Benefits Evaluation Experiences at Canada Health Infoway

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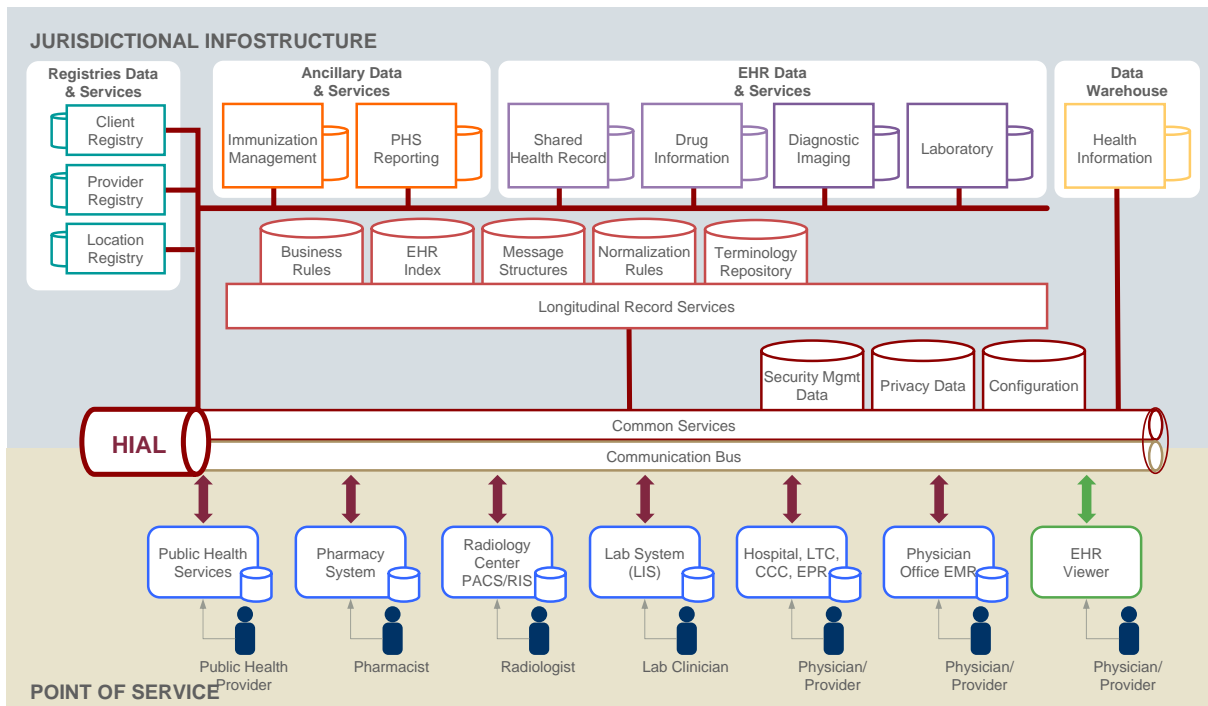*shagens@infoway-inforoute.ca*

Infoway Background

Canada Health Infoway

- Created in 2001
- Independent, not-for-profit corporation
- Accountable to 14 federal/provincial/territorial governments
- Strategic Investor

Mission:

Fostering and accelerating the development and adoption of electronic health information systems with compatible standards and communications technologies on a pan-Canadian basis with tangible benefits to Canadians. *Infoway* will build on existing initiatives and pursue collaborative relationships in pursuit of its mission.

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EHR architecture

JURISDICTIONAL INFOSTRUCTURE

Registries Data & Services: Client Registry, Provider Registry, Location Registry

Ancillary Data & Services: Immunization Management, PHS Reporting

EHR Data & Services: Shared Health Record, Drug Information, Diagnostic Imaging, Laboratory

Data Warehouse: Health Information

Business Rules, EHR Index, Message Structures, Normalization Rules, Terminology Repository

