Newfoundland & Labrador Centre for Health Information

Canada Health Infoway Inforoute Santé du Canada

Memorial University of Newfoundland

AN EVALUATION
OF THE
NEWFOUNDLAND AND LABRADOR
CLIENT REGISTRY

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LIST OF ACRONYMS

BoB	Best of Breed
BDBC	Benefits Driven Business Case
CRMS	Client Referral Management System
CDMS	Clinical Database Management System
CR1	Client Registry Project 1
DHCS	Department of Health and Community Services
EHR	Electronic Health Record
FTE	Full Time Equivalent
HIC	Human Investigation Committee
HIN	Health Information Network
IT	Information Technology
LOS	Length of Stay
MCP	Newfoundland Medical Care Plan
MVR	Motor Vehicle Registration
NCTRF	Newfoundland Cancer Treatment and Research Foundation
NLCHI	Newfoundland and Labrador Centre for Health Information
OOP	Out of Province
PIN	Personal Identification Number
RIU	Registry Integrity Unit
RFP	Request for Proposals
RHB	Regional Health Board
SJNHB	St. John’s Nursing Home Board
SME	Subject Matter Expert
TCO	Total Cost of Ownership
UPI	Unique Personal Identifier

Evaluation of the UPI/CR
Newfoundland and Labrador
Doreen Neville, Don MacDonald, Kayla Gates

WHAT IS A UPI/CR?

A UPI/CR is a Unique Personal Identifier and Client Registry. The Client Registry is a provincial database which contains the most current demographic information on clients of the provincial health and community services system, and facilitates the appropriate linkage of client records across source systems. The Unique Personal Identifier is the unique reference number that is assigned to each individual represented in the Client Registry database. The UPI/CR is the foundation for a provincial Electronic Health Record.

WHY DID WE DO THIS STUDY?

The Newfoundland and Labrador Centre for Health Information (NLCHI) implemented a provincial UPI/CR in 2001. In partnership with Canada Health Infoway Inc. "Canada Health Infoway", enhancements to the original UPI/CR system were completed in February 2005, using Best of Breed (BoB) components. These enhancements were designed to create a reusable client registry solution which can be shared with other jurisdictions across Canada (CR1). An evaluation of this initiative was required to (1) ensure accountability for the funding received to develop the system; and (2) ensure that important knowledge gained from the Client Registry Project in NL is documented and shared with other jurisdictions in order to enhance their EHR related initiatives.

HOW DID WE DO THIS STUDY?

The evaluation was designed as a pre/post implementation study and involved a number of strategies. *Infoway* and NCLHI collaborated on the identification of the major research questions to be addressed, which focused on accountability and knowledge transfer issues. These questions were:

- What benefits were anticipated and realized arising from the implementation of the Client Registry in NL?
- What was the total cost of ownership of the Client Registry in NL?
- What were the key facilitators and barriers to successful implementation of the UPI/CR/CR1?

Data available from earlier scoping exercises contributed to the pre-implementation information. Post-implementation data was collected via key informant interviews and a secondary data analysis of project documents related to costs and other resource requirements.

WHAT WERE THE KEY FINDINGS FROM THE EVALUATION?

- The projects resulted in the successful implementation of a reusable client registry system.
- The major benefits achieved were improved data access and data quality; revenue and cost recovery/avoidance opportunities; and capacity building, including the development of a Toolkit which can be shared with other jurisdictions.
- The total cost of ownership for the UPI/CR/CR1 in NL was approximately $8.9M, with ongoing annual costs of approximately $600,000.
- Key facilitators included leadership, stakeholder engagement processes, team work and preparatory work among system users.
- Key barriers involved unanticipated changes in project scope, timing of the implementation, and limitations in the supply of human resources available.

HOW WILL THE RESULTS OF THIS EVALUATION STUDY BE USED?

The findings from this study will be shared with other jurisdictions across Canada to assist them in: (1) providing evidence regarding the costs and benefits of a UPI/CR to their funding partners; (2) planning the implementation of a similar system; and (3) leveraging and consolidating resources and expertise across Canada to undertake evaluations of health information system projects.

HOW CAN I LEARN MORE ABOUT THIS PROJECT?

If you are interested in learning more about the evaluation study, you can contact Dr. Doreen Neville (709-777-6215; **dneville@mun.ca**). If you would like a copy of the report, it can be downloaded from the following site: **www.nlchi.nl.ca/research_evaluations.asp**

EXECUTIVE SUMMARY

Background

The Newfoundland and Labrador Centre for Health Information (NLCHI) implemented a provincial UPI/CR in 2001. In partnership with Canada Health Infoway (*Infoway*), enhancements to the original UPI/CR system were completed in February 2005, using Best of Breed (BoB) components (CR1 project). These enhancements were designed to create a reusable client registry solution which can be shared with other jurisdictions across Canada (CR1). *Infoway*'s financial contribution to the CR1 project was $5.4 million. This study is a deliverable identified as part of the joint Newfoundland & Labrador Client Registry and Canada Health Infoway Client Registry Project (CR1). Canada Health Infoway engaged NLCHI to complete this evaluation of CR1.

In July 2004, a two day meeting was held in St. John's, Newfoundland and Labrador, and was attended by Don MacDonald, Sandra Cotton, Kayla Gates and John Knight of NLCHI, Dr. Doreen Neville of Memorial University of Newfoundland, and Keith Monrose and Peggie Willett of *Infoway*. The purpose of the meeting was to formulate a joint approach by NLCHI and *Infoway* to evaluate the Client Registry system being implemented by NLCHI in Newfoundland and Labrador with financial support from *Infoway*.

At this meeting it was agreed that a formal evaluation of the Client Registry Project was required in order to assess and report on the development and implementation of the Client Registry Project in Newfoundland and Labrador, and in particular to assess the total investment and benefits that have resulted. It was also agreed that the approach to the evaluation would follow the guidelines presented in the report "Towards an Evaluation Framework for Electronic Health Records: A Proposal for an Evaluation Framework, March 2004" (www.nlchi.nl.ca/research_evaluations.asp), hereafter referred to as *The Evaluation Framework for EHR Initiatives.*

Rationale for the Evaluation

The Evaluation Framework for EHR Initiatives suggests that there are three general types of rationale for conducting an evaluation in the field of health information systems: (1) to ensure accountability for expenditure of resources; (2) to develop and strengthen performance of agencies, individuals or systems; and (3) to develop new knowledge in one or more of the disciplines involved in the initiative, such as usability engineering, cognitive psychology or organizational behavior. After discussion among those present at the meeting, it was agreed that the rationale for an evaluation of the Client Registry project in NL was primarily related to issues around accountability and knowledge transfer to enhance performance in other jurisdictions.

Research Questions

Three research questions guided the evaluation of the Newfoundland and Labrador Client Registry:

1. ***What benefits were anticipated and realized arising from the implementation of the Client Registry in Newfoundland and Labrador*?**
   - What were the projected benefits?
   - What are the actual benefits realized (to date)?

2. ***What was the total cost of ownership of the Client Registry in Newfoundland and Labrador?***
   - What were the projected costs?
   - What are the actual costs?

3. ***What were the key facilitators and barriers to successful implementation of the Client Registry in Newfoundland and Labrador?***

Study Design and Methods

The evaluation was designed as a pre-/post-implementation study. Pre-implementation data was obtained from scoping exercises conducted prior to system implementation, or from separately conceived and completed evaluations of work flow, audits of patient charts and other research studies. Post implementation data collection occurred during the period November 2004 - February 2005, and consisted of two main strategies: (1) review of existing data sources/secondary data analysis of project reports and reports generated by the Client Registry; and (2) key informant interviews with stakeholders, including: members of the Project Team; Directors of Health Records across the province; registration and laboratory personnel in the largest institutional board; staff from the Medical Care Plan (MCP) and staff of the Registry Integrity Unit (RIU). A total of 29 interviews were requested and 23 were obtained.

The evaluation study protocol was submitted to the Human Investigation Committee of the Faculty of Medicine, Memorial University of Newfoundland, for ethics review; approval to conduct the study was received.

Key Findings

The UPI/CR and CR1 projects resulted in the successful development and implementation of a reusable client registry system. Other key findings are organized around the three research questions which guided the evaluation study and are summarized below.

Major Benefits Anticipated and Achieved:

- ***improved data access:*** Key informants indicated that the UPI/CR and CR1 provided a more accurate list of the current system users and enabled access to up-to-date demographic data on their clients.

- ***improved data quality:*** Key informant interviews confirmed that anticipated improvements in data quality had been achieved, in particular:
  - (a) improved capacity to identify patients accurately;
  - (b) elimination of duplicate patient files in health care facilities; and
  - (c) elimination of duplicate or terminated patient identification numbers with the provincial insurance payment program (i.e., MCP).

  In addition to findings from the key informant interviews, summary data generated through the Client Registry was used as an indicator of data quality pre- and post- implementation of the Best-of-Breed (BoB) Client Registry system in Newfoundland and Labrador (CR1). Results indicated that CR1 enables the detection of additional data quality issues beyond those detected by the original UPI/Client Registry. These additional data quality issues will subsequently be resolved, enabling a higher level of data quality than could be achieved with the original Client Registry.

- **revenue and cost recovery/avoidance opportunities*:*** Key informants confirmed that financial savings had been realized through the provision of eligibility information (for public insurance) at the point of registration. Additional analyses conducted by NLCHI estimated that in the year 2000 (one year prior to the introduction of the UPI/CR), $3.9M (0.48% of the total health care boards budgets in 2000) was lost due to hospitals not identifying non-residents who received in-patient or out-patient services in NL, as hospitals can bill other provinces for providing services to non-residents.

  A reduction in the need for storage space associated with the culling of duplicate records and records of persons who had died was suggested as a possible benefit by one key informant, but to date this benefit had not been realized in their facility. Additional analyses by NLCHI projected that an additional 76.2 linear feet of storage space could be saved per 1,000 deaths, an estimated savings of $7,000 per year, as a result of the elimination of duplicate files in facilities/regions. Currently, information systems in the province do not allow for the refining of this benefit beyond the provincial level. Storage space for medical records will be revisited with the evolution of the Electronic Health Record (EHR).

- ***enhanced capacity***: Key informants identified three main aspects to the capacity enhancements which had been achieved in this area: (1) The UPI/CR is widely viewed as the cornerstone/solid foundation for the development of a provincial EHR; (2) The technical skills developed, along with the creation of the Toolkit and the Lessons Learned Documents, were noted as contributing to the overall expertise which is now available for the province and the country as a whole; and (3) The standardization of procedures around registration was also identified as an important component of system capacity development.

Total Cost of Ownership

Total Cost of Ownership (TCO) of the Newfoundland and Labrador Client Registry was a one-time cost of $8,935,999, with an ongoing annual cost of approximately $600,000. More difficult to quantify are the investments of time and expertise that were made available by Regional Health Boards and other participants throughout the project life cycle. Items included in the detailed breakdown of costs for each phase of system development were categorized under four major headings: human resources; establishment of the technical environment; administrative expenses; and other associated costs. Actual costs closely paralleled projected costs.

The TCO was based on the development, implementation and maintenance of a province-wide Client Registry system that serves a population of approximately 520,000. Population size should be considered when using the Newfoundland and Labrador TCO to determine resources required to implement and maintain a similar system in another jurisdiction. In addition, it should be noted that the TCO reflects the fact that the final CR product was developed in two separate phases (the original UPI/CR and CR1) which involved unavoidable duplication of some costs. These costs would likely not be incurred in other jurisdictions if they proceeded directly to the implementation of the Best of Breed Client Registry solution (CR1).

Key Facilitators and Barriers to Successful Implementation

Key facilitators included:

- ***leadership***: Throughout the planning, design and implementation of the UPI/CR and CR1 projects, the leadership of the NLCHI Director of Data Standards and Information was considered to be a key factor in the success of the project, particularly with respect to the original UPI/CR.

- ***stakeholder engagement processes in the original UPI/CR:*** In the first iteration of the project, the major system users impacted were the Health Records Directors and this group met regularly with each other and the Director of Data Standards and Information at NLCHI for a number of years preceding roll-out of the original UPI/CR.

- ***teamwork:*** the Project Team included individuals with business process and information technology (IT) expertise, who worked well together, and with Health Records and IT representatives from the system. The Business and Technical Leads for the project, in both the original UPI/CR and CR1 projects, had extensive experience in the provincial health care system and credibility with key stakeholders.

- ***preliminary efforts among system users:*** The institutional sector in the health care system had previously made the decision to deal with one vendor and product for hospital information systems (Meditech) province-wide. The community sector shared one provincial Client Referral and Management Information System (CRMS). Several of the institutional boards and MCP also made preliminary efforts to clean up their own database prior to the introduction the Client Registry.

Key barriers included:

- ***project scope challenges:*** The biggest challenge to successful implementation involved several changes in project scope related to the implementation of CR1.These included: (1) *reversing* an early stakeholder decision regarding CR-Meditech interaction. During the latter stages of the project, both the stakeholders and the project team agreed that reversing a very early scoping decision would result in a much more streamlined registration process. Since both parties agreed that the change was crucial to a successful project implementation, substantial work was undertaken to accommodate this change*; (*2) modifications required to move some elements of the original UPI/CR technology to the new CR1 requirements were more extensive than originally anticipated; and (3) the Project Team anticipated contributing 50 documents to the Toolkit, but the contribution requirement essentially doubled; 92 documents were submitted in total.

- ***timing of the implementation:*** There were two issues with respect to timing for CR1: (1) there was a significant time delay between the scoping exercise and the implementation; and (2) CR1 went live in the first site during the summer months, when key personnel in the facility were on vacation.

- ***shortage of human resources:*** Although the health system partners were supportive of the Client Registry project, they were under-resourced in terms of: (1) personnel who were available to assist with training staff impacted by the technology; and (2) personnel who were available to complete the time consuming task of database cleanup arising from the large volume of duplicates identified when CR1 was introduced. In addition, changes in the project scope described above placed additional pressure on the human resources of the Project Team during the "go live" phase of CR1.

- ***unanticipated performance limitations of the new technology:*** While the response to the UPI/CR and CR1 has been positive overall, implementation of CR1 did not go as smoothly in the hospital sector as hoped. Problems were encountered as a result of technical difficulties associated with the interaction between the registration modules and the Community-Wide Scheduling Modules in Meditech. The technical difficulties were mainly the result of the change in business processes noted above. Addressing this interaction required further modifications to the CR1 and extensive consultation with the vendor. The community sector experienced fewer problems with CR1, as they use 2-Way Passive and Query (Web) interfaces with the Client Registry.

Lessons Learned and Recommendations to Other Jurisdictions

Lessons learned and recommendations to other jurisdiction were identified in three main categories: (1) planning/scoping the project; (2) stakeholder relationships (engagement and communications); and (3) human resource requirements. Each is summarized below.

1. Planning/Scoping the Project

- ***Conduct regular audits of business processes throughout the design, testing and implementation phases.*** Experience with CR1 would suggest that continuous auditing is particularly important if: (1) the technology is assumed to be an enhancement of an existing system and therefore does not require as extensive a scoping exercise as a major installation would need; and (2) the time delay between the scoping exercise and the implementation is significant.

- ***Establish a MOU/agreement with ALL key stakeholders:*** Working jointly on a project with stakeholders in a dynamic changing environment means that all parties concerned should agree upon the ways that they will work together and communicate about changes required; this includes both end user groups and the funding agencies/partners.

- ***Plan for more change management than you think you will need***: Since CR1 was an enhancement of the original UPI/CR project, it was originally anticipated that change management requirements would be minimal. However, experience with this project suggests that you should always plan for more change management time and resources than you think you will require, as new end users may be identified at any point in the planning/implementation process.

- ***Test in the real system***: Whenever possible, it is preferable to conduct limited testing of the real system on site (versus the test system in the lab) to identify glitches in how the technology will work.

2. Stakeholder Relationships: Engagement and Communications

- ***Expand stakeholder engagement:*** It is vital with each new project/project enhancement to identify changes in the user groups who will be impacted by the technology and include them in communications and change management plans. In CR1, fuller engagement of registration personnel from both the institutional and community health boards was required.

- ***Enhance communication plans***: A complete communications plan is required, even when the new technology is viewed as an enhancement to an existing system. In particular, it is important to ensure that adequate personnel are available to respond in a timely manner to feedback from user groups during the implementation phase at each site.

- ***Maintain visibility during the implementation phase***: The CR1 experience suggests that it is very important for members of the implementation team to be visible to the front line users at the first (and the biggest) sites for implementation. It is more likely that glitches in implementation will occur in the earliest implementations, and the impact of these glitches will be most pronounced in the higher volume facilities.

3. Human Resource Requirements

- ***Anticipate additional resource requirements***: Additional human resource capacity requirements over and above those anticipated during the project scoping exercise are likely. Changes in project scope are inevitable and the team should have sufficient business process and IT capacity to address the unexpected. It is also likely that the human resources available in the system to assist with database clean-up and maintenance of the integrity of the Client Registry database may be limited.

Concluding Remarks

As a result of *Infoway*'s **$5.4 M** financial investment in the CR1 project in NL, the following outcomes were achieved:

(a) A reusable client registry solution which can be shared with other jurisdictions was successfully developed and implemented, on time and on budget;

(b) A Toolkit and Lessons Learned Document were developed by the Project Team and can serve as major knowledge transfer vehicles for other jurisdictions planning a similar initiative;

(c) An evaluation report which highlights the major benefits achieved and key facilitators and barriers for successful project implementation is available and can be shared across Canada. Major benefits that have been realized include:

- improved access to patient demographic information
- improved data quality
- financial savings
- enhanced capacity to achieve strategic goals;

(d) An evaluation methodology which can inform evaluation efforts in other jurisdictions has been tested and validated; and

(e) A successful implementation experience involving national, provincial and regional health information stakeholders has been gained. The CR1 project enhanced the capacity of all partners involved and laid a foundation of trust and expertise which can facilitate future collaboration.

INTRODUCTION

Newfoundland and Labrador UPI/Client Registry

The Newfoundland and Labrador Centre for Health Information (NLCHI) was established in 1996 to provide quality information to health professionals, the public and people involved in policy-making and management of the health system. Collaborating with stakeholders, NLCHI has a provincial mandate to develop and manage a health information network (HIN) as a means of achieving the best possible health care for the province.

In November 1998, a Benefits Drive Business Case (BDBC)[1] was completed which identified eight components for a comprehensive HIN. The cornerstone of the HIN is the Unique Person Identifier (UPI)/Client Registry. The Client Registry is a provincial database which contains the most current demographic information on clients of the provincial health and community services system, and facilitates the appropriate linkage of client records across source systems. The UPI will enable person-specific clinical information to be consolidated from multiple regions and sources as the HIN is further developed.

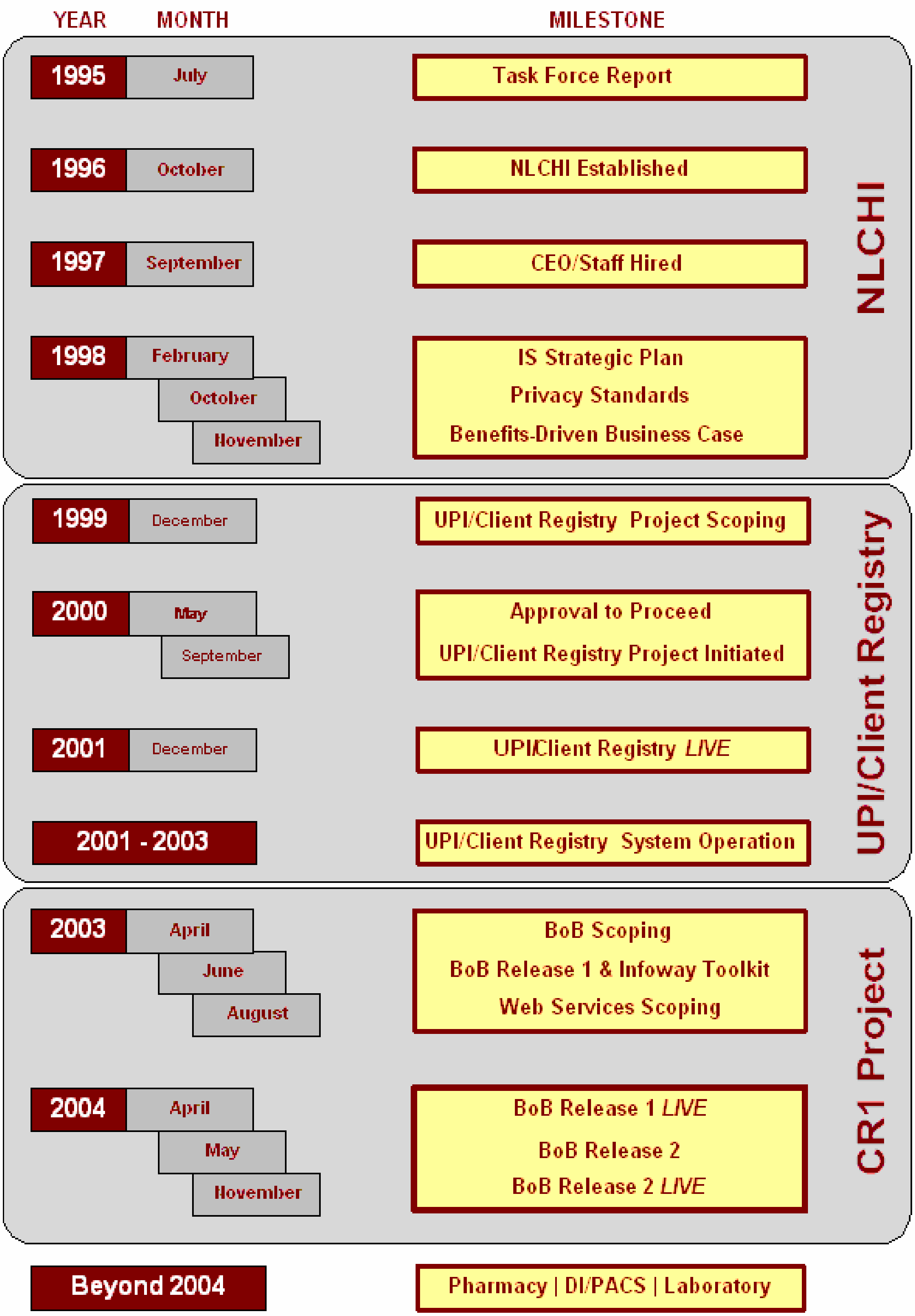
As summarized in the Flow Chart (Figure 1, page 2), in July 1999 NLCHI received permission from the Minister of Health and Community Services to proceed with defining the project scope of the UPI/Client Registry, which builds on the BDBC and lays the foundation for development of the Client Registry and introduction of the UPI[2]. In 2001, the Newfoundland and Labrador UPI/Client Registry was successfully implemented at a cost of $3.6 million, with funding from the Government of Newfoundland and Labrador. As a result of this benchmark, in 2002, NLCHI was selected by Canada Health Infoway (*Infoway*) to upgrade its UPI/Client Registry system to “Best of Breed” status[3]. *Infoway* committed an investment of $5.4 million to the project (the CR1 project).

