Modeling a Health Care Enterprise

by

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Performed at
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In partial fulfillment of the requirements of the Master of Health Informatics Program,
Dalhousie University

Report of Internship for the period May 2 – September 1, 2006

Date Submitted: September 11, 2006

This report has been written by me and has not received any previous academic credit at this or any other institution.

Acknowledgements

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Executive Summary

The federal government is responsible for the direct or indirect medical care of nearly a million people. It is the fifth largest jurisdiction in Canada. Certain groups, such as members of the military, inmates at federal institutions and First Nations peoples, are either excluded from the Canada Health Care Act or are provided care through a long standing policy decision. The Federal Healthcare Partnership (FHP) is a partnership of 6 major departments responsible for providing the direct or indirect care. The FHP includes the Department of Defence, Correctional Services Canada, Health Canada, the RCMP, Veteran's Affairs Canada and Citizenship and Immigration Canada.

In an effort to benefit from an electronic system, a few of the departments are currently in the planning or implementation phase of a major health information system. In addition to the individual partner departments, the FHP is currently undertaking an Enterprise Architecture Plan to develop an electronic health record, much like that of Canada Health Infoway, to provide a level of interoperability between the partners and the jurisdictions the partners interact with.

The internship at the FHP consisted of one month placements at 3 of the 6 departments with the final month at the FHP. The intern was hosted at the Department of Defence, Correctional Service Canada and the First Nations and Inuit Health Branch of Health Canada. The internship's main object was to observe and participate in the various major health information system projects within each partner department.

Each placement yielded different issues and challenges for research as well as the application of some of the theory learned to date in the form of minor projects. These projects included developing questionnaires as well as technical requirement documents. The main benefit from the internship, though, was the opportunity to observe and compare the different departments undertake similar projects at different points of the project life cycle. From this experience was the observation that the knowledge among the project teams about the implementation and maintenance of a health information system varied.

One of the objectives of the internship was to maintain a horizontal management perspective in keeping with the mandate of the FHP. In light of the differences of understanding in the necessary elements of health care enterprise, what developed was the start of an enterprise architecture for the health care enterprise that includes not only the health information system but also the governance, people and operational support aspects. In working through an adapted version of the Zachman Framework, the result was a contextual and the start of a conceptual model.

The benefit of this effort for the partners and the FHP is to provide a means to not only define the enterprise and the necessary components to function effectively but also to leverage current knowledge resources filling any knowledge gaps the individual partners departments have.

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1. Introduction

The following is a summary of experiences, observations and participation as an intern with the Federal Healthcare Partnership. During the internship and line keeping with the objectives set prior to the internship beginning, a few challenges presented themselves of which one was analysed. Before turning to this piece of work, a description of the organizations that were involved and internship and work performed.

1.1. Description of Organizations

The Federal Healthcare Partnership (FHP) is a partnership of 6 federal departments that provide direct or indirect healthcare services to specific groups of Canadians with the goal of extending cost savings through the process of collective federal department purchasing of selective healthcare products/services.

By virtue of the Constitution Act or other federal laws, regulations and policies, the following specific populations are provided health services by the federal government:
• First Nations and Inuit individuals;
• eligible Veterans (for services that are not already insured in the provinces);
• members of the Canadian Forces;
• Regular Members of the Royal Canadian Mounted Police and eligible retired members;
• federal inmates; and
• refugee protection claimants, sponsored convention refugees, and individuals detained by Citizenship and Immigration Canada.

In total the partners of the FHP constitute a jurisdiction of roughly 1.1 million people with health expenditures of 2.5 billion annually. It is the fifth largest 'jurisdiction' in Canada.

The permanent members of the FHP are the Department of National Defence (DND), Health Canada (HC), Veterans Affairs Canada (VAC), the Royal Canadian Mounted Police (RCMP), Correctional Service Canada (CSC), and Citizenship and Immigration Canada (CIC).

The two main goals of the FHP are to achieve economies of scale while enhancing the provision of care, and provide strategic issues leadership. [1]

The FHP member departments are currently engaged in a number of health informatics projects and activities. In addition, the FHP is in the process of creating an e-health strategy, namely an enterprise architecture plan, for the federal health jurisdiction.

Partner Departments Included in Internship

DND

DND is responsible for providing direct care to roughly 90,000 members of the Canadian Forces. The scope of care is mainly outpatient care with emergent and specialized care handled by the provincial health care system that each base is located in. DND employees or contracts the services of numerous health care providers ranging from physicians to radiology technicians.

DND is currently implementing a department-wide health information system, the CFHIS. The project is in the second of three phases with the piloting of select features of a fully featured electronic medical record.

CSC

CSC is responsible for roughly 15,000 inmates in correctional institutions spread throughout Canada. Much like DND, the type of care provided is outpatient but includes public health activities accounting for an equal share of the work. The organization is nurse driven with physician and other health care provider services contracted out.

CSC is in the preliminary planning stages for a department-wide electronic medical record. The system has been dubbed the Health Information Management Module (HIMM), as it is seen as a part of a larger information system, the Offender Management System.

FNIHB – HC

FNIHB's population of interest is certainly the largest with the First Nation and Inuit population constituting roughly 3% of Canada's population or 800,000 people. Health care delivery is a mix of direct and indirect care provided on and off reserve. The care delivered on-reserve is mainly conducted by nurses located in approximately 600 health care delivery units across Canada.

FNIHB is set apart from DND and CSC as they are currently focussing on participation in the broader pan-Canadian public health surveillance system project currently underway in Canada. FNIHB is in the preliminary planning stages of the implementation of the pan-Canadian public health surveillance system. Unlike the other departments, FNIHB is taking a strategy to partner with the provinces on the implementation versus implementing a FNIHB version of the pan-Canadian solution.

1.2. Description of Internship

The internship consisted of one month placements at 3 of the 6 partner departments beginning with DND, followed by CSC and then FNIHB – HC with the final wrap-up at the FHP. The objective was to gain practical experience in health informatics issues.

The following with the learning objectives set up before the internship began. The objectives were used as a framework for observation and research.

1. Information Flow and Use
   - Evaluate the flow of information in each individual department as it pertains to business processes
   - Assess potential gaps in the flow of information and deficiencies in information
2. Knowledge Management
   - Assess and understand the role of knowledge management in initiatives
   - Evaluate potential new knowledge management initiatives
3. Health Technology
   - Assess health technology being designed and developed including its benefits and limitations
4. System Analysis and Design
   - Participate, if possible, in electronic health system analysis and design
   - Assess current system design to understand choices made and how it aligns with the information flow and use
5. Project Management
   - Observe project management in practice and learn the different management techniques to keep a project on track
   - Assess project plans to determine appropriateness of scope, timeline and cost
6. Risk Management
   - Evaluate aspects of risk management employed by the different departments as the health informatics initiatives are taken on
   - Assess potential of post-project evaluation including evaluation measures as apart of risk management strategy

As well, in keeping with the mandate of FHP, one overarching objective was to maintain a horizontal perspective and identify systemic issues that may apply to all of the partner departments.

1.3. Description of Work Performed

1.3.1. <u>DND</u>

This first placement consisted mainly of attending meetings to observe the different management aspects of the pilot roll-out of the CFHIS. The meetings were structured by purpose and held weekly. Different areas included project management meetings related to the schedule, the scope of work, interaction with the contractor, among others. There were also meetings related to functional issues and training, all of which quickly showed to be just as or more important than the project management meetings.

There wasn't much work generated out of these meetings but it provided the opportunity to raise some questions for further research. The following are some ideas of the type research that came from the observations.

Research Questions

Information Flow and Use

Question/Concept: What comprises the medical record? Does it included everything or were items excluded?

Research: The Primary Care Reform Initiative has outlined a model of care for the Canadian Forces. The CFHIS is to be laid on top of this model facilitating the work but also not allow the model to be disregarded. Assessing the information flow and use against the model of care will provide some insight into how these two concepts work together and what issues/challenges are presented.

Question/Concept: How is the information within the CFHIS to be used?

Research: The Preliminary Privacy Impact Assessment (PIA) outlines the appropriate primary and secondary uses of the information. Reviewing this document should provide some understanding on how information will be used within the system. It may identify issues and challenges in relation to the differences between how it is suppose to be used and how it is used.

Question/Concept: Interoperability between FHP partners

Research: Related to both the PIA and HL7 questions is the longer term interoperability issue and whether or not information can be 'passed' between users groups (provincial jurisdiction or external department). Simple question of whether the pertinent information in the CFHIS can be used by the appropriate FHP partners (Veterans Affairs Canada, RCMP)

Knowledge Management

Question/Concept: Terminology and semantic interoperability

Definition of semantic: Of or relating to meaning, especially meaning in language

Research: At present, interaction with the CFHIS is not based on a controlled vocabulary such as SNOMED CT. This may present many challenges as the number of users connecting to the system may have a difficult time understanding the information captured. Each user brings their own understanding to the terms used and this may produce unwanted effects. Related to this are the potential issues with using discrete entry based on one terminology system. Diagnosis of the patient by the physicians is an example and the current process of discrete entry may not allow the semantic flexibility to avoid misdiagnosis (e.g. Physician typically calls ailment mechanical neck pain but system requires the user to enter the true diagnosis, Cervicalgia, presenting a problem of term association)

Research: Assess potential to introduce technology such as Clue5, Mycroft, MMTx or UMLS into the system to alleviate the issues of users needed to relearn terminology and standard meaning of terms.

Question/Concept: Structure of the clinical note and the degree to which the data within the medical chart is coded and who performs this codification

Research: Research the importance and worth of structured, coded data for DND. Assess current direction on clinical notes, determine, if possible, how the records management group is involved and potentially propose two models, depending on the findings of assessment to meet the objective of implementing structured, coded data. This research to work in conjunction with the research on controlled vocabulary.

Question/Concept: Decision Support Systems (DSS)

Research: Current plan to implement DSS as part of CPOE. The DSS is built into the drug library of software called Medi-Span. Assess or obtain documentation on sensitivity and specificity of this technology. Simply question, "How well does it detect drug-drug interactions?"