Longitudinal Record Services

Security Mgmt Data, Privacy Data, Configuration

Common Services

HIAL — Communication Bus

POINT OF SERVICE

Public Health Services — Public Health Provider

Pharmacy System — Pharmacist

Radiology Center PACS/RIS — Radiologist

Lab System (LIS) — Lab Clinician

Hospital, LTC, CCC, EPR — Physician/Provider

Physician Office EMR — Physician/Provider

EHR Viewer — Physician/Provider

Infoway's Business Strategies

1. Participate in healthcare renewal
2. Collaborate with our partners
3. Target the investments
4. Support solution deployment
5. Promote solution adoption and benefits realization

Benefits Realization & Quality Improvement Approach

- Emphasis on Change Management and gated funding with Adoption Targets

- Benefits Evaluation Approach
  - Advance further investment
  - Encourage end user adoption
  - Highlight necessary adjustments
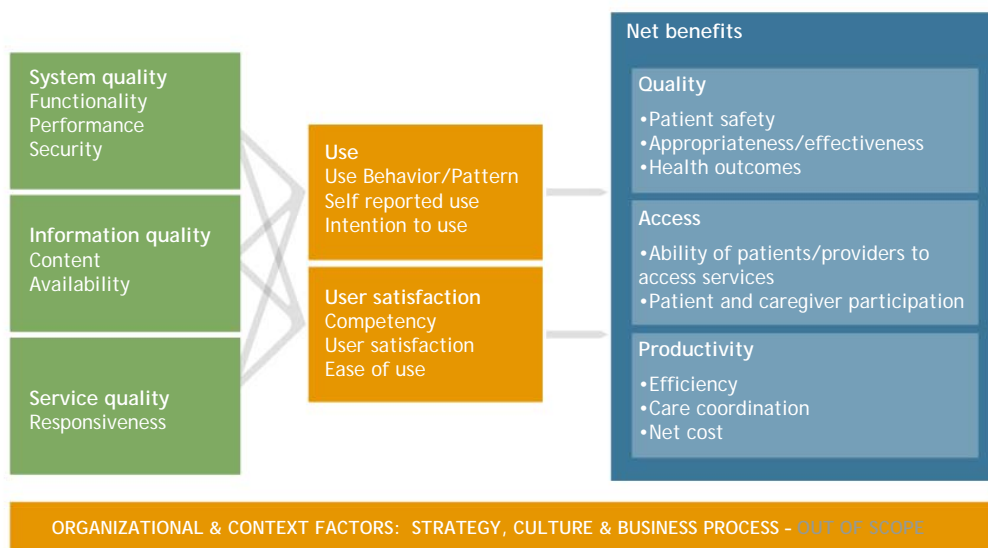
- Knowledge Management is core to our business

As projects and partners mature, need to evolve to a more comprehensive "benefits realization" approach

Benefits Evaluation Strategy

Infoway Benefits Evaluation Framework

Net benefits

System quality
Functionality
Performance
Security

Information quality
Content
Availability

Service quality
Responsiveness

Use
Use Behavior/Pattern
Self reported use
Intention to use

User satisfaction
Competency
User satisfaction
Ease of use

Quality
•Patient safety
•Appropriateness/effectiveness
•Health outcomes

Access
•Ability of patients/providers to access services
•Patient and caregiver participation

Productivity
•Efficiency
•Care coordination
•Net cost

ORGANIZATIONAL & CONTEXT FACTORS: STRATEGY, CULTURE & BUSINESS PROCESS – OUT OF SCOPE

Based on the DeIone & McLean IS Success Model

Benefits Evaluation Indicators

Diagnostic Imaging Systems

- Efficiency improvements for staff (radiologists and technologists)
- Quality benefits of timely service delivery (with improved turnaround time)
- Availability of previous DI results decreasing duplicate exams
- Sharing test results with offsite specialists to reduce patient transfers

Example: Ontario Duplicate Exams Study

The study measures the number of diagnostic imaging exams which are duplicated unnecessarily.   Using administrative databases, the rate of individual patients having the same exam within a 2 month period was compared pre and post implementation of Diagnostic Imaging systems.

A modest reduction of 1.7% of total exams was identified, indicating that the technology is effective at achieving these cost savings, but also highlighting that continued improvements (such as inclusion of all exams in the network and enhanced functionality) will be required to achieve the full potential.

