



**HIMSS Healthcare Information Exchange  
National / International Technology Guide White Paper**

**April 2009**

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# **RHIO HIE National and International Technology Guide**

## ***Introduction***

The RHIO HIE National and International Technology Guide Task Force was charged with development of a white paper to describe technology tools and solutions that have been proven successful within Health Information Exchange (HIE) and Regional Health Information Organization (RHIO) environments across international borders. The research supporting this paper and development of the white paper was conducted in 2008. Base line information exchange initiatives share the same common goals and objectives regardless of country - *data exchange*. This white paper explores those technical solutions currently deployed across international boundaries as well as examples of those deployed within the United States. The goal of this effort is to explore the lessons learned and technical solutions deployed in other countries that may benefit others involved in data exchange deployment.

## **Organization of this paper**

This paper has been organized into chapters with each chapter representing an HIE entity. In the first three chapters, three examples of United States based HIEs (or RHIOs) are reviewed. The remaining chapters are dedicated to a more in depth look at HIEs outside of the United States, with HIEs that have shown significant acceptance and a large installed base of users. The final chapter summarizes the findings of this research.

The information provided in this paper on international entities is based solely on a literature research effort with all sources referenced. The United States based entity information is developed through research efforts with the final summary reviewed and approved by the entity prior to publication of this paper.

## **South Florida Information Exchange**

### ***Overview***

The South Florida Health Information Exchange (SFHIE) is a convening organization that involves multiple partners in the development of a community health information exchange to improve health care efficiency and quality, enhances patient safety and care and to meet the needs of consumers and health care providers.

In October of 2006, the SFHIE received funding from the Agency for Health Care Administration (AHCA) to build a Health Information Network that will allow for the private and secure exchange of health information between health care providers who are treating the same patients in different health care environments. The use of electronic health information provides many benefits, including:

- A method for sharing health information among key stakeholders, including patients, doctors and payers.

- The ability to create patient medical records that are transportable, accessible and available on demand for patients and doctors.
- Improved medical efficiency (decreased patient wait times, improved access to medical information, etc.).
- Decreased costs due to reduced duplication of tests and medical procedures and improved clinical efficiencies.
- Improved health outcomes through improvement of continuity of care through:
  - Enhanced ability for real-time clinical decision support at the point of care.
  - Increased patient safety due to reduced medical errors.
- Reduced fragmentation of the health care system.

Goals for the South Florida HIE include:

- Develop the organizational structure required for operating a private, secure and financially sustainable Community Health Information Exchange (CHIE).
- Develop operational policies and procedures that will guide utilization of the CHIE.
- Implement an expansion strategy for incorporating additional data sources into the CHIE, including Jackson Health System.
- Demonstrate how the CHIE can be used to improve the coordination of care for children receiving health related services from The Children’s Trust.
- Determine a ‘Direct to Consumer Health Information Product’ that will complement the CHIE and promote provider and patient participation in Health Information Exchange.

### ***Technology Overview***

The initial participants in the CHIE are Mercy Hospital, Health Choice Network (HCN) and its South Florida federally qualified health centers. These entities have provided the initial data to the CHIE. The medical providers associated with these health care entities will have access to a web portal, along with 30 additional providers who are representative of the Florida Academy of Family Physicians (FAFP), AvMed Health Plans, and Blue Cross Blue Shield of Florida. The providers were involved in the design and development of the CHIE and provided valuable feedback on how to incorporate the use of the web portal into their normal work flow. As more funding becomes available, additional data sources will be added to the CHIE and additional providers will be able to benefit from its multiple capabilities.

The initial name for this web portal is the Tri-County Uninsured Patient Information Exchange that links emergency rooms to facilities in the South Florida Area. Initially, Jackson Memorial Hospital and the Health Center in South Florida belonging to the Health Choice Network, have agreed to begin sharing files on uninsured patients via a common web-based portal, along with insurance providers.

The deployed Microsoft technology platform provides an interoperable framework that can be expanded to additional providers, payers and ancillary services to increase functionality and depth of data. The platform uses a service-oriented architecture and exchanges information using the Continuity of Care Record (CCR) standard.

## *Challenges*

SFHIE is in a precarious position, as it has utilized the state grant money from 2006. At the current time, the organization is in hibernating mode, receiving sustaining funding from the Health Foundation of South Florida. HCN has been appointed as the acting executive director exploring strategic alternatives related to funding, as one of its major funding sources, AHCA, experiences deep funding cuts at the state level.

## *Adoption*

This RHIO received funding from three major sources: Florida Agency for Health Care Administration (AHCA), Health Foundation of South Florida, and University of Miami Miller School of Medicine.

## *Applicability*

While SFHIE has a business model in place that could potentially be supported through grant funding, the current model is not sustainable at a time of decreasing state budgets. As such, the model is an example of significant reliance on state grant funding to support a health information exchange.

## *Task Force Contributor*

Erik Pupo, Practice Leader, for Project Performance Corporation.

## **WNC Data Link HIE**

The Western North Carolina (WNC) Data Link is the first operational HIE in North Carolina and one of the largest in North America. It links all 16 hospitals serving western North Carolina using a solution provided by IBM and Medseek. The member hospitals range in size from 25 to 730 beds and are spread across 15 western North Carolina cities and towns. The region has a very high proportion of elderly population, along with a large number of low-income and uninsured individuals. The area served also suffers from a chronic shortage of medical professionals.

The Western North Carolina Health Network (WNCHN) developed and operates this HIE. The Network is a collaboration of hospitals and other health care providers that support the delivery of cost-effective, quality health services to the Western North Carolina (WNC) region. The network's members participating in the HIE include Angel Medical Center, Blue Ridge Regional Hospital, CarePartners Health Services, Cherokee Indian Hospital, Harris Regional Medical Center, Haywood Regional Medical Center, Highlands-Cashiers Hospital, the McDowell Hospital, Mission Hospitals, Murphy Medical Center, Pardee Memorial Hospital, Park Ridge Hospital, Rutherford Hospital, St. Luke's Hospital, Swain County Hospital and Transylvania Regional Hospital.

## ***Technology Overview***

The WNCHN model differs from many electronic health record exchange systems in that it is based on an innovative "virtual" records system that uses the data from hospitals' existing records systems instead of creating a new, centralized system. The model, known as Data Link, allows authorized physicians and clinicians to view a patient's electronic records across all WNC hospital systems, which all have their unique information systems.

