1. Case studies/series<br>2. Interviews<br>3. Cross sectional survey | |
| Productivity: Efficiency/costs | Avoidable admissions | 1. Age-standardized acute care hospitalization rate for conditions where appropriate ambulatory care prevents or reduces the need for admission to hospital, per 100,000 population 75 years and under. | 1. Administrative data analysis (EMR non-EMR patient groups) | |

(continued)

## 8.1 Electronic Medical Record Program Indicators Summary (continued)

| Category & Sub-category | Benefit Area<br>*Benefit Sub-Area* | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Micro-Net Benefits | | | | |
| Productivity: Net Cost | Test costs and duplicate diagnostic tests | 1. Number of order forms<br>2. Number of tests per order form<br>3. Costs of laboratory requests<br>4. % of diagnostic tests re-ordered because original is not available or unknown or not located at time of appointment. (stratified by EMR and non-EMR/paper-based practices)<br>5. Change in volume of diagnostic tests over time | 1. Quasi-experimental before and after | |
| Productivity: Net Cost | Net cost savings - return on investment | 1. Increased reimbursement:<br>a) full capture of available funding through accurate billing info in EMR<br>b) Preventative measures<br>c) Chronic disease<br>d) Increased volume<br>e) Improved audit performance<br>2. Reduction in net overhead costs (i.e. Admin FTE, office supplies, etc.) (stratified by EMR and non-EMR/paper-based practices) | 1. Detailed ROI study pre-EMR, adoption, and sustainability phases | |

BP: Blood Pressure
BPMH: Best Possible Medication History
CDM: Chronic Disease Management
CIHI: Canadian Institute for Health Information
CTFPHC: Canadian Task Force on Preventative Health Care
FTE: Full-time Equivalent
GP: General Practitioner
HHI: Herfindahl-Hirschman Index
LDL: Low-density Lipoprotein
PCP: Primary Care Physician
PHC: Primary Health Care
Rx: Prescription

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## 8.2 Electronic Medical Record Benefits Evaluation – Example Details

### 8.2.1 High quality data structure and completeness

| | |
|---|---|
| **Title** | Measuring EMR adoption amongst Family Physicians in Ontario. Does this get better over time? |
| **Question/ Purpose** | To develop measure of EMR adoption (as measured by data completeness within the EMR data abstract) and to examine these measures by duration of physician use. |
| **Context** | As Family Physicians in Ontario and in Canada increasingly adopt EMRs into their clinical practice, it is unknown how complete physician adoption is with respect to data elements across the patient record and if physicians are using their EMRs for all aspects of patient care. |
| **Methods/ Design** | Looked at field completeness of primary care EMR patient records as a function of physician and patient time on an EMR using the Electronic Medical Record Administrative data Linked Database (EMRALD) |
| **Measures** | • Percentage of active rostered patients with billed visits that had corresponding documentation in their EMR record, laboratory tests, prescriptions, referrals, consultation letters, blood pressures, weights<br>• Completeness of cumulative patient profile fields over the number of active rostered patients in a given year |
| **Limitations** | • Study was limited to physicians in Ontario on one proprietary EMR system<br>• The quality of the completeness of these fields and whether physicians were using more advanced functions such as reminders and clinical decision support was unable to be assessed |
| **Source** | Tu, K., Jaakkimainen, L., Young, J., Oud, W., Ivers, N., Butt, D., Wang, M., Widdifield, J., Leaver, C. (2012). Measuring EMR adoption amongst family physicians in Ontario. Does this get better over time? |