Benefits Evaluation Indicators

Drug Information Systems

- Efficiency improvement for patient assessment
- Efficiency improvement for pharmacists & prescribing physicians
- Medication error avoidance by identifying duplications/interactions
- Medication error avoidance with e-prescribing completeness/legibility
- Medication error avoidance with physician alerts when e-prescribing
- Reduction in adverse drug events (ADEs)

Example: Newfoundland Adverse Drug Events Study

The study measures the incidence of community based ADEs which result in an Emergency Department visit. In the baseline, a random sample of 1,434 visits were selected and reviewed by a team, consisting of a physician with ED experience and an acute care nurse, and classified into the potential ADE categories through a consensus process.

The baseline results indicate that 10.8% of ED visits were a high or moderate potential of being caused by an ADE. Following the implementation and adoption of the provincial Drug Information System, the study will be repeated for comparison.

Benefits Evaluation Indicators

Laboratory Information Systems

- Quality benefits of timely service delivery (with improved turnaround time)
- Efficiency improvement for laboratories and referring physicians
- Completeness of lab profile
- Availability of previous lab results decreasing duplicate orders
- Impact on clinician workflow and patient safety
- Improved coordination of care

Interoperable EHR

- Improved provider efficiency & effectiveness in emergency departments
- Reduction in readmission rates with shared health record in use in the community
- Improved management of chronic disease

Benefits Evaluation Indicators

- Public Health Surveillance
  - Improved outbreak detection and intervention
  - Reduction in time spent managing cases
  - Improved vaccination rates
  - Avoidance of vaccine wastage and unnecessary duplicate vaccinations

- Telehealth
  - Efficiency of recovery and effectiveness of care
  - Adherence and compliance with practice standards
  - Information flow between providers
  - Change in work practices
  - Efficiencies (e.g. 'right siting')

Assessment Surveys

Assessment surveys are used soon after adoption to determine the acceptability of the system, information and service, and assess use and perceived benefits. Infoway has developed a standardized tool for this purpose, which is used in most BE projects.

Example: Ontario Drug Profile Viewer Survey

The survey was completed by administrative users (n=284) and healthcare providers (n=380) who use the system. The results provided evidence that the DPV system was effective at providing more complete information about patients and improving patient safety, and had the potential to improve efficiency.
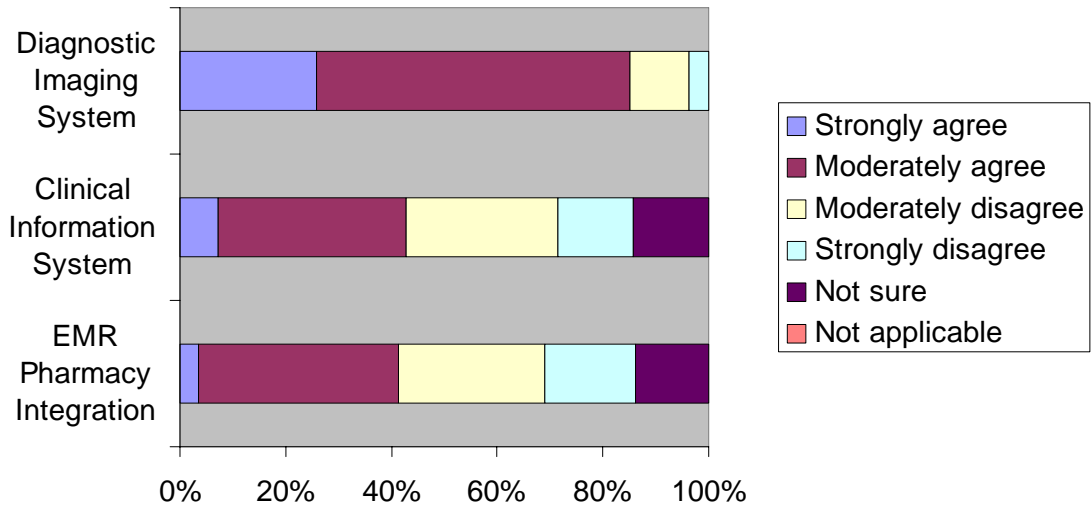
The survey also provided valuable information about barriers to adoption and challenges in realizing the full benefits, which was used by the project team to address these issues. Infoway and the province are now planning a more in depth study to quantify the patient safety and efficiency impacts.