Upon request, WNC Data Link searches all WNC hospitals' information systems for a patient's records and collates them in a standardized format in real time. Clinicians can access the records through any internet connected device. In future phases, authorized users will be able to access electronic records from physician offices, health departments, clinics and other health care providers to create a longitudinal view of the patient's medical history.

A single logon for users (physicians) allows access to the WNC Data Link Web site, which automatically lists the physician's patients who are currently admitted to any of the participating hospitals. Physicians also can search for information on a particular patient, and the system will query each hospital's database for any relevant lab, radiology, transcribed reports, allergies, administrative and medications data.

## ***Challenges and Issues***

After extensive analysis, the WNC network chose *NOT* to use a stand-alone Enterprise Master Patient Index (EMPI)-based solution to link patient records together. The Medseek solution has a master patient cache built into the system that links patients based on matching demographics. The solution ultimately employed had to integrate seamlessly in a "vendor-neutral" fashion with each hospital's existing health information system.

It is also essential for each hospital to retain control over its own electronic medical records (EMRs); therefore, they could not be commingled with other hospitals' EMRs in a central data repository. This step helped assure the hospitals that the system remained compliant with the Health Insurance Portability and Accountability Act (HIPAA) privacy regulations while meeting the highest security standards.

Current funding is supported by the hospitals involved in the network. Governance of the RHIO, whose initial \$2.5 million in federal Health Resources and Services Administration funding was secured with the help of their local congressmen, is provided by the participating hospitals.

## ***Adoption***

System usage has grown tremendously over the past year, with nearly 5,000 user log-ins per month. Physicians find the system intuitive and easy to use, and particularly like the instantaneous access they now have to patient records from across the region.

## *Applicability*

The WNC Data Link architecture is applicable to many specific organizations or countries that may be interested in establishing a HIE but may not have the capabilities to support the purchase of new technology hardware and software. By using a federated architecture that leverages existing information technology resources to build the HIE, the initial investment in the HIE was fairly minimal. The level of adoption increased as ease of use and familiarity with existing software and hardware made issues related to adoption easier to overcome.

Clearly, identifying sources for operational funds for the HIE infrastructure is one of the key challenges in the United States market. Currently, hospitals participating in WNC Data Link support the HIE. A payment model is being explored to make this HIE a utility-based model with payment for services used. This type of model needs to require some level of investment from insurers and payers as well, which remains a significant roadblock.

## *Task Force Contributor*

Erik Pupo, Practice Leader, Project Performance Corporation.

## **Bronx New York RHIO**

The Bronx Regional Health Information Organization (Bronx RHIO) is a not-for-profit organization established by the borough's leading healthcare organizations. Participants include hospitals, health systems, ambulatory care centers, individual physician offices, long-term care and home care services. Collectively, these providers deliver the vast majority of the healthcare received by the borough's 1.36 million residents, including over 95% of the borough's annual hospital discharges, over 600,000 annual Emergency Department visits and 4.5 million annual ambulatory care visits.

## *Mission*

The Bronx RHIO's mission is to build a secure, interoperable health information exchange that will make it possible for patients' medical records to follow them wherever they go for health services in the Bronx. The health information exchange will achieve this by integrating clinical information drawn from multiple sources and sites into a virtual medical record that will be available to authorized users.

## *Vision*

The Bronx RHIO's vision is to create a health information exchange that will transform healthcare delivery in the Bronx to a patient-centered, rational, cost-effective system. Patients and clinicians will have vital health information when and where it is needed, enabling significant improvements to be achieved in patient safety, health outcomes and practice efficiencies.

## ***Technology Overview***

A clinical committee, with representatives from all participating organizations, has been key to design and implementation decisions. The Bronx RHIO is a federated model - each contributor of data keeps that data behind its own firewall.

Participants must sign a Participation Agreement, which establishes the policies and procedures for governance and operation of the RHIO and the information exchange. These policies are available on line at the Bronx RHIO's website - [www.bronxrhio.org](http://www.bronxrhio.org)

Users are authenticated in an Active Directory (AD) -- either the local AD, if the site is contributing data to the Bronx RHIO and has a dedicated dbMotion platform, or through the Bronx RHIO AD, which supports all "view-only" users. Users are grouped into categories that define system permissions: registrar (patient identity and consent management only); clinical views; printing. Local User Management authority determines permissions for each user and communicates these permissions to the Bronx RHIO which establishes each user for access in the security management module. The system uses AD for authentication prior to access management.

Initiate's Identify Hub provides a centralized Record Locator Service (RLS) and/or RHIO-wide Master Patient Index (MPI) with the technology platform providing all other services of the data exchange, including mapping tables for data normalization. Raw data is stored in the application with the Local Code but normalizes the data to Bronx RHIO standards in the business and presentation layers.

The initial dataset includes: demography, encounters, lab results, diagnoses, procedures, medications prescribed and, to a lesser extent, dispensed. Logical Observation Identifiers Names and Codes (LOINC) is used for approximately 50 different lab results that have been identified as useful in a longitudinal view of the patient record. Further identification and normalization will continue over time. Additional data will be added throughout 2009-2010 and will include discharge summaries, radiology reports and EKG strips.

Microsoft server farms contain the data and the backup library. All users access data via the web portal view custom developed. Redundancy and disaster recovery have been taken into account throughout the design of the data exchange -- however cost implications have limited implementation in some areas. The Identity Hub remains a single point of failure, and will be upgraded in the 2009-10 timeframe, as use of the exchange grows.

## ***Challenges***

The most significant challenge that was encountered to date is with the patient consent authorizations. While this is a difficult problem for all RHIOs, New York State laws around consent are much more stringent than what is routinely required.

In addition, the project team wrestled through the decision to include history data or to begin 'fresh' on the first day. They determined that having historical patient data available would be

the most effective course, otherwise it would take too long for the application to become of value to the users. They identified to ‘go live’ with 9 months of historical data.

Normalization of lab tests was also a challenge. The LOINC standards used by the labs were not well known. Typically the labs would rely on their partner firms to handle this. This would not work in a RHIO scenario. In order to accommodate this, the team limited the number to 50 tests for the clinical for the longitudinal view. They provided resources to the users to help them with these codes.

### ***Adoption***

First use was on June 2, 2008. The incorporation of Bronx RHIO, Inc. took place about 2 years prior, and the Board of Directors (an earlier organizing committee) has been meeting since the 3rd Quarter, 1995.

The Bronx RHIO actively involves early adopters at six facilities in the Bronx. They have decided to slow down rollout at one point since there was a concern around the accuracy and quality of the consent forms. Today, the Bronx RHIO is back on track to vigorously continue their roll out.