The CR1 project was designed to be carried out in two phases. Phase I of the project involved identification of the requirements for the upgrade/enhancements of the Client Registry to reach this accolade. Phase II of the project, system implementation, consisted of two distinct ‘Releases’. Release 1 involved the migration to a new Client Registry software product and an upgrade of the integration engine and other related hardware and software. Release 2 involved the upgrade of interfaces between the UPI/Client Registry and several key stakeholder systems to enhance communication and information flow (connectivity) between these systems.

Release 1, the database upgrade, was completed in March 2004 and interface specifications relative to this work were submitted to Canada Health *Infoway*. Release 2 involved the replacement of customized interfaces with standards-based software. As of December 17, 2004, all Institutional Boards in the province were utilizing the interfaces in their “live” operational environments to provide active query and passive update transaction capability. As of mid-January 2005, all Health and Community Service Boards and MCP were using 'two-way' passive transactions in a “live” environment. As of February 11, 2005, the St. John’s Nursing Home Board (SJNHB), also using Meditech, was operating in a “live” environment, providing active query and passive updates. This completed the roll out of the Client Registry system as defined in the Project Scope.

This study is a deliverable identified as part of the joint Newfoundland & Labrador Client Registry and Canada Health Infoway Client Registry Project (CR1). Canada Health Infoway engaged the Research and Development Division of NLCHI and Dr. Doreen Neville of Memorial University to complete this evaluation of CR1.

Figure 1. UPI/Client Registry Development Flow Chart



Development of the Evaluation Protocol

In July 2004, a two day meeting was held in St. John's, Newfoundland and Labrador, and was attended by Don MacDonald, Sandra Cotton, Kayla Gates and John Knight of NLCHI, Dr. Doreen Neville of Memorial University, and Keith Monrose and Peggie Willett of *Infoway*. Discussions were facilitated by John G. Abbott of *The Institute for the Advancement of Public Policy, Inc.*

The purpose of the meeting was to formulate a joint approach by NLCHI and *Infoway* to evaluate the Client Registry system being implemented in Newfoundland and Labrador by NLCHI with financial support from *Infoway*. Following a series of presentations by personnel from *Infoway*, NLCHI and Memorial University, the following key points were noted:

1. There is a recognition to leverage and consolidate resources and expertise across Canada to undertake evaluations of health information-related projects; the question is how to engage persons in this process;

2. NLCHI and Memorial University are looking to contribute to a national inventory/clearinghouse in the evaluation of electronic health records;

3. *Infoway* representatives recognize the need to build evaluation capacity in Canada and that NLCHI and Memorial could assist in that endeavour given their experience in evaluating various components of an Electronic Health Record;

4. There is a need and opportunity to collect baseline data on NLCHI's Client Registry in a definitive time frame by using both *Infoway* and NLCHI resources; and

5. From the perspective of the *Infoway* representatives, three priorities were clear, namely: (i) initiating the evaluation of the NLCHI Client Registry project (ii) developing an evaluation approach for all Client Registry projects and (iii) identifying the resources required for the key evaluation initiatives across the country.

It was also agreed that the approach to the evaluation would follow the guidelines presented in the report "Towards an Evaluation Framework for Electronic Health Records: A Proposal for an Evaluation Framework, March 2004", hereafter referred to as *The Evaluation Framework for EHR Initiatives*[4].

The major recommendations of *The Evaluation Framework for EHR Initiatives*[4] focus on the involvement of key stakeholders throughout the evaluation process and reaching agreement among stakeholders on the purpose of the evaluation (why it is needed), the key goals and research questions, the methods to be used to collect the information and the strategies for reporting the findings and agreeing on recommendations arising from the report. A summary of the group's discussions around each of these areas is provided below.

Purpose (Why the evaluation is needed)

A formal evaluation of the Client Registry project was needed ***to assess and report on the development and implementation of the Client Registry project in Newfoundland and Labrador, and in particular, to assess the total investment and benefits that have resulted.***

Core Principles/Ways of Working

a. ***Collaboration:*** NLCHI, *Infoway* and Dr. Neville worked collaboratively throughout the process of designing, conducting and reporting on the evaluation of the UPI/Client Registry project in Newfoundland and Labrador. Regular teleconference meetings were held to provide a forum for information exchange, advice and updates regarding the progress of the evaluation study.

b. ***Stakeholder involvement:*** Ideally, representatives from the broader stakeholder community, such as the regional health boards, would have participated in the design of the evaluation study. However, due to the time constraints identified by the *Infoway* representatives, the evaluation study was designed in consultation with the 2 key stakeholders, *Infoway* and NLCHI only. A significant focus of the study includes key informant interviews with stakeholders in the regional health boards involved with the design and implementation of the UPI/Client Registry.

c. ***Rigor:*** The project was conducted in accordance with the ethical and scientific standards for independent research established by Memorial University Faculty of Medicine and the Tri-Council Guidelines for the conduct of ethical research. The evaluation protocol was submitted for scientific and ethical review to the Human Investigation Committee, Faculty of Medicine, Memorial University of Newfoundland.

d. ***Independence:*** Dr. Doreen Neville, Associate Professor of Health Policy and Health Care Delivery, Faculty of Medicine, Memorial University is the Principal Investigator of the study and oversaw all data collection, analysis and reporting processes.

Goals and Objectives

The Evaluation Framework for EHR Initiatives[4] suggests that there are three general types of rational for conducting an evaluation in the field of health information systems: (1) to ensure accountability for expenditure of resources; (2) to develop and strengthen performance of agencies, individuals or systems; and (3) to develop new knowledge in one or more of the disciplines involved in the initiative, such as usability engineering, cognitive psychology or organizational behavior. After discussion among those present at the meeting, it was agreed that ***the rationale for an evaluation of the Client Registry Project in NL was primarily related to issues around accountability and knowledge transfer to enhance performance in other jurisdictions.*** The goals and objectives subsequently identified for this evaluation include:

GOAL 1: To ensure accountability for expenditure of resources related to the Client Registry in Newfoundland and Labrador

Objectives:

1. To quantify system level health and IT benefits from the Client Registry in Newfoundland and Labrador. Health system benefits include managerial, provider, patient and cost avoidance. IT benefits include personnel and innovations in infrastructure.
2. To document the total cost of ownership of the Client Registry in Newfoundland and Labrador.

GOAL 2: To ensure that important knowledge gained from the Client Registry Project in Newfoundland and Labrador is documented and shared with other jurisdictions in order to enhance their EHR related initiatives

Objectives:

1. To describe the capacity building experience that occurred as a result of the Client Registry project in NL, including: the degree to which the province is positioned to move forward with the development of the full HIN (EHR cornerstone); the degree to which the project leveraged provincial sources of investment; the skill development and transfer among those involved in planning and implementing the Client Registry.
2. To document lessons learned from the processes used to: (1) implement the Client Registry in Newfoundland and Labrador; and (2) develop a knowledge-transfer oriented Toolkit.

The research team was cognizant that both objectives under Goal 2 are, at least in part, the responsibility of NLCHI's Best of Breed (BoB) Project Team. However, given that these objectives are also a significant component in the development of an overall Client Registry evaluation framework, the research team felt it was necessary to include them in this study design. As such, the research team agreed to work in partnership with the NLCHI BoB Project Team in delivering on these objectives. No resources for this study were allocated for activities which fall under NLCHI's previous commitment to Canada Health Infoway under the BoB (CR1) Project.

Research Questions

Discussion around the goals and objectives of the proposed evaluation resulted in the identification of three key research questions to guide the evaluation of the Newfoundland and Labrador Client Registry

1. What benefits were anticipated and realized arising from the implementation of the Client Registry in Newfoundland and Labrador?

- What were the projected benefits?
- What are the actual benefits realized (to date)?

Potential benefits of the UPI/Client Registry were identified during the meeting and are presented in Table 1 (page 6).

2. What was the total cost of ownership of the Client Registry in Newfoundland and Labrador?

- What were the projected costs?
- What are the actual costs?

3. What were the key facilitators and barriers to successful implementation of the Client Registry in Newfoundland and Labrador?

Table 1. Potential Benefits of the Client Registry

No	Beneficiaries	Benefits – Direct (D)/ Indirect (I)	When	How	Benefit
1.	Patient/Client	I	Point of service	Verification of identity	Improved outcomes
2.	Facility Administrator	D	Registration	Resolution of duplicates Identification of deaths	Accuracy Savings in storage
		I		Confirmation of insurability	Cost-recovery for out-of-province
3.	Provincial Insurer	D	Billing	Non-eligibility of out-of-province residents	Cost-avoidance
4.	Department/Ministry	D/I	Strategic	Investment	Cornerstone for EHR
5.	Province	D/I	Strategic	Economic multiplier/interagency collaboration	Regional, economic and social development
6.	National	D	Strategic	Sharing of expertise	Knowledge transfer

Study Design

It was jointly agreed that the evaluation be designed as a pre-/post-implementation study. As recognized in the two-day meeting, as well as in the *Evaluation Framework for EHR Initiatives*, baseline data collection is not always possible, as many EHR initiatives are already underway before a formal evaluation has been initiated. However, pre-implementation data is often available from scoping exercises conducted prior to system implementation or from separately conceived and completed evaluations of work flow, audits of patient charts and other research studies. It was agreed that such pre-existing data would be utilized in the evaluation of the Newfoundland and Labrador Client Registry in order to establish baseline (pre-implementation) measurements.

Key Indicators

Building on the goals/objectives established for the study and the identified potential benefits of the UPI/Client Registry proposed above, indicators were identified as important and feasible to include in the evaluation study. These are presented in Table 2 (page 7).

Table 2. Key Indicators for the Evaluation

Evaluation Perspective: Accountability

Indicator	Summary Approach
Improved Outcomes: Data quality	While verification of identity is important to patient care, improved patient outcomes are difficult to quantify. Reports generated from the Client Registry were used to establish the quality of data in the Client Registry pre- and post-implementation. Data quality, established using these reports, was related to expected benefits as identified in the BDBC and scoping exercises, as well as expected/actual benefits identified in the literature.
Financial benefits: Physical Storage	Resolution of duplicates/identification of deaths will result in savings in physical storage of hospital charts. Number of deaths were identified by generating reports from the Client Registry and savings in physical storage was quantified.
Financial benefits: Cost-recovery/avoidance	Number of times MCP eligibility is denied at registration was determined through reports generated from the Client Registry and translated into cost-recovery/avoidance. Pre-implementation data was available from a financial benefit analysis carried out by linking MVR data (cancelled drivers license) to hospital data.
Administrative benefits: enhanced capacity to achieve strategic goals	Expectations of the UPI/Client Registry as the EHR cornerstone were established during the development of the BDBC and scoping exercises. Post-implementation realizations were established through key informant interviews and compared to expectations.
Costs: Total cost of ownership	Total cost of ownership of the Client Registry in Newfoundland and Labrador, including RIU maintenance, initial and ongoing hardware and software costs, network connectivity, and costs for technical and business support was identified. Expected costs were compared to actual costs

Evaluation Perspective: Knowledge Transfer

Indicator	Summary Approach
Capacity Building: Regional/economic/social development	Financial support and interagency collaboration with respect to health information system projects since the implementation of the UPI/CR were documented. Employment and training opportunities that resulted and skill sets which were acquired were outlined. Processes used to ensure stakeholder engagement and the barriers and facilitators for these processes were described. Data sources included existing documentation and key informant interviews.
Knowledge Transfer	Lessons learned about barriers and facilitators for successful project implementation which can be useful in other jurisdictions were highlighted. Total investment (time, cost, personnel, etc.) in, and the products of, the Newfoundland and Labrador Client Registry project were described in detail. Time and potential financial savings to other jurisdictions were identified where possible. Data sources included existing documentation and key informant interviews.

Data Validation

The evaluation team provided a summary of the study findings to key stakeholders as part of a data validation exercise and as a prelude to dissemination of study findings.

Reporting Findings and Agreeing on Recommendations

It was agreed that bi-weekly teleconferences would be held to provide updates on the work in progress and obtain feedback/suggestions about methodological issues as they arise. A draft report, outlining how the study was conducted and key findings to date would be submitted in mid December, with revisions and updates for completion early 2005. Recommendations arising from the report would be mutually agreed upon by the key stakeholders at NLCHI and *Infoway*.

EVALUATION REPORT

Conflict of Interest Statement

The Principal Investigator for the study was Dr. Doreen Neville, Faculty of Medicine, Memorial University of Newfoundland. The two co-investigators were employees of the Centre for Health Information and included Ms. Kayla Gates, Manager, Research and Development, and Don MacDonald, Director, Research and Development. No person involved with, or part of, the Client Registry Project Team had a role in the study design, data collection, analysis or interpretation. The investigators are not aware of any potential conflicts, either financial or personal, in carrying out and reporting on the evaluation of the Client Registry in Newfoundland and Labrador.

Methods

Ethical Considerations

The evaluation study protocol was submitted to the Human Investigations Committee (HIC) of Memorial University of Newfoundland for ethics approval. Approval to conduct the study was received on October 29, 2004. Once data collection commenced, the research team recognized that additional personnel should be interviewed for the study. The inclusion of these individuals/organizations was pertinent to an objective evaluation of the Newfoundland and Labrador Client Registry project. An Amendment was submitted to the HIC on December 2, 2004 and approval to add additional interviews was received on December 9, 2004. As the data collection continued, the need to interview additional personnel was again identified. A second Amendment was submitted to the HIC on January 21st, 2005 and approval to add the additional interviews was received on January 27th, 2005 (see **Appendix A** for Ethics documentation).

All data collected for the study were stored on password protected computer files (electronic records) or in a locked filing cabinet (paper records) at NLCHI or Memorial University.

Data Collection

Data collection consisted of 2 main strategies:

1. Review of existing data sources/secondary data analysis:

- Data pertaining to pre-implementation expectations of the UPI/Client Registry was obtained from a review of existing documentation, including: (a) Report on a Unique Lifetime Health Identifier For Newfoundland and Labrador: An Analysis of Options and Implementation Strategies (1995)[5]; (b) Options and Issues Related to a Unique Personal Identifier for the Newfoundland and Labrador Centre for Health Information (1997)[6]; (c) the NLCHI Benefits Driven Business Case (1998)[1]; (d) the original UPI/Client Registry Project Charter[2]; (e) the UPI Due Diligence Studies (1999)[7] ; (f) the Hospital Insurance Plan and Medical Care Plan Out of Province Utilization Study (2002)[12], and (g) the BoB Project Charter (November 2003)[3]. A summary of this review is presented in **Appendix B**.

- Aggregate (anonymous) reports generated from the Client Registry were used to: (a) establish the quality of data in the Client Registry pre- and post-implementation; (b) identify the number of patients who presented for services, but were deemed ineligible for provincial insurance coverage.

- Data related to the Total Cost of Ownership of the UPI/Client Registry, and financial benefits arising from the project were obtained from existing project management documentation and previously conducted financial analysis studies.

2. *Primary Data Collection - Key Informant Interviews*:

Data pertaining to post-implementation realization of expectations and lessons learned, including barriers and facilitators for successful project implementation, were obtained from key informant interviews. Personnel interviewed for this study included:

- Staff of NLCHI: Director of Data Standards and Information
  Health Information Network (HIN) Project Lead
  HIN/CR1 Technical Lead
  UPI/Client Registry Integrity Unit Personnel
  UPI/Registration Subject Matter Expert (SME)
- Directors of Health Records for the Health Boards
- Registration and Laboratory Personnel in the largest institutional board
- Staff from the provincial Medical Insurance Plan (MCP)

All interviews were conducted by telephone by Dr. Doreen Neville and Ms. Kayla Gates, using interview guides developed for this study (see **Appendix A**). A total of 29 interviews were requested and 23 were obtained. Detailed notes were taken by both Dr. Neville and Ms. Gates, separately compiled and compared to ensure accuracy and completeness. Interview notes were analyzed according to key questions in the interview guide and major themes arising in the responses. **Appendix C** presents a summary of the participants and responses received.

It should be noted that the timelines for completing all key informant interviews had to be extended into February 2005, due to delays in the “go live” dates for several of the health boards.

Findings

Findings are organized around the two broad rationales for conducting the evaluation (accountability and knowledge transfer), and the research questions which were identified during the stakeholder meeting held in July 2004 and noted above.

Accountability

A. Benefits Anticipated and Realized from the Implementation of the UPI/Client Registry in Newfoundland and Labrador

A review of documents preceding the implementation of the UPI/CR project revealed that benefits anticipated included both short and long term benefits in the areas of health, IT, financial savings and capacity building (see **Appendix B**). These anticipated benefits were also identified in the process leading up to the development of the evaluation proposal for this project (see Table 2).

The key anticipated benefits of the UPI/CR project associated with accountability include:

Improved Access to Patient Demographic Information: Key informants indicated that the UPI/CR provided a more accurate list of the current system users, and enabled access to up-to-date demographic data on all their clients, including those who had not been recently seen in their facility. Health and Community Services Boards in particular found the project resulted in improved access to information, such as the client’s MCP number, which they previously did not have recorded in their database.

"When we look at Phase 1, once the information was in the UPI, it gave us access to information that we wouldn't have, like baby's first name. It allowed us to get a list of deaths province-wide with identifiers, so we could cull our records"

Improved Data Quality: The literature suggests that patient databases, such as the Client Registry, contain 5-10% duplicate entries[8,9]. Also recognized is that the number of entries that do not uniquely identify the patient and the number of entries which contain data errors are much more difficult to estimate.[10] Carine and Parrent[10] offer seven areas of focus for Patient Master Index (i.e. Client Registry) data integrity:

1. Inconsistent practices for collecting patient demographic data;
2. Inconsistent practices for recording patient demographics;
3. Inconsistent recording of default values;
4. Non-patient demographic data recorded in key demographic fields;
5. Unreliable data recorded in the registry (e.g. incorrect health insurance number);
6. Key demographic data items not recorded; and
7. Inappropriate characters recorded in data fields.

Key informant interviews confirmed that anticipated improvements in data quality had been achieved, in particular: (a) improved capacity to identify patients accurately; (b) elimination of duplicate patient files in health care facilities; and (c) elimination of duplicate or terminated patient identification numbers maintained in the provincial insurance payment program (MCP).

"The major benefit is improved ability to accurately identify patients."

"The information that's there is current…If we have patients coming from other institutions, their information is there….It's a better process and a time saver"

"The outcome was positive because it identifies duplicates we never would have looked at."

"We do have the ability to provide eligibility information at the point of registration, which is good for the institution and the MCP program as well."

In addition to findings from the key informant interviews, summary data generated through the Client Registry was used as an indicator of data quality pre- and post- implementation of the Best-of-Breed (BoB) Client Registry system (CR1) in Newfoundland and Labrador. Where possible, data was obtained for three time points prior to CR1 implementation (T1, T2 and T3), and at one time point following CR1 implementation (T4).

As shown in Table 3, the potential duplicate count in the original Client Registry decreased from T1 (214,682) to T3 (78,699), indicating an improvement in data quality over time. Immediately following CR1 implementation (T4), the number of potential duplicates increased to more than five times that in the old system, from 78,699 to 421,534 (or approximately 6% to 34%). Similarly, the number of records that contain incomplete demographics or a community code error increased substantially following the implementation of CR1. This increase is expected as it indicates the detection of additional data quality issues beyond that detected by the original Client Registry. These additional data quality issues will subsequently be resolved, enabling a higher level of data quality than could be achieved with the original Client Registry. This increase is partially a result of the added ability to identify data quality issues within source systems. The identification of data quality issues at the source system level provides feedback to individual registration departments regarding their adherence to registration protocols and indicates where measures could be taken to improve data quality. This was not possible with the original Client Registry (i.e. pre-CR1).

It is anticipated that CR1 will continue to improve data quality as more data quality issues are identified and resolved. In order to confirm this assumption, data quality will be continuously monitored, with additional measurements planned for T5 and T6.

Table 3. Data Quality Monitoring Reports

Report	Description	Pre- CR1			Post- CR1		
		T1	T2	T3	T4	T5	T6
Tasks	Potential duplicates within and across source systems	214, 682 (Mar/03)	141, 749 (Aug/03)	78,699 (Mar/04)	421,534 (Jan/05)	6 months	12 months
Incomplete Demographics	T1-T3 = Where either name, DOB, gender or address is missing T4-T6 = Where either name, DOB, gender or address is missing	not available	not available	29,944 (Mar/04)	133,737 (Mar/05)	6 months	12 months
Community Code Error	Where community name does not match valid entry in community table	not available	not available	64,554 (Mar/04)	313, 288 (Mar/05)	6 months	12 months

T1 – Early implementation, original UPI/CR
T2 – Mid-point between original UPI/CR and CR1
T3 – Immediately prior to CR1
T4 – Immediately following CR1 implementation
T5 – Post-CR1 follow up 1 (6 months)
T6 – Post-CR1 follow up 2 (12 months)

Financial Savings: With access to accurate demographics through the implementation of a Client Registry, there is the potential to increase both revenue and cost saving opportunities in a hospital setting. Two areas of financial benefit resulting from the implementation of the Client Registry in Newfoundland and Labrador were investigated as part of this evaluation: (1) increased revenues from non-resident hospital claims, (2) reduced physical storage of non-active medical records.