### 8.2.2 Capacity to respond to public health priorities and medication recalls/ warnings

| | |
|---|---|
| **Title** | The Population Health Management Challenge – Final Report |
| **Question/ Purpose** | The challenge was conducted to review the capacity and preparedness of primary care settings to engage in practice-based population health management (p. 2) |
| **Context** | • EMR-enabled community-based primary care clinics across Canada<br>• Paper-based community-based primary care clinics across Canada |
| **Methods/ Design** | • Convenience sample of EMR-enabled and paper-based clinics across Canada recruited (p. 2)<br>• Completed time-controlled evidence-based practice reviews (p. 2)<br>• On-site observation (p. 5)<br>• Follow-up semi-structured qualitative phone interviews conducted (p. 6)<br>• Quantitative analysis: ranking of clinics based on preparedness score (p. 7)<br>• Qualitative analysis: within-case analysis and cross-case analysis using a grounded theory approach (p. 7) |
| **Measures** | • Descriptive characteristics of the clinic and participating clinician practices (p. 5)<br>  • Number of active patients<br>  • Number of clinicians and care staff<br>  • Year of primary care clinician graduation<br>• Type and utilization of chart recording systems (EMR, paper) (p. 5)<br>• Challenge participant's function within the clinic (p. 5)<br>• "Preparedness score": percentage of the Challenge that the clinic was able to complete in the time given, relative measure of the capacity to engage in practice-based population health management, based on (p. 7):<br>  • Time required to complete each of the six modules<br>  • Percentage complete for each indicator/task within each Challenge module |
| **Limitations** | N/A |
| **Source** | Lapointe, L., Hughes, J., Simkus, R., Lortie, M., Sanche, S., & Law, S. (2012). The population health management challenge final report. |

### 8.2.3 Chronic disease management

| | |
|---|---|
| **Title** | Effectiveness of the Electronic Medical Record in Cholesterol Management in Patients with Coronary Artery Disease (Virtual Lipid Clinic) |
| **Question/ Purpose** | To evaluate the effectiveness of a cholesterol management tool integrated into an EMR (p. 163) |
| **Context** | Practice with an electronic medical record system developed for cardiac patients which contains an integrated cholesterol management tool (p. 193) |
| **Methods/ Design** | • Compared cholesterol management of patients with coronary artery disease using the EMR to a control group with "pen and paper" charts. (p. 163)<br>• Observed patient care and cholesterol management at monthly intervals for EMR intervention group<br>• Manual chart audit done for randomly chosen control group of patients with paper charts |
| **Measures** | Quality-of-care parameters (p. 163):<br>• Documentation of low-density lipoprotein (LDL) on the chart<br>• LDL at or below goal (LDL < 100 mg/dl)<br>• Use of lipid-lowering drugs |
| **Limitations** | N/A |
| **Source** | Kinn, J.W., O'Toole, M.F., Rowley, S.M., Marek, J.C., Bufalino, V.J., Brown, A.S. (2001). Effectiveness of the electronic medical record in cholesterol management in patients with coronary artery disease (virtual lipid clinic). The American Journal of Cardiology, 88:163-165. |

## 8.2.4 Management of laboratory information

| | |
|---|---|
| **Title** | EMR Integrated Labs Workflow Evaluation |
| **Question/ Purpose** | The challenge was conducted to review the capacity and preparedness of primary care settings to engage in practice-based population health management (p. 2) |
| **Context** | EMR-enabled community-based primary care clinics across Canada |
| **Methods/ Design** | An operations research approach was used to compare workflow in practices managing paper, scanned, and/or fully electronic laboratory reports. A three-phase methodology first reviewed the workflow management of laboratory information within each primary care practice by means of a telephone interview with the lead physician or clinical system analyst. In the second phase, follow-up observational site visits informed the preparation of detailed workflow diagrams, leading to the third phase, the development and administration of a standardized questionnaire that provided comparative quantitative and qualitative data upon which detailed operational assessments were based. |
| **Measures** | • Descriptive characteristics of the clinic and participating clinician practices<br>• Type of Lab management (Paper, Scanned, Electronic – EMR-integrated)<br>• Process steps and time to Order, Sort, Action, Archive and retrieve<br>• Remote review of laboratory information<br>• Comparative review of laboratory information (paper, scanned, electronic)<br>• Qualitative interviews identifying benefits of EMR-integrated management of laboratory information. |
| **Limitations** | • A sample size of nine does not support detailed statistical analysis and the conclusions must be interpreted accordingly.<br>• The quantitative data obtained from the post-site visit questionnaire and qualitative interview are estimates provided by the lead physician and in most cases were rarely based on objective and validated measurement. |
| **Source** | Centre for Research in Healthcare Engineering at The University of Toronto (2012), *EMR integrated labs workflow evaluation* |