### ***Task Force Contributors***

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## **Canada – Health Information Exchange (HIE)**

### ***Overview of Canada***

Canada has a publicly funded universal healthcare system for its population of 33+ million people. Under the Canada Health Act any care deemed medically necessary must be funded publicly by federal or provincial governments if delivered in a hospital or by a physician. In Canada, this accounts for approximately 70% of healthcare costs, while the remaining 30% is funded privately by private insurance plans. In 2007, total healthcare spending was expected to reach 10.6% of GDP (\$160 billion) in Canada.<sup>1</sup> This is slightly above the average for Organization for Economic Co-operation and Development (OECD) countries.<sup>2</sup>

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<sup>1</sup> Canadian Institute for Health Information, *National Health Expenditure Trends, 1975.2007*. p.3-7. (Ottawa: CIHI, 2007).

<sup>2</sup> *OECD Health Data 2007; How Does Canada Compare*. <http://www.oecd.org/dataoecd/46/33/38979719.pdf>. OECD.

The federal government assumes responsibility over funding public health, First Nations (Indian Health Services) and Veterans Health. The government also provides block-funding support through cash and tax transfers to support healthcare at the provincial level. The provinces are then responsible for determining service coverage and direct funding for their population. It is often argued that the provinces bear the brunt of healthcare costs and, to some extent, have more autonomy in determining healthcare design and operation. As a result, there are wide variations across the provinces as to what falls within publicly funded care. Funding variation can occur across prescription drugs, ambulance services, physical therapy, dental care, home care and long term care.

To effectively manage and deliver healthcare for their population almost all provinces and territories partially devolved their responsibilities to sub-provincial regions in the 1990s. These Regional Health Authorities (RHAs) are designed to integrate services along a continuum of care and streamline the delivery system, making it less fragmented and more responsive to local needs. RHAs are often responsible for hospitals, continuing care facilities, community health services and public health programs within their jurisdiction.

Like healthcare services, health information management (IM) and health information technology (IT) strategies are often developed and deployed provincially and regionally. Historically, RHAs and provinces across Canada have been chronically under-funded on health IM/IT (~1.4-2%) relative to the recommended 3-5% by IT executives in Canadian hospitals and compared to the 9-13% spent by other information-intensive industries, such as financial services.<sup>3</sup>

In 2001 the federal government created Canada Health Infoway (Infoway), a not-for-profit corporation tasked with “*accelerating the development and adoption of electronic health records (EHR)*” across the country thereby increasing the amount of health IT investments. The goal is to achieve an interoperable electronic health record (EHR) across 50% of Canada by 2010. To do this, Infoway was provided with over \$1.6 billion in capital to invest in the public sector to develop, implement, and use EHRs that can be shared or replicated in another jurisdiction.

Today, with the growing focus on health information exchange (HIE)<sup>4</sup>, Canada is beginning to see an increase in health IT spending and anticipates reaching 4% by 2010. The country is now positioned to move towards successful HIE developments and implementations. This allows better management over the issues faced within the Canadian healthcare system, including chronic disease management, access to care, patient safety and primary care reform.

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<sup>3</sup> *Infoway Pan-Canadian EHR Survey Phase I Results and Analysis. September 2002. p.4-5. Canada Health Infoway.*

<sup>4</sup> HIE is not a term used in Canada. Rather, the “interoperable EHR” is often used to describe how sharing/exchange of healthcare information is facilitated within a “jurisdiction” (where a jurisdiction can refer to any governance entity). Having said this, this paper will continue to reference “HIE” in order to be comparative with other nations’ descriptors.

## *Overview of HIE Initiative*

Similar to the United Kingdom model, Canada's HIE initiative executed through Infoway, is a national strategy. However, the Canadian model is distributed with different operational applications supported and maintained by the provinces and RHAs. This model, carried out by RHAs, should not be confused with American RHIOs (Regional Health Information Organizations), which focus primarily on clinical data exchanges. RHAs are held directly responsible for the organizations within it and have the ability to influence how their organizations function and deliver care.

Infoway's key stakeholders are the federal and provincial deputy ministers of health from across Canada and as a result all provinces and regions have aligned their strategies with Infoway investment programs to attain funding. The ten investment programs include:<sup>5</sup>

- Innovation and Adoption (\$60M)
- Interoperable EHR (\$365M)
- Drug (\$250M), Lab (\$170M), Imaging (\$340M), Public Health (\$135M) and Telehealth (\$100M) Information Systems
- Client, Provider and Location Registries (\$134M)
- Infostructure (\$32M)
- Patient Access to Quality Care (\$50M) – *new investment program developed in the first half of fiscal year 2007/08*

Since its inception, Infoway has approved \$1.176 billion for more than 227 projects across Canada, and currently 35% of projects are in planning phase and 65% of projects in implementation and adoption phase.<sup>6</sup>

One aspect that sets Canada apart from other countries is the national architectural framework, Infoway's Electronic Health Record Solution (EHRS) Blueprint that HIE initiatives across the country can align to. The EHRS Blueprint describes the EHR architecture which defines how systems can work together to share patient information throughout the continuum of care and across geographical distances. The Blueprint addresses how the system functions and outlines technology guidelines, deployment models and potential applications to ensure interoperability and cost savings through standardization. The EHRS Blueprint has been expanded through extensive participation, including government representatives, healthcare professionals, privacy and security experts, and vendors across the country.

Infoway is composed of three core components:

- The **Electronic Health Record (EHR)** provides each individual in Canada with a secure and private lifetime record of their key health history and care within the health system.

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<sup>5</sup> *Corporate Business Plan 2007-2008. Electronic Health Records: Transforming health care, improving lives.* p.14. Canada Health Infoway.

<sup>6</sup> *Corporate Business Plan 2007-2008. Electronic Health Records: Transforming health care, improving lives.* p.9-12. Canada Health Infoway.

The record is available electronically to authorized health providers and the individual anywhere, anytime in support of high quality care.<sup>7</sup> This record is designed to facilitate the sharing of data – across the continuum of care, across healthcare delivery organizations and across geographies.

- The **EHR Solution (EHRS)** is a combination of people, organizational entities, business processes, systems, technology and standards that interact and exchange clinical data to provide high quality and effective healthcare.<sup>8</sup>
- The **EHR Infostructure (EHRi)** is a collection of common and reusable components in the support of a diverse set of health information management applications. It consists of software solutions for the EHR, data definitions for the EHR and messaging standards for the EHR.<sup>9</sup> The EHRi will include access to patient and provider directories, as well as laboratory test results, diagnostic images, medication histories and other repositories for informed decision making by healthcare professionals.