Work Performed

Beyond attending meetings, there was one piece of work performed. In and effort to understand how the CFHIS will impact the users, the project was to research and develop the first draft of a user satisfaction survey. (Appendix 1) One of the critical success factors for the CFHIS is that the end-user is satisfied with the application. There are a few ways of collecting this type of information but a questionnaire was seen to be the most effective. Different established surveying instruments were evaluated for their appropriateness. The End-User Computing Satisfaction (EUCS) (Doll & Torkzadeh, 1988) was selected. Questions were also generated to cover issues such as privacy and security, business transformation and the implementation and training of the system.

The questionnaire questions as well as option analysis of the different modes of delivery were detailed evaluating each against the literature to balance the different types of bias that can impact the results.

1.3.2. CSC

The placement at CSC was much different in style than DND. Rather than meetings, the placement consisted of more analysis and one-on-one collaborations. During the placement, the staff at CSC had issued a Request for Information (RFI), which is essentially a request to health information system vendors to provide details about their systems as well as answer specific questions that the CSC staff were interested in. The results of the RFI were analyzed by different members of the project team and presented to the remaining members.

Much like the meetings at DND, the different activities gave rise to research questions.

Research Questions

Information Flow and Use
Question/Concept: What type of information is used by nurses versus physicians and how is the information used by nurses?

Organizational Change
Question/Concept: What needs to be done to assess the organizational readiness for an EMR?
Question/Concept: What strategies need to be employed to achieve successful business transformation of the health care organization?

Work Performed

In addition to the RFI analysis work and building on the user satisfaction work started at DND, a User Readiness Assessment was started (see Appendix 2). Again the literature provided validated instruments in which to implement and pull from avoiding the problem of generating questions that are not linked to the concepts under study.

The key issue is the introduction of an innovation, in this case an EMR, and whether or not the recipients are ready to adapt to the changes that it will bring. Not only is there issues related to computer skills and knowledge but also attitudes and expectations. As well, project ownership is seen in the literature as a critical success factor and raises a challenge in how to achieve this in a distributed organization like CSC.

1.3.3.   FNIHB – HC

The last placement again differed from the other two in substance and style. At the time of the placement, FNIHB was in early stages of planning for the implementation of the pan-Canadian public health solution, temporarily named EPHS within FNIHB's health regions.

FNIHB and HC are structured into regional offices which are located in one or a couple provinces. The regions work closely with provincial partners in providing public health services. In light of this, a decision was made to partner with the provinces in that the region staff would work together with the provinces to implement the provincial version of EPHS. The result would then be that FNIHB would access this web-based application.

Like the other placements, there were research questions generated around issues specific to the project and general area of public health surveillance.

Research Questions

Question/Concept: Public Health activities concentrate on 4 main elements of "assess, diagnose, treat, and evaluate". How is this different than primary care in terms of a health information system?

Questions/Concept: Evidence-based public health, how to operationalize this? How to translate population-based data/information/research to patient-based care?

Work Performed

The work consisted of participating in meetings related to the set up of a working group as well as outlining the technical requirements for the regional and national configuration of data warehouses to support data management and reporting (see Appendix 3).

As the bulk of the work is conducted at the regional level and these groups of health care providers will be potentially accessing the EPHS directly, there was an interest in modelling the technical aspect of the capture, storage and submission of appropriate health care data to the federal level. Each level has its own information needs and constraints and this needed to be reflected in the technical model.

1.3.4. FHP

The last month of the internship was spent at the FHP. Work mainly focussed on synthesizing the previous months work. In addition, review of different documents related to the ongoing enterprise architecture plan project was also conducted.

As mentioned, the partners of FHP have the responsibility of providing direct or indirect care for roughly 1.1 million people. In an effort to facilitate this process and bring the partner departments in line with the major electronic health record initiative currently being undertaken by the provinces and Canada Health Infoway, the partners agreed to develop a plan to become interoperable between themselves and the jurisdictions they are in contact with.

Looking to the Canada Health Inforway iEHR Blueprint as a reference model, the partners have conducted analyses of their baseline applications and data needs as well as the future desired state that incorporates interoperability. A gaps analysis and an implementation plan are in the initial draft stages.

Research Questions

Question/Concept: What is the business case for an EMR? What will the EMR change and what is going to be better?

Question/Concept: Beyond the technical hurdles, what other challenges will be encountered in achieving interoperability? Issues around privacy, security and governance are just as important. How are these issues to be handled? How are these issues to be addressed as the pan-Canadian EHR is implemented?

Work Performed

The work performed is discussed below in the section dealing with a single problem and the health informatics recommendations.

Overview of how work is related to health informatics

1.4. Overall

The importance of the work around implementing and maintaining an electronic medical record cannot be underestimated. Many of the potential benefits of advanced health informatics (HI) work such as decision support and context specific information retrieval rely upon an EMR to be in place and functioning properly. Yet, developing and implementing and EMR presents its own set of health informatics challenges and represents a risk to further HI work if the EMR and the setting in which it is placed is not well understood. Thus, this internship, in providing an opportunity to observe and research some of the issues surrounding EMRs and their implementation, is very much related to study of health informatics.

The issues and challenges that were encountered during the internship fall into the three domains of informatics as outlined by Turley; cognitive, information and computer science. [2]
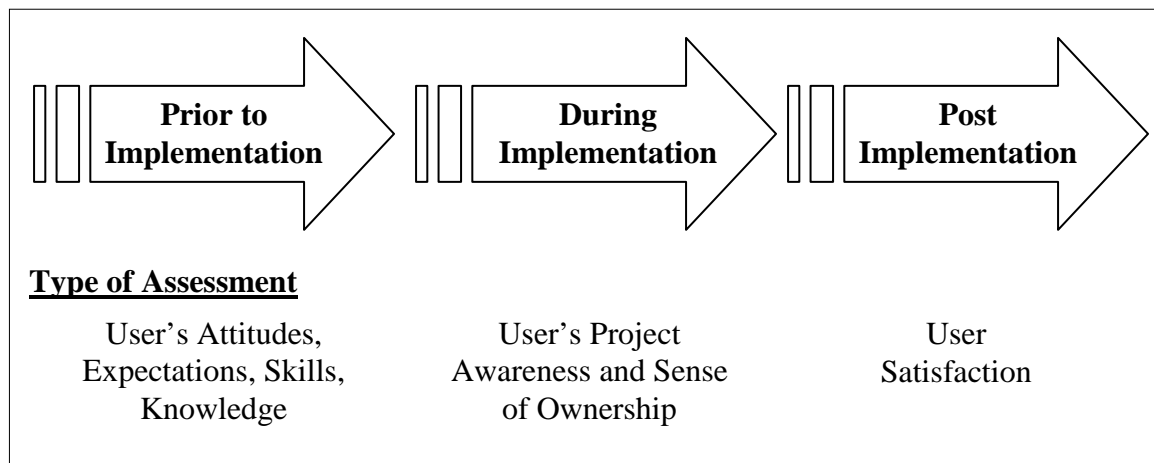
Nursing Informatics Model [2]
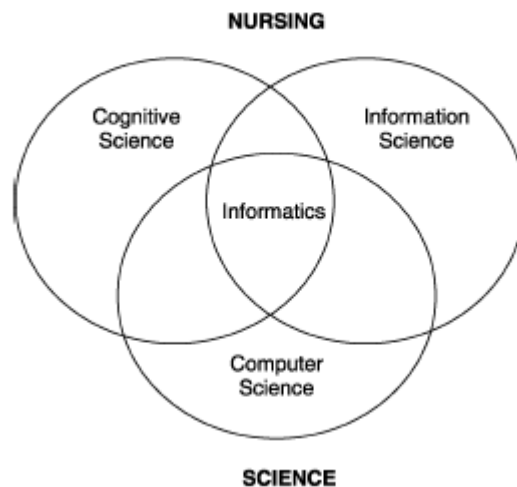
1.5. Cognitive Science

In the cognitive science domain, the user of the EMR was pushed to the fore. Prompted by the research into a user satisfaction survey, the user becomes quite important to the success in implementing the EMR. As stated by Lorenzi *et al*, "the major challenges to system success are often more behavioural than technical." [3] In view of this, the user's skills, abilities, attitudes and expectations come into play with the development and implementation of an EMR.

From the research conducted over the summer on the user, this work can be summarized in the form of a user assessment cycle for the introduction of an innovation, Figure 1, as an illustration of how the work that was conducted is related to HI.

This cycle, used in conjunction with the implementation of an innovation, can be seen to cover the necessary aspects of user and the types of assessments that need to be conducted through the implementation cycle.

Figure 1 User Assessment Model for the Introduction of an Innovation

| Prior to Implementation | During Implementation | Post Implementation |

Type of Assessment

| User's Attitudes, Expectations, Skills, Knowledge | User's Project Awareness and Sense of Ownership | User Satisfaction |

Prior to the implementation of the innovation, in this case the EMR, the user's attitudes, expectations, skills and abilities should be assessed. The outcome of this assessment will inform and potentially constrain the implementation. During the implementation, it could be seen that the user's awareness and sense of ownership of the innovation are requisite to facilitate the implementation and build the foundation for continued use of the innovation. Once the innovation is in place, the user's satisfaction needs to be assessed to determine if the innovation met is requirement. As any new innovation is introduced, the cycle can be employed.

1.6. Information Science

The information science aspect was drawn out while observing and reviewing the flow and use of information in all three partner departments. Issues related to what information and how the information is captured, disseminated and used.

The capture and use of health information falls squarely into the information domain of Turley's model. Though the internship was restricted to observation of the activities in this area, it is easy to understand the difficult nature of the activities.

1.7. Computer Science

With the observation and participation of the planning of the implementation of an electronic medical record, elements of computer science were seen in the challenges of how the users where going to implement technology to good effect. Issues such as the physical location of computers, configuration of the network and implementation of encryption and public key infrastructure were all observed.