### 8.2.5 Timeliness of transitions in care (wait times)

| | |
|---|---|
| **Title** | Patient and provider characteristics of wait times from Primary to Speciality Care |
| **Question/ Purpose** | To use an EMR to administrative data linkage to examine patient and provider characteristics for wait times from primary to specialty care in Ontario |
| **Context** | Mechanisms to improve wait times from specialty care have been developed across Canada. However, little is known about wait times from primary to specialty care and even less on strategies to improve these wait times. |
| **Methods/ Design** | Electronic Medical Record (EMR) data from a convenience sample of 54 community-based family physician (FP) practices in Ontario was linked to health administrative data to create the Electronic Medical Record Administrative data Linked Database (EMRALD). Wait times were calculated from when a patient was referred by a FP to when they visited a specialist physician. |
| **Measures** | • Median and 75th percentile wait time measures were estimated for referral to medical and surgical specialists<br>• Patient characteristics examined included age, sex, comorbidity, socioeconomic status and continuity of care with their FP<br>• FP provider characteristics include age, sex, rurality, and participation in a primary care delivery model |
| **Limitations** | • Wait times were determined from a convenience sample of community-based family physicians using one EMR vendor in Ontario<br>• All referrals to specialists were examined and they were not differentiated based on urgency. |
| **Source** | Jaakkimainen, L., Tu, K., Glazier, R., Barnsley, J., Salkheld, E., Lu, H., Pylepenko, B. (2012). *Patient and provider characteristics of wait times from primary to speciality care.* |

# 9. PUBLIC HEALTH SURVEILLANCE PROGRAM

## 9.1 Public Health Surveillance Program Indicators Summary

| Category & Sub-category | Benefit Area Benefit Sub-Area | Indicators | Methods/Data Sources | Examples |
|---|---|---|---|---|
| Net Benefits | | | | |
| Quality: Appropriateness and effectiveness | Vaccination rate | 1. Number of eligible individuals with full vaccine coverage<br>2. Number of vaccinated individuals that received vaccinations according to schedule | | See 9.2.1 |
| Quality: Appropriateness and effectiveness | Outbreak detection and intervention | 1. Number of outbreaks detected<br>2. Average time until an outbreak is detected<br>3. Average number of secondary infections per case | | See 9.2.2 |
| Access: Ability of patients and providers to access services | Notification rate | 1. Number of providers reached by a health alert<br>2. Time until provider is reached by a health alert | | |
| Productivity: Efficiency | Time to manage a case | 1. Average time to investigate a case, by type of communicable disease | | |
| Productivity: Care coordination | Time spent managing outbreaks | 1. Average time to share case data with patient's region of residence<br>2. Average time per case for managing outbreaks that span regions | | See 9.2.3 |
| Productivity: Net cost | Vaccine wastage and unnecessary vaccinations | 1. Cost of vaccines wasted<br>2. Cost of unnecessary vaccinations | | See 9.2.4 |
| Productivity: Net cost | Cost-effectiveness of registry | 1. Incremental cost-effectiveness of an immunization registry as compared to the approach used currently in a jurisdiction | | |

### Sources

1. Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0.*

## 9.2 Public Health Surveillance Benefits Evaluation – Example Details

### 9.2.1 Vaccination rate

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Vaccination rate |
| **Question/ Purpose** | "Does establishment of an immunization registry with the necessary functionality result in an increase in immunization rates for children and eligible adults?" (p. 77) |
| **Context** | Indicator setting and population (p. 77):<br>• Geographic areas with plans to establish an immunization registry<br>• Children ≤ 24 months of age<br>• Adults eligible for pneumococcal vaccination |
| **Methods/ Design** | • "Before-and-after design, ideally with multiple follow-up assessments and across multiple regions" (p. 78)<br>• For children, a series of cross-sectional surveys using cluster probability sampling of small-areas conducted before and after implementation; multiple follow-up assessments and/or multiple studies in different regions (p. 78)<br>• For adults, same survey design as for children or alternate design using billing records to estimate pneumococcal vaccination and the population eligible for vaccination (p. 78) |
| **Measures** | Measures (p. 77):<br>• Proportion of children ≤ 24 months of age that are up-to-date for routine vaccinations<br>• Proportion of adults eligible for pneumococcal vaccine that are immunized<br>• Both measures should be calculated for all individuals, that is, individuals enrolled in the registry, and individuals not enrolled in the registry |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 5.2.* |