The relationship between these three components is as follows: The EHR is composed of many EHRS sharing a unique EHR infostructure (EHRi).

Infoway focuses on establishing pan-Canadian EHR standards in order to outline the standards and requirements for robust, interoperable products and outcomes across the country. Infoway actively partners with Health Level 7 (HL7) Canada and Integrating the Healthcare Enterprise – Canada (IHE Canada) which are organizations committed to improving the interoperability and integration of applications from different vendors through the use of standards. Infoway works closely with the Canadian Institute for Health Information (CIHI), a national not-for-profit corporation with a mandate to improve healthcare by providing quality, reliable and timely health information to the public. CIHI develops and manages health databases and registries and routinely publishes and disseminates aggregate population health information. In 2006, Infoway and CIHI partnered to establish a new pan-Canadian collaboration, the Standards Collaborative (SC), dedicated to support and sustain health informatics standards at a national level. To date, 20+ pan-Canadian health information standards projects have been completed or are in process by Infoway, representing a total investment in standards development of \$33 million, such as for client registry or provider registry initiatives.<sup>10</sup> Members of the SC also participate in international Standards Development Organizations (SDOs) to influence, leverage and align with international standards. They also work with Integrating the Healthcare Enterprise (IHE) which provides a common framework for achieving seamless health information exchange and promote established healthcare standards, such as the HL7 messaging standard.

Specific standards that the Infoway Standards Collaborative promotes across Canada include HL7 Version 3 (HL7v3) and Systematized Nomenclature of Medicine – Clinical Terms

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<sup>7</sup> *EHRS Blueprint: an interoperable EHR framework. Infoway Architecture Update. Slide 15. March 2006. Solution Architecture Group. Canada Health Infoway.*

<sup>8</sup> *EHRS Blueprint: an interoperable EHR framework. Infoway Architecture Update. Slide 16. March 2006. Solution Architecture Group. Canada Health Infoway.*

<sup>9</sup> *EHRS Blueprint: an interoperable EHR framework. Infoway Architecture Update. Slide 17. March 2006. Solution Architecture Group. Canada Health Infoway.*

<sup>10</sup> *Standards Collaborative: enabling solutions, enhancing health outcomes...together. p.6. May 2008. Canada Health Infoway.*

(SNOMED CT.) The HL7v3 suite of messaging standards, along with the HL7v3 Clinical Document Architecture (CDA-Release 2) standards, provides the basis for pan-Canadian EHR interoperability. Despite a large presence of HL7v2.x applications still deployed across Canada, HL7v3 is promoted as the primary messaging standard as it is found to have more flexibility. Infoway provides the necessary support to move from the HL7 V2.x environment to the pan-Canadian EHR standards.<sup>11</sup> SNOMED CT, another international standard, provides the basis for clinical healthcare terminology and is recommended as the best choice of terminology for HIE initiatives, however, other clinical terminology standards, including International Classification of Diseases, 10<sup>th</sup> revision Canada (ICD-10-CA) and the Canadian Classification of Health Interventions (CCI,) are also accepted as they are still highly prevalent in organizations today. A few other terminology standards promoted include the pan-Canadian Laboratory Observation Code Database (pCLOCD), which focuses on the laboratory domain and is based on LOINC (Logical Observation Identifiers Names and Codes), as well as Digital Imaging and Communications in Medicine (DICOM.)

### *Challenges*

Despite the standard model promoted across the country, there are many challenges that Canadian HIE initiatives face. Three challenges reviewed in this paper include integrating existing disparate systems, privacy and security, and local physician adoption.

A central issue with proposing a new architecture or standard, such as EHRi, is that hospitals and other clinical data providers have built their own information technology (IT) architecture over time. For Infoway's vision to become a reality, these disparate systems need to communicate with the jurisdictions registry systems. The goal is to have one single interface from each facility to the region's registry systems. This eliminates the problem of integrating every facilities' separate IT systems (i.e. ADT, Lab, pharmacy) with the regions and also means the internal IT structure of each facility is not relevant at the HIE level. As stated before, Infoway has proposed, and has the funding to implement, a national standard for communication at both the intra-facility and intra-jurisdictional levels.

It is also the jurisdiction's responsibility to both gather and present the information in the repository to the end users, both patients and clinicians, in a timely manner. While no set standard for delivery has emerged, the existing portals, such as in Alberta's Netcare initiative, use a simple web hosted method for accessibility<sup>12</sup>. Internally they must deal with the connections to other Infostructures as well as the connections within their own Infostructure. Additionally, the security, response times and distributed access to the system are all under each region's control.

An example of a Canadian initiative focused on overcoming this challenge of integrating existing disparate systems and achieving maximum interoperability is the EHR Reference Implementation project initiated by the Mohawk College of Applied Arts and Technology in

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<sup>11</sup> *Standards Collaborative: enabling solutions, enhancing health outcomes...together.* p.19. May 2008. Canada Health Infoway.

<sup>12</sup> Alberta Netcare Electronic Health Record. <http://www.albertanetcare.ca/>. 2008. Government of Alberta.

Hamilton, Ontario.<sup>13</sup> This project will act as a reference implementation for Canada, adhering to Infoway's EHR Blueprint and pan-Canadian standards. The project focuses on supporting and building out message exchanges and use cases to support iEHR transactions, as well as other domains such as laboratory testing, drug information and diagnostic imaging among others. The outcome will be a working prototype for jurisdictions across Canada to leverage, replicate, and learn from.

Security and privacy of patient health data has also presented itself as a challenge in HIE initiatives in Canada, like in other countries. Canadian governments have developed federal and provincial laws on privacy including the Federal Personal Information Protection and Electronic Document Act (PIPEDA) and Alberta Health Information Act (Alberta), Loi sur la protection de l'information (Québec) and Ontario Personal Health Information Protection Act (PHIPA). These regulations help ensure all HIE initiatives meet the highest standard of privacy and confidentiality.

Today, privacy and security have become mandatory components of Infoway sponsored HIE initiatives. Infoway has developed the Privacy and Security Conceptual Architecture (PSCA) which integrates with the EHRs Blueprint. This architecture is considered to guide the sharing of health information and outlines the available standards and services for privacy and security, such as user identity management services, user authentication services and informational consent directives management services.