Although it is easy to dismiss this area as purely computer science, it became obvious that without the understanding and correct implementation in this area, the other two would certainly not succeed either. Yet as seen during the internship and in the literature, this element needs to be balanced with the others to achieve the goal of a successful implementation.

2. Modeling the health care enterprise

2.1. Background

One issue or challenge that presented itself early was the organization of the department to support and sustain an electronic health information system. Considering the scope of activities related to the use of an EMR, understanding and quantifying the necessary components would provide a means for successful implementation and use of the system.

From this need and in line with the enterprise architecture work already started within the FHP, a conceptual model of a health care enterprise was started. It is hoped that this will provide a basis for knowledge sharing through analyzing and documenting the enterprise activities as per the modified Zachman Framework. The following is a better description of this work.

2.2. Purpose

"Enterprise Architecture is the practice of applying a comprehensive and rigorous method for describing a current and/or future structure and behaviour for an organization's processes, information systems, personnel and organizational sub-units, so that they align with the organization's core goals and strategic direction." [4]

The process involved developing models with different levels of detail that define the organizations, roles, entities and relationships that exist or should exist to perform a set of business processes. These models form a framework that provides a taxonomy of entities that clearly identifies what processes an enterprise performs and detailed information about how those processes are executed. [4]

The objective of using a framework to develop the necessary models is to use this information to understand what processes are needed in order to conduct the 'business' of the enterprise successfully. The effort of documenting what activities the organization is performing is worth the effort in itself, but this information can also provide an opportunity to evaluation and assess the processes to improve them.

2.3. Approach

This effort builds upon the Zachman Framework for Enterprise Architecture. [5] The framework provides a structure for enumerating the different perspectives necessary to fully define an enterprise. The difference will be in which areas of activity or domains are the basis for modeling.

The framework is comprised of 4 different perspectives: contextual, conceptual, logical, and physical. As one moves to a lower level, the level of detail about the entities or elements of the enterprise and definition of the relationships between entities increases (see Figure 1). Taken from the document Conceptual Health Data Model v2.3, Canadian Institute for Health Information, the levels are defined. [6]

The contextual level model illustrates the scope of the enterprise identifying the different entities of the complete enterprise as well as their relationships. At this level there is not much detail, rather the overview of the entities and the links between them.

The conceptual level defines the entities and relationships in greater detail. At this point, the entities and relationships are better defined adding enough clarity as to define each entity so that it can be distinguished from all others.

The logical level illustrates the full complexity of the enterprise entities and all their relationships.

The physical level contains the same level of detail as the logical level but defines how the entity would be operationalized.

The Zachman Framework lists a fifth level, Detailed Representation, but this has been interpreted as sub-models within the physical level and is dependant on the entity being modeled.

Figure 1 Illustration of Zachman Framework Perspectives [6]
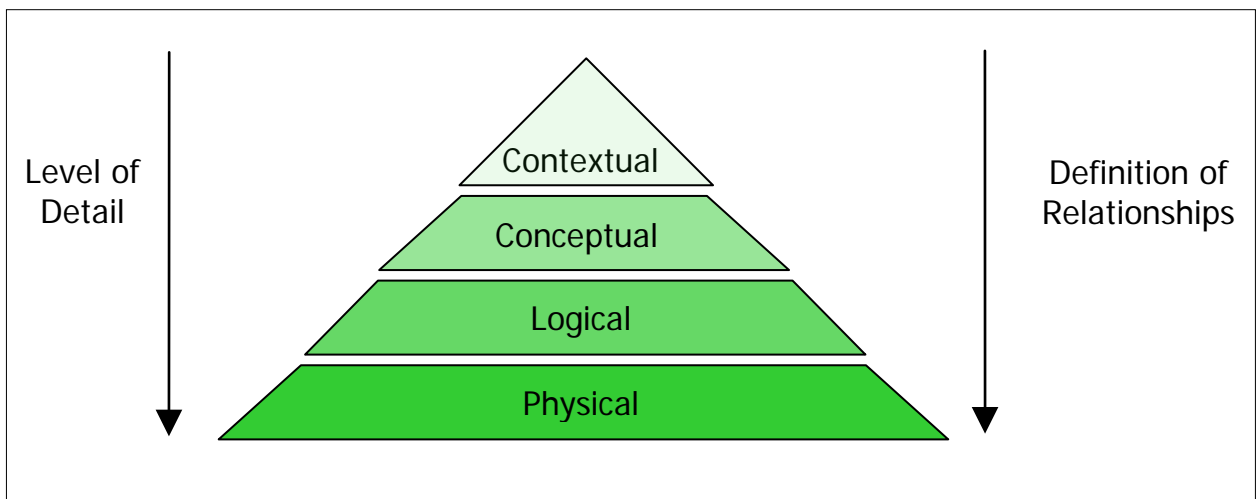
The lower into the architecture the more interconnected the entities are, such that there is little separation when modeled. Each of the domains modeled that may appear as separate entities in the higher levels of the framework integrate as one moves into the lower levels and into operationalization.

One thing to note is the types of work needed to move from one level to the next. The activities in order to further define and detail the enterprise can be developed to provide a standard approach. Examples range from using industry standard methodologies like Rational Rose's Rational Unified Process on the technical side to rigorous statistical methodologies to study client and user attitudes and expectations.

2.4. Contextual Model of the Health Care Enterprise

The goal is to provide high quality care in a timely and efficient manner.

The contextual activity model of the health care enterprise is illustrated in *Figure 2*. The graphical depiction is followed by a list of the entities and their definitions.

Figure 2. Contextual Model of the Health Care Enterprise
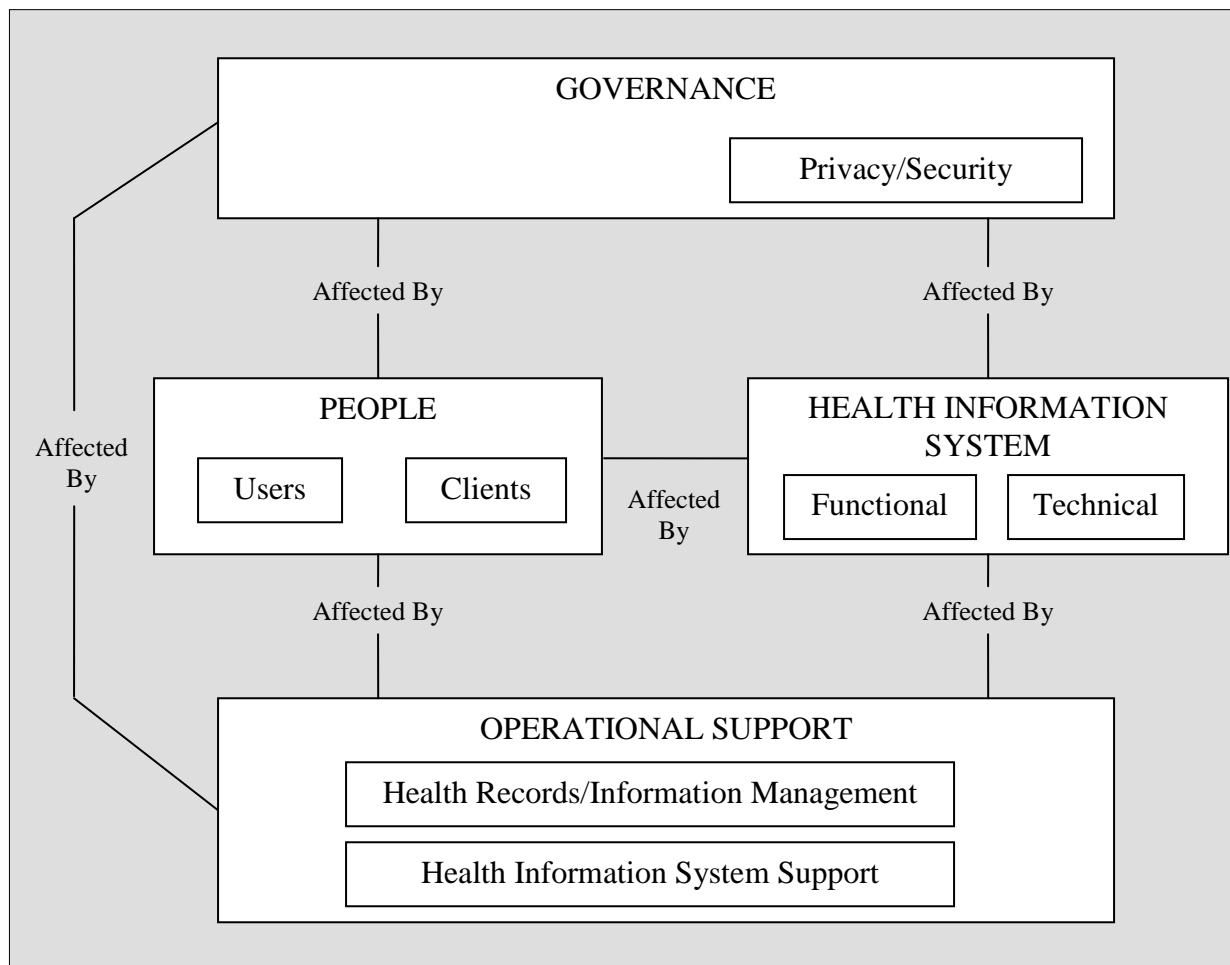
2.4.1. Governance

Governance is defined as any activities or elements that compel or constrain the behaviour of people. [6]

Legislation, policy, standard operating procedures, professional standards, industry standards are examples of the types of elements in this domain.

Privacy/Security Domain

Privacy and security represent an area of governance constrains the enterprise activities around the privacy and security of health information.

2.4.2. People

The entity People represents those persons that interact with the health care enterprise. From the health information system perspective, this domain relates to the skills, abilities, attitudes and expectations.

Users

Users are defined as the users of the information system. This group represents the actors performing the activities of the enterprise.

Clients

Clients are those in which the health care activities are performed on. This is the group that is the recipient of the health care enterprises' activities.