### 9.2.2 Outbreak detection and intervention

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Outbreak detection and intervention |
| **Question/ Purpose** | "Does a public health surveillance system enhance the detection of outbreaks and limit the spread of disease?" (p. 81) |
| **Context** | Indicator setting and population (p. 81):<br>• Entire population in a region<br>• Cases of selected reportable diseases associated with outbreaks |
| **Methods/ Design** | • Before-and-after design, ideally across multiple locations, with lowest level of regionalization (e.g. health department as opposed to province) where outbreak detection and control are performed as the unit of analysis (p. 82)<br>• Baseline assessment of measures prior to implementation of the PHS, either prospective or retrospective (p. 82)<br>• Assessment of measures at least once after implementation (p. 82)<br>• Data collection about the methods used (1) to analyze data for outbreaks, (2) to investigate potential outbreaks, and (3) to manage cases of disease (p. 82) |
| **Measures** | • Number of outbreaks detected (p. 81)<br>• Time until detection of an outbreak (p. 81)<br>• Number of secondary cases attributable to each case (p. 81) |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 5.3.* |

### 9.2.3 Time spent managing outbreaks

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Time spent managing outbreaks |
| **Question/ Purpose** | "Does a PHS change the amount of time spent managing cases within and across regions?" (p. 84) |
| **Context** | • Indicator population and setting (p. 84):<br>• Reportable disease unit within a public health department<br>• Personnel involved in receiving reports, opening case files, and managing cases<br>• Selected reportable diseases |
| **Methods/ Design** | Time and motion study, performed prior to implementation of the PHS and at least once following implementation (p. 84)<br>• Study conducted in at least two neighboring public health units (p. 84)<br>• Stratification of average time calculations by disease and whether cases were managed wholly by one health department or not (p. 84) |
| **Measures** | Measures (p. 84):<br>• Time used to receive a report of a disease and file the report<br>• Time used to open a case file for a reportable disease<br>• Time used to manage a case of a reportable disease |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). Benefits Evaluation Indicators Technical Report v1.0 – Section 5.4. |

### 9.2.4 Vaccine wastage and unnecessary vaccinations

| | |
|---|---|
| **Title** | Benefits Evaluation Indicators Technical Report v1.0<br>Indicator: Avoidance of vaccine wastage and unnecessary vaccinations |
| **Question/ Purpose** | "Does an immunization registry reduce unnecessary vaccine costs?" (p. 87) |
| **Context** | Geographic region with plans to implement an immunization registry (p. 87) |
| **Methods/ Design** | • Review of expense records to calculate number and cost of wasted vaccine doses over time and total number of vaccines administered (p. 88)<br>• Survey (same as for assessment of vaccine coverage rates) to assess number and cost of invalid doses over time and total number of vaccines administered (p. 88) |
| **Measures** | Measures (p. 87):<br>• Number and cost of wasted vaccine doses by vaccine type<br>• Number and cost of invalid doses by vaccine type |
| **Limitations** | N/A |
| **Source** | Canada Health Infoway. (2006). *Benefits Evaluation Indicators Technical Report v1.0 – Section 5.5.* |

# 10. ADDITIONAL RESOURCES

- eHealth Observatory: http://ehealth.uvic.ca/
- Canada Health Infoway Change Management Toolkit (2011): https://www.infoway-inforoute.ca/about-infoway/approach/managing-change
- DeLone, W. and E. McLean. 1992. *"Information System Success: The Quest in the Dependent Variable." Information Systems Research 3(1):* 60–95.
- DeLone, W. and E. McLean. 2003. *"The DeLone and McLean Model of Information System Success. A Ten Year Update." Journal of Management Information Systems 10(4): 9–30.*
- Lau F, Hagens S, Muttitt S. A proposed benefits evaluation framework for health information systems in Canada. Healthcare Quarterly 2007; 10(1):112-6,118.
- Lau F. Extending the Infoway benefits evaluation framework for health information systems. *Studies in Health Technologies and Informatics 2009;* 143:406-13.
- Lau F, Kuziemsky C, Price M, Gardner J. A review on systematic reviews of health information system studies. *Journal of the American Medical Informatics Association 2010;* 17(6):637-645.
- Lau F, Price M, Keshavjee K. From benefits evaluation to clinical adoption – Making sense of health information system success. *Healthcare Quarterly 2011;14(1):39-45. http://www.longwoods.com/content/22157.*
- Price M, Lau F, Lai J. Measuring EMR adoption: A framework and case study. *ElectronicHealthcare 2011; 10*(1):e25-e30.