1) *Increased revenues from Non-Resident Hospital Claims*

In 2000, the government of Newfoundland and Labrador (NL) budgeted approximately $20 million for medical reciprocal billing (i.e., payment for claims for NL residents receiving hospital and/or physician services in other provinces). Two earlier studies carried out in Newfoundland and Labrador[11,12] estimated 5%-10% savings in out-of-province hospital and physician claims ($1.2-$2.2 million annually) would result from having accurate demographic information on residents of the province.

The findings of these two earlier studies suggested there was also the potential for increased revenues when former residents return to the province and present for hospital services with an eligible MCP card. When the Client Registry (i.e., via the hospital registration system) identifies an individual as a non-resident, the hospital can bill the jurisdiction in which the patient is now residing.

Key informants interviewed for this current evaluation confirmed that financial savings had been realized following the implementation of the BoB Client Registry (CR1) through the provision of eligibility information (for public insurance) at the point of registration. Given the new capability to determine MCP eligibility at the point of registration, an individual that is determined ineligible for coverage within Newfoundland and Labrador would be followed up by the institution's Finance Department to bill other jurisdictions for services provided.

In 2004, as part of the NL Client Registry evaluation, the evaluation team carried out a third Client Registry financial benefit study to investigate potential revenues lost to hospitals in 2000 (Pre-Client Registry), when former residents returned to Newfoundland and Labrador and presented for hospital services with an eligible MCP card. Full details of this study are presented in Appendix D-1; summary findings are described below.

Methodology

With no direct means of identifying residents who move to another province, a proxy identification using demographic data on canceled drivers' licenses were obtained from Division of Motor Vehicle Registration (MVR). Canceled drivers' licenses were considered a valid proxy given: 1) it is illegal to have a valid driver's license in more than one province and 2), the majority of Newfoundland and Labrador residents who move out of the province submit a claim for reimbursement for that portion of their license fee not used (Source: communication with MVR). Potential former residents in 2000 were identified by linking demographic data on individuals in the provincial insurance plan (i.e., MCP), to individuals who, in 1999, had a driver's license in another province; only potential former residents with eligible MCP numbers were used in the analysis.

Estimated In-Patient Revenues

In-patient MCP numbers for those patients which hospitals in the province billed another jurisdiction were linked to the provincial hospital discharge database and removed. There were 734 of these non-resident in-patient events identified, totaling 3,464 days stay in hospital. These events included non-residents and former residents no longer having eligibility under the provincial insurance plan. Following the removal of these non-resident events, discharges remaining in the provincial database were considered by the evaluation team as resident discharges paid for under the provincial insurance plan.

MCP numbers for potential former residents, obtained from linkage of the MVR and MCP databases, were then linked to the 2000 provincial hospital database. Any matches identified during this linkage would be considered a potential former resident, given in 1999 the individual had a canceled NL drivers license, and had obtained a license in another province. This process identified 343 discharges for potential former residents paid for under the provincial insurance plan. The total days stay in hospital for these patients was 3,143. The estimated percent of hospital days stay not billed for former residents was found to be 47.6% (3,143/3,143 + 3,464). Note that length of stay was used as the measure, given costs are billed on days stay, not number of discharges.

Estimated Out-Patient Revenues

In NL, unlike in-patient events, there is no provincial database for capturing data on out-patient events. Therefore, two approaches were considered in estimating the total number of out-patient events in the province in 2000 (i.e., the denominator); the more conservative of the two approaches was used in the final analysis (Appendix D-1). Regional hospital boards provided NLCHI with data on all out-patient events which were billed to another province (N=17,517). Without a provincial out-patient database to link to, the assumption was made that hospitals were as efficient at identifying former residents in an in-patient setting as they would be in an out-patient setting. That is, given hospitals in the province were potentially missing 47.6% of hospital days stay billable to another province, they were also missing 47.6% of out-patient events billable to another province. Using this assumption it was estimated that hospitals in the province were missing 15,913 out-patient events by former residents, and that these events were paid for under the provincial insurance plan ((17,517 / (1-0.476)) – 17,517).

Summary of Findings

As shown in Table 4, Newfoundland and Labrador hospitals admitted 62,717 patients and recorded an estimated 1,496,000 out-patient events in calendar year 2000. When considering only in-patient events, it was estimated that 1.2% of all events were for potential former residents, accounting for approximately 0.7% of the total length of stay (LOS). The average LOS for potential former residents was estimated to be 9.2 days.

When looking at the total LOS estimated for potential former residents, 47.6% was found not to have been billed to another province. A further 15,913 out-patient events for former residents were potentially not billed to another province. Combining potential revenues not captured for in-patient and out-patient events, the total lost revenue in 2000 is estimated at $3.95 million, or 0.48% of the combined budgets for all health Boards. Based on these estimates the investment in the Client Registry in Newfoundland and Labrador would be recouped in approximately 2.3 years.

Table 4. Indicators of Potential Hospital Revenue (2000)

INDICATOR	VALUE	FORMULA	
In-Patient Events (Admissions)			
Total In-Patient Events	62,717	A	
In-Patient Events per 1,000 Population	122.5	B	
Total Non-Resident In-Patient Events Billed to other Provinces	734	C	
Total Estimated Non-Resident in-Patient Events not Billed to other Provinces	343	D	
% Non-Resident In-Patient Events Billed to other Provinces to all Inpatients Events	1.2%	E	C/A
% Non-Resident In-Patient Events Not Billed to other Provinces to all Inpatients Events	0.6%	F	D/A
% Non-Resident In-Patient Events (Billed + Not Billed) to all Inpatients Events	1.8%	G	E+F
In-Patient Events (Total Length of Stay – TLOS)			
TLOS for In-Patient Events (days)	492,613	H	
Total Non-Resident In-Patient LOS Billed to other Provinces	3,464	I	
Total Estimated Non-Resident In-Patient LOS not Billed to other Provinces	3,143	J	
Estimated % Non-Resident In-Patient TLOS not Billed to other Provinces	47.6%	K	J/(I+J)
% Non-Resident In-Patient TLOS Billed to other Provinces to all Inpatients TLOS	0.70%	L	I/H
% Non-Resident In-Patient TLOS Not Billed to other Provinces to all Inpatients TLOS	0.64%	M	J/H
% Non-Resident In-Patient TLOS (Billed + Not Billed) to all Inpatients TLOS	1.3%	N	L+M
In-Patient Events (Estimated Revenues not Captured)			
Estimated Revenues[1] Not Billed to other Provinces for Non-Resident In-Patient Events	$2,200,000	O	$700xJ
Out-Patient Events			
Total Estimated Out-Patient Events[2,3]	1,496,000	P	
Estimated Out-Patient Events per 1,000 Population	2,922	Q	
Total Non-Resident Out-Patient Events Billed to other Provinces	17,517	R	
Total Percent Estimated[4] Non-Resident Out-Patient Events Not Billed to other Provinces	47.6%	S	K
Total Estimated[4] Non-Resident Out-Patient Events Not Billed to other Provinces	15,913	T	SxR/(100-S)
Out-Patient Events (Estimated Revenues Not Captured)			
Estimated Revenues[5] Not Billed to other Provinces for Non-Resident Out-Patient Events	$1,750,000	U	$110xT
Summary – Estimated Hospital Revenues Not Captured			
In-Patient Events	$2,200,000	V	O
Out-Patient Events	$1,750,000	W	U
Total Estimated Revenues for Non-Resident Events Not Claimed	$3,950,000	X	V+W
Total Hospital Boards Budget[6]	$819,000,000	Y	
% Revenue Not Billed to Total Hospital Budget	0.48%	Z	X/Y %

(1) Based on $700 per day stayed
(2) Estimated from ratio of in-patient claims submitted to total in-patient events
(3) See Appendix D (Table 2) for list of out-patient services captured
(4) Based on estimated percent of LOS not billed for former residents
(5) Based on $110 per out-patient event
(6) Global Funding

2) *Reduced physical storage of non-active medical records*

A reduction in the need for storage space associated with the culling of duplicate records and records of persons who have died was suggested as a possible benefit by one informant, but to date, this benefit had not been realized in their facility.

An analysis carried out by the Health Records Retention Committee in April 2003, estimated that, in the province of Newfoundland and Labrador, there were 26,000 linear feet of medical records in storage (2001). Available storage space for medical records is at a premium, and hospitals in the province have been shredding non-active charts (not accessed for 10-30 years), as a means for freeing up storage space in their facilities. Identification of patient deaths is one means of freeing up additional storage space for medical records in the hospital setting.

Prior to the implementation of the Client Registry (2001) in Newfoundland and Labrador, hospital health record departments were notified of patient deaths only for those that occurred in the hospital where the death occurred. If a patient died in hospital "A", and that patient also had a chart in hospital "B", only hospital "A" would know of the death and could remove the patient chart from active storage. Since 2001, reports generated from the Client Registry have been used to notify all hospitals of all deaths regardless of what hospital the patient died in. Based on calculations (see **Appendix D-2**), it is estimated that 76.2 linear feet of storage can be freed up for every 1,000 deaths. Using a conservative rental cost for storage (heated) at $10 per sq.ft./month, annual savings is estimated at $7,000 per 1,000 deaths (see **Appendix D-3**).

<u>Estimated rental costs using a 40'x30' storage area as an example</u>

Total Area 30' x 40' = 1,200 square feet

Total Linear Feet of Storage = 1,596 linear feet (See **Appendix D-2**).

2 shelf's (A) 30 feet long and 8 feet high (2 x 30 feet x 7 shelves) = 420 linear feet
7 shelf's (B) 24 feet long and 8 feet high (7 x 24 feet x 7 shelves) = 1,176 linear feet

Estimated Number of Charts that can be Stored = 1,596/76.2 = 21,000

Estimated Cost for Storage Space = 1,200 x $10/month x 12 = $144,000 per year

Estimated Annual Storage Cost per 1,000 Charts = 144,000/21,000 x 1,000 = $7,000.

Perhaps more important to consider than actual rental costs, is the ability of the building to hold the weight of the patient charts. Not all office space is designed to support the loads associated with densely packed paper files. Such a process requires selective tendering of rental space, which may increase the square footage cost, and/or severely limit rental options in a local area. It should be noted that information systems in the province currently do not allow for the refining of this benefit beyond the provincial level. It is also recognized that death clearance is only one small benefit with respect to storage space. With the evolution of the Electronic Health Record, and with it the digitizing of all heath records, significant savings in record storage will be realized.

<u>Increased capacity to achieve strategic goals</u>: Key informants identified 3 main aspects to the capacity enhancements which had been achieved in this area:

Cornerstone of an EHR: The majority of key informants identified the UPI/CR as a solid foundation for the development of a provincial EHR. It is viewed as a platform which facilitates the introduction of the next components of the EHR, specifically the Pharmacy

Network, Laboratory Network and DI/PACs. It is also regarded as a key achievement for Infoway in terms of creating a necessary element for a Pan Canadian EHR.

"The Client Registry is a building block, the bricks and mortar for the EHR and the Health Information Network in the Province."

"It is a platform for an electronic health record and other systems like pharmacy, diagnostic imaging and lab. You have to have a client registry to start that".

"The UPI/CR is a benefit to the province and Infoway…they have in place a key element for a Pan Canadian EHR."

Expertise: The successful implementation of the UPI/CR and CR1 were viewed as establishing the province and NLCHI as a leader in this technology. The technical expertise which was developed, along with the creation of the Toolkit and the Lessons Learned Document, were noted as contributing to overall expertise which is now available for the province and the country as a whole (additional details in **Appendix G**).

"On the whole it was a positive experience. It is exciting that it has come to fruition and that the province is on the leading edge of this technology".

"There is a Toolkit which was developed. All the specifications and working documents will go into a Toolkit which Infoway will provide to other jurisdictions."

Standardization of Procedures: Key informants identified the increased skill set among health records and registration personnel in the system as one aspect of capacity development which had occurred. In particular, the standardization of procedures around registration was deemed to be a positive outcome of the project.

"In terms of current benefits, some of them are just that it has everyone doing the same thing in the same way around registration."

"The UPI/CR has created a focus on data quality and standards across the province- a common dictionary, process and standards for registration."

B. Total Cost of Ownership

Total Cost of Ownership (TCO) refers to all costs incurred from planning, building, implementing, operating, and maintaining the Newfoundland and Labrador Client Registry. Items included in the Total Cost of Ownership are based on a province-wide Client Registry system that serves a population of approximately 520,000. Population size should be considered when using the Total Cost of Ownership of the Newfoundland and Labrador Client Registry System to determine resources required to implement and maintain a similar system in another jurisdiction.

The development and implementation of the Client Registry in Newfoundland and Labrador was carried out using a multi-step process. **Appendix E** presents a breakdown of costs for each phase of system development categorized under four major headings: 1) human resources, 2) establishment of the technical environment, 3) administrative expenses, and 4) other associated costs. Such detail will hopefully enable other jurisdictions to determine where they are able to leverage existing resources, such as infrastructure or office space, and where they require additional investment, at each phase of system development.

Tables in **Appendix E** show expected (budgeted) and actual costs associated with each phase of development. The near parallel expected to actual costs offers support for a thorough project scope prior to system development and implementation, as well as an indication of specific areas in which required resources are likely to be under or over estimated.

In addition to estimated personnel costs, human resources are presented as full time equivalents (FTEs). Identifying human resource requirements in terms of FTEs along with details of major responsibilities (**Appendix F**) will enable other jurisdictions to estimate the required resources based on their respective remuneration standards.

Table 5 below presents a summary of budgetary requirements (one-time costs and on-going maintenance costs) for each phase of system development. The one-time costs for the Client Registry project in Newfoundland and Labrador were approximately $8,935,999 and ongoing annual costs are estimated at $606,331. **It should be noted that the TCO reflects the fact that the final CR product was developed in 2 separate phases (the original UPI/CR and the CR1) which resulted in unavoidable duplication of some costs. These costs would likely not be incurred in other jurisdictions if they proceed directly to the implementation of the Best of Breed Client Registry Solution (CR1).**

In addition to the $8,935,999 one-time investment and the $600,000 in associated on-going costs**,** there were significant investments of time and expertise made available by Regional Health Boards (RHBs) and other participants throughout the project life cycle. Key participants included Directors of Information Systems, Admissions, and Medical Records as well as additional time allowed for employee involvement at the design, development and end user level. While stakeholder contribution is difficult to quantify, at the Regional Health Board level it is estimated that the project cost each participating jurisdiction approximately $20,000. Allotment of similar time has been made for other non-RHB participation. Non-RHB participation included the Department of Health and Community Services, Vital Statistics, MCP, NLCHI Board of Directors and NLCHI Project Steering Committee. A very conservative estimate of stakeholder contribution in the CR1 project is $200,000. The estimate includes project overhead such as telecommunications and travel costs.

Table 5. Total Cost of Ownership/Total Investment Summary

Development Phase	Cost (actual)	
	One-time	On-going (annual)
Pre-Infoway: RFP (2000)	$479,483	N/A
Pre-Infoway: UPI/Client Registry Implementation (2001)	$3,258,912	$399,000
Infoway: Client Registry Project Scope (2003)	$275,487	N/A
Infoway: 'Best of Breed' Client Registry Implementation (CR1) (2004)	$4,922,117	$606,331
TOTAL	**$8,935,999**	**N/A**

Note: Cost for each development phase may not sum to total 'official' investment due to slight differences in items that were included in and/or excluded from the calculation of each (official provincial investment = $3.6 M; official *Infoway* investment = $5.4 M).

Knowledge Transfer

A. Key Facilitators and Barriers to Successful Implementation

Key informant interviews **(Appendix C)** identified a number of key facilitators and barriers to successful implementation of the UPI/CR, as described below.

i.) Key Facilitators

Leadership: Shortly after NLCHI became operational in 1997, a Director of Standards position (later title change to Director of Data Standards and Information) was created and filled by a Health Records professional with extensive experience in the Newfoundland and Labrador health system. This individual undertook the task of starting to harmonize standards for data collection and coding in major health facilities across the province. The expertise of this individual has been recognized by provincial colleagues and counterparts in national organizations such as the Canadian Institute for Health Information (CIHI). This individual was well positioned to lead the business process end of the UPI/CR project and her leadership was identified as one of the key facilitators for successful implementation of the project, particularly with the original UPI/CR initiative.

"[the Director of Data Standards and Information] had a very good impact on the whole process. She had the qualities to get people to stick to timelines and is very articulate. Her lead was very beneficial."

Stakeholder Engagement Processes: In the original UPI/CR project, the major system users impacted were the Health Records Directors. This group met regularly with each other and the Director of Data Standards and Information for NLCHI for a number of years preceding roll-out of the first phase. Health Records Directors attended demonstrations of the new technology and were given an overview of what would be happening. This group of stakeholders continued their regular contact with the Project Team throughout the implementation of the BoB CR1 project as well, and felt that they were meaningfully engaged throughout the process.

"For the initial part of the UPI, there was very good requests of input from the health records perspective and the IT perspective. There was great opportunity for input and what impressed me was that those who were identified as having expertise in these areas were actually asked. Sometimes it is people who are further up in the organization who are asked, but they probably can't answer the questions…the realization was there that they had to ask the people involved in the system. I really did appreciate that."

Teamwork: The team which was assembled to implement the UPI/CR worked very well together and valued the unique contributions that both the technical and business process experts brought to the table. The Registry Integrity Unit (RIU) personnel worked well with this team, as did the health records and IT representatives from the provincial health care system. Several of the key Project Team members had extensive experience and credibility in the IT sector of the provincial health care system, most notably NLCHI's Health Information Network Project Lead and Health Information Network Technical Lead.

"We had a tremendous NLCHI project team"

Preliminary Efforts among System Users: It has been well recognized that the previous implementation of a similar hospital information system (Meditech) across the province and the development of the Client Referral Management System (CRMS), a province-wide information system for community health boards, facilitated the introduction of the UPI/CR. However, during the key informant interviews, other contributions from system partners were noted. The largest regional health board in the province was already moving ahead with hospital integration activities and had implemented one corporate identifier across their sites. Several of the other boards commenced clean up of their client databases in preparation for linking with the provincial database. The provincial health insurance plan, the Medical Care Plan (MCP), had also introduced some initial measures to eliminate duplicate or terminated numbers from their records.

ii.) Barriers Identified

Project Scope Challenges: The biggest challenge to successful implementation of the UPI/CR involved several changes in project scope related to the implementation of CR1, as noted below:

(1) During the latter stages of the project, both the stakeholders and the project team agreed that reversing an earlier scoping decision would result in a much more streamlined registration process. Since both parties agreed that the change was

crucial to a successful project implementation, substantial work was undertaken to accommodate this change.

"The project timeline was so long that business processes changed in the regions and had to be accommodated after the UPI/CR went live."

(2) The 2-way passive systems for CRMS and MCP had to be built, as opposed to "tweaking" the existing system, as had originally been anticipated.

(3) One site did not have a Magic Client System, and although this site was relatively small compared to the others, the adaptation of technology to meet their special circumstances required a disproportionate amount of time when compared to the total time allotted for the entire project.

(4) The Project Team originally expected to contribute 50 documents to the Toolkit, but this expanded to 92 by the end of the project.

Timing of the Implementation: CR1 went live in the first site during the summer months, when key personnel in the facility were on vacation. Several respondents from this site also indicated that they had received inadequate advance notice about the "go live" date. They felt users in the organization would have benefited from more training and preparation time before CR1 went live in their facility.

Shortage of Human Resources: Although the health system partners were receptive to, and supportive of, the UPI/CR project, including the CR1 enhancement, they remained under-resourced in terms of personnel who: (a) would be available to assist with training staff impacted by the technology; and (b) would be involved with the time consuming activity of database cleaning in response to information received from the Registry Integrity Unit. Despite previous clean up efforts by several regions in the province, a tremendous volume of potential duplicate records was identified when CR1 was introduced and most facilities, including the Registry Integrity Unit itself, required more resources to complete the database checking and cleaning activities.

Unanticipated Performance Limitations of the New Technology: While the overall response from the provincial health care system to the UPI/CR and CR1 has been positive, initial implementation of CR1 did not go smoothly in the hospital sector. This was due to technical difficulties associated with unanticipated interaction between the registration modules and the Community-Wide Scheduling Module in Meditech. Addressing this interaction required further development of the technology, including extensive consultation with the vendor. While the situation is improving, at the time of this study, time delays remained between the point at which the correct demographic information is filed at registration and the time when this information is promulgated within the hospital information system. Consequently, there were still organizations which are experiencing concerns about when and where it is appropriate to query the UPI/Client Registry following the initial contact with the patient at registration. The NLCHI Project Team is working to resolve these issues with the vendors and the stakeholders.

The Community sector experienced fewer problems with implementation of CR1, as they have 2-Way Passive and Query (web) interfaces only with the Client Registry. Overall, the users are very pleased with their improved access to patient information, including date of birth and the MCP number. They have reported incidences where unexpected linkages between old and new files on the same client have been made, and are addressing this issue with the IT personnel who maintain the CRMS database.

Exclusions from the Province-Wide System: Currently, the provincial Vital Statistics Division, Department of Government Services and Lands, does not have an active interface with the UPI/CR. As a result, one of the NLCHI staff members receives monthly readouts of registered events from Vital Statistics, checks it against the Client Registry data and manually enters in any changes required. This process is affectionately labeled "sneaker net" by NLCHI. In light of the interconnectivity between all the other major players in the health care system, the continued exclusion of the major steward of vital demographic data in the province from the Client Registry initiative is a continuing barrier to achieving the full potential of the UPI/CR technology.