Examples of Evaluation Findings

Standardized assessment surveys

Example of benchmarking across technologies:

The system is well integrated with my workflow:

Legend:
- Strongly agree
- Moderately agree
- Moderately disagree
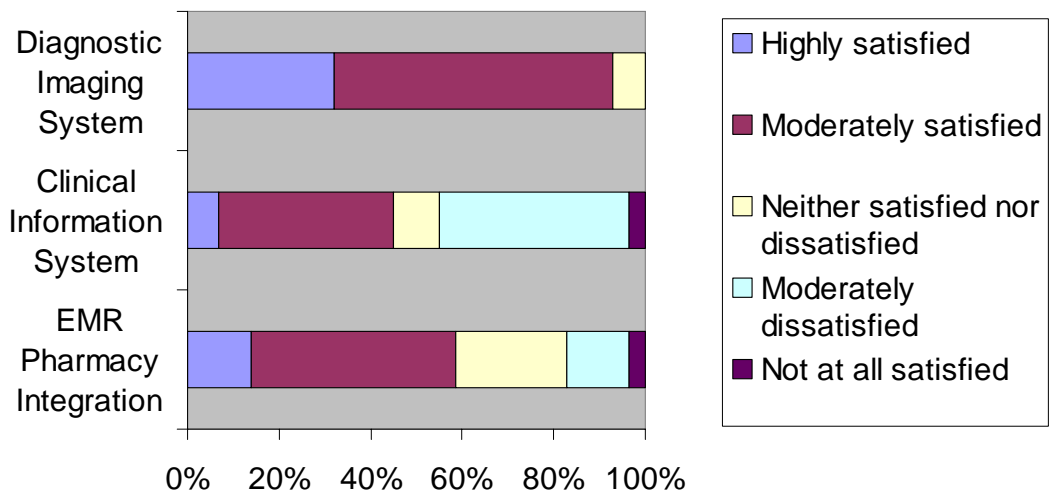- Strongly disagree
- Not sure
- Not applicable

Standardized assessment surveys

Example of benchmarking across technologies:

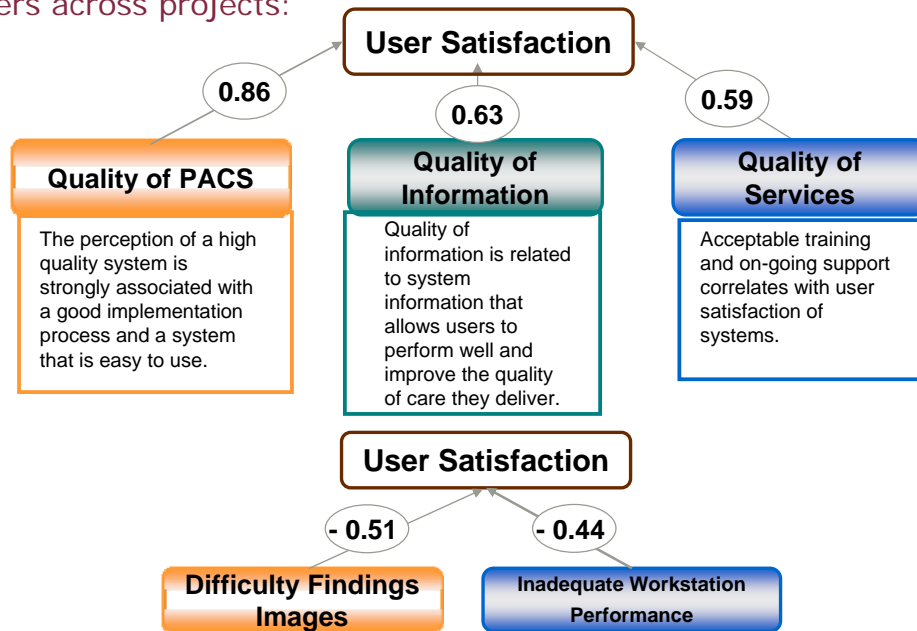## In general, how satisfied are you overall with the system you are working with?