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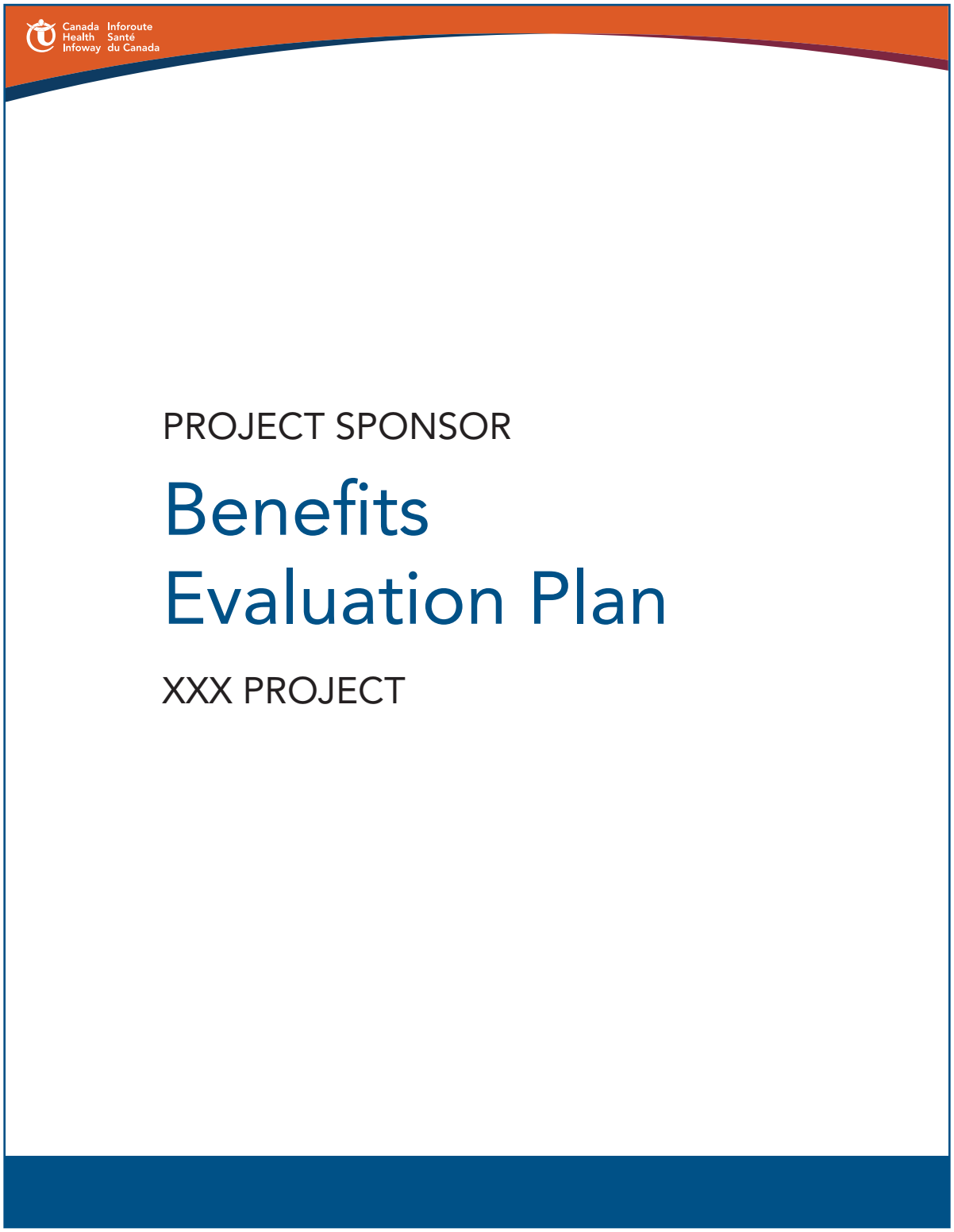
[1] Infoway would like to acknowledge the significant contributions of Jesdeep Bassi, from the eHealth Observatory at the University of Victoria. Ms. Bassi compiled all new applied evidence and led the systematic review and indicator assessment process for all chapters.

# APPENDIX A. BENEFITS EVALUATION PLAN STRUCTURED TEMPLATE

The following template is provided to help plan components of a benefits evaluation study.

Key lessons learned are highlighted within the template to help support and guide the development, coordination and successful execution of a benefits evaluation study.