B. Lessons Learned and Recommendations for other Jurisdictions

Previously, NLCHI prepared a document for Canada Health Infoway which summarized the key lessons learned from the perspective of the CR1 Project Team (January 2005). Key informant interviews conducted as part of this evaluation project also addressed the issue of lessons learned, but solicited feedback from a wider range of stakeholders, including both members of the implementation team and the users of the system. Below, we summarize the findings regarding key lessons identified by our respondents using, where possible, headings similar to those used in the January 2005 report.

Planning/Scoping of the CR1 project.

The issue:

The scoping/planning process for the Best of Breed (BoB) Client Registry (CR1) commenced in January 2003 and was conducted over a 3 month period. This 3 month planning process identified resources and costs along with high level business and technical requirements. However, implementation of CR1 did not commence until the summer of 2004. During this period, the business processes around registration in the institutional health boards changed in a significant manner. Specifically, the hospitals began to use the Community-Wide Scheduling Module in Meditech to complete all of their registrations. An earlier decision regarding the level of interaction between the Client Registry and this Meditech module was reversed during implementation in order to ensure successful completion of the project. Consequently, implementation of CR1 did not proceed as smoothly as anticipated and post-implementation adaptation of the technology was required to accommodate the new business processes.

Several factors appear to have contributed to this situation. The first of these is time. The timeline between the initial assessment of the business processes and the "go live" date at the first site was long enough that it was possible for a significant change to occur in the way facilities register patients.

The second factor was that regular audits of the business processes in the sites leading up to the implementation of CR1 were not conducted. NLCHI did recruit a registration subject matter expert (SME) from the first site scheduled to go live with CR1 to assist with the project design and implementation. This individual, however, worked in the main office of NLCHI and was able to conduct only one audit during the time the system was being developed.

Another area where problems surfaced involved the development of the Toolkit. "Scope-creep" appears to have resulted in the expansion of the Toolkit from the originally anticipated 50 documents to 92 documents upon completion. There were a number of reasons contributing to this and required a great deal more time commitment from the Project Team than was originally anticipated.

Recommendations

- **CONDUCT REGULAR AUDITS OF BUSINESS PROCESSES**: Health care settings are dynamic and continuous monitoring/auditing of business processes is required throughout the development of the new technology, during the implementation period and for several weeks/months post-implementation as well. The experience in Newfoundland and Labrador would suggest that regular auditing is particularly important if: (1) the new technology is assumed to be an enhancement of an existing system and therefore does not require as extensive a scoping exercise as a major installation would need; and (2) the time delay between the scoping exercise and the implementation is significant.

- **ESTABLISH A MOU/AGREEMENT WITH STAKEHOLDERS**: Working jointly on a project with stakeholders in a dynamic environment requires that all parties concerned agree upon the ways that they will work together and communicate about changes required. Experience with this project suggests that adherence to Project Management best practices are essential. With respect to dealing with the end-user stakeholders, particular attention should be paid to: (1) developing Terms of Reference for committees established in the course of planning and implementing the technology; (2) discussing the types of activities/changes in business processes, existing technology or other modifications in the host environment which would impact on the project scope. These changes should be communicated formally to the technical teams developing the new technology; and (3) continuously reviewing the list of front-line workers who will be impacted by the technology to determine if any user groups have inadvertently been excluded in the communication and change management plans. When dealing with the funding agency, it is important that changes in expectations/deliverables be negotiated in a manner that recognizes the impact of such changes on resources available to complete the entire project.

- **PLAN FOR MORE CHANGE MANAGEMENT**: Since CR1 was an enhancement of the original UPI/CR project, it was anticipated that change management requirements would be minimal. However, experience with this project suggests that you should always plan for more change management time and resources than you think you will require, as new end users may be identified at any point in the planning/implementation process. Education of all front-line workers who will be impacted by the system should take place prior to implementation, and this training should involve the business and technical team at both the project management site and the host site.

- **TEST IN THE REAL SYSTEM**: No matter how thorough the scoping exercise and technology development activities are, there will always be unanticipated problems once the system goes live. These problems may be minor, but if they occur in a high volume site, the impact can still be substantial. Whenever possible, it is preferable to conduct limited testing of the real system on site (versus a test system in the lab) to identify glitches in how the technology will work.

Stakeholder Relationships: Engagement and Communications

The issue:

NLCHI has a long history of successful stakeholder engagement, which was very much valued and evident in the original UPI/Client Registry project implementation. An initial province-wide stakeholder consultation was complemented by monthly meetings among key stakeholders in the system (e.g. Health Records Directors). A high degree of trust and open communication characterized this implementation process.

However, this level of engagement, open communication and trust was not experienced to the same extent during the implementation of the BoB CR1 project. As noted previously by the CR1

Project Team (January 2005), “Due to the full change management assessment for the initial UPI system implementation in 2001, it was anticipated that change management relative to the CR1 project would be minimal….As a result, communication would be limited to informal tactics such as sending “screen shots” of the graphical user interface or making phone calls to the region” (p.17). The CR1 team did hire a hospital registration SME and continued monthly meetings among the Health Records Directors. Nonetheless, the respondents in the evaluation study supported the perception of the Project Team that “The CR1 project could have benefited from improved communications” (p.18). The problems with communication were most pronounced in the first site to go live with CR1.

There are two major factors which appear to have contributed to the problems experienced with stakeholder communications during CR1. The first of these was the absence of a plan to continuously engage system stakeholders other than the Health Records and IT Directors. The Health Records Directors in particular have a strong history of working together through monthly meetings on a variety of issues, including the original UPI/CR project and the CR1. They also had the experience of working well with NCLHI personnel on a number of other projects. IT Directors in the facilities also had regular communications among themselves and with NLCHI. However, other key stakeholders for CR1, such as the registration personnel in each facility, did not have pre-existing communications vehicles, and did not have extensive knowledge or experience dealing with NLCHI personnel. When problems arose with the implementation of CR1 in the first site, the front-line registration staff, and staff who registered patients for various procedures throughout the hospital (such as lab and x-ray), were impacted by the confusion and patient line-ups which were common until the necessary technical adjustments were implemented. There was no pre-existing engagement strategy or trust relationship between these staff and NLCHI personnel which could have buffered the inevitable frustration that accompanies the initial roll-out of any new technology.

The second factor appears to have been a resource issue, compounded by timing. The CR1 went live in the first facility during the summer months, when typically fewer personnel are available to perform regular work routines, let alone trouble shoot or develop communications plans to deal with newly identified problems. Personnel at NLCHI were also stretched to the limit with the demands associated with completion of the (greatly expanded) Toolkit and preparations for implementation of CR1 in the other sites. The Project Team consequently: (a) did not deploy personnel **on–site** to monitor the situation post- implementation of the CR1 in the first region; and (b) their responses to the initial reports that all was not well with the CR1 implementation in the first region could have been more timely. That being said, once the problems identified with the registration processes in the first site were realized, regular weekly teleconferences involving the affected stakeholders (registration personnel) were put in place and technical solutions were developed to address the changes in business processes which had occurred.

Recommendations

- **EXPAND STAKEHOLDER ENGAGEMENT**: NLCHI’s established processes for stakeholder engagement and communication are the foundation of its success to date. These processes were critical in the development of Newfoundland and Labrador’s potential for a province-wide EHR and should be continued. However, the difference in the experiences between the original UPI/CR project and CR1 suggest that it is vital with each new project/project enhancement to identify changes in the user groups impacted by the technology and include them in communications and change management plans. With respect to CR1, fuller engagement of registration personnel from both the institutional and health and community services boards was required.

- **ENHANCE COMMUNICATION PLANS**: As time-consuming and costly as a full communications plan can be, the absence of one can have a significant detrimental impact on stakeholder acceptance of a new intervention and their willingness to support future initiatives. In particular, it is important to ensure that adequate personnel are available to respond in a timely manner to feedback from user groups during the implementation phase at each site.

- **MAINTAIN VISIBILITY DURING THE IMPLEMENTATION PHASE**: While it may not be possible to provide on-site personnel to monitor the implementation of new technology at every site, this project's experience would suggest that it is very important that members of the implementation team are visible to the front line users at the first and the biggest sites. It is more likely that problems in implementation will occur early in the roll-out, and the impact of these problems will be most pronounced in facilities with high volumes of registrations.

Resource Requirements

The issue:

This evaluation identified several areas where limitations in human resources impacted the planning, implementation and post-implementation monitoring of the UPI/CR. These included:

- Inadequate auditing of business processes in the sites post the project scoping exercise;
- Time delays in responding to user concerns about the CR1 implementation in the first site;
- Constrained capacity to address expanded expectations of the Toolkit;
- Incomplete training of all potential users in the facilities; and
- Constrained capacity to complete database cleanup activities, given the volume of potential duplicate reports.

Recommendations:

- **ANTICIPATE ADDITIONAL RESOURCE REQUIREMENTS:** It is important to recognize that additional human resource capacity requirements over and above those anticipated during the project scoping exercise are likely and to plan accordingly. This is critical in terms of personnel available for both the business process and IT components of the project team. Host site capacity can vary substantially in terms of human resources over the lifespan of a major technology implementation. In addition, changes in project scope are inevitable and the team should have sufficient capacity to address the unexpected.

CONCLUDING REMARKS

NLCHI implemented a UPI/Client Registry in 2001. This project saw the design, development and implementation of a provincial client registry system, and included the deployment of interfaces between the client registry and various stakeholder systems. The successful implementation of the unique provincial registry system established NLCHI as a leader in health informatics in Canada.

The Client Registry (CR1) health informatics project, funded by Canada Health Infoway, was implemented between April 2003 and January 2005. This project was designed to provide Newfoundland and Labrador with a Best-of-Breed Client Registry system and achieve the first step toward realizing Canada Health Infoway's mandate of creating an interoperable pan-Canadian Electronic Health Record (EHR).

In the fall of 2004, Canada Health Infoway and NLCHI agreed to partner in the development of an evaluation study which would assess and report on the development and implementation of the Client Registry Project in Newfoundland and Labrador. This evaluation study was funded by *Infoway* and led by Dr. Doreen Neville, Associate Professor of Health Policy and Health Care Delivery in the Faculty of Medicine, Memorial University of Newfoundland.

The evaluation was conducted over a six month period, commencing in November 2004. Using a pre- and post-implementation design, the study employed a variety of methods including: (a) primary data collection through key informant interviews; and (b) secondary analysis of existing data sets and reports.

Several key take-away messages were identified from the evaluation study:

1. As a result of *Infoway*'s $5.4 M financial investment in the CR1 project in NL, the following outcomes were achieved:

    (a) A reusable client registry solution which can be shared with other jurisdictions was successfully developed and implemented, on time and on budget;

    (b) A Toolkit and Lessons Learned Document were developed by the Project Team and can serve as major knowledge transfer vehicles for other jurisdictions planning a similar initiative;

    (c) An evaluation report which highlights the major benefits achieved and key facilitators and barriers for successful project implementation is available and can be shared across Canada;

    (d) An evaluation methodology which can inform evaluation efforts in other jurisdictions has been tested and validated;

    (e) A successful implementation experience involving national, provincial and regional health information stakeholders has been gained. The CR1 project enhanced the capacity of all partners involved and laid a foundation of trust and expertise which can facilitate future collaboration.

2. Study findings show that the anticipated benefits associated with the Client Registry have been achieved. Major benefits that have been realized include:

   (a) improved access to patient demographic information;

   (b) improved data quality;

   (c) financial savings through: i) increased revenues from non-resident claims and ii) reduced physical storage of non-active medical records.

   (d) enhanced capacity to achieve strategic goals.

3. The Total Cost of Ownership for the Best of Breed Client Registry in Newfoundland and Labrador was $8.9M in one time costs and approximately in $600,000 annual ongoing costs. Estimates provided by NLCHI indicate that improved capacity to identify clients who are not eligible to receive services under the provincial health insurance plan coverage will save the province an estimated $3.9M annually (or 0.48% of the health boards annual budget) arising from ineligible out-of province claims. The Client Registry project should pay for itself in less than 3 years.

4. NLCHI, *Infoway* and the Health System partners experienced many unanticipated challenges throughout the course of the CR1 project, but were able to work successfully through them to achieve the project goals.

5. The evaluation approach, based on the *Evaluation Framework for EHR Initiatives* and elaborated in collaboration with the *Infoway* partners, can be applied to future Client Registry Projects across Canada.

The evaluation team enjoyed the experience of working with key stakeholders in the Client Registry project to complete the study. It is hoped that the information contained in this report provides a useful summary of the outcomes and benefits achieved as a result of the Client Registry project in Newfoundland and Labrador and identifies important considerations for future EHR project implementation and evaluation initiatives.

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GLOSSARY OF TERMS

Accountability: a type of governance. Specification of what a person or group is responsible for, to which a person or group is accountable for. Any contract, agreement, or other statement that formalizes the relationship.

Active Interface: Active refers to a real-time direct 'hit' off the centralized data repository. That is, if a patient shows up, the clerk at registration desk can do an 'active query' off the client registry, meaning that it will immediately take the client's data from the client registry (i.e. source of truth) and active interface allows this data to populate the fields in Meditech ADM (registration) module.

Acute Admission: admission to a health care facility with a service code other than that for long term care or rehabilitation.

Architecture: the physical construction or design of a computer system and its components.

Billable Days: Hospital days stayed that can be billed to another jurisdiction.

Clinical Database Management System (CDMS): stores demographic, clinical and procedural data collected by health agencies (Hospitals and Heath Centers) on all Acute Care, some Long Term Care, all Surgical Day Care, and some Medical Day Care patients. The information includes Newfoundland and Labrador residents receiving care in Newfoundland and Labrador provincial health agencies and out of province residents receiving care in Newfoundland and Labrador health agencies.

Client and Referral Management System (CRMS): a system which consists of two components: 1) a client management component to assist Health and Community Services in managing demographics, needs, service plans, and specific services for their clients; and 2) a referral management component which provides a standardized method of identifying all requests.

Consent: voluntary agreement by an individual or his or her legally authorized representative to collect, use or disclose his or her own personal information. Consent can be *express*, where an individual specifically agrees to some action, or *implied,* where consent is understood by an action by the individual. When the process of implied consent is used by the custodian, the individual has the right to refuse consent.

CR1 Project: led by the Newfoundland and Labrador Centre for Health Information (NLCHI), this initiative supports the development of a reusable jurisdictional client registry by using best-of-breed components from existing systems and capitalizing on NLCHI's knowledge and experience in this area. The final deliverable is a reusable client registry solution.

Due Diligence: The process of investigation, performed by investors, into the details of a potential investment, such as an examination of operations and management and the verification of material facts.

Department of Health and Community Services (DHCS): the department within the Newfoundland and Labrador provincial government responsible for providing a leadership role in health and community services programs and policy development for the Province; the actual delivery of programs and services are provided by community health boards. The Department provides support services to six Regional Institutional Boards, four Regional Health and Community Services Boards, two Regional Integrated Boards and one Regional Nursing Home Board in St. John's.

Full-Time Equivalent (FTE): a computed statistic representing the number of full-time employees that would be required if the total number of hours worked by all part-time employees was worked by full-time employees.

Health and Community Services Board: responsible for health promotion, disease prevention, child welfare and community corrections, family and rehabilitative services, addictions, mental health, and continuing care.

Integrity: the preservation of the information's quality and accuracy of data content throughout storage, use and retrieval so there is confidence the information has not been modified in any way other than as authorized.

Interoperability: The ability of two or more systems to exchange information or function together.

Institutional Health Board: responsible for hospital services and long-term residential services to persons over 65 and persons suffering from chronic debilitating diseases.

Integrated Health Board: responsible for both community and institutional health. Also see *Institutional Health Board* and *Health and Community Services Board*.

Inpatient Service: service where a patient is admitted to a hospital for at least one night.

Medical Care Commission: the provincial organization responsible for determining medical service eligibility for residents.

Meditech (Medical Information Technology Inc.): a software and service company that provides system integration solutions to the medical community. Their information systems are installed in health care organizations worldwide, and provide financial and clinical data systems used primarily in acute care facilities.

MCP Eligibility: Whether card holder is eligible for medical insurance under provincial medical insurance plan (MCP).

Newborn Metabolic Screening: a provincial program to conduct blood screening of all newborns two to three days after birth to test for congenital anomalies.

Outpatient Service: service where a patient receives medical treatment, but is not admitted to stay overnight.

Out-of-province Medical Claim: a claim made for reimbursement of medical care costs incurred while outside the province of Newfoundland and Labrador.

Passive Interface: Passive refers to transactions that occur 'in the background' - for example, after a registration in the Meditech system the updated patient demographic information is sent to the client registry (centralized data repository) - depending on the source system, this update to the client registry could take minutes, hours or days. **Two-way Passive** refers to the information being transmitted from both the Client Registry to the source system as well as from the source system to the Client Registry.

Provincial Medical Insurance Plan: the provincial medical insurance plan for Newfoundland and Labrador is the Newfoundland Medical Care Plan (MCP). MCP provides coverage to bonna fide residents of the province for medical care and certain surgical-dental procedures preformed in hospital.

Primary Registration Point: the first contact point a patient has at a health care facility.

Query: the act of requesting information from a database.

Reciprocal Billing: a claim processing arrangement between all Canadian provinces and territories (except Quebec). Under the Reciprocal Billing Agreements, a beneficiary's home province is billed for the cost of medical services that the beneficiary receives elsewhere in Canada.

Registration: the service area in a facility responsible for registering patients at each visit, and for capturing accurate demographic data.

Registry: directory-like system that focuses solely on managing data pertaining to one conceptual entity. The primary purpose of a Registry is to respond to searches using one or more pre-defined parameters in order to find and retrieve a unique occurrence of an entity. Examples of registries include: Client Registry, Provider Registry, Location Registry, and Consent Registry.

Registry Integrity Unit (RIU): the organization responsible for the file maintenance of the UPI/Client Registry.

Research Ethics Committee: an independent board, committee, or similar body authorized to review and approve research involving personal information under a law of Canada or Newfoundland and Labrador, or under applicable international and national research ethics standards.

Stakeholder Systems: the computer systems (e.g., MCP, CRMS, Meditech) used by UPI/Client Registry stakeholders (e.g., Institutional/Integrated Regional Health Boards, Department of Health & Community Services, Community Health Boards, Medical Care Commission) that interface with and exchange data with the UPI/Client Registry database.

Scoping Exercise: the task of determining, in detail, the work required to meet the project's goals; states what is included in, or excluded from, the project.

Secondary Registration Point: any registration point at a health care facility beyond the first registration point (e.g. blood collection, clinic, x-ray).

Vital Statistics: a division of the Newfoundland and Labrador Department of Government Service and Lands, responsible for registering births, marriages, deaths, adoptions and legal name changes.

APPENDIX A
Forms submitted for Ethics Approval, including Study Instruments

Initial Contact Letter emailed to Potential Study Participants

Background

This study is designed to measure the costs and benefits resulting from the implementation of the Unique Personal Identifier/Client Registry Best of Breed (BoB) Project in the province of Newfoundland and Labrador.

Objectives

1. What health system benefits were anticipated and realized arising from the implementation of the Client Registry in Newfoundland and Labrador?
    - What were the projected benefits?
    - What are the actual benefits realized (to date)?
2. What is the total cost of ownership of the Client Registry in Newfoundland and Labrador?
    - What were the projected costs?
    - What are the actual costs?
3. What were the key facilitators and barriers to successful implementation of the Client Registry in Newfoundland and Labrador?

Description of Study Procedures

We are seeking consent from all potential participants (i.e., thirteen (13) regional Health Record Directors, three (3) Registry Integrity Unit staff, NLCHI's Director of Information and Standards, NLCHI's Technical Lead of the Health Information Network, and MCP's Manager of Public Service and Administration) to participate in this study. You will be contacted by the research analyst working on the study (Ms. Kayla Gates) to ask for your participation in the study. With your consent, an interview time will be arranged. The interview will be conducted by telephone and will take approximately 40 minutes to complete. The interview will be conducted by the Principal Investigator, Dr. Doreen Neville, with one other member of the study team present to document responses.

Confidentiality

Documentation of your participation in this study will be maintained at the Newfoundland and Labrador Centre for Health Information (NLCHI) until such a time that it is no longer required for further evaluations of the Health Information Network (approx. 5 years). Only the Principal Investigator (Dr. Doreen Neville) and authorized NLCHI staff will have access to any confidential documents pertaining to your participation in this study that may identify you. Furthermore, your name will not appear in any report or article published as a result of this study.

Questions:

If you have any questions about taking part in this research, you can meet with, or contact, the Principal Investigator who is in charge of this study at the Faculty of Medicine, Memorial University of Newfoundland. That person is:

Dr. Doreen Neville Phone: 777-6215 e-mail: DNeville@mun.ca.

Thank you very much for taking the time to inform yourself about this study.

Doreen Neville
Kayla Gates

Elements of Informed Consent – Emailed to Key Informants prior to Interview

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

Sponsor: **Canada Health Infoway**

You have been asked to take part in a research study. It is up to you to decide whether to be in the study or not. Before you decide, you need to understand what the study is for, what risks you might take and what benefits you might receive. This consent form explains the study.

The researchers will:

- Discuss the study with you
- Answer your questions
- Keep confidential any information which could identify you personally
- Be available during the study to deal with problems and answer questions

You may decide not to take part in, or leave the study, at any time.

Background

This study is designed to measure the costs and benefits resulting from the implementation of the Unique Personal Identifier/Client Registry Best of Breed (BoB) Project in the province of Newfoundland and Labrador.

Purpose

The purpose of this study is to determine the perceptions of the Unique Personal Identifier/Client Registry post-implementation among key informants involved in this new system.

Description of the Study Procedures

If you are willing to be interviewed, a research analyst will arrange a time for a telephone interview.

Length of Time

The interview will take approximately 40 minutes to complete.

Possible Risks and Discomforts

There are no anticipated risks and discomforts associated with this study. However, participants will be asked to give freely of their time and will be asked to provide honest feedback.

Benefits

It is not known whether this study will benefit you personally.