A third challenge with EHR development in Canada is the use of IT in the primary care environment. Throughout the country physician practices are primarily private fee-for-service operations unlike hospitals which are public organizations. Physicians are not required to adopt the HIE initiatives that hospitals and RHAs implement. As a result, personal EHRs primarily begin gathering data in the hospital environment, even though the actual start of the continuum of care is most often in physician offices. Additionally, it is difficult to achieve physician buy-in for IT in their private offices, as they would bear all the cost but do not see all of the direct benefit. This is similar to the US model: individual institutions or operations are reluctant to spend funds that benefit others. The true benefactors are the patients, who can easily move to different physicians or hospitals.

To overcome this challenge, many provinces and regions have outlined the benefits of interdisciplinary collaboration across primary care providers and have established incentive models to promote health IT adoption in the primary care setting.

### ***Adoption***

Despite these challenges, the level of adoption of health information exchange in Canada continues to increase. This is made apparent with the increasing health IT expenditures and the increased effort directed towards these initiatives across all Canadian jurisdictions. It is often

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<sup>13</sup> M.A.R.C Health Informatics – EHR Project. <http://www.mohawkcollege.ca/marc/hi/>. 2007. Mohawk College of Applied Arts and Technology.

said that the governance models in Canada have made adoption possible. Canada has the ability to impose standards and align financial incentives to national HIE objectives.

There are many examples of successful HIE initiatives across the country. Alberta is often looked at as leading Canada in the implementation of a province-wide EHR – Netcare. Netcare is one example of successful HIE and health IT adoption in Canada. Netcare is a program that provides an EHR viewer or portal for physicians, nurses and other healthcare providers in Alberta to access up-to-date information at the point of care allowing for better care decisions and improved patient safety. Starting in 2004 from Edmonton’s Capital Health RHA, this viewer will be available across the province by 2008.<sup>14</sup>

Despite facing the major challenges that all HIE initiatives are familiar with, including adoption and acceptance by healthcare professional, privacy, and interoperability, the Alberta Netcare initiative has had great success. This is demonstrated by the increasing number of active users of the viewer from month to month. Lessons learned from this initiative that can be leveraged for other HIE initiatives across Canada and other countries include the following:<sup>15</sup>

- A clear value proposition (complete clinical content) was established at the beginning of the project
- Tracking of activity to focus improvement efforts
- Successive implementation waves after pilot
- Additional new versions with new clinical content, such as EKGs and PACS among others
- Strong leadership for the initiative
- Protection patient privacy and security and compliance with the Alberta Health Information Act
- Compliance with Infoway standards, leading to Infoway funding and support

### ***Applicability***

The Canadian model to HIE is not likely one that can be directly adopted in the United States, due to the difference in governance and funding structures. In Canada, the governance and administrative model provides an infrastructure conducive to the national strategy’s HIE goals. In the United States, there is not an equivalent cohesive infrastructure and healthcare financial incentives are not presently aligned with national HIE objectives. Many of HIE initiatives in the United States have been funded by grants and do not have business models for sustaining the projects after the grants finish.<sup>16</sup> Additionally, United States RHIOs are based on voluntary

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<sup>14</sup> *Fulfilling the Promise, Canada Health Infoway Inc. Annual Report 2005-2006.*  
<http://www.infoway-inforoute.ca/Admin/Upload/Dev/Document/Annual%20Report%2005-06%20EN.pdf>. p.4.  
Canada Health Infoway.

<sup>15</sup> Dr. Mike Guerriere. *Annual Review of IM/IT in Healthcare. Breakfast with the Chiefs.* Slides 14-18. March 6, 2007. Courtyard Group.

<sup>16</sup> David E. Garets. *Why RHIOs Aren't Working: Views from an American Who Can See White Rock, British Columbia, from His Backyard.* <http://healthcarepapers.com/product.php?productid=19633&cat=541&page=1>.  
*Electronic Healthcare*, 6(4) 2008: 102-103.

collaborations for data sharing among local healthcare organizations. They do not possess the authority, like Canadian RHAs, to dictate terms to their members.<sup>17</sup>

This is not to say that the United States cannot adopt lessons learned from Canada. Some key benefits that could be leverage from the Canadian model include:

- Develop national policies early for HIE initiatives to align themselves to, such as policies on standards to achieve interoperability. A single standard prevents reconciliation of competing standards in the future. For example, use what Infoway has already created as basis for discussion – all of Infoway’s materials are publicly available.
- Do not mandate any hardware/software requirements, only the standards to facilitate interoperability. Use freely available open source tools for sample applications to help drive quick adoption.
- Provide funding for regional (State) repositories as an extension of existing state funded healthcare initiatives such as Medicaid.

Overall, despite the unique differences in the two healthcare systems, the United States can definitely learn from the unified Canadian model and leverage areas for US HIE initiatives.

### ***Section Reference Sites***

- Infoway Website: <http://www.infoway-inforoute.ca>
  - Infoway Corporate Business Plan, 2007-2008.
  - Infoway EHRs Blueprint
  - Infoway Privacy and Security Overview
  - Standards Collaborative Guide and Standards Catalogue
- Mohawk College, EHR Reference Implementation Project: <http://www.mohawkcollege.ca/marc/hi/>
- Alberta Netcare Project: <http://www.albertanetcare.ca/>
- Denis Protti. US Regional Health Information Organizations and the Nationwide Health Information Network: Any Lessons for Canadians? *Electronic Healthcare*, 6(4) 2008: 96-103
- David E. Garets. Why RHIOs Aren't Working: Views from an American Who Can See White Rock, British Columbia, from His Backyard. <http://healthcarepapers.com/product.php?productid=19633&cat=541&page=1>. *Electronic Healthcare*, 6(4) 2008: 102-103.

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<sup>17</sup> Denis Protti. *US Regional Health Information Organizations and the Nationwide Health Information Network: Any Lessons for Canadians?* *Electronic Healthcare*, 6(4) 2008: 96-103

## Israel – Health Information Exchange

### *Overview of Israel’s Health Care System and RHIO*

Israel’s 7.3 million residents obtain their health services from four health funds and numerous state and private hospitals that serve as providers to the health funds and the public<sup>18</sup>. The health funds are Health Maintenance Organization (HMO)-like comprehensive health organizations that run hospitals, laboratories, pharmacies, imaging centers, primary clinics, and specialty centers<sup>19</sup>. Health coverage for all Israelis is funded by the Ministry of Health budget, the National Insurance Institute (akin to the U.S. Social Security Administration), employer taxes, health insurance premiums from each resident, and health fund member fees<sup>18</sup>.