2.4.3. Health Information System

This entity represents core of the enterprise activities, essentially the "what" and "how" of the enterprise. It is comprised of many elements ranging from information needs to application functionality. In addition to these 'soft' elements are some more concrete issues such IT infrastructure and hardware.

Functional Area

This entity represents the collection of activities or tasks and information that comprise the business of the enterprise from the health information system perspective. These represent the more intangible items within the system that supports the enterprise's functions.

Technical Area

This entity represents the technology that supports the functional domain to achieve the enterprise goals. These are more of the tangible items such as computers, printers and barcode readers to network infrastructures made up of routers and servers.

2.4.4. Operational Support

The operational support domain covers all the activities necessary to support the enterprise.

Health Records/Information Management

Taking the industry standard definition, this is support related to the medical record and information contained within as well as legal obligations to the documentation of the health encounter.

Information System Support

Like that of the HR/IM, information system support covers the activities necessary to keep the information system functioning.

2.5. *Conceptual Model of the Health Care Enterprise*

The Conceptual Model presents the same entities as the contextual model providing more definition as well as adding the significant relationships to the model.

The first draft of the conceptual model of the health care enterprise is illustrated in *Figure 3*. The graphical depiction is followed by a list of the entities and their definitions.

Figure 3 Conceptual Model of the Health Care Enterprise
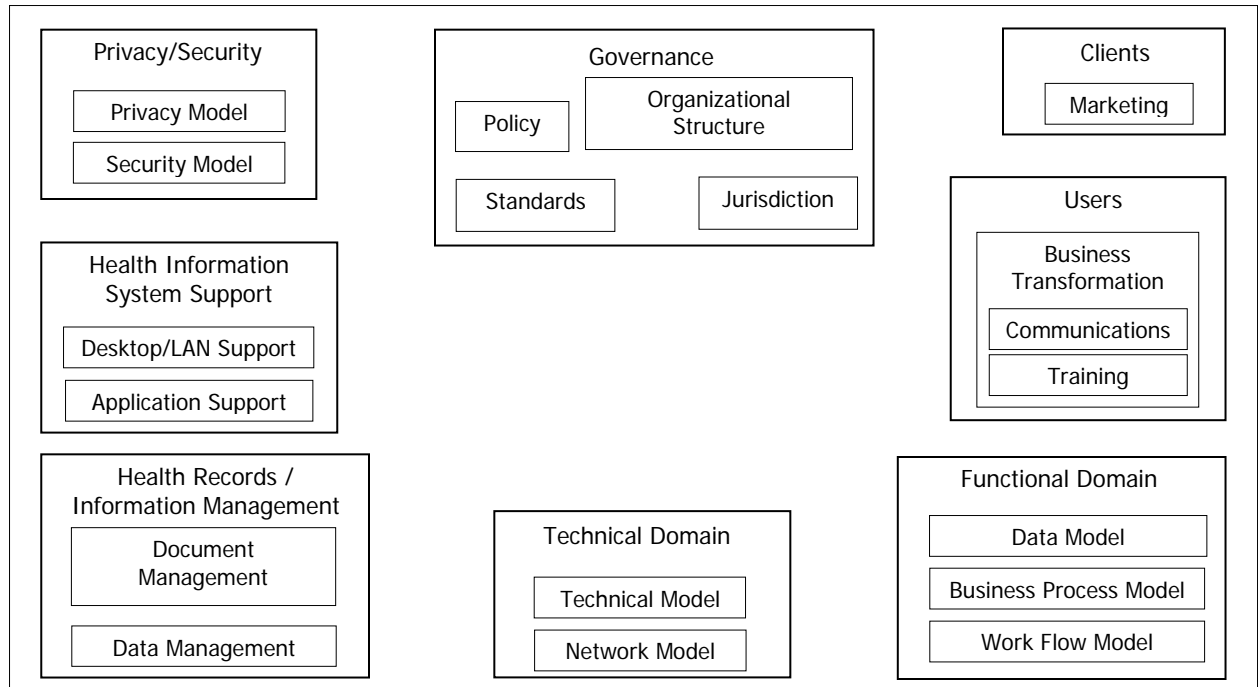
The relationships between the entities have yet to be worked out. They are an important component of the conceptual model that further defines the interactions between entities. Work will continue in developing the model to its completion.

2.5.1. Governance

Governance can be further defined as policy, legislation, standards, organizational structure and jurisdiction. This may not include all the necessary items in this first draft. Further research is required to confirm these four elements cover the area sufficiently.

2.5.2. Privacy/ Security

The Privacy model can be further defined to mean role based, organization based and location based access. Each of the elements set boundaries to who can gain access to the health information contained within the health information system.

The security model is related more to the safe storage or how the data is protected against unauthorized access. Public key infrastructure and encryption are two examples of the elements included in the security model.

2.5.3. User Domain

The domain related to the user is larger concerned with the attitudes, expectations, skills and knowledge around the innovation being implemented. This can be seen as business transformation and relates to the type of activities encompassed in this work.

Communications and training are key tools in transforming the organization to accept an innovation. Fostering a sense of project ownership and comprehensive training plans are examples of the type of activities in this domain.

2.5.4. Client Domain

Much like the User domain, the client of the enterprise in this model brings their own attitudes, expectations and knowledge. Unlike the User group, they are not direct users of the health information system but still need to view the system in a positive or neutral light. The client has an important voice in the activities of the enterprise and needs to be informed and possibly persuaded of the systems benefit as it relates to them. From this comes the notion of marketing which provides a means of conveying information as well as persuasion if necessary.

2.5.5. Functional Domain

The functional domain is comprises of three elements, the data model, the business process model and the work flow model. The data model represents all the information deemed important to the enterprise. The business process model represents the process the agents of the enterprise interact with the health information system in conducting the business of the enterprise. The last model is how the health information system interacts with the setting it has been placed in. Issues around where the agents will interact with the health information system are included in this area.

2.5.6. Technical Domain

The technical domain contains the technical and network model which represent the hardware and networking requirements necessary for the health information system to be used by the enterprise.

2.5.7. Health Information System Support

A health information system requires specific support in order to be implemented and used successfully by the enterprise. The information captured and used by the system is vital for the operation of the enterprise and traditional 'desktop support' is required but not sufficient. Support of the application by personnel that understand the context in

which it is being used is requisite. Desktop and local area network support are also vital and the two areas of support should work in concert to reap the greatest benefit.

2.5.8. Health Records/Information Management

Health Records/Information Management is concerned with the proper management and activities around the capture of, health data. In the traditional sense of health records, the health records department had the obligation that the medical records met the necessary legal requirements. Falling under document management, health records activities currently employed by health institutions are required to continue.

In addition to these activities is the management of the data and the quality of the data. Within data management come the capture and storage of high quality health information.

3. Conclusion

Based on the observations and participation in major health information system projects among 3 of the 6 partner departments in the Federal Healthcare Partnership, knowledge and understanding of what is involved in the implementation of the health information system varied. One key observation made from the internship was that understanding the scope of the activities necessary to implement and sustain a health information system was vitally important.

From this, and taking the lead from current enterprise architecture work underway at the FHP, building on the modeling work seemed appropriate. Leveraging the Zachman Framework, the departments within the Partnership could be modeled at the contextual level to include governance, people, the health information system and operational support. From this one can move to the conceptual, logical and physical levels of the Framework.

The key benefit, through the effort of modeling the enterprise, is for the organization to gain an understanding of the business processes necessary for the successful operation of the enterprise.

4. Recommendations

The role of the Partnership is to take the lead on strategic direction in regards to electronic health system initiatives. Under this mandate it is then recommended that the Partnership and partner departments complete the enterprise architecture activities started in this document for the Partnership itself and for each individual partner department. In doing so, the member partners will gain the benefit and understanding of the implementation from those that have proceeded them.

In addition, as the Partnership works through the development of the architecture, methodologies can be identified or developed for the identification of the necessary

entities and relationships to provide a guideline for the partners as they work through an enterprise architecture effort for their own department.

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Appendices

Appendix 1 User Satisfaction Survey

1. Study Design

1.1 Objective of the evaluation

This questionnaire's aim is to assess users' satisfaction based on critical evaluation of several areas of the CFHIS project. Aspects of the system and its use, the implementation process, and the business transformation process are to be included in the evaluation.

Definition of user satisfaction

"The complete construct "user satisfaction" would be defined as "the extent to which individuals utilizing a specific software product convey their attitudes about how well that product fulfills or fails to fulfill their needs and expectations."

1.2 Constraints or underlying assumptions to be considered when drafting questions
- Only elements under control of HSI can be changed. These include configuration of the given software but not the software itself as whole (ex. Nothing can be done if user doesn't like, computers or a specific software such as Adstra);
- Business processes may be altered by must fit the PCRI model of care prescribed by DND's Surgeon General;
- Privacy/confidentiality and security policies must be followed.

With these types of constraints, the questions should be restricted to elements that can be manipulated by DND.

1.3 Methodology

The method of deployment will be an online survey.

Response rate is a key issue with questionnaires. Too low of a response and the results are open to bias. In essence, the results only reflect the opinions of the people interested enough to respond which may not reflect the opinion of the population as whole. To address this issue, different modes of delivery can be used to assess user satisfaction.

Mode of delivery options:
1. Population survey
Deliver questionnaire via a website and encourage every current user to complete it.
Benefits: if high enough response rate (>60%) then truly representative sample
Drawbacks: none currently identified
Risks: "Encouragement" will not be enough to gain an appropriate response rate to generalize results

2. Random or non-random stratified sample
As the staff using the system is differentiated by role profile and task, stratification of the different groups will provide a more representative picture of the users. Groups could be established by role and task and a random sample generated. Using the HRMS, each user could be assigned a random number and those with even numbers are sampled or use an **every kth** sample, whereby every 3rd person is asked to complete the questionnaire, as examples.