Liability Statement

You will be contacted by the research analyst working on the study (Ms. Kayla Gates) to ask for your participation in the study. If you verbally consent to participate in the study, this tells us that you understand the information about the research study. When you consent to participate, you do not give up your legal rights. Researchers or agencies involved in this research study still have their legal and professional responsibilities.

Confidentiality

Your name will not appear in any report or article published as a result of this study. By verbally agreeing to participate in the study, you will be giving your permission for this inspection of information given by yourself during your participation.

Questions

If you have any questions about taking part in this research, you can meet with, or contact, the Principal Investigator who is charge of this study at the Faculty of Medicine, Memorial University of Newfoundland. That person is:

Dr. Doreen Neville Phone: 777-6215 e-mail: DNeville@mun.ca.

Or you can talk to someone who is not involved with the study at all, but can advise you of your rights as a participant in a research study. This person can be reached through the:

Office of the Human Investigative Committee (HIC) at (709) 777-6974 (HIC@mun.ca)

Conflict of Interest Statement

Three co-investigators of this study are employees of the Newfoundland and Labrador Centre for Health Information and therefore may have a particular interest in the success of the study.

Key Informant Interviews - Initial Contact Telephone Script

Hello Mr. /Ms. _______________

This is Kayla Gates calling. I am working with Dr. Doreen Neville on a study in which we are measuring the costs and benefits resulting from the implementation of the Unique Personal Identifier/Client Registry in Newfoundland and Labrador.

Approximately one week ago, you were sent a letter, via email, that describes the study as well as a document that outlines exactly what your participation in the study would entail. As you read in those documents, participation in the study is voluntary and confidentiality of all information is ensured.

I am calling now to ask for your participation in the study. This will involve participating in a telephone interview in which you will be asked a series of questions regarding your perceptions of the Unique Personal Identifier/Client Registry. Are you willing to volunteer approximately 40 minutes of your time to participate in the study?

(If the individual agrees to participate) Shall we go ahead and schedule a time for the interview?

Scheduled interview date/time: ____________________________

Thank you very much Mr./Ms. ____________________________. You will be contacted by the Principal Investigator in charge of the study, Dr. Doreen Neville, on *(interview date/time)* at which time the interview will take place.

We look forward to speaking with you again.

Key Informant Interview Telephone Script

Hello Mr. /Ms. _______________

This is Doreen Neville calling. As Kayla indicated I would, when she spoke with you previously, I am calling now to ask you a few questions regarding your perceptions of the Unique Personal Identifier/Client Registry in Newfoundland and Labrador.

Before we begin, I want to let you know that Kayla *(or Mr. Don MacDonald*) is also present and that both of us will be taking notes during the interview.

Do you have any questions before we begin?

(see interview guides)

Thank you very much Mr./Ms. ____________________________. Your participation and time is very much appreciated.

Key Informant Interview Guide – Health Record Directors

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

1(a) What do you feel have been the major benefits of the UPI/Client Registry Project so far?

1(b) What do you think the future benefits will be?

2(a) What aspects of the implementation went well? What factors helped it go well?

2(b) What aspects of the implementation were challenging or could have been improved? What factors contributed to the problems with implementation?

3) Were there unintended consequences as a result of introducing the UPI/Client Registry Project? If so, what were they?

4) What type of feedback have you received from the Registry Clerks and Health Records staff regarding the UPI/Client Registry in your region?

5) What functions of the UPI/Client Registry do you find to be the most useful?

6) On a scale of 1 to 5, with 1 being not at all useful and 5 being extremely useful, how would you rate the following reports:

a)	Potential Duplicates	1	2	3	4	5
b)	Birth Report	1	2	3	4	5
c)	Death Listing	1	2	3	4	5
d)	Alias Report	1	2	3	4	5

7) Are there any additional reports you would like to see generated?

8) On average, how much time per week does your RIU contact person spend on the phone with RIU?

00-15 minutes { }
16-30 minutes { }
31-45 minutes { }
46-60 minutes { }
> 60 minutes { }

9) Have you initiated any changes in your business processes as a result of the data and/or reports provided by the RIU?

Yes { } No { }

If so, what changes have you made?

10) One a scale of 1 to 9, where 1 is strongly disagree and 9 is strongly agree, please rate the following statements:

a)	The UPI/Client Registry is beneficial	1 2 3 4 5 6 7 8 9
b)	The UPI/Client Registry provides me with useful information	1 2 3 4 5 6 7 8 9
c)	The UPI/Client Registry is an effective building block for an Electronic Health Record	1 2 3 4 5 6 7 8 9
d)	The feedback that I have received from Registration Clerks in my region regarding the implementation of the UPI/Client Registry has been positive	1 2 3 4 5 6 7 8 9

11) What if any, take away messages or lessons learned would you consider important for Health Record Directors in other jurisdictions to be aware of before they undertake a UPI/Client Registry Project?

12) Do you have any other comments/suggestions?

Thank you for your time and participation.

<u>Key Informant Interview Guide – Registry Integrity Unit Staff</u>

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

1) What was your role in the development of the Client Registry?

2) What was your role in the process of implementing the Unique Personal Identifier as a building block for an Electronic Health Record?

3) What are your responsibilities as a staff member of the Registry Integrity Unit?

4) About what proportion of your time is spent cleaning data?

5) About what proportion of your time is spent compiling reports?

6) About what proportion of your time is spent merging client data?

7) What do you feel are the benefits of the Unique Personal Identifier/Client Registry?

8) What do feel are the potential future benefits, if any, of the Unique Personal Identifier/Client Registry?

9) What do feel are the challenges, if any, of the Unique Personal Identifier/Client Registry?

10) What do feel are the potential <u>future</u> challenges, if any, of the Unique Personal Identifier/Client Registry?

11) Is there anything else, in relation to your role as a staff member of the Registry Integrity Unit that you would like to give us feedback on?

Thank you very much for providing valuable feedback on the current roles and responsibilities of the Registry Integrity Unit.

Key Informant Interview Guide – Director of Data Standards and Information

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

I will ask you a series of questions directly related to your involvement in the development of the Unique Personal Identifier/Client Registry in Newfoundland and Labrador

1) What has your role been in the development and maintenance of the Unique Personal Identifier/Client Registry?

2) What was the process for communicating with the necessary individuals and groups to develop the Client Registry?

3) What issues and/or elements of registration need to be addressed or brought to the attention of the registration clerks?

4) What is your continuing role in the maintenance of the Unique Personal Identifier/Client Registry?

5) What do you feel were the major benefits of the Unique Personal Identifier/Client Registry to date?

6) What do you think the future benefits of the Unique Personal Identifier/Client Registry will be?

7) What aspects of the implementation went well?

8) What aspects of the implementation were challenging, or could have been improved?

Thank you for your time and participation.

Key Informant Interview Guide – Technical Lead, Health Information Network

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

I will ask you a series of questions directly related to your involvement in the development of the Unique Personal Identifier/Client Registry in Newfoundland and Labrador

1) What has your role been in the development and maintenance of the Unique Personal Identifier/Client Registry?

2) What was the process for communicating with the necessary individuals and groups to develop the Client Registry?

3) Was the required infrastructure and equipment in place or built during system implementation?

4) How well were the regional stakeholders able to work together and with NCHI during system development and implementation?

5) What is your continuing role in the maintenance of the Unique Personal Identifier/Client Registry?

6) What do you feel are the major benefits of the Unique Personal Identifier/Client Registry to date?

7) What do you think the future benefits of the Unique Personal Identifier/Client Registry will be?

8) What aspects of the implementation went well?

9) What aspects of the implementation were challenging, or could have been improved?

Thank you for your time and participation.

Key Informant Interview Guide – MCP's Manager of Public Services and Administration

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

I will ask you a series of questions related to the impact of the Newfoundland and Labrador Unique Personal Identifier/Client Registry had/has on the business processes at the Medical Care Commission.

1) When did MCP first have access to the UPI/Client Registry?

2) How does MCP currently access the UPI/Client Registry (e.g., one-way passive, two way passive, active, etc.), and has this type of access changed since implementation of the Registry?

3a) If the type of access **has changed**, what changes in business practices have you experienced because of this?

or

3b) If the type of access **has not changed**, are there any changes in the current type of access you would like to see, and if so, why?

4) What aspects of the implementation went well?

5) What aspects of the implementation were challenging, or could have been improved?

6) Has the implementation of the UPI/Client Registry resulted in any change management issues at MCP? If so, what were they and how were the addressed.

7) Has the implementation of the UPI/Client Registry resulted in any resource (human or financial) efficiencies at MCP? If so, what were they?

8) MCP currently receives several reports from the Registry Integrity Unit at NLCHI. I will name a report and I would like you to indicate if this report provides any value to MCP, and if so, why?

Report Code	**Description**
E2	PIN number not numeric
E3	Beneficiary not on file
E4	Beneficiary has been purged
E5	Postal code invalid
E6	Address exceeds maximum length
E8	Phone number is out-of-province
E9	Inactive pins updated
E10	Neonatal beneficiary updated
E11	Beneficiary termination - deaths

Thank you for your time and participation.

Key Informant Interview Guide - Registration and Health Records Department Data Integrity Staff

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

1) What is the relationship between you/your staff's day-to-day work processes and the UPI/Client Registry?

2) What aspects of the UPI/Client Registry do you/your staff find useful?

3) Has their been any changes in your/your staff's day-to-day work processes as a result of the implementation of the UPI/Client Registry system? If so, what are they?

4) Were there any unintended consequences as a result of introducing the UPI/Client Registry? If so, what are they?

5) What role did you/your staff play in the development and implementation of the UPI/Client Registry?

6) a) What aspects of system implementation went well?

   b) What aspects of system implementation were challenging or could have been improved?

7) Do you feel that you/your staff had sufficient training with the implementation of the UPI/Client Registry?

8) a) What do you feel are the major benefits of the UPI/Client Registry?

   b) What do you think the future benefits will be?

9) What take away messages or lessons learned would you consider important for individuals working in registration (or data integrity) in other jurisdictions to be aware of before they undertake such a project?

10) Do you have any other comments or suggestions that you would like to add?

Additional questions for data Health Records Department registry integrity staff

11) On average, how much time per week do you spend on the phone with the RIU?

12) On a scale of 1-5, with 1 being not at all useful and 5 being very useful, how would you rate the following reports:

Potential duplicates report	1	2	3	4	5
Birth report	1	2	3	4	5
Death Listing	1	2	3	4	5
Alias Report	1	2	3	4	5

13) a) Are there any other reports that are generated from the UPI/Client registry that you use in your day-to-day work processes?

    b) Are there other reports that you would like to see generated?

Thank you very much for your time and participation.

Key Informant Interview Guide - Health Care Corporation of St. John's Laboratory Medicine Program

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

1) I understand that you receive reports generated from the Client Registry that list all births that occur in the province.
   a. How often do you receive these reports?
   b. How are these reports used?

2) a) Are there any other reports that are generated from the UPI/Client registry that you receive or use?

   b) Are there other reports that you think would be useful or would like to see generated?

3) Has there been any unintended consequences as a result of introducing the UPI/Client Registry and/or the use of these reports? If so, what are they?

4) From your perspective, what do you feel are the major benefits of the UPI/Client Registry?

5) Do you have any other comments or suggestions that you would like to add?

Thank you very much for your time and participation.

Key Informant Interview Guide – NLCHI Project Team

Title: **Post-Implementation Evaluation: The Unique Personal Identifier/Client Registry in Newfoundland and Labrador**

Investigator: **Dr. Doreen Neville**

1) a) What aspects of system implementation went well?

   b) What aspects of system implementation were challenging or could have been improved?

2) a) What do you feel are the major benefits of the UPI/Client Registry?

   b) What do you think the future benefits will be?

3) What take away messages or lessons learned would you consider important for individuals working in other jurisdictions to be aware of before they undertake such a project?

4) Do you have any other comments or suggestions that you would like to add?

Thank you for your time and participation.

APPENDIX B
Anticipated Benefits of a UPI/Client Registry

Tables 1- 4 below summarize the benefits that were anticipated and the sources where these expectations were documented. The benefits are grouped as health system level, IT, financial and capacity building benefits, and categorized as immediate or longer term in nature. The reference numbers identify the source documents where these anticipated benefits were noted.

Table 1. Anticipated Benefits of a UPI/Client Registry: Health System Level

IMMEDIATE TERM

- Accurate patient identification [1, 2, 3, 4]
- Standardization of registration coding structures and practices [2]
- Expedited registrations for health interventions at hospitals and doctors offices and other health agencies by eliminating needless repetition of demographic information [1,3, 4]
- Avoidance of duplication of unnecessary duplication of diagnostic tests and assessments [1,3, 4]
- Capacity to link databases across health sectors [1, 3,4]
- Capacity to track clients over time and across health care providers [1]
- Timely registration of newborns in NL [4]
- Streamlining of timely birth and death notifications in the province [4]
- Definitive linkages to enhance the Newborn Metabolic Screening Process [4]

The BoB project was expected to provide the following benefits: [7]

- Enhanced capacity to identify duplicate patient files
- Increased access from within the Meditech boards; no longer just primary registration points possible

LONGER TERM

- Improved patient care resulting from the easy sharing of patient information across providers [1,3,4]
- Improved coordination among partners in the health care delivery process and among the various groups, services and agencies who are caring for the same clients or group of clients [1,3, 4]
- Avoidance of drug interactions and poly pharmacy which result in unnecessary morbidity and hospitalization [1]
- Enhanced drug utilization analysis [4]

- Improved capacity to evaluate health services, including outcome assessment [1,3, 4]
- Research and statistical opportunities arising from linkage of data sets and capacity for longitudinal analysis [1,3, 4]
- Improved management and administration of health programs [1,3,4]

Table 2. Anticipated Benefits of a UPI/Client Registry: Information Technology Level

IMMEDIATE TERM
• Development of a single registration database for assignment of the unique identifier numbers that can be used across the system [1, 2] • Use of real time data processing concepts, including point-of-service and electronic database management [1] • Maintenance of program files and databases that are up to date and accurate [1] • Foundation for person oriented health information approach [1] • Decrease in the size of the Registration Master File which would lead to faster, less expensive on-line access costs [1] • Elimination of probabilistic name matching of reports from the regions with clinical records in the Newfoundland Cancer Treatment and Research Foundation (NCTRF) [4] • Use of a single card for health and social services in NL [2, 4] • Original UPI/Client Registry: [4] - one way passive and query (Citrex Client) for 8 Institutional/Integrated Boards using the Meditech system, the MCP, CRMS [4] - no interface with Vital Statistics, NCTRF, St. John's Nursing Home Board (SJNHB) - Emerge Look-up Client (System Administration) for the Registry Integrity Unit (RUI) • CR1 (BoB Upgrade): [7] - Active-Passive and Query (Web) for 8 Institutional/Integrated Boards - Two-way passive and Query (Web) for MCP, CRMS, - Query Only (Web) interface with Vital Statistics and NCTRF - Query (Web) and One Way passive for the SJNHB - Initiate TM Enterprise Suite Administrator/Auditor and Query (Web) for the RIU

The BoB project was expected to provide the following benefits: [7]

- Easier maintenance of the UPI/Client Registry
- Creation of a more reliable/stable interface
- Creation of tools which could be shared with other Canadian jurisdictions:
    - reusable and scalable code components and programming reference guides
    - communication protocols and messages between the client registry and external systems.
- Assist *Infoway* in the definition of a minimum data set in order to uniquely identify an individual from a pan Canadian perspective
- Assist *Infoway* in the identification and development of business and technical standards for client registries across Canada
- Overall, develop deliverables that facilitate inter-operability and pull-through to other jurisdictions for a pan-Canadian Client Registry system

LONGER TERM BENEFITS

- Development of an Electronic Health Record [1,3,4]

Table 3. Anticipated Benefits of a UPI/Client Registry: Financial Level

IMMEDIATE TERM

- Reductions in the amount of inappropriate reciprocal billing payments associated with the absence of an expiry date on the MCP card [1, 3, 4]
- Ready confirmation of the eligibility status of a resident by health service providers [4]
- Estimated annual financial benefits from a UPI:
    - $1, 077,000 (worst case) to $1,188,000 (probable) [3]
    - $1.1M [5]
    - $1.7 M [6]

LONGER TERM

- Ability to identify misuse and abuse of health services and benefits by clients, such as double doctoring, doctor shopping or unnecessary over utilization [1]
- Ability to track correlations between program costs, outputs (services provided) and outcomes (improvements in health) [1]
- Reductions or elimination of separate hospital card and numbering systems [1]

Table 4: Anticipated Benefits of a UPI/Client Registry: **Capacity Building**

SHORT TERM
• Growth in the IT sector in the province: [3, 8] - employment and training opportunities - skill sets that were acquired • Leveraging of financial and interagency support with respect to health information system projects in the past/present /future

APPENDIX C
Key Informant Interviews: Summary of the Data

Respondents by Position, Position Category, Organization and Geographic Area

RESPONDENTS	NUMBER
POSITION	
Health/Client Records Director/Manager	8
Health Records Clerk	1
Data Integrity Specialist	3
Admissions/ Registration Personnel	3
Information Systems/Technology Director/Manager	2
Manager of Public Service and Administration, MCP	1
HIN Project Lead	1
CR1 Project Manager	1
HIN Technical Lead	1
Director of Data Standards and Information	1
UPI Subject Matter Expert	1
POSITION CATEGORY	
Institutional Health Board	8
Health and Community Services Board	4
Integrated Health Board	2
CR1 Project Team	5
Registry Integrity Unit	3
Provincial Health Insurance Plan	1
ORGANIZATION	
Newfoundland and Labrador Centre for Health Information	8
Health Care Corporation of St. John’s	5
Avalon Health Care Institutions Board	1
Peninsulas Health Care Corporation	0
Central East Health Care Institutions Board	0
Central West Health Corporation	1
Western Health Care Corporation	1
Health Labrador Corporation	1
Grenfell Regional Health Services Board	1
Health and Community Services St. John’s	1
Health and Community Services East	1
Health and Community Services West	2
Health and Community Services Central	0
Newfoundland Medical Care Commission	1
GEOGRAPHIC AREA	
St. John’s	15
Eastern	2
Central	1
Western	3
Grenfell	1
Labrador	1
TOTAL	**23**

What do you feel have been the major benefits of the UPI/Client Registry so far?

BENEFITS CATEGORY = HEALTH SYSTEM	**NUMBER OF RESPONDENTS**
Improved access to patient information; all the patient's demographic information is in one place	**10**
Improved data accuracy/integrity	**9**
Elimination of duplicate patient files	**5**
Improved patient identification	**2**
Standardization of registration procedures throughout the health boards in the province	**2**
MCP is able to use the information in the Client Registry to keep their information up-to-date	**2**
More accurate list of who the users in the system are; all clients within NL who have received a service now have a unique identifier	**2**
Allows updating of information on individuals who had not been recently seen in the facility	**1**
Prevents a lot of unnecessary duplication of tests	**1**
Community sector can verify DOB and MCP#s and obtain MCP#s they do not currently have on clients	**1**
BENEFITS CATEGORY = IT	
Knowledge gained about how Meditech interacts with a client registry will be good for other jurisdictions, as there are many Meditech installations across Canada	**1**
BENEFITS CATEGORY = FINANCIAL	
Provides eligibility information (for public insurance) at the point of registration	**4**
Elimination of duplicate files; space savings	**3**
Income and Security receives information that helps them remove persons from their files and allows them to cut off the benefits they were receiving (2-3 per month)	**1**
Revenue generation	**1**
BENEFITS CATEGORY = CAPACITY BUILDING	
Registration clerks more acutely aware of the importance of their role in maintaining a provincial data base and are more likely to adhere to provincial protocols	**2**
Involvement of the Health Records personnel from the beginning; recognition of their expertise	**1**
Development of the Toolkit	**1**
Development of the Lessons Learned document	**1**
Improved data quality in each region overall	**1**
Improved business processes within organizations	**1**
Common dictionary, standards and processes across the province	**1**

"When we look at Phase 1, once the information was in the UPI, it gave us access to information that we wouldn't have, like baby's first name. It allowed us to get a list of deaths province-wide with identifiers, so we could cull our records. It facilitated communication between Health Records Directors in terms of what information is needed….The outcome was positive because it identifies duplicates that we would never have looked at, but it is a resource issue"

“In terms of current benefits, some of them are just that it has everyone doing the same thing in the same way around registration. And, we are able to exchange useful information using a system that is working”

“Hospitals now ask the patient to contact MCP directly if a problem with the MCP number is identified on registration; it allows the problem to be dealt with up front”

“The major benefit is improved ability to accurately identify patients.”

“The information that’s there is current…If we have patient coming from other institutions, their information is there….It’s a better process and a time saver”

“The outcome was positive because it identifies duplicates we never would have looked at.”

“We do have the ability to provide eligibility information at the point of registration, which is good for the institution and the MCP program as well.”

What do you think the future benefits will be?

BENEFITS CATEGORY = HEALTH SYSTEM	**NUMBER OF RESPONDENTS**
Foundation for a provincial EHR/ sound building block	**15**
Way to communicate and ultimately link information over a large geographical setting	**3**
Permits the introduction of the Pharmacy Network and PACS	**3**
Raises awareness of the EHR and what it will eventually look like	**1**
CR1 increases capacity to catch duplicates (50,000 – 133, 325 = 83,335 more potential duplicates identified by CR1)	**1**
Accurate demographics helps us to locate clients to offer services to, such as pre-school health checks etc	**1**
CR1 enables us to expand access to other staff	**1**
BENEFITS CATEGORY = IT	
Building block for Pan Canadian EHR	**1**
Establishes a minimum data set and Client Registry that other jurisdictions can link into	**1**
BENEFITS CATEGORY = FINANCIAL	
Improved records management	**1**
BENEFITS CATEGORY = CAPACITY BUILDING	
Establishes the province as a leader in development of the UPI/Client Registry	**1**
Development of expertise that can be shared with the rest of Canada	**1**
Will help keep the data bases clean into the future	**1**

"The Client Registry is a building block, the bricks and mortar for the EHR and the Health Information Network in the Province."