Israel benefits from a relatively mature RHIO that serves about 5 million patients, roughly 68% of Israel’s population. The RHIO, known as the Ofek Network, consists of Clalit Health Services (Israel’s largest health organization), Rambam Medical Center, and Sheba Medical Center (the two largest government hospitals in Israel). In total, the Ofek Network is comprised of 18 hospitals (over 8,100 beds) and 1,600 clinics, pharmacies, labs and imaging centers, with over 9,000 users nationwide<sup>19,20,21</sup>.

Clalit Health Services and Sheba Medical Center, the larger components of the Ofek Network, were both driven towards the RHIO care delivery model by similar factors: (1) a large variety of clinical information systems (25 Electronic Medical Records across Clalit) functioning as information silos, (2) shared patient populations, and (3) leadership committed to improving access to patient information within and between health care organizations<sup>19,22</sup>. The successful implementation of the technology solution at Clalit and Sheba led to an easy deployment at the 900-bed Rambam Medical Center, which has only one Electronic Medical Record (EMR.)

The Ofek Network is considered a model for a national health information exchange or “virtual EHR” in Israel. However, at the national HIE level, its use is restricted to the Emergency Department (ED) for life-threatening conditions, with only a minimal dataset for shared patient information<sup>23,24</sup>. Key issues facing the development of a national HIE in Israel are privacy of

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<sup>18</sup> Damelin, B. “Israel’s Health Care System: An Overview.” La-Briut: The Israel Association for the Advancement of Women’s Health. <http://www.la-briut.org.il/english/article/?id=5d4818ba4f9348515449e5720b25ea78>

<sup>19</sup> dbMotion White Paper: “A Practical Approach to RHIO Formation: How an early understanding of technology can assist and accelerate the process.” January 2006.

<http://www.worldcongress.com/events/NW715/pdf/thoughtLeadership/dbMotion%20RHIO%20White%20Paper.pdf>

<sup>20</sup> Broder, C. “Israeli Company to Announce First U.S. Win.” Healthcare IT News, April 28, 2006.

<http://www.healthcareitnews.com/story.cms?id=4842>

<sup>21</sup> “HIN Trailblazer: Israel’s Ofek Network.” Healthcare IT Management, April 2007. Vol 2, Iss 1.

<http://www.dbmotion.com/site/modules/newsItem.asp?itemID=66&Pid=247&Sid=70>

<sup>22</sup> “RHIO Spotlight: Physicians in Israel Reaping Benefits of RHIOs.” HIMSS RHIO Connection. March 2006.

<http://www.himss.org/content/files/rhioconnection/200603.htm>

<sup>23</sup> Edwards, Jonathan. “Case Study: Clalit Health Services Creates the Basis for Health Information Exchange in Israel.” Gartner Research (ID Number: G00152016), November 15, 2007.

<http://64.233.169.104/search?q=cache:Ag4ybs56j0QJ:130.115.129.18/gartner/research/152000/152016/152016.html+ofek+network+rhio&hl=en&ct=clnk&cd=13&gl=us&client=firefox-a>

medical information (i.e. genetic information, child adoption, pregnancy, abortion, HIV status), quality and uniformity of data sources (i.e. standard documents and data elements, differences in ICD-9 codes for diagnoses) and cultural barriers (i.e. concern for doctor-patient relationship, demand for increased time per visit due to technology)<sup>24</sup>.

### ***Technology Overview***

#### **Development of the Data Exchange Model: Stakeholders and Requirements**

Established in 2001, the Ofek Network uses a web-based federated, or decentralized, data exchange model in which data resides on a server at the site of creation, rather than in a central depository<sup>19</sup>.

A few years prior, Clalit's senior leadership established requirements for a solution that would address the difficulty of accessing patient data across its 14 hospitals and various practices and clinics, including: (a) local ownership of data, (b) no central database (no change to legacy systems), (c) point-of-care, real-time retrieval of information in one minute or less, (d) clinical decision support, (e) security and privacy compliance with national laws, (f) minimal data sets to support sharing patient information, and (g) scalability<sup>22,23</sup>. Then, they assembled consumer and hospital groups consisting of steering, user, legal and ethics committees. The steering and legal & ethics committees were led by a senior hospital manager. The user committee, comprised of hospital and community care clinicians and Information Technology (IT) staff, legal specialists, and IT security specialists, defined the features and functionality of the user interface<sup>23</sup>.

In 2000, a large Clalit-affiliated hospital engaged dbMotion to integrate its departments into a local data repository<sup>21</sup>. Favoring integration over a single-vendor EMR conversion, Clalit leveraged the success of the affiliate hospital into a Clalit-wide deployment of the software in 2001, leading to the creation of several local data repositories across the organization<sup>20,25</sup>. By 2003, primary care clinics were able both to view and provide data<sup>24</sup>. Prior to deployment, the legal and medical ethics committees developed roles and definitions within the new system for: (a) caregivers and what medical data they could see, (b) conditions for and duration of a caregiver-patient relationship and (c) which ancillary functions (lab and imaging technicians) would have access to limited data. Clalit's chief medical officer would determine user restrictions in cases where patient privacy could be affected<sup>23</sup>.

Local data repositories were created outside Clalit at Sheba Medical Center in 2004 and Rambam Medical Center in 2005, since both sites shared patient populations with Clalit. These new network participants were required to have existing EMRs, agree to Clalit's security and ethics policies, and accept the technology solution without specialized configuration<sup>23</sup>. Because the technology did not change the existing EMRs or require much training, implementation took only 3-4 months at the non-Clalit sites.

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<sup>24</sup> Codish, S. "RHIOs and HIEs: Implementation, Benefits, and Roadmap." PowerPoint Presentation, Soroka University Medical Center, Clalit Health Services, September 2007.

[http://www.worldofhealthit.org/docs/presentations/45\\_codish.pdf](http://www.worldofhealthit.org/docs/presentations/45_codish.pdf)

<sup>25</sup> van der Grinten, P. RHIOs Aim to Transform Quality of Care and Patient Safety." Patient Safety and Quality Healthcare. May/June 2006. <http://www.psqh.com/mayjun06/rhio.html>

## **Technology Infrastructure and Data Structure**

Each organization within the Ofek Network stores data on a separate server, or node, with a virtual repository or “proxy” database running dbMotion software<sup>19,23,24</sup>. A node is a server or group of servers at a specific site associated with local applications at that site, and the “proxy” database is an internal catalog to which selected patient data elements are copied from each site’s information systems<sup>19,23</sup>. Key data such as labs and surgery reports are updated within a minute of any changes to the local application<sup>23</sup>. The data in the local applications retains its original format, location and ownership<sup>19</sup>. The minimal clinical data set includes: hospitalizations, diagnosis, visits, medications, labs, imaging, pathology, procedures, surgery, Emergency Room (ER) and outpatient visits, allergies, chief complaints, problem list, general physician encounters, vital signs and caregiver-to-caregiver messaging<sup>23</sup>.