3. Purposive sample
A purposive sample attempts to indentify individuals that are considered experts, or small group people in a unique situation. Another way of looking at this is identifying bellweather users that are seen to represent the rest of the user population. The reasoning for this type of sampling technique stems from the objective. Based on the definition, satisfaction is a derivative of the gap between expectation and reality and potentially many of the users do not have any expectations. The electronic health record is certainly a new area and many people cannot visulize the implications it will have on their daily routine. If their current process is fractured and/or cumbersome, a piece of software that streamlines and unifies the process will produce positive results but not useful results. There is a need for the users to be critical of the system so that issues can be indentified and possibly rectified.

User Satisfaction Questionnaire Questions

Computer Use and Experience

Purpose: This section is to provide background information on the user completing the survey. It may have an impact on their comments and thus needs to be controlled for. As well, it provides an opportunity to collect usage information that can be used by other groups within HSI.

1. On average, how much time do you spend per week using a computer for your work?

Specifically to the use of the CFHIS,
2.1 On a typical day, how much time are you spending using the system?

    Between 6:00 and 7:00 {repeat for full work day plus beyond work day}
    - <10 minutes,
    - between 10 minutes and 20 minutes,
    - between 30 and 45,
    - >45 minutes

2.2 Which day of the week do you typically use the CFHIS the most?

Monday – Tuesday – Wednesday – Thursday – Friday – Saturday – Sunday

2.3 Which day of the week do you typically use the CFHIS the least?

Monday – Tuesday – Wednesday – Thursday – Friday – Saturday – Sunday

3. What training with computers have you had? (Check all that apply)
    - Formal courses
        o University, college courses
        o Software specific (MS Word, Excel) seminars
    - Informal training on the job
    - Self-taught
    - None

4. Overall, how would you rate your computer knowledge?
Scale: Basic Understanding to Extensive

5. Overall, how would you rate your computer experience?
Scale: Limited to Extensive

System Satisfaction

Purpose: This section deals with the interaction of the user with the various components of the software. This section measures whether or not the user satisfied with the different aspects of the software.

1. End-User Computing Satisfaction (EUCS) (Doll & Torkzadeh, 1988)

Scale: Almost never, Some of the time, Almost half of the time, Most of the time, Almost always

Content
- Does the system provide the precise information you need?
- Does the information content {on the screen} meet your needs?
- Does the system provide sufficient information?
- Does the system provide reports?
- Do these reports present just about exactly what you need?

Format
- Do you think the output is presented in a useful format?
- Do you think the screen is presented in a useful format?
- Do you think the reports are presented in a useful format?
- Is the information clear?

Ease of Use
- Is the system user friendly?
- Is the system easy to use?

Accuracy
- Is the system accurate?
- Are you satisfied with the accuracy of the system?

Timeliness
- Do you get the information you need in time?
- Does the system provide up-to-date information?

Additional Comments

2. Software Usability Measurement Inventory (SUMI)

Questionnaire listed in Appendix 1.

-some or all of the questions from SUMI

<u>Implementation Process</u>

Purpose: This section deals specifically with the implementation process. This is defined as the process to take the site from their current business process to the new process that is centered on the CFHIS. It is divided into subgroups, overall, communication, training, support and business transformation.

1. Overall Satisfaction with the Implementation

Do you agree or disagree with the following statements?
Scale: Disagree, Somewhat Disagree, Neutral, Somewhat Agree, Agree

- Overall, the process of switching over from the old system to the new system was well-planned and well-executed
- The people helping with the project were knowledgeable and effective
- The time and effort required of me personally to learn and to help set up the new system were reasonable & not disruptive
- My time was well utilized & not wasted (e.g. due to poor planning, communication, etc.)
- Additional comments

2. Communication {about the implementation or in general about the CFHIS project}

- I knew what to expect and was kept informed through adequate communication

3. Training

Do you agree or disagree with the following statements?
Scale: Disagree, Somewhat Disagree, Neutral, Somewhat Agree, Agree

- The training adequately prepared you for the use of the software.
- The training adequately prepared you for the process changes.
- The training adequately covered the workflow and SOPs.
- The length of the training was adequate.
- There was adequate time to work with the software during training.
- Additional comments/suggestions.

4. Business Transformation

This concerns only the processes to move the system from paper to electronic and not the broader PCRI initiatives. PCRI is asked in order to provide some context for the environment in which the CFHIS is being placed. As well, questions related to PCRI possibly control for any positive or negative bias the PCRI project is creating.

Do you agree or disagree with the following statements?
Scale: Disagree, Somewhat Disagree, Neutral, Somewhat Agree, Agree

4.1 Status of the PCRI for your site

- Is your site currently following the model of care prescribed by the PCRI?
    o Yes No Unknown
- Your work has changed significantly because of the renewal initiative.
- CFHIS will support the Primary Care Renewal Initiative initiatives.

4.2 SOPs
- The SOPs for the use of the system adequately fit the automated business processes.
- The SOPs will be used regularly in conducting your duties.

4.3 Ergonomics/Workflow
- The position of the computer presents a potential hazard.
    o If you agree, please explain.
- The process for infection control is adequate while using the computer.
- The monitor can be easily seen from the position I typically work.
- The position has no impact on the flow of work.
- Overall, the position of the computer is satisfactory.
- You are able to access the system when and where you require.
- Interaction with patient is not impeded or compromised.
- Are you able to function at the pace you are comfortable/most efficient.
- Additional comments/suggestions.

Support

1. Specific to support provided by the local or Super User; do you agree or disagree with the following statements?
Scale: Disagree, Somewhat Disagree, Neutral, Somewhat Agree, Agree

- The support available meets your needs.
- The support is available when you need it.
- You are kept apprised of the status of your problem.
- The support staff is knowledgeable about the application.
- You were provided the appropriate support for your problem.

2. Specific to support provided by the HSI Helpdesk; do you agree or disagree with the following statements?

- The support available meets your needs.
- The support is available when you need it.
- You are kept apprised of the status of your problem.
- The support staff is knowledgeable about the application.
- You were provided the appropriate support for your problem.

Privacy and Security of Information

Purpose: This section is to obtain an understanding of the viewpoint of users on CFHIS related security practices.

Do you agree or disagree with the following statements?
Scale: Disagree, Somewhat Disagree, Neutral, Somewhat Agree, Agree

Overall
- I feel the necessary steps have been taken to protect the information.
- I feel the security measures in place distract me from my duties.
- I feel the security measures in place prevent me from doing my duties.

Role based access
- I don't understand how role based access affects me. {sample}
- I have signed a confidentiality agreement
- Role based access control is an appropriate way to provide the necessary security.
- The role profile for your position appropriately set.
- You feel that you require more information to perform your duties.
- You feel that you have access to too much information.

Overall Impression

Do you agree or disagree with the following statements?
Scale: Disagree, Somewhat Disagree, Neutral, Somewhat Agree, Agree

- Overall, I am satisfied with the new computer system
- The new system satisfies my expectations of a new and improved way of conducting my work
- I don't mind investing the time and effort that is required to learn and adopt the new system
- The new system represents a step in the right direction in terms of improving CFHS services for patients

Please briefly describe the things that work well and are good about the system

Please briefly describe the things that don't work well and could be improved

CFHIS User Profile

Purpose: This section is to provide the necessary information to both stratify the user (into their respective role) and information about which part of CFHIS they use.

1. Site:

2. Civilian/CF Member:

3. Role:
  - Physician / Physician Specialist
  - Nurse Practitioner / Physician Assistant
  - Nurse / Allied Health
  - Clinic Staff
  - Clinic Manager
  - Transcriptionist
  - Mental Health Practitioner
  - Radiologist
    o Radiology tech
  - Pharmacist
    o Pharmacy tech
  - Health Records
  - Dentist
    o Dental Assistant
  - Lab tech
  - Other

4. Components of CFHIS:

Please indicate which functions of CFHIS you use:
  - Scheduler
  - Core clinical
  - Lab
  - Diagnostic Imaging
  - Pharmacy
  - Dental

Appendix 1.

Software Usability Measurement Inventory (SUMI)

The **Software Usability Measurement Inventory** is a rigorously tested and proven method of measuring *software quality* from the *end user's point of view*. SUMI is a consistent method for assessing the quality of use of a software product or prototype, and can assist with the detection of usability flaws before a product is shipped. It is backed by an extensive reference database embedded in an effective analysis and report generation tool.

The questions are grouped into the following categories:

Global

The Global scale consists of 25 items out of the 50 which loaded most heavily on a general usability factor. Because of the larger number of items which contribute to the Global scale, reliabilities are correspondingly higher. The Global scale was produced in order to represent the single construct of perceived quality of use better than a simple average of all the items of the questionnaire.

Efficiency

Efficiency measures the degree to which users feel that the software assists them in their work and is related to the concept of transparency.

Affect

Affect measures the user's general emotional reaction to the software -- it may be glossed as likeability.

Helpfulness

Helpfulness measures the degree to which the software is self-explanatory, as well as more specific things like the adequacy of help facilities and documentation.

Control

Control dimensions measures the extent to which the user feels in control of the software, as opposed to being controlled by the software, when carrying out the task.

Learnability

Learnability, finally, measures the speed and facility with which the user feels that they have been able to master the system, or to learn how to use new features when necessary.

Scale: Agree, Undecided, Disagree

Item	Statement
1	This software responds too slowly to inputs.
2	I would recommend this software to my colleagues.
3	The instructions and prompts are helpful.
4	The software has at some time stopped unexpectedly.
5	Learning to operate this software initially is full of problems.
6	I sometimes don't know what to do next with this software.
7	I enjoy my sessions with this software.
8	I find that the help information given by this software is not very useful.
9	If this software stops it is not easy to restart it.
10	It takes too long to learn the software commands.
11	I sometimes wonder if I am using the right command.
12	Working with this software is satisfying.
13	The way that system information is presented is clear and understandable.
14	I feel safer if I use only a few familiar commands or operations.
15	The software documentation is very informative.
16	This software seems to disrupt the way I normally like to arrange my work.
17	Working with this software is mentally stimulating.
18	There is never enough information on the screen when it's needed.
19	I feel in command of this software when I am using it.
20	I prefer to stick to the facilities that I know best.
21	I think this software is inconsistent.
22	I would not like to use this software every day.
23	I can understand and act on the information provided by this software.
24	This software is awkward when I want to do something which is not standard.
25	There is too much to read before you can use the software.
26	Tasks can be performed in a straight forward manner using this software.
27	Using this software is frustrating.
28	The software has helped me overcome any problems I have had in using it.
29	The speed of this software is fast enough.
30	I keep having to go back to look at the guides.
31	It is obvious that user needs have been fully taken into consideration.
32	There have been times in using this software when I have felt quite tense.