"It is a platform for an electronic health record and other systems like pharmacy, diagnostic imaging and lab. You have to have a client registry to start that".

"The UPI/CR is a benefit to the province and Infoway…they have in place a key element for a Pan Canadian EHR."

"On the whole it was a positive experience. It is exciting that it has come to fruition and that the province is on the leading edge of this technology".

"There is a Toolkit which was developed. All the specifications and working documents will go into a Toolkit which Infoway will provide to other jurisdictions."

"In terms of current benefits, some of them are just that it has everyone doing the same thing in the same way around registration."

"The UPI/CR has created a focus on data quality and standards across the province- a common dictionary, process and standards for registration."

What aspects of the implementation went well? What factors helped it go well?

ASPECTS OF IMPLEMENTATION WHICH WENT WELL	NUMBER OF RESPONDENTS
Meaningful key stakeholder involvement	**6**
Weekly teleconference calls between one of the health boards and NCLHI once problems with the registration module during Phase 2 were recognized by all parties	**3**
In Phase 1, good communication processes on both the business and technology side	**2**
In Phase 1 (pre-BoB) the process was seamless	**1**
Identification of the core elements which needed to be included	**1**
Information sharing	**1**
Access to demographics from other regions	**1**
In Phase 2, were able to use many of the same people from Phase 1	**1**
Work on Toolkit	**1**
Improved data accuracy within the CRMS	**1**
Creation of 2 new interfaces for Meditech in the region	**1**
FACTORS THAT HELPED IT GO WELL	
Communication among the regional directors and staff at NCLHI was facilitated by regular meetings and updates	**4**
Health Records Directors attended demonstrations of the new technology and were given an overview of what would be happening	**2**
NLCHI and RIU staff	**2**
Leadership skills of the Director of Standards at NLCHI	**1**
Health records personnel kept informed throughout BoB as well	**1**
During Phase 2 (BoB) a registration expert was seconded to NLCHI which allowed a much better knowledge of the registration process	**1**
During Phase 2 (BoB) weekly conference calls were held with Meditech Boston and the vendor Quovadex	**1**
Weekly teleconference calls between one of the health boards and NCLHI once problems with the registration module during Phase 2 were recognized by all parties	**1**
Facility already had moved to one corporate patient identifier because of hospital integration	**1**
Health records and IT personnel involved together	**1**
People using the system received an orientation to it	**1**

"For the initial part of the UPI, there was very good requests for input from the health records perspective and the IT perspective. There was great opportunity for input, and what impressed me was that those who were identified as having expertise in these areas were actually asked. Sometimes it is people further up in the organization who are asked, but they probably can't answer the questions…..The realization was there that they had to ask the people involved in the system. I really did appreciate that."

"We had a tremendous NLCHI project team"

What aspects of the implementation were challenging or could have been improved? What factors contributed to the problems with implementation?

CHALLENGING COMPONENTS OF IMPLEMENTATION	NUMBER OF RESPONDENTS
Implementation of BoB in the first site did not go smoothly, due to technical difficulties associated with unanticipated interaction between the registration modules and scheduling modules in the MEDITECH system	**5**
Big time delays between when the information is filed with the UPI in registration and makes its way back to the system; up to 1.5 hours originally but is improving	**2**
In Phase 1, the technology was new to the sites who were used to a Meditech dumb terminal; sites had to be visited to show staff how to use a PC, use the new screens, copy from one screen to another, and use a mouse	**1**
Tremendous volume of duplicate records which had to be addressed (500,000 at the start of the project)	**1**
Workload related to checking for problems with the data was much greater than anticipated	**1**
Training of registration personnel and nurses to use BoB version of UPI/Client Registry was not as complete as was desired	**1**
Challenges associated with determining the exact amount of hardware that was required	**1**
Still a problem deciding when to query the UPI	**1**
Frustration was experienced by front-line staff when the system (BoB) did not work as well as originally anticipated.	**1**
Challenges associated with promoting the positive aspects of the new system with front line staff when problems were experienced.	**1**
Sometimes the link to the UPI is down and you will get old information from the CR; now NLCHI has put a flag on the UPI to let personnel know that the CR is down and not to query the UPI	**1**
FACTORS THAT CONTRIBUTED TO IMPLEMENTATION PROBLEMS	
The project timeline was so long that business processes changed in the regions and had to be accommodated after the UPI/CR went live	**4**
Different personnel were impacted by BoB; registration personnel, not health records personnel, were involved in updating records	**2**
Not enough preparation time before BoB went live in the first site	**2**
Length of time it took the NCLHI team to respond to complaints from one of the health boards regarding problems experienced with respect to the registration process after Phase 2 went live	**2**
personnel turnover in the regions	**1**
2-way passive systems had to be built for CRMS and MCP as opposed to “tweaking” the original system, as originally planned	**1**
BoB went live in the first sites during summer months when key personnel in the facility were on vacation	**1**
one small board does not have a Magic System which is different from the other boards and this adaptation took a long time relative to the total time allotted for the project	**1**
human resource issues; large numbers of duplicates were identified but personnel were not always available to do the work associated with eliminating the duplicates	**1**
Demands regarding completion of the Toolkit were more aggressive than originally anticipated	**1**

Human resources issues with respect to training registration personnel and nurses to use BoB version of UPI/Client Registry; few resources available to do the job	**1**
Factors at high volume sites not necessarily generalizeable to low volume sites	**2**
Needed more representatives from the community side	**1**

"In Phase 1, the interface with Meditech was problematic. In Phase 2, it was seamless and only information was required, not training sessions"

(In phase 2)" Our biggest challenge was the changing of business protocols from the time we started to implementation. "

"With respect to hardware, there were issues in relation to how much was needed. It was initially done as a best guess by the vendor based on the volume of transactions in the initial system. Some of this had to be revised and we had to buy other hardware. But I am not sure how this could have been improved. Other jurisdictions will be able to learn from this, but there was no other jurisdiction that we could go to. Other jurisdictions would have to anticipate a 3 fold increase in transactions or a 5 fold increase in transactions and base their hardware needs on that"

"We originally expected to contribute 50 documents to the Toolkit, but this expanded to 92 by the end".

Investigator Notes:

Prior to BoB, the Client Registry was used mainly in the Health Records Department and the health records Directors had been intimately involved with the design and implementation of the system.

However, with BoB:

- The primary personnel involved were the registration employees, who did not have a long history of involvement with the project.
- When the system went live in a major health board, a previously undetected problem involving the interaction between the registration modules and other modules in MEDITECH created confusion. For example, information would change in other modules such as appointment scheduling and there was a risk of the wrong patient being identified and contacted regarding an appointment.
- Consequently, the BoB process required action on the part of the registration clerks which was more complicated than the usual registration process they were used to.
- In addition, even though the registration clerks would go through the protocols to update the demographic information in the Client Registry when the patients registered, when the patient presented in other areas of the hospital such as the lab, the information updated in the client registry was not available and the patients had to provide the information again.
- The community dictionary caused problems as well. Not all residence codes were accepted by the system, which caused delays in registration as people gave their community address but the system did not recognize it as legitimate.
- These problems were most pronounced in bigger centers (due to large patient volumes).

- Many of the problems had been addressed by the time the interviews were conducted

There was also recognition that there should have been more representatives from the community side, but at the time many of the Records Directors and Managers were not in place in the Community Boards, and consequently the community side was often represented by the technical people involved with the CRMS from XWave.

Were there any unintended consequences as a result of introducing the UPI/Client Registry Project? If so, what were they?

UNANTICIPATED CONSEQUENCES	NUMBER OF RESPONDENTS
Implementation of BoB in the first site did not go smoothly, due to technical difficulties associated with unanticipated interaction between the registration modules and scheduling modules in the MEDITECH system	**6**
Phase 2 implementation slowed down registration processes in a large volume health board and caused a great deal of frustration and confusion until the problem was resolved	**3**
After BoB was introduced, it was discovered that the community dictionary that was used did not allow staff to register patients in their home community if that community was not part of the dictionary	**2**
Glitches have occurred with the CRMS/UPI interface	**2**
System reports which were forwarded to regional health records directors from the Registry Integrity Unit on a monthly basis during Phase I of the UPI/Client Registry project were not forwarded after BoB and had not been reinstated up to the point of interview.	**1**
BoB is much more intensive in terms of man hours required to do data cleaning and accuracy checks; RIU needs 2 more full time staff and the regions are understaffed as well	**1**
Now when a question arises about the validity of the MCP number, staff have to give the patient a piece of paper with a 1-800 number so that they can call and have this addressed	**1**
Time required to make necessary changes to the system was longer than anticipated	**1**
When the BoB system first came on line, we couldn't do a lot of edits because RUI wouldn't allow us to make the changes	**1**
In smaller regions, sometimes errors made in the UPI/CR elsewhere resulted in inaccurate data over-writing their own accurate data when they queried the UPI (see comments below)	**1**
It has become apparent that increased bandwidth is required in some regions	**1**

"When over 1000 people can access the UPI/CR, it is difficult to maintain consistency in approach."

"In CRMS, when they bring up their search tree and then query the UPI, if the person has more than one name, the name comes up twice. It's confusing for our workers. They think it is a duplicate but it's not. It's just another name for the same person. We called XWave and they are going to fix it for us."

"***In the community boards, there have been some unintended linkages between an adopted child's previous name and their new name via the UPI."***
Investigator Notes:

- Some smaller regions already commenced data cleanup as part of the original UPI/Client Registry project, and their demographic information is fairly accurate. Since BoB however, their systems have been impacted by data errors in other jurisdictions. For example, if one of their patients is seen in a larger region and inaccurate info is entered into the UPI/Client Registry from somewhere in that setting, when the staff in the home region queries the UPI/Client Registry I they see inaccurate information. This requires re-entry of the accurate data they already have in their system, which is time consuming and annoying. One practice which has evolved to address this is that staff simply change one small piece of information (like a postal code) in their own files and submit it to the UPI/Client Registry, thus triggering a change back to the original data (with one small error) in the UPI.

- Some of the key informants indicated that they had been told to expect an interruption in the generation of the reports during the BoB implementation but that the reports would resume once the full upgrades had been introduced in all the regions.

- There is a significant backlog of files that need to be updated; in one of the regions, health records staff are still working on cleaning up files from the RIU from 1.5 years ago.

Take-Away Messages/ Lessons Learned

MESSAGES/LESSONS LEARNED	NUMBER OF RESPONDENTS
Appropriate stakeholder engagement and communication is key	**10**
Bring in front-line workers to assist with development and testing	**4**
Education of all front-line workers who will be impacted by the system should take place prior to implementation, and this training should involve NLCHI staff as well as internal staff, including Information Systems staff	**3**
Joint IT/Business process meetings to plan out how things will work are important	**3**
Ongoing feedback from front-line workers is important	**3**
Need for regular audits of the business processes to ensure that technology continues to fit the current business process	**2**
Need to include workers outside the usual health records personnel who will be impacted by the technology	**2**
It is important to test in the real system, not just the test system	**2**
Registration processes need to consider other contacts that patients make, such as blood tests and appointment scheduling	**2**
It is important for site to begin cleanup of their own systems prior to the implementation of the UPI/CR	**2**
During registration, it is important to verify everything, including the DOB	**2**
Continuous challenge to keep the data clean	**2**
Need to continually reinforce the need for consistent standards	**2**
Change management pieces must be in place	**1**
Do not design reports to be generated from the UPI/Client Registry too far in advance because your needs will change before the end of the project.	**1**
If business processes change, advise the project implementation team at once, so that the technology can be adjusted as well	**1**
MCP should have done more cleanup of their system prior to implementation of the UPI/CR	**1**
A technical writer is important	**1**
Establish an MOU/agreement on how you will proceed to work jointly on a project with key stakeholders	**1**
Establish Terms of Reference for your committees	**1**
There is a big learning curve; this project required years of planning	**1**
Infoway requirements that messaging transactions be XML based can put a heavy load on a given hardware.	**1**
In the community sector, need to find a way to include data on clients who are only registered in family groups; currently the data is focused only on individual clients	**1**

“Beta testing for BoB at NLCHI was not sufficient; you need to test it in the actual practice setting to uncover the implications of the technology on other MEDITECH modules”

“With BoB, need to involve front line registration personnel in the process from the beginning, because registration with BoB is not a straightforward process”

“We need to be flexible, address mistakes and learn from them”

‘I think there may have been an aspect of ‘well, I know the system’**,** Respondent referring to why it took a while to get the implementation team to set up weekly meetings to deal with the problems encountered at one of the sites.

“[The Director of Standards and Information] had a very good impact on the whole process. She had the qualities to get people to stick to timelines and is very articulate. Her lead was very beneficial”

“*Back when we started all of this, the community side was viewed as a second cousin to the process and at some point in time we should have done more or thought harder about how to include the community*”

“You can’t do enough communication with stakeholders”

“There are challenges working with Infoway”

“Map out internally the processes used for registration. Start out with ‘I’m the patient and what steps do I have to do before I get registered?’ A flow chart or a gant chart. If we did this, we might have figured out these issues before implementation. Working with the front-line staff who can tell you here’s the way we do it, here’s where we search or change things”

“Never underestimate how little people understand the systems they operate on a day to day basis. They can’t always tell you how the business processes work, and then the system you build does not align with what they really do”

“If you are going to have a project that is going to span as long as BoB has, have regular audits to make sure that they are still using the same business processes”

“The biggest thing is the continuous challenge of keeping the data clean and educating people about the importance of keeping the data clean”

“Staff training is really important, especially when the system involves staff not directly under the control of the health records directors – it can help avoid turf wars”

“One of the things that really helped was that we had a technical writer, which some people thought was unnecessary, but it helped the process with the technical development tremendously”

“We need ongoing evaluation and monitoring of how this system is operating”

“*On the whole it was a positive experience. It is exciting that it has come to fruition and that the province is on the leading edge of this technology”*

INVESTIGATOR NOTES:

- For Phase 2 (BoB) NLCHI seconded a registration person from one of the health boards to ensure that there was a good fit between the technology and business processes. However, this individual was away from the field for 2 years, and during this time some of the business processes changed. This was not detected because this individual was able to complete only one audit of the registration processes during the period of secondment.

What type of feedback have you received from the Registry Clerks and Health Records staff regarding the UPI/Client Registry Project in your region?

FEEDBACK RECEIVED BY HEALTH RECORDS DIRECTORS FROM THE REGISTRY CLERKS AND HEALTH RECORDS STAFF	NUMBER OF RESPONDENTS
Frustration with delays	**3**
Hasn't been overwhelmingly good or bad; generally positive once people started using it	**3**
Initial reluctance to take on another task, but this has diminished	**2**
Recognition of the importance of their efforts at registration; all the data they are collecting not only impacts their own institution but also a provincial registry	**2**
Concerns about when to query the UPI	**1**
Community health staff have come to rely on it to obtain missing demographic data	**1**

"It's good working with the RIU. Now we can verify DOB and MCP rules. And we can get MCP numbers we didn't have on our files"

What functions of the UPI/Client Registry do you find to be most useful?

MOST USEFUL FUNCTIONS OF THE UPI/CLIENT REGISTRY	NUMBER OF RESPONDENTS
Demographic information is accurate and up to date	**8**
Determination of patient eligibility for provincial health care insurance (MCP)	**5**
Availability of demographic information saves time in registration	**2**
Demographic information is available for patients from the whole island, not just patients within your region	**2**
Community sector can obtain MCP and DOB information that they did not have previously in their files	**2**
Potential for an electronic health record and linking information electronically	**1**
Reports received are beneficial	**1**
Little internal disruption in normal work processes (with the Phase 1 project and with CR1, once the initial problem with BoB was fixed)	**1**

On a scale of 1-5, with 1 being not at all useful and 5 being extremely useful, how would you rate the following reports?

Ratings
(By Respondent Code)

REPORTS	1	2	3	4	5	TOTAL
Potential Duplicates				1 (9%)	10 (91%)	11
Birth Report		2(22%)	2(22%)	3(33%)	2(22%)	9
Death Listing				2 (20%)	8 (80%)	10
Alias Listing		1(11%)	2(22%)	3(33%)	3(33%)	9

Note: Percentages may not add to 100% due to rounding.

Investigator Notes:

- Respondent indicated that the alias report would be more useful if the organization had the human resources available to follow up on the report.
- Respondent indicated that having the death listing more region specific would be useful.
- Respondent indicated that the birth report is more useful if it contains the birth name assigned; Respondent wanted the birth report to also contain the baby's MCP number.

Are there any additional reports that you would like to see generated?

- Would be nice to see reports on error rates in terms of data accuracy by worker and region in the fields that report to the UPI.
- It would be nice to know the number of clients whose demographics were being updated by pushback from the UPI/CR to the CRMS system.
- It would be nice to see births in all regions, not only our own.

On average, how much time per week does your RIU person spend on the phone with RIU?

TIME PER WEEK SPENT IN CONTACT WITH RIU	NUMBER OF RESPONDENTS
minimal,15 minutes to one hour a week; 3 hours per month (Community board)	4
2-3 hours/week	3
14-15 hours per week 2 staff, 7 hours per week each = 14 hours/week 1 staff, 2-3 hours per day = 10-15 hours/week	2

Have you initiated any changes in your business processes as a result of the data and/or reports provided by the RIU?

CHANGES IN BUSINESS PROCESSES	NUMBER OF RESPONDENTS
Yes	9

TYPES OF CHANGES IN BUSINESS PROCESSES	NUMBER OF RESPONDENTS
More inclusive list of deaths available because it is an accessible master list; easier to cull records	**2**
Will question patient to get an accurate provincial health insurance (MCP) number	**2**
If patient is not eligible for provincial health insurance (MCP) then we try to advise the fee-for-service physicians who will be affected (but service is not denied)	**2**
Time delays at registration are substantial. When we register a patient and query the UPI, it takes time for the UPI information to be dispersed throughout our system. So, a patient can be registered and then go to the lab, and the lab will still have incorrect information and print this out instead of the correct information.	**2**
Able to identify a baby's Christian name	**1**
Duplicate reports keep the index as clean as possible	**1**
Registration process was more time consuming when BoB first came on but this has subsided over time	**1**
Provincial tracking of PKU results now sent to HCCSJ lab	**1**
Now that community staff can access gender, BOB and MCP information from the UPI/CR , they input this data manually into the CRMS data when the data is missing	**2**

It has become a routine thing that if we are unable to contact a client to schedule an appointment on the first try, we use the UPI to try and get good demographic data	**2**
established a corporate policy regarding the registration protocol, how to enter the data	**1**
Use the UPI to get good data on client intake	**1**
There is more awareness by all staff of the importance of the demographic data elements	**1**
We are trying to work our a consistent community dictionary for NLCHI, CRMS and the regional health boards	**1**
a pop-up screen has been developed to remind staff that if the patient has been registered in another unit that day that you should not query the UPI	**1**
When boards are planning to incorporate new practice sites, they have to consider how that decision will impact on the data going to the UPI/CR	**1**

INVESTIGATOR NOTES:

- At one site, the delays in the UPI/Client Registry updates have led to the staff in departments other than registration to be told to ask the patient if this is their first contact with the organization that day, and to not query the UPI/Client Registry if the patient says they have already been registered somewhere else, but not all staff remember to do this. If a staff member forgets and queries the UPI/Client Registry, the correct data that was entered in registration will be replaced by the incorrect data

- Problems with community dictionary also caused delays at registration. If the patient came from a community that was not in the dictionary, then there was a problem with the residence code and you had to re-enter this again. In one region, up to 50% of registrations were delayed because of this.

"***Because there is a time lag between registration and the information getting to the UPI…peak time is 45 minutes and non-peak time is about 1 minute….what we do is if a patient has to go to other clinics during their visit, only the first registration searches the UPI because there is not enough time to get it updated. The other registration points would have to re-enter the patient's information if they didn't do this. So now we have a screen that pops up to ask the patient if they have been to another clinic today. We didn't realize this time lag at the beginning. I think it's a volume issue because of the server. The volume of data going across slows it down."***

On a scale of 1-9, where 1 is strongly disagree and 9 is strongly agree, please rate the following statements?

Ratings
(By Respondents)

STATEMENT	1	2	3	4	5	6	7	8	9	TOTAL
The UPI/Client Registry is beneficial								3 (30%)	7 (70%)	10
The UPI/Client Registry provides me with useful information							1 (10%)	3 (30%)	6 (60%)	10
The UPI/Client Registry is an effective building block for an EHR									10 (100%)	10
The feedback that I have received from Registration Clerks in my region regarding implementation of the UPI/Client Registry has been positive.			1 (13%)			1 (13%)	3 (38%)	1 (13%)	2 (25%)	8

Note: Percentages may not add to 100% due to rounding.

Summary of Additional Responses Received From RIU Staff

What was your role in the development/implementation of the Client Registry?

Respondent
- full time employee; 35 hours per week
- first staff member, trained by UPI implementation team
- assisted in the training of other RIU personnel

Respondent
- full time employee
- hired at the start of the RIU
- trained by staff at NLCHI (Director of Data Standards and Information and IT lead)

Respondent
- full time employee at NLCHI doing related work for RIU

What are your responsibilities as a staff member of the Registry Integrity Unit?

Respondent:
- eliminate duplicate charts throughout the island
- assign one identifier called an EID (used to be UPI)

Respondent:
- checking the data for accuracy
- receive email notifications indicating that something is wrong with an entry; it is her responsibility to call the regions and ask them to check the data
- assist in compiling the monthly reports (prior to the introduction of CR1; no reports produced since that point)

Respondent:
- receives monthly readouts of registered events from Vital Statistics; compares them to RIUrecords and enter it into the database
- some coding of deaths
- some potential duplicate work for one of the boards

About what proportion of your time is spent cleaning data?

Respondent:

- 7 hours per day for phase 1
- started with 500,000 duplicates, got down to 50,000 before CR1, then back up to around 100,000

Respondent:

- 60% of her time (full time employee; 35 hours per week = 21 hours per week)

Respondent:

- 95% (32 hours per week)

About what proportion of your time is spent compiling reports?