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Canada Health Infoway | Inforoute Santé du Canada

# INTRODUCTION

## *Purpose of Benefits Evaluation*

*The purpose defined by Infoway for benefits evaluation is:*

Assess the impact of Infoway investments in electronic health record solutions on healthcare quality, productivity and access.

Impacts identified will be used to:

- Demonstrate value of investments
- Advance further investments in EHR solutions
- Encourage end user adoption
- Highlight necessary adjustments in the Infoway investment strategy

**Lessons Learned:**

Defining the purpose for the evaluation concretely and confirming with key stakeholders is a commonly missed step.

Evaluations can be focused on demonstrating value, improving processes, or many other purposes, but evaluation approaches to meet these objectives will differ and there will be important trade-offs.

## *Scope of Benefits Evaluation*

*The proposed benefits evaluation will evaluate the benefits of the following:*

- Benefit Area 1, 2, 3, etc.,
  - o Brief descriptions of each Benefit Area under study

**Lessons Learned:**

It's leading practice to incorporate your evaluation into a comprehensive Benefits Realization approach, which includes the following kinds of activities:

Target the benefits: Take the time to document and socialize the scope of your evaluation. What technologies are involved, where will it be deployed, who are the anticipated users, and what benefits are anticipated. Be specific and quantify adoption levels and benefits expected.

Focus on the changes required: Achieving the benefits will invariably require more than just technology. There will be processes, behaviors, policies, etc., that need to change. Identify and address critical success factors for achieving benefits (e.g. optimizing alerts). Infoway's Change Management Framework and Toolkit can help: https://www.infoway-inforoute.ca/flash/lang-en/change-management/

Measure and improve over time: Evaluation can be most powerful when applied to continuous improvement. Measure adoption, perceptions of users and objective benefit indicators, so issues can be identified and successes celebrated.

This approach requires alignment of benefits evaluation planning with project management so that the benefits being measured in the evaluation are also the ones that are the focus of all aspects of the project, from solution design to change management.

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## BENEFITS EVALUATION PLAN

*Stakeholders can be internal or external to the organization, and should include any group or individual who may affect or be affected by, the achievement of the project's objectives.*

**Lessons Learned:**

Stakeholder engagement is often not comprehensive enough in evaluation efforts. For many stakeholders, awareness may be all that's required, but it's important to track these. Others will need to contribute to or buy into the purpose and scope. Stakeholders who will need to contribute should be engaged early. Accountabilities for all stakeholders should be clear. Infoway's Change Management toolkit has more comprehensive tools which may be of interest.

| Stakeholder | Role |
|---|---|
| (e.g. CIO, Treasury Board, Project Team, User Groups, Researchers) | (e.g. Evaluation Lead, Participant, Audience) |
| | |
| | |
| | |

**Lessons Learned:**

Governance is critical for long-term success in realizing benefits.

Governance must extend beyond implementation and include consideration for ensuring adoption and benefits are optimized over time (continuous quality improvement). Evaluation will occur months or sometimes years after go-live – make sure its clear who has accountability in those timeframes, and that the support for evaluation will be maintained.

Stakeholders need to understand benefits evaluation as one component of a comprehensive Benefits Realization approach rather than an independent activity that can be planned when the project is well underway. Effective benefits evaluation and realization requires developing consensus on well-defined and measurable benefits at the beginning of the project.

Benefits will cross the boundary between accountabilities of the IT organization and clinical or business leaders. If the project has specific quality of care objectives, those accountable for that quality area need to be prominent. If the objective is to reduce costs, then the budget owner should have a significant role.

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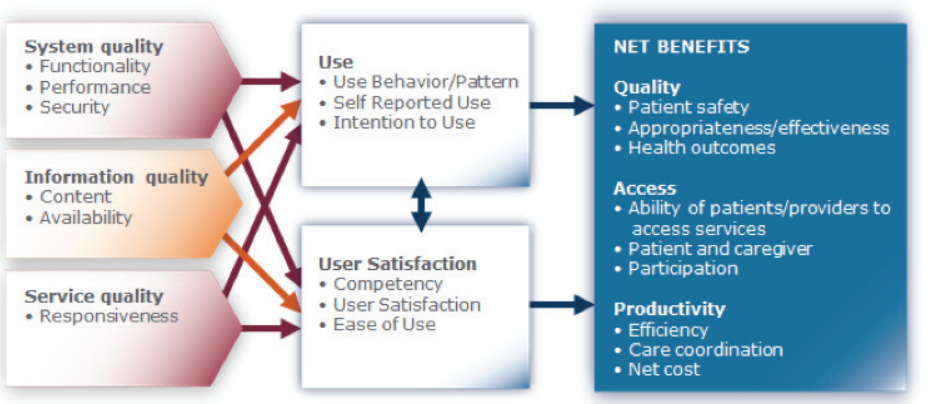
## BENEFITS EVALUATION FRAMEWORK