Item	Statement
33	The organisation of the menus or information lists seems quite logical.
34	The software allows the user to be economic of keystrokes.
35	Learning how to use new functions is difficult.
36	There are too many steps required to get something to work.
37	I think this software has made me have a headache on occasions.
38	Error prevention messages are not adequate.
39	It is easy to make the software do exactly what you want.
40	I will never learn to use all that is offered in this software.
41	The software hasn't always done what I was expecting.
42	The software has a very attractive presentation.
43	Either the amount or quality of the help information varies across the system.
44	It is relatively easy to move from one part of a task to another.
45	It is easy to forget how to do things with this software.
46	This software occasionally behaves in a way which can't be understood.
47	This software is really very awkward.
48	It is easy to see at a glance what the options are at each stage.
49	Getting data files in and out of the system is not easy.
50	I have to look for assistance most times when I use this software.

Appendix 2 HIMM Readiness Assessment

1. Study Design

1.1.   Background

The Health Information Management Module project is an initiative to implement a health information system within the correctional setting. The HIMM project has the following vision and objectives:

Vision of HIMM:

>   Improve the quality of health care by improving the collection and availability of information, improving the efficiency of service delivery, enhancing the capacity to monitor quality of care.

HIMM Objectives:

*   To provide an automated offender health information management system which is supportive of the CSC Health Services business processes;
*   To provide a venue for evidence-based practice resulting in enhancing the capacity to track and monitor healthcare delivery and treatments in an accurate and real-time fashion;
*   To streamline frontline processes and facilitate meaningful direct care delivery to the inmate population;
*   To simplify and standardize the existing CSC Health Services business environment and ultimately;
*   To improve the quality of health care available to CSC offenders by improving the efficiency and effectiveness of health service delivery.

The HIMM project success is predicated on the successful live implementation with training requirements met and front line employee satisfaction with its ease of use, rapid data access, integration, storage and retrieval of health information.

Satisfaction is defined as how, in this case, the system meets the users' expectations and needs. Project success could be seen to be more obtainable if the project team understands the expectations and needs of the front line employees and, as much as possible, tries to accommodate them in an effort to achieve the appropriate level of end-user satisfaction.

1.2.   Objectives

Computer skills questionnaire:
This questionnaire intends to capture the current state of the front line employee's skills, abilities, knowledge and attitudes related to computers and their use.

EMR questionnaire:
This questionnaire intends to capture front line employees' knowledge and attitudes related to electronic medical records and the impact the EMR will have.

HIMM Project Awareness:
This questionnaire intends to capture front line employees' awareness related to the HIMM project.

Current practice:
This questionnaire intends to capture front line employees' current practice in an effort to provide a benchmark and assess the gap between current business practices and the intended structured, standardized practice.

General purpose:
The purpose of this work is gain a better understanding of the composition of the organization in order to better target communication and training initiatives.

1.3.   Methodology

Using a questionnaire provides a way to involve as many of the end-users as possible. Not all of the 1000 health services staff can comment on each business requirement, but through a questionnaire or survey, they may feel connected to the project and this in turn may foster a sense of ownership. Education on what the EHR is and can do can also be integrated into the surveys.

The mode of delivery will need to be paper bases as well as online, if possible, to fully capture the intended audience.

1.4.   Constraints/Assumptions

Question Bank

1. <u>Computer Experience</u>

This section is intended to capture the baseline information on the staff's computer experience as well as identify the level of access by the staff.

1.1. Do you have access to a computer at work?
1.2. At work, how many hours do you personally use a computer per day?
1.3. What do you typically use the computer to do at work?
- Email
- Search the internet for information
- Write reports using a word processor (Microsoft Word)
- Track appointments using Microsoft Excel or Access
1.4. Do you have access to a computer at home?
1.5. At home, how many hours do you personally use a computer per day?
1.6. What do you typically use the computer to do at home?
- Email
- Search the internet for information
- Write correspondence using a word processor
1.7. What type of training have you received on using computers?
- University/college based courses
- CSC sponsored training
- Informal training on the job
- Self-taught
- None
1.8. Did you use computers as part of your training as a nurse?
- Yes
- No
1.9. Overall, how would you rate your experience in using a computer?
     1.9.1. I have little experience – I am very experienced (1-7 scale)

2. Computer Knowledge

This section is intended to assess the staff's knowledge of computers as well as some elements information management. It should provide a snapshot of general awareness of current computers applications and their functions.

Know most things – Know some things – Know a little – Know nothing

What knowledge do you have of:
1. Opening an internet browsing application
2. Using email
3. Writing a letter using a word processor
4. Spell checking a document
5. Open, modify, close and save a database
6. Retrieve information from a database
7. Data collection (observations/values)
8. Coding and classification of information
9. Data analysis
10. Inspecting, correcting, and verifying analysed data
11. Data standards
12. Clinical record keeping
13. Using computers to access reference information to assist in the diagnosis, planning and delivery of care
14. Sharing patient information electronically between clinical staff
15. Systematically reviewing the delivery and efficacy of clinical care
16. Evidence based practice

Which of the following is not a dedicated search engine?
- Google
- Yahoo
- Ask Jeeves
- Amazon
- Don't know

If you want to send an email and include a photograph, how would you send the photo?
- as an inclusion
- as an attachment
- as an amendment
- as a separate email
- don't know

Which of the following keys on a keyboard usually allows you to move between fields in a database?
- Tab
- Esc
- Shift

- Caps lock
- Don't know

Which of the following software would be best for analysing inmate attendance at the health care centre?
- MS Powerpoint
- MS Excel
- MS Word
- MS Outlook
- Don't know

Which would be the best indicator of an improvement in a patient's condition?
- A reduction in the number of attendances at the health care centre
- Attaining the goals set out in the patient's treatment plan
- A reduction in the cost of medication used for a patient
- A report from the discipline staff stating they seemed better
- Don't know

You wish to review attendances at the health care centre. Which information would be most appropriate to collect?
- Numbers booked in for clinics per day
- Number of prisoners registered with health care centre
- Number of face to face contacts, by professional
- Names of prisoners attending health care centre in one day
- Don't know

Which of the following is LEAST important in assessing the value of information?
- Timeliness
- Accuracy
- Who collects the information
- Relevance
- Don't know

Which is the clearest method of presenting simple figures about total daily attendances (over a two week period) at the health centre?
- Textual description
- Bar chart
- Line Graph
- Table
- Don't know

3. Computer Attitudes

This section intends to illustrate the staff's attitudes towards using computers to conduct their work. It should result in knowing whether there is a negative or positive attitude overall as well as 'hot spots' as the questions are related to specific concepts. This is explained in the study the questionnaire was pulled from.

3.1. See appendix 1 for Nurses' Attitudes Toward Computerization Questionnaire and Computer Attitude Scale

4. EMR knowledge

More specific to the EMR than the general computer knowledge, this section intends to capture the staff's understanding and knowledge of what an EMR is.

4.1. If you were to be given an EMR, which of the following components would you expect to see?
- Clinical documentation
- Scheduling system
- Order entry
- Review of test result

5. EHR expectations/attitudes

Again, attitudes and expectations are important to capture. The results of the following section should indicate the staff's attitudes and expectations towards the EMR.

5.1. What is your opinion of paper medical chart and documentation process?
    Taxing – burdensome – no opinion – effective – cannot be improved
5.2. How do you expect an EHR to impact your daily work routine?
5.3. Expectations of the impact in the:
- short term (0-6mths),
- medium (6mths – 2yrs),
- long term (2yrs +)
5.4. See appendix 2 – Potential effects and attitudes toward of EHR
5.5. If I were to say the EMR would reduce the time you take to chart per day by: over 1 hour, 1 hour, 30 minutes, 15 minutes, less than 15 minutes
- Disagree – Somewhat Disagree – No opinion – Somewhat Agree - Agree
5.6. From the list what do you think are the features most important in an EHR?
- See appendix 3 – Capabilities and expectations of an EHR

6. Current practice

One important element is to try and capture the current practice to set a benchmark. From this it may be possible to determine has much the EMR will change the current business practice. It is important to understand if the current practice is not conducive to the structured, standardized nature of an EMR. Questions should be contained to the use of the paper chart.

6.1. Do you document the health encounter during the encounter or at another time?
      6.1.1.   If not during the encounter, when?
6.2. How much time do you feel you are taking to document your health care activities during the day?
6.3. Of this time what percentage of this time is split between primary care and public health activities?

7. HIMM Project

7.1. Communication
      7.1.1.   Newsletter – have you seen it, where did you see it, do you have any comments about it
7.2. Project Awareness
      7.2.1.   project ownership – high – low {expect it to be low but to increase as progress continues – goal?}
      7.2.2.   Vision of Health Services – agree or disagree, don't understand why need for change – change is imperative, concern for patient safety
      7.2.3.   Objectives – do you understand them – what is not clear? (term:automated)
        7.2.3.1. Do you understand how this will impact you?

8. Respondent profile
8.1. Region
8.2. Role (list needed)
8.3. Age group?
8.4. Number of years at CSC?
8.5. Number of years as registered nurse?

Nurses' Attitudes Towards Computerization Questionnaire

Disagree – Somewhat Disagree – No opinion – Somewhat Agree – Agree

{The user should only see the scale as listed above. For the analysis, numbers should be assigned to each factor depending on if the question is positively or negatively worded. The highest score is 100, the lowest 20. A value of 60 or greater indicates a positive attitude to toward computerization.}

References:
Stronge JH, Brodt A. Assessment of nurses' attitudes toward computerization. Computers in Nursing. 1985; 3:154-158.
McBride SH, Nagle LM. Attitudes Toward Computers: A Test of Construct Validity. Computers in Nursing. 1996; 14(3):164-170.