Respondent:

- one person one day per month to compile the reports
- one person one half a day per month to print the reports
- one person one half a day to package and courier reports to the regions

About what proportion of your time is spent merging client data?

Respondent:

- 40% of her time (14 hours per week)

What do you feel are the benefits of the Unique Personal Identifier/Client Registry?

(*responses coded in tables located in the summary tables)*

What do you feel are the potential future benefits, if any, or the UPI/Client Registry?

(*responses coded in the summary tables)*

What do you feel are the challenges, if any, of the UPI/Client Registry?

Respondent:

- the amount of work still out there to be done

Respondent:

- getting the data as clean as possible
- old system 50,000 duplicates remaining; new system 133,325

Respondent:

- need good communication between agencies
- not all agencies are equally cooperative in sharing information for the purposes of confirming accuracy of patient demographic data

What do you feel are the potential future challenges, if any, of the UPI/Client Registry?

Respondent:
- the system may get more advanced and we will need more training
- technology can only do so much if remote regions are not connected
- need to be able to send the reports electronically to remote regions, which is not always possible currently
- work is very time consuming /labor intensive

Respondent:
- regions will have to clean their own data
- understaffing in the regions is a major problem
- CR1 has increased need for staff; RIU needs 2 more full time people
- Changes to the technology requires further staff training as well

Respondent:
- Getting everyone to use the system correctly/keeping the data clean
- Lot of education required for registration clerks and health records staff
- Need to integrate Vital Statistics and MCP electronically to have the system perform cohesively

Is there anything else, in relation to your role as a staff member of the Registry Integrity Unit that you would like to give us feedback on?

Respondent:
- rewarding work to see duplicates drop from 500,000 to 50,000
- good cooperation received from the system

Respondent:
- enjoys the work

Respondent:
- Things are going well

Summary of Additional Responses from NLCHI Project Team Members

What was the process for communicating with the necessary groups and individuals to develop the UPI/Client Registry?

Business Processes

- Weekly conference calls with all record and client managers
- Health Records and Registration (combined) Quarterly meetings and other meetings as required had been ongoing for years prior to the start of the project and continued throughout the project
- Emails sent out as issues arose
- Voting approach to ensure regional jurisdictions were on side

IT Team

- Project IT team already had pre-existing contacts in the health boards IT departments
- Conference calls
- Emails
- A few combined Health Records/IT/Technical team meetings

How well were the regional stakeholders able to work together and with NCLHI during system development and implementation?

- It would have been nice to have more combined meetings with IT, Health Records and the Technical team, but busy schedules did not permit it

Was the required infrastructure and equipment in place or built during system implementation?

- The network and communications links to various facilities were there, with the exception of the St. John's Nursing Home Board.
- However, hardware and software on the Client Registry side needed to be upgraded and in some cases changed all together. Those that were upgrades from the existing company went smoothly… we just had to buy it. There were also some tenders issued.
- This information is documented in more detail in the CR1 Toolkit

What issues and/or elements of registration need to be addressed or brought to the attention of registration clerks?

- Reinforcement of standard approaches; e.g. don't state the information, ask the client for the information
- Registration personnel needed to be informed about the additional fields that were involved in the registration process
- With the introduction of Phase 2 (BoB) an issue arose with registration because business processes changed in some of the boards that we were unaware of. All Health Records and Registration Directors originally agreed upon what modules within the admissions module would have active interface. However, before the start of Phase 2, some boards started using different modules, like patient scheduling, and there was no active interface design for these modules in the technology. Meditech designed their interface one way, and because of this change in business processes an additional modification in the interface was required. This took time to achieve.

APPENDIX D-1
Financial Savings: Detailed Analyses

1. Increased revenues from Non-Resident Hospital Claims

Introduction

In 2000, the government of Newfoundland and Labrador (NL) budgeted approximately $20 million for medical reciprocal billing (i.e., payment for claims for NL residents receiving hospital and/or physician services in other provinces). Two studies carried out in Newfoundland and Labrador; (Wall M., MacDonald D., Ivany B., 2000; Valvasori G., MacDonald D. Ivany B., Wall M., 2002) estimated 5%-10% savings in out-of-province hospital and physician claims ($1.2-2.2 million annually) would result from having accurate demographic information on residents. If a province can show that an individual is no longer a resident (i.e., a former resident), then that province is no longer responsible for medical services provided to that individual. In the study by Valvasori et al (2002), it was estimated that between 40-50% of residents moving out-of-province did not cancel their MCP eligibility, and that a large proportion of these 'former' residents continued to present with an eligible MCP card when presenting for medical services.

The findings of these two earlier studies suggested there was also the potential for increased revenues when former residents return to the province and presented for hospital services with an eligible MCP card. It should be noted that 'true' non-residents are individuals who were never residents of Newfoundland and Labrador. These individuals are easily identified at hospital registration as non-residents. It is more difficult to identify a former resident of Newfoundland and Labrador, who returns to the province temporarily and presents an eligible MCP card at hospital registration. This 'former resident' is a sub-category of a non-resident.

When the Client Registry (i.e., via the hospital registration system) identifies an individual as a non-resident, the hospital can bill the jurisdiction in which the patient is now a resident. Identification of former residents receiving in-patient and out-patient hospital services would translate into direct revenue for the hospital, as such revenues are not part of government's budget process. Key informants in this current evaluation study confirmed that financial savings had been realized following the implementation of the BoB Client Registry (CR1) through the provision of eligibility information at the point of registration. Given this new capability to determine MCP eligibility at the point of registration, an individual that is determined ineligible for coverage within Newfoundland and Labrador will be followed up by the institution's Finance Department to bill for services provided.

In 2004, as part of the NL Client Registry evaluation, the research team carried out a third Client Registry financial benefit study to investigate potential revenues lost to hospitals when former residents returned to Newfoundland and Labrador and presented for hospital services with an eligible MCP card. (MacDonald D., Neville D, and Gates K., 2004).

Study Objective

The objective of this study was to estimate potential annual hospital revenues through the identification of former residents presenting for services in Newfoundland and Labrador with an eligible MCP card.

Methodology

With no direct means of identifying residents who move to another province a proxy identification using demographic data on canceled drivers' licenses were obtained from Division of Motor Vehicle Registration (MVR). Canceled drivers' licenses were considered a valid proxy given: 1) it is illegal to have a valid driver's license in more than one province, and 2), the majority of Newfoundland and Labrador residents who move out of the province submit a claim to MVR for reimbursement for that portion of their license fee not used (Source: communication with MVR).

Potential former residents were identified by first obtaining the name, gender and date of birth for individuals, who in 1999 (or earlier), had canceled their NL drivers' licenses, and at the time of the study had a driver's license in a province other than Newfoundland and Labrador. This demographic data was then linked to the provincial health insurance database (i.e., MCP) to obtain the individual's health insurance number. Only eligible MCP numbers were used in the study.

The linkage of drivers' license data to the provincial health insurance database resulted in a list of 17,418 potential former residents who in 1999 had a driver's license in another province, yet still retained an eligible MCP card in 2000.

Methodology for Identifying Potential In-Patient Revenues

All claims submitted to another province for hospital services (i.e., in-patient and out-patient) provided to a non-resident were provided to NLCHI by seven of the eight provincial hospital Boards. The smallest hospital Board in the province, serving a population of less than 30,000, did not provide data for the study. The data fields provided included chart number, admission date and discharge date for fiscal years 1999/00 and 2000/01. These two fiscal years of data were merged; only 2000 calendar year was used in the study. Using these three fields, a link was made between the in-patient claims and the provincial hospital abstract database. Only in-patient claims were linked, as the hospital abstract database does not capture out-patient events.

Once the linkage was complete, all in-patient events identified for a non-resident (via out-of-province claims) were removed from the provincial hospital abstract database. All in-patient events remaining in the hospital database were then considered by the evaluation team as services provided to residents of Newfoundland and Labrador.

All eligible MCP numbers for residents having a high probability of being a non-resident in 1999 (as identified through the MVR database) were then linked to the provincial hospital abstract database for year 2000. The assumption used by the evaluation team was that a former resident, who was living in another province in 1999, did not regain residency in Newfoundland and Labrador in 2000. As a certain proportion of these former residents would have moved back to the province in 2000, the term "potential" former resident is used in this study.

Methodology for Identifying Potential Out-Patient Revenues

In NL, unlike in-patient events, there is no provincial database for capturing data on out-patient events. Therefore, two approaches were considered in estimating the total number of out-patient events in the province in 2000 (i.e., the denominator); the more conservative of the two approaches was used in the final analysis.

Calculation

Total In-patient Events in 2000	62,717
Total Non-Resident In-Patient Claims Submitted	734
Total Out-Patient Events	**X**
Total Non-Resident Out-Patient Events Submitted	17,517
Total Out-Patient Events **(X)** = (62,717/734) x 17,517=	1,496,000

Using this approach for estimating total out-patient events assumes the ratio of total in-patient events to non-resident in-patient claims is equal to the ratio of total out-patient events to non-resident out-patient events.

An alternate approach for estimating the total number of out-patient events was carried out using out-patient data provided by the largest hospital Board in the province. This is the only hospital Board in the province that tracks all out-patient events, and services a catchment area comprising approximately 37% of the population of the province (189,000/512,000). In 2000/01, this Board recorded 747,869 out-patient events (see Table 2). Assuming out-patient encounters are consistent across all Boards, we would estimate the total out-patient encounters to be three times the largest hospital board, or approximately 2.0 million per year.

<u>Calculation</u>

37% of population resulted in 747,869 out-patient events

X = (747,869/0.37) = 2,021,268 (estimated total out-patient events for province)

Note: For the purpose of this study the lower estimate of 1,496,000 out patient visits were used.

Regional hospital boards provided NLCHI with data on all out-patient events which were billed to another province (N=17,517). Without a provincial out-patient database to link to, the assumption was made that hospitals were as efficient at identifying former residents in an in-patient setting, as they would be in an out-patient setting. That is, given hospitals in the province were potentially missing 47.6% of hospital days stay billable to another province, they were also missing 47.6% of out-patient events billable to another province. Using this assumption it was estimated that hospitals in the province were missing 15,913 out-patient events by former residents, and that these events were paid for under the provincial insurance plan ((17,517 / (1-0.476)) – 17,517).

Findings

As shown in Table 1, Newfoundland and Labrador hospitals admitted 62,717 patients and recorded an estimated 1,496,000 out-patient events in calendar year 2000. When considering only in-patient events, it was estimated that 1.2% of all events were for potential former residents, accounting for approximately 0.7% of the total length of stay (LOS). The average LOS for potential former residents was estimated to be 9.2 days. When looking at the total LOS estimated for potential former residents, 47.6% was found not to have been billed to another province. A further 15,913 out-patient events for former residents were potentially not billed to other provinces. Combining potential revenues not captured for both in-patient and out-patient events, the total lost revenues in 2000 is estimated at $3.95 million, or 0.48% of the total health Boards budget (2000). Based on these estimates the investment in the Client Registry in Newfoundland and Labrador would be recouped in approximately 2.3 years.

Table 1. Indicators of Potential Hospital Revenue (2000)

INDICATOR	VALUE	FORMULA	
In-Patient Events (Admissions)			
Total In-Patient Events	62,717	A	
In-Patient Events per 1,000 Population	122.5	B	
Total Non-Resident In-Patient Events Billed to other Provinces	734	C	
Total Estimated Non-Resident in-Patient Events not Billed to other Provinces	343	D	
% Non-Resident In-Patient Events Billed to other Provinces to all Inpatients Events	1.2%	E	C/A
% Non-Resident In-Patient Events Not Billed to other Provinces to all Inpatients Events	0.6%	F	D/A
% Non-Resident In-Patient Events (Billed + Not Billed) to all Inpatients Events	1.8%	G	E+F
In-Patient Events (Total Length of Stay – TLOS)			
TLOS for In-Patient Events (days)	492,613	H	
Total Non-Resident In-Patient LOS Billed to other Provinces	3,464	I	
Total Estimated Non-Resident In-Patient LOS not Billed to other Provinces	3,143	J	
Estimated % Non-Resident In-Patient TLOS not Billed to other Provinces	47.6%	K	J/(I+J)
% Non-Resident In-Patient TLOS Billed to other Provinces to all Inpatients TLOS	0.70%	L	I/H
% Non-Resident In-Patient TLOS Not Billed to other Provinces to all Inpatients TLOS	0.64%	M	J/H
% Non-Resident In-Patient TLOS (Billed + Not Billed) to all Inpatients TLOS	1.3%	N	L+M
In-Patient Events (Estimated Revenues not Captured)			
Estimated Revenues[1] Not Billed to other Provinces for Non-Resident In-Patient Events	$2,200,000	O	$700xJ
Out-Patient Events			
Total Estimated Out-Patient Events[2,3]	1,496,000	P	
Estimated Out-Patient Events per 1,000 Population	2,922	Q	
Total Non-Resident Out-Patient Events Billed to other Provinces	17,517	R	
Total Percent Estimated[4] Non-Resident Out-Patient Events Not Billed to other Provinces	47.6%	S	K
Total Estimated[4] Non-Resident Out-Patient Events Not Billed to other Provinces	15,913	T	SxR/ (100-S)
Out-Patient Events (Estimated Revenues Not Captured)			
Estimated Revenues[5] Not Billed to other Provinces for Non-Resident Out-Patient Events	$1,750,000	U	$110xT
Summary – Estimated Hospital Revenues Not Captured			
In-Patient Events	$2,200,000	V	O
Out-Patient Events	$1,750,000	W	U
Total Estimated Revenues for Non-Resident Events Not Claimed	$3,950,000	X	V+W
Total Hospital Boards Budget[6]	$819,000,000	Y	
% Revenue Not Billed to Total Hospital Budget	0.48%	Z	X/Y %

(1) Based on $700 per day stayed
(2) Estimated from ratio of in-patient claims submitted to total in-patient events
(3) See Appendix D (Table 2) for list of out-patient services captured
(4) Based on estimated percent of LOS not billed for former residents
(5) Based on $110 per out-patient event
(6) Global Funding

Study Weaknesses and Strengths

Weaknesses

1) The MVR data only identifies that a person has canceled their NL driver's license, not when the license was canceled. That is, a person identified as having a canceled license in 1999 could have canceled their license any time between 1987 and 1999, the period for which the MVR system has been operational. However, if a person comes back to the province and renews their NL drivers license, the MVR database would be updated and would identify that person as having a valid NL drivers license. Therefore, all individuals used in this study had not renewed their NL drivers licenses as of 1999.

2) It is recognized that not all former residents identified in 1999 would continue to be former residents in 2000, as a certain number would have moved back to the province in 2000. In such instances, that person would be eligible for health insurance in the province at the time of the study. The term “potential” former resident is used and reflects such occurrences.

Strengths

1) Only former residents who had a canceled drivers license were tracked in the hospital database. In Newfoundland and Labrador, only 65% of the population had a drivers license in the year 2000, thus, 35% of potential non-residents were not tracked in this study. The young and very old, who generally use hospital services more than other age cohorts, and usually do not have a drivers license, would be included in this 35%.

2) A total of 66,234 MVR records were flagged in 1999 as having a canceled NL drivers license. Of these records, approximately 43,000 linked to the MCP Master File, with 17,418 of these still having an eligible MCP number. Approximately 23,000 were not matched to a MCP number when linked to MVR data. While no investigation was carried out on these 23,000 individuals, it was assumed that the majority were not linked because of the manner in which a persons last name was entered in the MVR and MCP databases (e.g., name change resulting from marriage). Given this, it is estimated an additional 9,000 eligible MCP numbers for former residents were not tracked in this study.

3) Cost per hospital day in 2000 (i.e., $700) is a conservative cost per hospital days stay.

4) With respect to revenues for out-patient events, the assumption used is that a hospital would be as efficient in identifying former residents in an in-patient setting, as they would in an outpatient setting. However, it is likely that identifying out-patient encounters for former residents would be less efficient than an in-patient setting, given the short period of time for the patient encounter.

5) A conservative estimate of out-patient encounters was used in the analysis (1,496,000 versus 2,020,000). Given this, revenues for out-patients encounters may be underestimated.

6) Only in-patient and out patient hospital services were used in this analysis. Additional revenues would be captured through general physician and specialist visits.

Table 2. Outpatient Registrations
Health Care Corporation of St. John's 2000/01

Ambulatory Care Event	Registrations
Unknown	17
Allied Health	78,385
Asthma teaching	15
Ambulatory Treatment	7,699
Clinics	205,688
Cardiac Rehabilitation	1,089
Dental	2,766
Diagnostic Imaging	115,508
Diabetes Teaching	838
Diagnosis	25,123
Dialysis	23,415
Dermatology Treatment Centre	11,261
Hyperbaric Chamber	75
Laboratory Sample Collection	125,494
Miscellaneous	1
Outpatient Rehabilitation	5,039
Pre-admission Clinic	6,475
Psychiatric Day Care	13,641
Public Health Lab	930
Patient Research Centre	495
Same Day Admissions	3,869
Still Births	9
Sub Total	627,832
ER	118,670
Cancer Clinic	1,367
Total	747,869

APPENDIX D-2
Financial Savings: Detailed Analysis

2. Storage of Medical Charts

An analysis carried out by the Health Records Retention Committee in April 2003, estimated that in 2001 there were 26,000 linear feet of medical records in storage in the province of Newfoundland and Labrador. Available storage space for medical records is at a premium, and hospitals in the province have started shredding non-active charts (not accessed for 10-30 years), as a means for freeing up storage space in their facilities. Identification of patient deaths is a more controlled means for freeing up storage space for medical records in the hospital setting.

Prior to the implementation of the Client Registry in Newfoundland and Labrador (2001), hospitals were aware of patient deaths only for those that occurred in their hospital. That is, if a patient died in hospital "A", and that patient also had a chart in hospital "B", than only hospital "A" would know of the death and could remove the patient chart from storage. Since 2001, the Client Registry notifies hospitals of all deaths regardless of what hospital the patient died in. The following presents the calculation for estimating addition storage space for hospital records that could be made available through the identification of deaths in the province:

Pre-Client Registry (2000)

Average number of Deaths per Year (1996-2000) = 4,200

Average number patients who died in hospital and only had one hospital record = 1,000

Average number of patients who died having more than one hospital record = 3,200

Post-Client Registry (2002)

Since 2001, the Client Registry notifies all hospitals of all deaths regardless of what hospital the patient died in.

Potential Freed Up Storage Space

	Number of Deaths	Linear Feet[1] of Storage
Patient Died (one hospital record)	1,000	100
Patient Died (2 or more hospital records)	3,200[2]	320

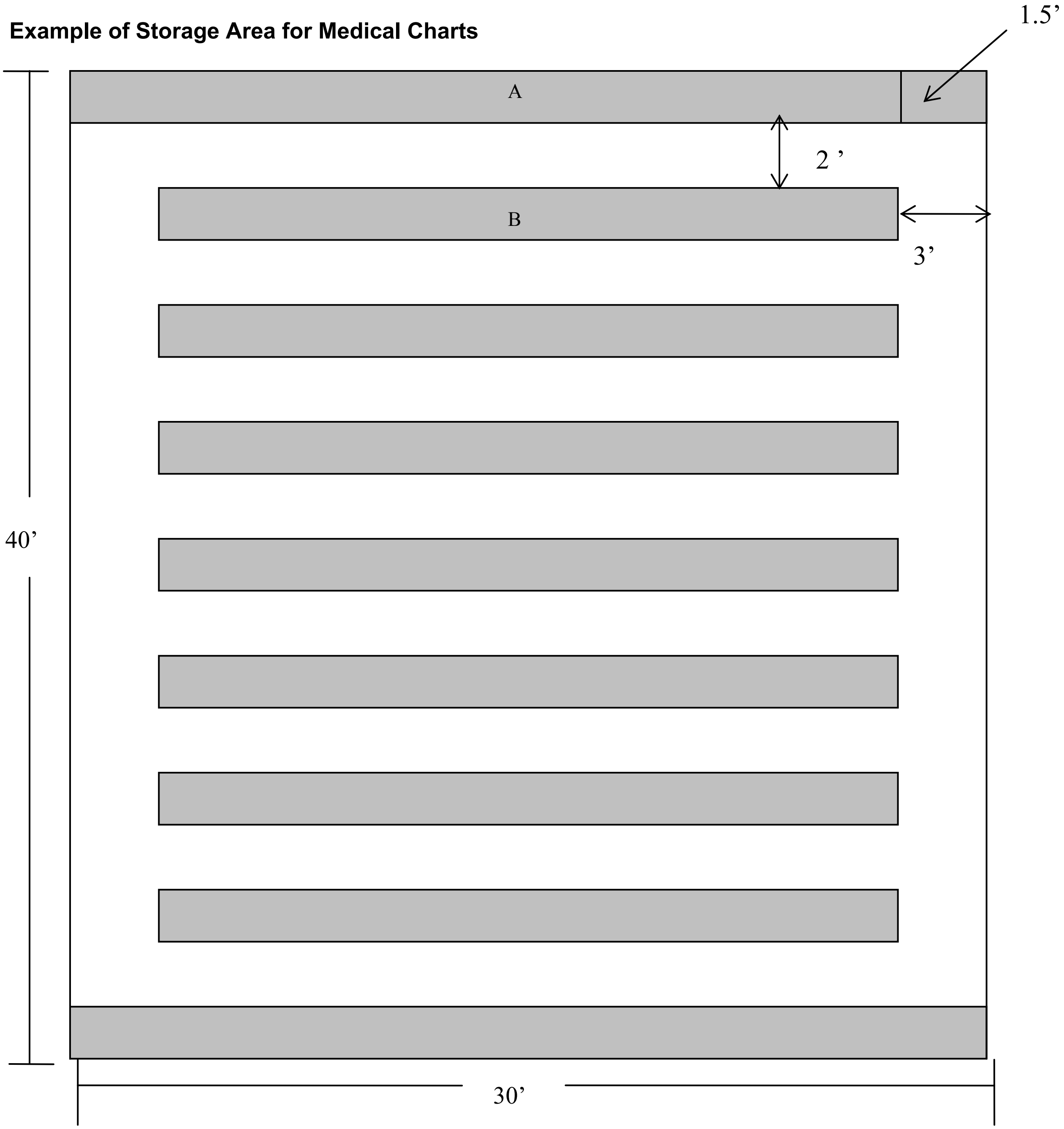
Additional Storage Space Available per 1,000 deaths = 76.2 linear feet (320/4200 x 1000)

It should be noted that information systems in the province currently do not allow for the refining of this benefit beyond the provincial level. More defined benefits related to medical record storage space will be available with the evolution of the Electronic Health Record (EHR).