- Infoway recommends application of the Benefits Evaluation Framework.
- Further details can be found in the Infoway Benefits Evaluation Technical Report, or in the Electronic Healthcare publication (http://www.longwoods.com/content/18657)

# Infoway benefit evaluation framework

The framework articulates the link between the systems in which Infoway invests and the resulting benefits, providing a basis for measurement.




**Lessons Learned:**

While Infoway's Framework has proven effective in evaluation across Canada and internationally, there are other frameworks, models and processes which may be useful and compliment the Infoway framework, or as alternatives. Some resources include:

- UVic eHealth Observatory
  - o http://ehealth.uvic.ca/index.php
- US Agency for Healthcare Research and Quality, Health Information Technology Evaluation Toolkit
  - o http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS_0_875888_0_0_18/09_0083_EF.pdf
- NLCHI Framework and Evaluations
  - o http://www.nlchi.nf.ca/research_evaluations.php
- Connecting BE plans to the language use d in articulating jurisdictional objectives and expected benefits can facilitate support and ownership. Further alignment of benefits evaluations with eHealth strategic plans at the jurisdictional level to strategic eHealth investment objectives provides the higher level context for vbenefits realization.

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## EVALUATION STUDIES AND INDICATORS

- The final benefits evaluation plan should include a combination of Infoway and sponsor proposed indicators, and have received initial review by Infoway's Benefits Realization and Quality Improvement Leader, prior to submission.

**Lessons Learned:**

Defining the right set of indicators is a substantial challenge, but borrowing ideas from others is the easiest path to success. A few things to keep in mind:

- A mix of methodologies is recommended (e.g. administrative data, surveys, chart abstracts, observation, etc.).
- Different methods will give different perspectives
- Some methods and data sources will inevitably fail, so mixed methods reduce risk
- Be strategic about your sample – if it's a large deployment, measurement can be done selectively
- Qualitative and quantitative methods can be very complimentary
- Short-term evaluations and long-term indicators are also complimentary. Rigorously measuring an impact can be too costly to repeat, but once completed, a proxy indicator may be possible to track
- Anticipated benefits may vary by specific use cases for the same solution. Examples of factors that may affect uses cases and associated benefits and indicators include: context (e.g. primary care practice vs. Emergency department); the end user's healthcare role; the patient population; and specific care scenarios. For example, access to patients' immunization history via iEHR viewer may be anticipated to either increase or decrease immunization volumes depending upon the situation (e.g. increasing childhood immunization in primary care versus avoiding unnecessary, repeat tetanus shots in urgent or Emergency care). In this example, the system impact of the benefit of information-enabled practice improvement of increasing the proportion of care in accordance with guidelines depends upon the specific use case.
- It can be useful to develop a conceptual representation of the expected pathway to benefits realization (e.g. results chain) that clearly articulates how the solution enables healthcare improvement benefits. This type of tool can be used to identify and select indicators for the benefit enablers and benefits that are likely to be realized within the time frame for the BE study.
- Development of BE measurement time lines should be informed by anticipated time lines for achieving sufficient adoption and usage to enable benefits realization.
- Be flexible , adaptive and creative as the project and evaluation rolls out
- The table below will help you define what to measure and how. To evaluate successfully, you'll need to be able to fill out this table. Getting some outside help might make sense to complete planning, but procuring an evaluation team without having a clear idea of what you want to measure is a risk.