Legend:
- Highly satisfied
- Moderately satisfied
- Neither satisfied nor dissatisfied
- Moderately dissatisfied
- Not at all satisfied

Standardized assessment surveys

Example of correlation and factor analysis to identify drivers and barriers across projects:

User Satisfaction

0.86   **0.63**   **0.59**

Quality of PACS

The perception of a high quality system is strongly associated with a good implementation process and a system that is easy to use.

Quality of Information

Quality of information is related to system information that allows users to perform well and improve the quality of care they deliver.

Quality of Services

Acceptable training and on-going support correlates with user satisfaction of systems.

User Satisfaction

- 0.51   **- 0.44**

Difficulty Findings Images

Inadequate Workstation Performance

Alberta WebSMR
Cancer Surgery Synoptic Reporting

- A structured, electronic, reporting process of operative records for cancer patients. The electronic synoptic reporting system utilizes procedure-specific synoptic templates that collect a series of defined data elements in a survey format. This new system results in a collection of accurate, complete and timely operative reports that cancer care teams can access to support decision making and improve cancer care.

1. Adoption is steadily increasing (26% of eligible surgeries in August, 1/2 of surgeons trained are active users)

2. In the past 85% of reports were submitted over one month following the surgery. Now, 77% of surgical reports are submitted through WebSMR on the same day as surgery

3. 51% of reports were entered by surgeons in less than 5 minutes

4. WebSMR reports contained 99% of data, compared to narrative report types missing 53% of data

5. 81% of users would recommend WebSMR to surgeons at other sites.

BC Patient Safety Learning System

- This project involves the implementation of the Patient Safety Learning System which will be a province wide web-based reporting and learning tool. The system is used by health care providers in acute care settings to support identification, investigation, and analysis of all safety and risk-related incidents, as well as to capture and facilitate response to client feedback and to enable claims management.

1. In the neonatal intensive care unit (NICU) pilot, dramatic increase in number of reports submitted (158% increase)

2. Greater diversity of those reporting (non-registerd nurses reports increased from 8% to 26%)

3. 84% submitted within 48 hrs (up from 2%), and average time to notifiy Quality, Safety & Risk Management (QSRM) is 1 day (down from 25 days)

4. High quality follow-up rate increased from 15% to 70%5. Positive impact on patient safety culture"

Cancer Care Ontario's CPOE and CDSS

- The purpose of this project is to implement the Computerized Physician Order Entry (CPOE), Clinical Decision Support System at an additional five cancer centres delivering systemic therapy across Ontario in 24 months. The CPOE system is a prescription ordering system where the prescriber enters orders directly into a computer. The CPOE also flags drug allergies, drug-drug interactions, or drug-disease interactions when medications are ordered, thus assisting clinicians in making the most appropriate clinical decisions at the point of care. CPOE technology has proven to reduce transcription errors, significantly reduce other errors and their resulting adverse effects.

1. 100% adoption of the Oncology Patient Information Systems (OPIS) by all clinicians with 99.8% of orders being placed into OPIS

2. The number of medication incidents for orders declined from 4.5% to 1.6%, which results in approximately 60% less incidents for the same number of medication orders

3. The frequency of incomplete or unclear medication orders was reduced from 4% to 1.1%, which results in 2/3 less unclear orders for the same number of total orders."

OTN Telehomecare for CHF and COPD

- The project focused on providing remote monitoring and education to patients with congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD). The FHTs collectively enrolled 813 patients into the Program. Three key interventions included: Education and support to learn how to self-manage their chronic disease; in-home patient monitoring equipment used on a daily basis to measure and transmit clinical indicators to a health care professional at the FHT; ongoing feedback and advice on their progress.

1. The large majority of assessed CHF and COPD patients reported improvements in their knowledge (89% and 95% respectively), confidence (86% and 85% respectively) and ability (78% and 72% respectively) to take care of their condition upon discharge from the program.