[1] Based on estimate of 10 hospital records per linear foot (Source: Provincial Health Records Directors)
[2] Estimated from NL Client Registry

APPENDIX D-3
Financial Savings: Detailed Analysis

Example of Storage Area for Medical Charts



Total Area 30’ x 40’ = 1,200 square feet

Total Linear Feet of Storage = 1,596 linear feet

2 shelf’s (A) 30 feet long and 8 feet high (2 x 30 feet x 7 shelves) = 420 linear feet
7 shelf’s (B) 24 feet long and 8 feet high (7 x 24 feet x 7 shelves) = 1,176 linear feet

Estimated Number of Charts that can be Stored = 1,596/76.2 = 21,000

Estimated Cost for Storage Space = 1,200 x $10/month x 12 = $144,000 per year

Estimated Annual Storage Cost per 1,000 Charts = 144,000/21,000 x 1,000 = $7,000 per year

APPENDIX E
Total Cost of Ownership: Detailed Analysis

Development Phase

Benefits Driven Business Case. In 1998, prior to *Infoway* investment, a Benefits Driven Business Case (BDBC) was prepared at a cost of approximately $400,000 that confirmed the health, economic and financial benefits to be realized through the development of a provincial Health Information Network (HIN), with the Unique Personal Identifier/Client Registry as the building block for future phases. As the savings identified in the cost-benefit analysis could be extrapolated to other jurisdictions, the costs associated with the development of the business case need not be incurred by other jurisdictions. The BDBC can be downloaded from the following website: http://www.nlchi.nl.ca/bdbc.asp

UPI/Client Registry Project Scope. Building upon the BDBC, a Scoping Project was carried out in 1999, at a cost of approximately $400,000 that defined the overall solution for the initial UPI/Client Registry in Newfoundland and Labrador. The Project Scope included descriptions, costs and timeframes for all activities through to final implementation. The UPI/Client Registry Project Scope can be downloaded at: http://www.nlchi.nl.ca/upi.asp

UPI/Client Registry Request for Proposals (RFP). Based on the results of the Scoping Project, a formal RFP was executed in 2000. Preparation of the RFP was carried out over a 7 month process, requiring a total of 4.6 FTEs and at a cost of $479,483. Presented in Table 1 is a detailed breakdown of the costs associated with the RFP process.

Table 1. Pre-Infoway: UPI/Client Registry Request for Proposals (RFP)

Phase 1 (2000) - Pre-Infoway: Client Registry RFP

Major Category	Description	Details	One-Time Costs Budgeted	One-Time Costs Actual	FTEs (7 months)	Source
Human Resources	Primary Professional Services	Project Manager	450,000	179,676	1.10	Based on workplan / project timelines / internal financial documents
		Bus / Tech Services		130,987	1.00	
	Internal NLCHI	Project Lead		69,860	1.20	
		Business Lead		69,860	1.20	
		Technical Lead		6600	0.10	
Administrative Expenses	Office Space (Rent)		15,000	0	N/A	
	Equipment / Supplies			15,000		
	Utilization of NLCHI SME's			0		
Other	Travel		15,000	7,500	N/A	
	Other					
Total Phase 1 Costs			**$480,000**	**$479,483**	**4.6**	

UPI/Client Registry Implementation. In 2001, the initial UPI/Client Registry system was implemented in Newfoundland and Labrador. Major human resource requirements included a Project Manager, Business Lead, Technical Lead and Technical Consultants (see Appendix F, Human Resources: Roles and Responsibilities). A Registry Integrity Unit was also established at this time. A Registry Integrity Unit is needed to achieve and maintain an accurate UPI/Client Registry. It should consist of dedicated staff (Data Integrity Specialists) assigned to identify and resolve potentially inaccurate demographics as well as inappropriate eligibility coverage with the provincial health insurance plan. While legacy systems and other existing infrastructure was leveraged where possible, the establishment of the technical environment required a significant investment at a cost of more than $1 million. As the cost of server storage is minimal, it has not been included in the total cost. Total cost of implementation was $3,258,912. On-going annual maintenance costs were estimated at $399,000. Presented in Table 2 is the detailed listing of the costs associated with the development and implementation of the initial Client Registry system.

Table 2. Pre-Infoway: UPI/Client Registry Implementation

Phase 2 (2001) - Pre-Infoway: Client Registry Implementation

Major Category	Description	Details	One-Time Costs		On-going Annual (Maintenance) Costs		FTEs (8 months)	Source
			Budgeted	Actual	Budgeted	Actual		
Human Resources	Primary Professional Services	Project Manager	198,450	244,887	**N/A**		1.3	Internal Financial documents
		Bus / Tech Services	544,176	480,510			3.0	
	Other consultants / vendors	Primary Vendor #1 (Quovadx)	725,118	730,938			3.7	
		Primary Vendor #2 (Medi-train)	50,000	65,000			0.4	
	Internal NLCHI	Project Lead	64,800	80,000			1.2	Based on workplan / project timelines
		Business Lead	64,800	80,000			1.2	
		Technical Lead	45,900	60,000			1.1	
	RIU	Data Integrity Staff	55,000	53,125	100,000	127,500	3.2	
	Stakeholder Contribution	Institutional/Community/Integrated Boards/MCP						
Establish Technical Environment	Hardware	Servers for data processing (3)	572,000	80,000	20,000	15,000	**N/A**	NLCHI Technical Lead
		Windows Servers		187,500	20,000	16,000		NLCHI Technical Lead
		PCs for health boards		75,000	0	0		NLCHI Technical Lead
	Software	Client Registry application (e-Merge)	550,422	375,000	40,000	40,000		Vendor
		Integration engine (Cloverleaf)		175,422	60,000	60,000		Vendor
		Oracle (UPI system database)	305,305	30,000	8,000	7,500		Vendor
		Citrix Software		75,000	2,500	1,500		NLCHI Technical Lead
		Memory Upgrades		10,000	0	0		NLCHI Technical Lead
	Network Connectivity	Private Network WAN Links *(Est. circuits for network access - HIN)*	8,000	7,500	100,000	100,000		NLCHI Technical Lead
		Est. Virtual Private Network	3,000	2,500	2,500	1,500		NLCHI Technical Lead
		Wide Area Network (WAN)	3,000	2,500	35,000	30,000		NLCHI Technical Lead
	Other Infrastructure	Est. Security	0	0	0	0		N/A
		Est. Firewall	0	0	0	0		
		3Com Switches	3,000	2,500	0	0		NLCHI Technical Lead
		Equipment Rack for Servers	8,000	7,500	0	0		NLCHI Technical Lead
Administrative Expenses	Office Space (Rent)		15,000	15,000	**N/A**		**N/A**	Internal financial documents
	Equipment / Supplies							
	Utilization of NLCHI SME's							
Other	Travel / Other[1]		216,950	419,031	**N/A**		**N/A**	Internal Financial documents
Total Phase 2 Costs			**$3,432,921**	**$3,258,912**	**$288,000**	**$399,000**	**15.1**	

Best of Breed (BoB) Project Scope. Following the development and implementation of the UPI/Client Registry in Newfoundland and Labrador, *Infoway* identified NLCHI as an emerging leader in the development of the electronic health record in Canada and formed a partnership with NLCHI to enhance the existing UPI/Client Registry into a Best of Breed (BoB) solution that would be reusable in other jurisdictions.

The BoB Project Scope, carried out in 2003, outlined enhancements to the existing Client Registry system which would increase its integration capabilities. In addition to the Project Manager, Business Lead and Technical Lead, the Project Scope required additional resources of a Business Analyst (0.7 FTE) and a Technical Architect. The BoB Project Scope was carried out over a 3 month period, requiring a total of 4.6 FTEs and at a cost of $275,487. Details of the costs associated with the BoB Project Scope are presented in Table 3.

Table 3. Infoway: Best of Breed (BoB) Client Registry Project Scope

Phase 3 (2003) - Infoway: Developing the 'Best of Breed' Client Registry: Scoping

Major Category	Description	Details	One-Time Costs		FTEs (3 months)	Source
			Budgeted	Actual		
Human Resources	Primary Professional Services	Project Manager	73,500	98,000	1.30	Invoices submiited to Infoway
		Technical Architect	85,080	76,815	0.90	
		Administration / Other	4,890	4,787	0.09	
	Internal NLCHI	Project Lead	16,210	13,679	0.56	
		Business Lead	15,352	8,624	0.36	
		Technical Lead	19,140	12,864	0.70	
		Business Analyst	13,754	10,402	0.58	
		Administration / Other	2,745	521	0.10	
	Stakehioder Contribution	Institutional/Community/Integrated Boards/MCP				
Administrative Expenses	Office Space (Rent)		8,500	8,500	N/A	
	Equipment / Supplies					
	SME's					
Other	Travel	Flight, Hotel, meals, other	20,000	41,295	N/A	Vendor invoices
	Other		20,000	0		
Total Phase 3 Costs			**$279,171**	**$275,487**	**4.6**	

<u>BoB Client Registry (CR1) Implementation</u>. The implementation of the BoB Client Registry took place over a 21 month period. The establishment of the technical environment required hardware and software beyond that of the original UPI/Client Registry. Where possible, however, existing infrastructure established during the implementation of the original UPI/Client Registry was leveraged and utilized. Thus, some items had no associated costs during the implementation of the BoB Client Registry. Similarly, the implementation of the Client Registry in two phases (the original UPI/Client Registry and CR1) resulted in unavoidable duplication of some costs. The implementation of the BoB Client Registry system required the resources of 10.6 FTEs, at a total cost of $4,922,117. On-going annual maintenance costs, including the cost of RIU operations, are estimated at approximately $600,000. Note that with the implementation of CR1, on-going costs associated with the original UPI/CR ($399,000) will be no longer incurred. Presented in Table 4 are the detailed one-time and on-going maintenance costs associated with the implementation of the system.

Table 4. Infoway: Best of Breed (BoB) Client Registry Implementation (CR1)

Phase 4 (2004) - Infoway: Developing the 'Best of Breed' Client Registry: Implementation

Major Category	Description	Details	One-Time Costs		On-going Annual (Maintenance) Costs		FTEs (21 months)	Source
			Budgeted	Actual	Budgeted	Actual		
Human Resources	Primary Professional Services	Project Manager	245,000	429,227	N/A		0.8	Invoices submiited to Infoway and jurisidictional financial forecasting
		Technical Architect	300,000	112,593			0.2	
		Technical Writer	175,000	280,600			0.6	
		Business Analyst	191,000	179,471			0.4	
		Technical Consultant	315,000	420,697			0.8	
		Bus / Tech Services	0	39,000			0.1	
		Administration / Other	25,000	55,000			0.2	
	Other consultants / vendors	Primary Vendor #1	899,000	900,000			1.1	
		Primary Vendor #2	1,500,000	1,500,000			2.4	
	Internal NLCHI	Project Lead	64,021	130,000			0.8	
		Business Lead	66,277	100,000			0.6	
		Technical Lead	82,852	105,000			0.8	
		Business Analyst	139,800	180,939			1.4	
		Administration / Other	17,568	30,500			0.4	
	RIU	Data Integrity Staff	0	0	127,500	127,500	3.2	
Establish Technical Environment	Hardware	Servers for data processing	250,000	86,000	15,000	15,000	N/A	Invoices submiited to Infoway and jurisidictional financial forecasting
		Servers for additional data capacity		18,000	5,000	4,785		
		Windows Servers		0	16,000	16,000		
		1 U Monitor Kits		2,500	0	0		
		KVM Switches; cables, etc.		9,743	0	0		
		Rack Mount Kits		320	0	0		
	Software	Client Registry application (Identity Hub)	0	0	70,000	70,000		
		Integration engine	0	0	30,000	30,000		
		Citrix Software	0	0	1,200	1,500		
		Oracle (UPI system database)	561,000	144,425	45,000	45,000		
		HL7 Interfaces		0	150,000	150,000		
		Clustering Software		72,000	12,000	12,000		
		Crystal Reports		1,300	250	250		
		Auto Load Tape Drive		8,545	0	0		
		Power Management / server control equipment		3,000	0	0		
	Network Connectivity	Private Network WAN Links	0	0	100,000	100,000		
		Virtual Private Network	0	0	1,500	1,500		
		Wide Area Network (WAN)	0	0	30,000	30,000		
	Other Infrastructure	Est. Security	0	0	0	0		
		Est. Firewall	60,000	38,257	5,000	2,795		
		Est. Virtual Private Network	0	0	0	0		
Administrative Expenses	Office (rent)		75,000	75,000	N/A		N/A	Internal financial documents
	Equipment/Supplies							
	Utilization of NLCHI SME's							
Other	Travel	Flight, Hotel, meals	141,000	0	0	0	N/A	N/A
Total Phase 4 Costs			**$5,107,518**	**$4,922,117**	**$608,450**	**$606,331**	**10.6**	

APPENDIX F

Human Resources: Roles and Responsibilities

Project Lead: will provide leadership to the project team to achieve project goals, including ensuring deliverables are produced on time, within budget and to an appropriate quality level. Will provide leadership in the development of the Project Charter and Project plans for Phase II of the project. Responsible for planning and oversight for the project. Responsible for communications with the Project Steering Committee to review project scope/progress and resolve issues.

Project Manager: will provide leadership to the project team to achieve project goals, including ensuring deliverables are produced on time, within budget and to an appropriate quality level. Will direct and document the activities for the development of the Project Charter and Project Plans for Phase II of the project. Responsible for planning and oversight for the project. Responsible for communications with the Project Director and the Project Steering Committee to review project scope/progress and resolve issues.

Business Analyst: will confirm business requirements for the project (including the definition/update for the Minimum Dataset, requirements for an upgrade Client Registry System, and provincial external interfaces). Will determine the change management strategy and work plan for Phase II of the project. Responsible for stakeholder, financial, and communications management.

Technical Architect: responsible for ensuring that technology choices support the project objectives. The technical architect will work with the NLCHI technical lead to provide support in translating stakeholder objectives and critical success factors into actionable business, organization, and technology strategies and selections. The technical architect is responsible for the creation of the overall architecture and assisting with the technology selections.

Technical Consultant: under general direction, applies knowledge to conceptualize, design, construct, test and implement business and technical information technology solutions through application of appropriate software development life cycle methodology. Interacts with the customer to gain an understanding of the business environment, technical context and organizational strategic direction. Defines scope, plans and deliverables for assigned tasks. Collects, identifies, defines and organizes detailed user and information technology requirements. Coordinates and collaborates with others in analyzing collected requirements to ensure plans and identified solutions meet customer needs and expectations. Understands and uses appropriate tools to analyze, identify and resolve business and or technical problems. Assists with product implementations and installations as necessary.

Technical Writer: under minimal direction, analyzes and interprets technical information to compose manuals, proposals, brochures, reports and presentations. Interfaces with customers to determine needs and designs appropriate text. Conducts research of technical manuals and journals to increase understanding of document requirements. Selects appropriate formats, develops detailed outlines and graphics and writes text. Provides editing assistance and revises existing documentation as needed. Interviews technical personnel, interprets reports, specifications and drawings to increase understanding of processes and document requirements. Assists others with technical interpretation and appropriate phrasing for document content. May plan documentation development process and coordinate writing projects. Reviews documentation for an entire project to ensure validity, completeness of content and consistency with order, style and terminology standards. Ensures that any documentation which will be released to the public has been edited to remove sensitive proprietary information.

Technical Lead: is responsible for ensuring that technology choices support the project objectives. The technical lead will work with the technical architect to provide support in translating stakeholder objectives and critical success factors into actionable business, organization, and technology strategies and selections. The technical lead is responsible for the technology selections and assisting with the overall architecture.

Administration/Project Support: will provide assistance to the project team members for the project environment including meetings, logistics, schedules, workspace, connectivity, project workbook, project library, presentations, and meeting documentation. Working with the Project Office, responsible for ensuring that client responsibilities for maintaining financial records are carried out. The Project Office will be responsible for maintaining financial records including the creation, collection, tracking and processing of billing sheets, invoicing the client (NLCHI) and maintaining accounting records, and the arrangement of payment of expenses including sub-contractor fees due. Responsible for maintenance of the project schedule, and for the tracking and maintenance of all legal correspondence, change controls, decision requests and outstanding issues.

Registry Integrity Unit (RIU): needed to achieve and maintain an accurate UPI/Client Registry. It will consist of a dedicated staff **(Data Integrity Specialists)** assigned to identify residents with potentially inaccurate demographics as well as inappropriate eligibility coverage with the provincial health insurance plan.

APPENDIX G
Capacity Building: Interagency Collaboration, Health IT Investment and Economic Growth

NLCHI is an innovative agency with a mandate to build a provincial Electronic Health Record (EHR), beginning with a Unique Personal Identifier/Client Registry. In fulfilling its mandate, NLCHI is promoting intersectoral and interagency collaboration, enabling further health IT investment and contributing to the Newfoundland and Labrador economy.

Interagency Collaboration

Developing an IT solution to meet the needs of all stakeholders, while reducing costs, requires intersectoral and interagency collaborations. Establishing such strategic partnerships:

- enables learning to take place from each other;
- builds supportive networks;
- establishes relationships and builds trust amongst all those involved;
- enhances organizational capacity and resources;
- creates opportunities for future partnerships;
- increases understanding of different organizational strengths and cultures and assists in overcoming barriers/reservations between organizations; and
- provides a forum to exchange ideas and experiences to identify innovative solutions.

During the development and implementation of the UPI/Client Registry in Newfoundland and Labrador, the Centre formed strategic partnerships with the following agencies:

- Newfoundland Medicare Care Commission (MCP);
- Newfoundland Public Health Laboratory and the Laboratory Medicine Program at the Health Sciences Centre;
- Health Canada;
- Newfoundland and Labrador Health Boards Association;
- Treasury Board, Government of Newfoundland and Labrador
- Department of Health and Community Services, Government of Newfoundland and Labrador
- Health and Community Services Boards, Institutional Health Boards and Integrated Health Boards; and
- created an environment for intersectoral collaboration between Health Records Departments and IT Departments, as well as among the various stakeholder groups.

Health IT Investment

Following the $3.6 million investment by the Government of Newfoundland and Labrador in 2001/02 to fund the development of the UPI/Client Registry, several major investments have occurred in health IT, some of which leverage the Client Registry infrastructure:

- In March 2002, a $1.5 million investment was made to further develop the CHIPP-initiated PACS systems in four regional health boards.
- A $1 million investment was made in March 2002 to further develop basic infrastructure and EHR systems in five regional boards.
- A $800,000 investment was made in May 2002 to fund the first phase of the Newfoundland and Labrador Pharmacy Network (Project Scope).
- $639,000 was allocated in 2002/03 to enhance the community sector's primary case management system, the Client and Referral Management System. The primary enhancement is the development of a module to support client payments for programs like Child Welfare, Family and Rehabilitative Services, Community Youth Corrections and Home Support.
- Following the development and implementation of the UPI/Client Registry in Newfoundland and Labrador, Canada Health Infoway identified NLCHI as an emerging leader in the development of the electronic health record in Canada and formed a partnership with NLCHI to enhance the existing UPI/Client Registry into a Best of Breed (BoB) solution that would be reusable in other jurisdictions. Total investment by *Infoway* was $5.4 million.
- $4.75M was allocated in March 2003 to further regional PACS implementations.
- $300,000 was allocated in March 2003 for a storage upgrade in the Central East Health Care Institutions Board.

Economic Growth

Innovation and technology are the primary drivers of economic growth. Utilizing a proactive business development approach that leveraged its existing strengths and capabilities, NLCHI, independently, has generated over $6 million in revenue since 2001 and will have spent over $1 million in the local economy related to activities associated with fulfilling its mandate.

With Newfoundland and Labrador in an advanced stage of readiness for electronic health record adoption, these elevated revenue streams are anticipated to continue to grow as pharmacy, diagnostic imaging, laboratory systems, and other health informatics projects are implemented.

- With the UPI/Client Registry as a building block, the establishment of a population-based pharmaceutical database is conservatively estimated to generate at least $10 million annually in Rx&D investment in the province. In addition to this research, the province is also well-positioned to engage in pharmacogenomics, the study of how genes determine drug behavior. Significant financial investment by pharmaceutical companies and publicly-funded research agencies is expected in this emerging field of research.
- Memorial University’s Faculty of Medicine was awarded $3.2 million from ACOA to develop a Pharmacy Research Database (PRD), as a component of the provincial pharmacy network. This project’s social and economic benefits are expected to accrue to a value of $5.5 million.
- A strategic alliance between EDS Canada Inc., NLCHI and three Newfoundland and Labrador companies is generating substantial economic returns for the province’s business

community. By June 2004, Zeddcomm, xwave and Jane Helleur & Associates Inc. will have shared over $1.6 million from participating in NLCHI's health informatics projects.

- NLCHI supports local companies in the export of their professional services expertise outside the province. The Centre recently collaborated with the Plato Group (www.platogroup.com) in its successful software development and evaluation proposal to the National Research Council (NRC). The proposal shows the strong potential for the company to export its product internationally.
- Meditrain Solutions (www.meditrain.com) developed core competencies in health information systems through its work with NLCHI. As a result of these new skill sets, new markets have been entered outside Newfoundland and Labrador.

Source: NLCHI Value Proposition Briefing Note, May 2004[13]