1. A computer increases costs by increasing the nurses' workload
2. Computers cause a decrease in communication between institutions
3. Computers will allow the nurse more time for professional tasks
4. Part of the increase in costs of health care is because of computers
5. The time spent using a computer is out of proportion to the benefits
6. Computers represent a violation of patient privacy
7. Only one person at a time can use a computer terminal and, therefore, staff efficiency is inhibited
8. Computerization of nursing data offers nurses a remarkable opportunity to improve patient care
9. Computers contain too much personal data
10. Computers can cause nurses to give less time to quality nursing care
11. If I had my way, nurses would never have to use computers
12. Computers should only be used in the financial department
13. Computers make nurses jobs easier
14. Paperwork for nurses has been reduced greatly by the use of computers
15. Orientation for new employees takes longer because of computers
16. Nursing data does not lend itself to computers
17. Computers save steps and allow the nursing staff to become more efficient
18. The more computers in an institution, the less number of jobs for employees
19. Increased computer use will allow nurses more time to give patient care
20. Because of computers, nurses will face more law suits

Computer Attitude Scale

Reference: Nickell G, Pinto J. The computer attitude scale. Comp Human Behav 1986; 2:301-306

Scale: Disagree – Somewhat disagree – No opinion – Somewhat agree – Agree

1. Computers will never replace human life.
2. Computers make me uncomfortable because I don't understand them.
3. People are becoming slaves to computers.
4. Computers are responsible for many of the good things we enjoy.
5. Soon our lives will be controlled by computers.
6. I feel intimidated by computers.
7. There are unlimited possibilities of computer applications that haven't even been thought of yet.
8. The overuse of computers may be harmful and damaging to humans.
9. Computers are dehumanizing to society.
10. Computers can eliminate a lot of tedious work for people.
11. The use of computers is enhancing our standard of living.
12. Computers turn people into just another number.
13. Computers are lessening the importance of too many jobs now done by humans.
14. Computers are a fast and efficient means of gaining information.
15. Computers intimidate me because they seem so complex.
16. Computers will replace the need for working human beings.
17. Computers are bringing us into a bright new era.
18. Soon our world will be completely run by computers.
19. Life will be easier and faster with computers.
20. Computers are difficult to understand and frustrating to work with.

appendix 2 – Potential effects and attitudes toward EMR

Adapted from: Cork RD, Detmer WM, Friedman CP. Development and Initial Validation of an Instrument to Measure Physician's Use of, Knowledge about, and Attitudes Toward Computers. JAMIA. 1998; 5:164-176.

Scale: Highly detrimental (1) – Detrimental on the whole – Neither detrimental nor beneficial – Beneficial on the whole – Highly beneficial (5)

Effect of electronic medical records on:

Costs of health care
Clinical autonomy
Quality of health care
Interactions within the health care team
Role of the government in health care
Management of medical/ethical dilemmas
Enjoyment of the practice of medicine
Status of medicine as a profession
Continuing medical education
The self-image of nurses
Humaneness of the practice of medicine
The rapport between clinicians and patients
Personal and professional privacy
Nurses' access to up-to-date knowledge
Patient's satisfaction with the quality of care they receive
Nurses' ability to manage more complex problems

appendix 3. Capabilities/expectations of future EHR

Reference: Cork RD, Detmer WM, Friedman CP. Development and Initial Validation of an Instrument to Measure Physician's Use of, Knowledge about, and Attitudes Toward Computers. JAMIA. 1998; 5:164-176.

If you were considering the use of an EHR, how necessary would the following capabilities be?

1. Vitally necessary: Any system I would use must have this capability. I would not use a system that lacked it.
2. Generally necessary: I would be much more likely to use a system having this capability, but I might use a system that lacked it.
3. Somewhat necessary: I would be somewhat more likely to use a system because it had this capability.
4. Not necessary: My decision to use a system would be unaffected by the presence of this capability.
5. Unable to respond: The meaning or implications of this capability are not clear to me.

Please provide one answer from the list above to each of the following statements. Statements:

1. I can enter information in my own words and not need to know any special codes.
2. I can learn the system in less than two hours.
3. I can access the system at any place in the clinical setting.
4. The system always responds to my queries in less than five seconds.
5. I can interact with the computer without using a keyboard.
6. The system can be implemented with no changes whatsoever to existing clinic routines
7. The system is always functioning. There is never any "down" time.
8. Help on how to use the program is available on-line
9. Level of confidentiality and security must be better than the paper record.

Appendix 3 FNIHB EPHS Implementation Project Requirements

Please note: due to technical difficulties in migrating a WordPerfect document to Microsoft Word, the diagrams referred to in this document were lost. Further attempts to retrieve the images will be made and the appendix resubmitted.

Overview

The provinces, territories and federal government have engaged in the development of an pan-Canadian public health system. The system, currently named Electronic Public Health System (EPHS), is expected to support public health activities such as case, outbreak and immunization management as well as public health surveillance reporting. This document focuses on the reporting aspect of this system at both the regional and national levels for the First Nation and Inuit Health Branch (FNIHB).

Taking the approach of working with the provinces versus implementing a version of its own, FNIHB will be required to work with the provinces/territories in implementing the EPHS in the respective jurisdictions. This may be the key challenge as FNIHB moves forward with this project.

There are 7 Regions within Health Canada of which FNIHB activities are conducted. The regions are BC/Yukon, Alberta/NWT, Saskatchewan/Manitoba, Ontario/Nunavut, Quebec and Atlantic (Newfoundland and Labrador, Nova Scotia, New Brunswick, PEI).

The regions mirror the EPHS implementations with the exception of Saskatchewan and Manitoba. The Atlantic region is collaborating on developing a joint implementation of the EPHS and the Territories are partnering with individual provinces. This is important to note as the FNIHB regions are naturally aligned with the provinces taking on the implementation of the EPHS and may potentially facilitate collaboration on the implementation project.

As stated, this document is focusing on the reporting aspect of the public health system, looking to address, in part, the requirements of the regional and national level to fully engage the EPHS. Its general structure is to follow the pattern of outlining the business requirement, in other words, what task is it that a staff person does, and from this the domain requirement needed to accomplish the business requirement.

There are currently 8 domains identified (in no particular order): Technical, Governance Functional, Helpdesk/IT support, Health Information/Records Management, Privacy/Security, Users and Patients. Thus the pattern will be business requirement then, for example, technical requirement. The requirements will be followed by a responsibility matrix. The matrix will attempt to identify the professional group responsible for the requirement as well as, the group that will support the responsible party. Finally, there may be an activity network outlining the dependencies or the steps as they need to be taken in order.

The purpose of this document is to provide the basis for more detailed requirements gathering by providing a starting point for discussion. It should be seen as a living document that is updated as the project progresses and more requirements emerge.

1. Technical Requirements

Overview
These are requirements related to hardware, software, connectivity and access to conduct the public health work. Item such as computers, connection to the Internet, databases, analysis software (SAS, Crystal reports) need to be identified and acquired if missing.

A. Requirement Details

1.1 Using EPHS

1.1.1 Business requirement: General Use of EPHS

Requirement 1. Input into data elements and configuration of the system providing FNIHB the information resources to conduct FNI specific programs.

Requirement 2. Data sharing agreements with each jurisdiction there is a regional office (intra- jurisdictional) outlining what data is to be shared, what can be done with this data in terms of reporting and distributing to other jurisdictions and to the federal level.

Requirement 3. Inter-jurisdictional data sharing agreements to gain access to data for people moving from one jurisdiction to the next.

Dependancies:
- ¬ Governance structure may be required to meet these requirements.
- ¬ Key dependancy is that FNIHB staff are able to provide input to partner jurisdiction implementation plan.
- ¬ FNIHB regional staff are able to appoint or second staff to implementation project and this person(s) are able to commit time and effort to the project

Risks:
- ¬ Unable to identify regional staff to provide input to EPHS
- ¬ FNIHB staff are unable to successfully provide input to implemenation plan and this deficiency has a negative impact on FNIHB business.

1.1.2 Business Requirement: Connecting to the EPHS

With the EPHS in place, there are some key requirements around physically connecting to the system.

Requirement 1 Users needing to access the EPHS have access to computer that can connect to the Internet.

Requirement 1.1 Each FNIHB Regional Internet infrastructure must be able to handle the load that EPHS will present. In lay terms, each user of the system presents a certain amount of workload for the technology they are using. If the system is unable to accomadate the load, the outcome may be system slow down, data loss or corruption and system instability (likely to 'freeze' on the user). It is important to be aware that this system will take up current network resources and may exceed current capacity leading to the negative affects listed.

Requirement 1.2 Region will need to perform technical inventory assessment to identify gaps. Related to 1.1 is for the regions to account for the technology they have and do not have to provide context for the implementation.

Requirement 1.3 Region will need to enumerate the number of concurrent users expected to connect to the system and an estimate of the number of health encounters for a given period for the partner jurisdiction to accommodate the information workload the region will present to the jurisdiction's infrastructure. Like 1.1 and 1.2, this information is useful for both the regional office and province. It will provide information assess if the current technical capacity is sufficient.

One way of envisioning requirements 1.1 to 1.3 is to think of yourself as a manager. You start off with one employee that comes to you periodically for input. You are able to balance your work and the request of your staff person. Now, two other employees have been assigned to you. You are now dealing with you work and requests from 3 people. Last, the first employee is given a task that requires a significant amount of your time. Your workload is becoming unbalanced as you are dealing with your own work, the requests from 2 of your employees and the constant communication with the third. This is in essence what a network has to contends with. At some point there are too many employees with requests that are too frequent and too laborious to deal with. It is important to balance the work coming in (workload) with available time (capacity) and be able to forecast resource deficiencies before the have a negative impact.