2. Utilization of (health) system resources were noted through reductions in hospital admissions. The average number of hospital visits per month decreased by 61% for CHF patients and by 55% for COPD patients. Based on the average cost per patient day in hospital, estimates indicate that the cost avoidance of the ~620 patients was $4.13M during the year. This represents an average cost avoidance of $6,667 per enrolled patient per year.

3. 2. Use of Telehomecare project resources also helped to reduce the number of unplanned physician visits (for a problem relating to the primary disease; CHF or COPD) by 47% for the CHF group and 9% for the COPD group.

PEI Drug Information System

- The provincial Drug Information System (DIS) is a province wide computer system in which a centralized medication profile can be accessed by pharmacists and select health care providers across the province.

1. Usage of the DIS is increasing. Survey results indicated that 93% of respondents were using the DIS during a typical day.

2. 87% of survey respondents feel that the DIS enhanced sharing of information.

3. The DIS captures very detailed information regarding prescription orders and dispenses, which in turn can be incorporated by pharmacists into their decision making. For example, drug utilization reviews conducted at time of dispense captured "alerts" logged by the DIS which resulted in the pharmacist taking action, in 30% of the DUR cases (conducted during the study period).

Diagnostic Imaging Evaluations

	Canada Health Infoway Benefits Evaluation Data					
	Qualitative Opinion Surveys		*Quantitative Research Studies*			
Jurisdiction	Pre-PACS	Post-PACS	Patient transfers	Duplicate exams	Cost per case	Turnaround times (TAT)
BC: Fraser Health Authority	✓		✓		✓	
Interior Health Authority		✓****				✓
ON: Thames Valley DI Network		✓		✓	✓*	
NS: Province-wide		✓				✓
NL: Province-wide		✓		✓		✓***

Response profile:		Count	% of total	Count	% of total
	Radiologists	6	5	78	35
	Referring physicians	36	32	146	65
	DI Technologists	53	47	n/a	n/a
	Other**	17	15	n/a	n/a
		112	100	224	100

It should be expressly understood that the qualitative surveys combined with quantitative research studies were not designed to be representative nor the findings expected to be consistent across all PACS implementations, rather the results provide insight on where opportunities and benefits are most likely to be realized

**** Respondents include Radiologists (19) only: referring physicians excluded
*** Turnaround time data for Newfoundland and Labrador not directly comparable due to differences in methodology (and lack of transcriptionists)
** Other is defined as clerical and related support staff (e.g., DI support staff)
* Actual data for baseline Year 1 only: forecasts represented for Year 2 to Year 8
Source: Canada Health Infoway; Videre team analysis

Productivity

Benefit	Description	Annual Value	Resources	Capacity
Technologist productivity	25-30% improvement in technologists' productivity	$122-148M	2,400-2,900 equivalent technologists	8-10M exams
Radiologist productivity	25-30% improvement in radiologists' productivity	$169-203M	450-540 equivalent radiologists	9-11M exams
Duplicate exams	2-3% reduction in unnecessary duplicate exams	$47-71M	43-63 radiologists 240-358 technologists	0.8-1.3M exams
Film costs	Elimination of film-related cost of materials and operations	$350-390M	N/A	N/A

Nancy Davis, Mgr. DI, Peterborough, ON
…moral has improved, report turn around has gone from 22 days to real time, efficiency is estimated at a 30% increase and patient care has been significantly enhanced…

We've seen a significant reduction in repeated exams: we have one PACS for three distinct geographic areas….sites no-longer have to remember to transfer films with patients (either acute transfer or follow-up with specialist in another city)…images are now available [with PACS] for review at any time, at any location in the region…
Nancy Davis, Mgr. DI, Peterborough, ON

Quality

Benefit	Description	Annual Value	Resources	Capacity
Referring physicians	Efficiency improved by 50-60 minutes	$160-190M	420-500 specialists	6-7M 10-min consults
Turnaround time	30-40% improvement in exam turnaround times	N/A	N/A	TAT reduced 10-24 hrs

...PACS enables quicker access to clinical information (exams and reports)...allowing for better informed patient management...
Bill Dow, Admin Director DI, Fraser Health Authority, BC

Prior to PACS, staff struggled to keep-up with ER and Fracture Clinic (FR)...now the ER and FR have to keep-up with DI...patients are realizing reduced lengths of stay as a result of real-time reporting available through PACS...