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## BENEFITS EVALUATION PLAN

**Example Worksheet to identify study questions and associated indicators and measures**

| Study Question | Indicator | Measures |
|---|---|---|
| e.g. Are the system, information, and service quality, and the use and user satisfaction sufficient to enable the desired benefits? | | • System and Use Assessment Survey Tool |
| e.g. Does an immunization registry increase immunization rates? | Vaccination rate | • Eligible individuals with full vaccine coverage.<br>• Vaccinated individuals that received vaccinations according to schedule. |
| e.g. Does the project support improved access to patient information? | Change in integration of patient information | • # and % of target population registered with technology<br>• # of integrated data sources |
| e.g. Does the jurisdictional laboratory information system (JLIS) result in a more complete LIS profile for patients? | Completeness of lab profile | • Pre & Post Implementation Evaluation of:<br>  • # of lab tests for an individual patient within a specified time period as documented in their chart<br>  • # of lab results available within JLIS for an individual patient within the same time period |
| | | |
| | | |

## PRINCIPLES FOR SHARING METHODS, DATA AND RESULTS

The benefits evaluation activities in this agreement will contribute to the broader understanding of the impact of the pan-Canadian EHR and to on-going research in this area. Further to this objective, the following principles apply to Infoway and its partners (project sponsors and sub-contractors):

1. Tools and methodologies will be openly shared among, and where applicable, collaboratively developed by Infoway and its partners.
2. Infoway and its partners will jointly communicate results, and will both have the right to further communicate these results.
3. All data will be retained by evaluators for further analysis, potentially in combination with data from other projects.
4. For those projects which make use of the System and Use Assessment survey tool, a copy of the cleaned survey dataset and data dictionary will be made available to and retained by Infoway for aggregated analysis.

**Lessons Learned:**

Agreeing up front on principles with key stakeholders is ideal. Communication objectives and processes for sharing results are especially important to gain agreement.

## Deliverables & Timelines

| | Timelines | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2011/12 | | | | 2012/13 | | | | 2013/14 | | | | |
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Anticipated Completion Date |
| Solution Implementation Timeline (key component 1, e.g. pilot) | | | | | | | | | | | | | |
| Detailed Evaluation Plan (including resourcing, tools and methodology development) | | | | | | | | | | | | | |
| System & Use Assessment | | | | | | | | | | | | | |
| Pre-implementation Evaluation (preliminary and final reports) | | | | | | | | | | | | | |
| Post-implementation Evaluation (preliminary and final reports) | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

**Lessons Learned:**

Planning timelines is critical, but keep in mind that evaluations are entirely dependent upon the implementation, deployment and adoption timeframes. Not surprisingly, evaluations rarely happen on schedule. Linking evaluation timelines to specific deployment and adoption achievement can help clarify dependencies, and avoid pressure to evaluate too soon.

## Budget

| Study | Resources | Estimated Budget |
|---|---|---|
| DIS Pre-Implementation Studies | Researcher - XX days @ XXX/Day<br>Pharmacist …<br>Analyst<br>Data Collection<br>Travel and expenses | |
| | | |
| | | |
| | | |
| | | |
| **TOTAL Pre-Implementation** | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| **TOTAL Post-Implementation** | | |
| **GRAND TOTAL** | | |

**Lessons Learned:**

Developing a budget estimate from the bottom-up at the start of the process will help to clarify what you need done … and what you don't.

## Benefits Evaluation Resources

- Specific resources will likely not have been identified at this stage, but please indicate the types of resources and roles anticipated

| Position | Main responsibilities | Timeline of involvement |
|---|---|---|
| Benefits Evaluation Lead Researcher, (MSSS Department or University of XXXX) | e.g.<br>Project management<br>Stakeholder relations<br>Status reporting | All stages |
| | | |
| | | |

**Lessons Learned:**

Finding the right evaluators is one of the biggest challenges. There is no right approach, but a number of options with pros and cons. Here are a few:

Academic-based research community:

There are many excellent researchers in eHealth across Canada (who Infoway can help you identify). They can often involve colleagues and students to get the expertise and person-power to get the job done. Credible results and opportunities for peer-review publications are a few more reasons to take this approach. Challenges can include procurement processes, IP/publication rights and timelines, and control and involvement in the process.

Conduct internally:

Some organizations have successfully built capacity to do evaluation activities within their organizations. This can range from conducting surveys and analyzing data from solutions, all the way to more complex research methods. This approach allows for a tight integration between the project and the evaluation – a Benefits Realization approach is much easier to implement, and results of evaluation can easily be fed back into the project. This requires long-term investment and commitment, and finding the right skills can be a challenge.

Private sector consultants/researchers:

Procuring a private sector team can provide the most efficient and flexible access to the resources needed to get the job done. Often this approach works for focused efforts where the organization wants control over the process and timelines. Challenges can include ensuing the resources have the right skill set for robust, credible evaluation, and ensuring value for money.

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