Real-time search capabilities allow records to be located within less than 8 seconds through a distributed query function. The Israeli national Identification Number (ID) is used throughout all health care organizations to identify patients<sup>23</sup>. When a patient record is requested via an “Ofek” button on the local application, or by direct access over a virtual private network (VPN) or the Clalit intranet, the node aggregates data by accessing a local clinical data repository<sup>23</sup>. The data is retrieved, copied to the internal catalog and normalized using a Unified Medical Schema, an information model based on standards such as HL7 v.3, open EHR, CEN, ASTM, and CCR<sup>19</sup>. A read-only “virtual patient record” is created to represent all relevant patient information. It is designed for single use only and not to save to any end-user application<sup>19,23</sup>. The virtual patient record can be viewed by a web-based customizable GUI for sites without EMRs (such as early adopting primary clinics). For sites with EMRs, an XML document is sent to the EMR, which processes and displays the virtual patient record in the EMR’s recognizable user interface<sup>19</sup>.

An action-based distributed rules engine that analyzes the virtual patient object (which generates the virtual patient record) is used to generate alerts and caregiver text messages based on client-defined rules<sup>19</sup>. The Ofek Network uses the technology platform and third party analytic software to examine statistics, such as hospital usage statistics and unnecessary admissions from the ED<sup>24</sup>. Finally, the use of service-oriented architecture (SOA) enables organizations to achieve semantic interoperability<sup>19</sup>. However, Clalit leadership, such as Soroka University Medical Center’s CMIO Shlomi Codish, argues that the technology’s limitations in translating clinical terminology (i.e. SNOMED, ICD-9) could pose a challenge to semantic interoperability<sup>24</sup>.

## **Securities and Access Management**

From a patient perspective, the Ofek Network allows patients to keep specific medical information private from all other clinicians except their general practitioners (GPs) by attaching confidentiality flags to that data within the local information system. However, Ofek does not obtain patient consent or allow patients to opt out completely from the network<sup>23</sup>. From a user perspective, since Ofek is accessed by almost 10,000 users, the Ofek Ethics Committee has established strict access policies and requires all new RHIO participants to agree contractually to those policies<sup>23,24</sup>. GPs can monitor their patients who are in Clalit ERs or admitted in any Israeli hospital. In addition, GPs and nurses in hospitals and clinics communicate with other provider staff via a messaging application, which keeps a log all such messages used for care coordination, discharge planning, and follow-up care<sup>23</sup>.

In addition, audit trails of user actions in Ofek can be retrieved even after role, profile, data, or view changes<sup>19</sup>. Finally, pilot projects for Ofek's expansion to a national HIE involve: (1) restricted for viewing life-threatening ED cases, and (2) patient consent to view all other ED data via scanning the patient's magnetic card<sup>24</sup>.

### **Disaster Recovery**

The federated model used enables Ofek's system to continue performing even when a facility or single point in the network stops working or goes offline. In addition, this information is communicated clearly to system users<sup>21</sup>. However, unlike in a centralized model, the federated does not provide redundancy, since information is stored only on local application servers.

### **Adoption**

Adoption of the technology across Ofek has increased for both hospitals and community clinics. Hospital adoption increased steadily from 7.5% in 2000, to 31% in 2002, to 57% in 2007. The addition of a new hospital center, as well as the ED pilot projects towards development of an HIE, will drive the adoption rate higher in subsequent years. Community clinic adoption increased sharply from 0% to 53% between 2001 and 2002 (when primary care clinics first began to view information), but has plateaued at the same adoption rate through 2007<sup>24</sup>.

Lessons learned from the RHIO's deployment include (a) accounting for political feasibility within the technical model (i.e. expansion beyond Clalit would mean that new sites might not want to share their data within a centralized repository) and (b) overcoming variation in technical sophistication and integration standards (i.e. detailed specification and data elements versus scanned PDF documents) across hospitals and clinics to achieve community-wide integration of medical information. The success of this approach is supported by rapid clinic adoption of the technology, as well as evidence of shorter length of stay and better follow-up care<sup>25</sup>.

### **Applicability**

The base technology solution and strategy used in this exchange has been adopted by two U.S. clients – the University of Pittsburgh Medical Center (UPMC), a 23-hospital integrated delivery network, and the Bronx RHIO, which includes 80% of the borough's providers and 50% of its practicing physicians who provide inpatient care for two-thirds of all Bronx patients<sup>26</sup>.

The UPMC-developed solution also uses a tiered architecture but has seemingly overcome the challenges of divergent clinical vocabularies by integrating medication orders across ICU, medical/surgical inpatient units and outpatient units on its user interface<sup>27</sup>. UPMC plans to expand the solution's decision support features as well<sup>28</sup>. While funding is less of an issue to the

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<sup>26</sup> Enrado, P. "On the Fast Track with the Bronx RHIO." NHIN Watch, January 1, 2007. <http://www.nhinwatch.com/news.cms?newsId=1926>

<sup>27</sup> Hagland, M. "HIMSS Plusses and Minuses - Best demo seen on the exhibit floor." Healthcare Informatics. February 27, 2008. <http://www.dbmotion.com/site/modules/newsItem.asp?itemID=94&Pid=247&Sid=70>

<sup>28</sup> "An Exclusive Interview with Peter van der Grinten, General Manager USA/Canada of dbMotion." HIS Talk. October 27, 2006. [http://histalk.blog-city.com/an\\_exclusive\\_interview\\_with\\_peter\\_van\\_der\\_grinten\\_gm\\_usacana.htm](http://histalk.blog-city.com/an_exclusive_interview_with_peter_van_der_grinten_gm_usacana.htm)

large integrated delivery network, it poses a challenge to the Bronx RHIO, whose operations rely on a \$4.1 million New York State grant and stakeholder contributions<sup>26</sup>. Despite the \$1 billion New York State bond and the \$139 million in Federal grants and contracts set aside for RHIOs, the predominance of grant-funded RHIOs in the United States will need to give way to a different revenue model to ensure self-sufficiency and success<sup>29</sup>.