Nancy Davis, Mgr. DI, Peterborough, ON

...the impact of better access to patient information and decreased report TAT is a real decrease in length of patient stays...the better access to images and shorter report TAT results in shorter lengths of stay...
John King, Executive V.P. of Hospital Services & Chief Administration Officer, St. Michael's Hospital, Toronto, ON

Access

Benefit	Description	Annual Value	Resources	Capacity
Patient transfers	Avoided unnecessary patient transfers	$8-14M	N/A	10,000-17,000 avoided patient transfers
Improved remote reporting	Enables 30-40% of radiologists to support care delivery and improve access for remote areas			

...prior to PACS, referring physicians would contact specialists by phone and describe the case over the phone, then transport (up to 6 hours) the patient to our main centre, and in many cases only to have the patient transported again to the appropriate centre...

...in one case, PACS may have actually saved the patient's life by avoiding a transfer to the wrong centre...

ThaliaVesterback, PACS Systems Administrator, Interior Health Authority, BC

A significant impact to locals such as Yellowknife, there are no Tertiary centres in the Territories...a valuable segment of the [Radiologist] workforce is now available...qualified Radiologists who previously left active workforce will now be willing to work part-time by tele-radiology...
Dr. Greg Butler, KentvilleN.S.(and Chief of Radiology, Stanton Memorial Hospital Yellowknife, N.W.T.)

Missed Opportunities in DI?

- Point of service functionality (e.g. CDS)

- Interoperability
  - Shared images
  - Messaging and terminology standards including SNOMED CT, DICOM, HL7 v3.0, LOINC
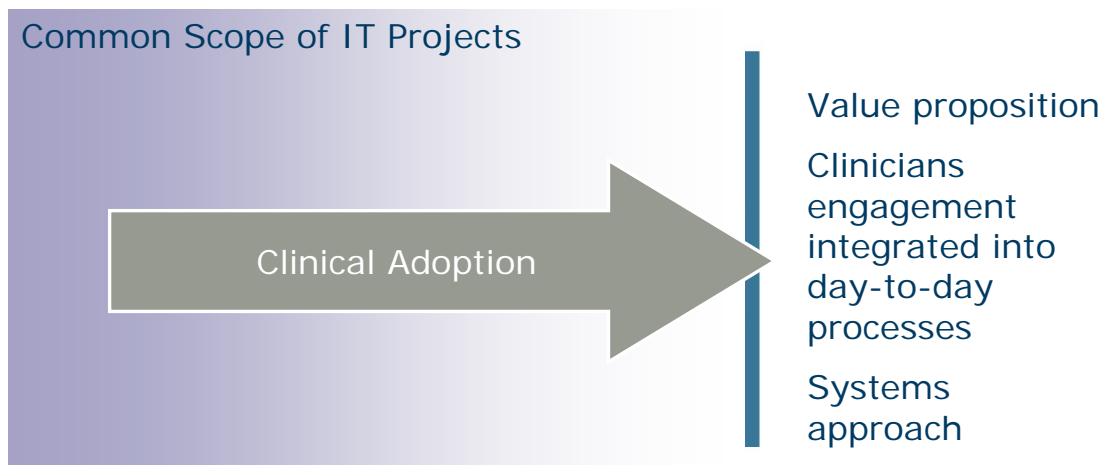
- Harvesting benefits effectively

Conclusions

Lessons Learned:
Measurement Approaches

- Engaging the right stakeholders early – clarifying roles and accountabilities

- Resourcing – find the right team and skills

- Iterative approaches

- Mixed methods
  - assume some data sources won't work
  - Qualitative and quantitative

- Short-term evaluations and long-term indicators

Increasing focus on adoption and benefits

Common Scope of IT Projects

Clinical Adoption

Value proposition

Clinicians engagement integrated into day-to-day processes

Systems approach

Evolution towards benefits realization

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