Requirement 2 The computer may require to connect to the EPHS via jurisdiction's extranet, essentially a private internet over the Internet. Depending on whether or not the EPHS is accessed through an extranet, issues will need to be identified around FNIHB staff in the region accessing the EPHS. An example of this is if the extranet allows FNIHB staff access to provincial resources beyond the EPHS.

Requirement 3 The user will require valid access to the EPHS such as a user name and password. This requirement is linked to governance and functional requirements listed elsewhere in this document.

Requirement 4 The region may need to comply with the jurisdiction's privacy and security policies. These policies may conflict with regional policies relating to security

and privacy. This requirement is linked to the security and privacy requirements listed elsewhere in this document.

Requirement 5 In collaboration with the jurisdiction, contingency planning will need to be conducted to mitigate the situation where the EPHS is non-operational. In essence, how much time can the organization continue to conduct work without access to the information stored in the EPHS.

Requirement 6 Determine if EPHS is a mission critical system for the region and what implications this carries. Related to requirement 5, mission critical designation, systems deemed vital to the operation of organization. Items such as the time the network is unavailable, what to do if there is a power failure (are power generators needed) and things of this nature.

Dependancies: None identified

Risks: None identified

B. Responsibility Matrix

Requirements	Business Analyst	IM/IT Rep	Public Health rep	Nurse Rep	Exec Rep	National Rep	Comments
1							
1.1							
1.2							
1.3							
2.							
3.							
4.							
5.							
6.							

R = Responsible; S = Supports

C. Activity Network

To be determined

1.2. Extraction of data for analysis

There are several approaches to extracting the data and storing it for reporting and analysis. The following are various models of how this activity could happen. Moving From the national perspective to the regional, the models illustrate the flow of information.

1.2.1 National Level Data Warehouse Configuration

National data warehouse configuration - option 1
Based on discussions with PHAC, the model depicted above is a proposed high level view of the system for the national level. Depending on the regional model, data would arrive to FNIHB HQ. From this point, the data would be managed by the enterprise services bus (ESB) and sent to extract/transfer/load (ETL) software that would route the data to different databases based on business line via a central data clearinghouse. The ESB or ETL software would manage some of the complexity that comes with a national program. The compiling of provincial data, inter-provincial duplicate record management, data quality assessments and the like may be managed by these software systems. As well the ESB may manage the 'shared services'. These services are much like those specific to the EPHS in managing roles, access and permissions as well as any transformations that cannot be handles by the ETL software.

Other models have not yet been identified.

It may be possible that at the national level, the technology infrastructure serves both PHAC and FNIHB. Access and control could be managed through role and organization based access. The key benefit is centralizing and minimizing duplication of costs with two implementations of the same technology.

1.2.2 Flow of information

Two options with variations within each option emerge for the submission and capture of information. The first (Option 1) is that the regions extract the data, the second (Option 2) is that is compiled nationally and then accessed regionally via some type of national system.

Option 1 - Regional submission to National level
Description:

Data would be compiled regionally. This data would then be submitted to the national level periodically, as agreed upon. Once the data arrives at FNIHB-HQ, the national data warehouse model is used.

Benefits to regional submission:
- ¬ "Face validity" - easier to sell to parties involved
- ¬ Regional control over the data - premise: "those closest to the data source know the data the best"

Drawbacks to regional submission:
- ¬ Possibility of regional databases to be as complex as national level
- ¬ Potential bottleneck if submission isn't carried through

Option 2 - National data warehouses accessed by regions
Description:

Data is submitted to FNIHB-HQ from the provincial systems. The data is then compiled and stored in a national data warehouse. The regions would then either have access to this national warehouse for the particular regional data or the data would be transmitted to the regions. Unclear how the technology supports this flow of information from the provinces to FNIHB-HQ then to FNIHB regions.

Benefits:
- ¬ Leveraging centralized services if achievable
- ¬ Centralizes support within FNIHB-HQ for all parties involved.

Drawbacks:
- ¬ Overly complex?
- ¬ Technically feasible?
- ¬ Timing of data submission - fast enough for regional work?

Option 1 Considerations: Regional configuration of data warehouses

Following the model where the regions are responsible for compiling the data first then submitting it to the national level, below is an assessment of two possible configurations.

Regional Data Warehouse Option 1a.
Description:

Either at a predefined time or interval or through a manual process, the data is pushed into a regional data warehouse. Each region would then send the appropriate data up to the national level. The data consists of all the elements defined in the data sharing agreement with the jurisdiction. The warehouse would then be accessed by regional staff on an ad-hoc basis to conduct their business. Role based access would be applied at the warehouse level at each region and nationally.

Benefits:
- ¬ No data elements will be missed if the extraction process follows the data sharing agreement. Users of the data warehouse don't necessarily need to be users of the EPHS. Centralized database management and infrastructure maintenance. Robust and scalable if the warehouse is built on flexible industry standard data model and technology (eg. Oracle, SQL Server).
- ¬ Consistency and compliance with analysis and reporting tools. Ability to share regional knowledge such as SAS scripts, Crystal Reports and the like.
- ¬ Consistency of the data elements metadata (the meaning of the data elements) as this would be better controlled in a centralized system.

Drawbacks:
- ¬ Data elements and dictionary are more critical as the context of which field the data was pulled from cannot be easily referenced by those not connecting to EPHS.
- ¬ Privacy and security has to be applied at the regional level incurs administrative costs.
- ¬ Large single database may not facilitate multiple access and system speed may impact business functions.
- ¬ Centralized administration can be seen as a benefit but also a drawback in that skilled staff may have to be hired and retained.

Regional Data Warehouse Option 1b.
EPR: Emergency Preparedness and Response

Description:
Either at a predefined time or interval or through a manual process, the data is pushed into a regional data warehouse. The data consists of all the elements defined in the data sharing agreement with the jurisdiction. The data would then be routed via extract/transfer/load (ETL) software to individual communicable disease specific databases.

Benefits:
- ¬ No data elements will be missed if the extraction process follows the data sharing agreement. Users of the data warehouse don't necessarily need to be users of the EPHS. May be more compliant with privacy rules not allowing users to go 'shopping' for data elements in a all-inclusive data warehouse or allow multi-business line linkages, for example TB and HIV co-infection. This may reflect current business more accurately.
- ¬ Smaller, more individual databases for a group that is more flexible and may be less cumbersome. May not need large scale database software such as Oracle, MS Access may suffice.
- ¬ Control of user access is simpler. May not require role based access infrastructure. This could be built into the rerouting technology.

Drawbacks:
- ¬ Maintenance and administration of N number of databases versus one depending on business lines identified.
- ¬ Extra step thus extra technology to reroute data. If inclusion and exclusion of data is somewhat dynamic, then this secondary software will need to maintained.

1.2.3 Requirements of data warehouses

In all models, there are a few general requirements that apply.

Requirement 1 The user will need to have an understanding of data elements and data dictionary. Jurisdictions will have the ability to define fields and this information will need to be shared by the jurisdiction with FNIHB regionally and nationally to avoid using the wrong data or the data incorrectly.

In the model where the regions are extracting the data, the following requirements apply:

Requirement 2 User may need access to the necessary data elements and extraction tool interface. Based on the security and privacy rules, the user will need the appropriate role and organization based access to gain access to the EPHS. This requirement is linked to governance and functional requirements listed elsewhere in this document

Requirement 3 The extracted data must be compliant with the data warehouse or database. An example is the data extract is a XML based data set that cannot be used by the data warehouse that is configured for text or MS excel files.

Dependancies: Access to the system and functions as stated previously. Privacy and security considerations developed during the project or elsewhere may dictate which configuration is used. As well, FNIHB regional IT policies may dictate that only certain types of database technology be used and this may force the implementation of one configuration over the other. Further research is required.

Risks: Understanding of the details and context in which the data is collected is important to ensure the data is used correctly. This understanding will come from knowledge of the system, how the information is captured and in which data elements it is stored. Gaining this knowledge will be a result of using the EPHS and working with the partner jurisdiction as the jurisdiction configuration is undertaken.

2. Governance
   1. Data sharing agreements to access data and jurisdictional agreements to access the system are just a few of the challenges in partnering with the jurisdictions.
   2. Maintenance of relationship with partnering jurisdiction to continue access to system and participate in jurisdictional configuration

3. Administration of the system at the regional level included here. Privacy and security policies enforced, administration of data warehouses are some examples.

4. Involvement with stakeholder groups - AFN as an example

3. Functional/Business Requirements
1. These are requirements about the business itself. In order to meet the needs of the health care providers, their work related requirements (what tools and information do they need to perform public health activities) need to be identified and met.
2. Identify workflows and the information (data elements) associated with this work

4. Helpdesk/IT support
1. The type of helpdesk support needed is application support. This is not done by the traditional government helpdesk. Support the health care providers on application functions and troubleshooting problems. Understanding of the work conducted by the health care provider is needed for context.
2. Regional or national support or both.

5. Health Information/Records Management
1. Data quality is a key item and is related to treating data with a view that the data needs to be complete, comprehensive, understandable. HI/RM can provide the strategies, policies around these items that supports the work with the data.
2. As well, continuous quality improvement (eg. chart reviews, charting standards) need to be identified.
3. Continuity of information from paper to electronic. The idea that when the system 'goes live' that there is something to work with and is not empty.

6. Privacy/Confidentiality/Security
1. The roles and level of access to the system and data extracted from it need to be identified as one example.
2. Development of Privacy Impact Assessments and Threat and Risk Assessments
3. Privacy Officer - development of position; roles/responsibilities
4. Adherence to CSA's 10 electronic information guidelines

7. Users

1. This area deals with the perceptions of the user. Training, project awareness, computer aptitudes, knowledge and attitudes are all items related to how the user will engage the system.

8. Patients

1. OCAP and the consent component are two items that the patient needs to be aware of and communicated the importance of.
2. Awareness of the system and how the patient's information is protected and to be used are the two key elements. Communication strategies around this may need to