Israel's state funded-RHIO and health organization structure—where an autonomous Clalit operates both hospitals and clinics—presented a more favorable environment for quick adoption of RHIO technologies than the more competitive and diverse United States market. Differing opinions may argue that competition between hospitals and community clinics for patient information can pose a barrier to rapid development of RHIOs in the United States, and that EMRs could further divide organizations due to cost barriers and a perceived competitive advantage. Some believe that a federated solution like the Ofek Network will reduce concerns around data ownership, drastic workflow changes, cost and duration of implementation<sup>30</sup>. The key difference between Israel's model and the path of RHIOs in the United States is a central force—with as much market share as Clalit—to take advantage of the lower costs and rapid deployment potential of technology.

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## **The United Kingdom and the National Health Service**

The United Kingdom of Great Britain and Northern Ireland (UK) is the sovereign state that includes England, Scotland, Wales, and Northern Ireland. England, Scotland, Wales, and Northern Ireland each have a publicly funded healthcare system, known as the National Health Service (NHS) established by separate pieces of legislation that began operating in 1948. The Department of Health is in charge of the NHS with a cabinet minister reporting as secretary of state for health to the prime minister. The department has control of England's 10 Strategic Health Authorities (SHAs)<sup>31</sup>, which oversee all NHS activities in England. In turn, each SHA is responsible for the strategic supervision of all the NHS trusts in its area. The devolved administrations of Scotland, Wales, and Northern Ireland run their local NHS services separately. NHS is the world's largest health service.<sup>32</sup>

The NHS provides care to all residents of the UK and most services are free at the point of use. Some services like eye tests, dental care, and prescriptions have associated charges. Private

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<sup>29</sup> Scalise, D. "A Primer for Building RHIOs." Health Forum. February 13, 2006. [http://www.hhnmag.com/hhnmag\\_app/hospitalconnect/search/article.jsp?dcrpath=HHNMAG/PubsNewsArticle/data/backup/0602HHN\\_FEA\\_CoverGatefold&domain=HHNMAG](http://www.hhnmag.com/hhnmag_app/hospitalconnect/search/article.jsp?dcrpath=HHNMAG/PubsNewsArticle/data/backup/0602HHN_FEA_CoverGatefold&domain=HHNMAG)

<sup>30</sup> Van der Grinten, P. "The Promise of RHIOs." For the Record: Committed to Enhancing the Health Information Profession. Vol 17, No 26, December 19, 2005. [http://www.fortherecordmag.com/archives/for\\_121905p17.shtml](http://www.fortherecordmag.com/archives/for_121905p17.shtml)

<sup>31</sup> NHS. *About the NHS* at <http://www.nhs.uk/aboutnhs/Pages/About.aspx>

<sup>32</sup> Wikipedia. *National Health Service*. [http://en.wikipedia.org/wiki/National\\_Health\\_Service\\_\(England\)](http://en.wikipedia.org/wiki/National_Health_Service_(England))

health care still exists in the UK but it is not widely used and is generally a supplement to NHS services. The population of the UK is 60,943,912 (July 2008 est.) with a median age of 39.9. Life expectancy is estimated at 78.85 years<sup>33</sup>.

NHS has recognized that there is a clear case for using information technology (IT) in healthcare to bring safety benefits for patients and this was a driver to move towards HIE. The National Programme for IT initiative was established in 2002 and the Connecting for Health agency (within NHS) was created in 2005<sup>34</sup>. The major goal is to provide and share electronic health records (Care Records) for 50 million people by 2010. This would also include linking approximately 300 hospitals and 30,000 physicians. However, there is additional functionality planned that make this a huge infrastructure project with many technological challenges including rapid deployment.<sup>35</sup>

The major issues facing the overall healthcare system include overcoming the public's concern about the privacy of their health information and project schedule slippage. Several events involving breaches of confidential information and missed project deliverables have virtually destroyed public confidence. In fact, there have been several grassroots efforts to rally UK citizens to request that their records be kept entirely out of the system<sup>36, 37</sup>. Despite an ongoing public relations campaign from NHS, the public seems to doubt the project. Additionally, serious concerns about project costs have been expressed by the Public Accounts Committee of the House of Commons in a 2007 report.<sup>38</sup>

### ***Technology Overview***

The Department of Health sets policy and funding; NHS is responsible for care delivery, infrastructure, and financial management. Primary Care Trusts are established to manage the primary care; and payment to care providers (Physicians, Hospital Trusts, Ambulance Trusts, etc.). Hospital Trusts are NHS entities and physicians are contract workers.

The key deliverables for the project involve: a National Care Record Service that would contain all clinical data for all NHS patients; 'Choose and Book' for scheduling appointments, electronic transmission of prescriptions, national Information Technology (IT) broadband IT network (N3), picture archiving and communications system; central email called NHS mail; GP2GP information transfer between physicians allowing secure transfer of records, and a portal (secure)

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<sup>33</sup> The World Factbook. *United Kingdom*. <https://www.cia.gov/library/publications/the-worldfactbook/print/uk.html>

<sup>34</sup> Connecting for Health. *Implementation Guide*. July 2007. [http://www.connectingforhealth.nhs.uk/systemsandservices/implementation/docs/national\\_programme\\_implementation\\_guide.pdf](http://www.connectingforhealth.nhs.uk/systemsandservices/implementation/docs/national_programme_implementation_guide.pdf)

<sup>35</sup> Department of Health. *Delivering 21st Century IT Support for the NHS* [http://www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digitalassets/@dh/@en/documents/digitalasset/dh\\_4071684.pdf](http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4071684.pdf)

<sup>36</sup> Guardian. *What can patients do?* <http://www.guardian.co.uk/society/2006/nov/01/health.medicineandhealth2>

<sup>37</sup> Daily Mail. *Revolt, 200,000 people demand to opt out of new NHS database scheme*. <http://www.dailymail.co.uk/health/article-505419/Revolt-200-000-people-demand-opt-new-NHS-database-scheme.html>

<sup>38</sup>Parliament The House of Commons Public Accounts Committee Reports. <http://www.publications.parliament.uk/pa/cm/cmpubacc.htm>

website called Healthspace that stores and allows access to a summary care record.<sup>39</sup> The data warehouse known as the “Spine” is the set of services used by the Care Record Service. The NHS Spine is a care record repository, deposited into and accessed by electronic health record (EHR) systems - it is not itself an EHR system. The Care Record has a detailed record held locally and the summary record held nationally<sup>40</sup>. The Spine includes:

- Persona/Patient Demographics Service (PDS) - stores demographic information about each patient and his or her NHS number, it functions as the master patient index. Patients must provide the PDS at a hospital or physician appointment to be identified and then the NHS number is used to access the care records.
- Personal Spine Information Service - summarizes the patient’s clinical information.
- Secondary Uses Services - uses data from patient records to provide anonymous research information.

There are significant challenges involved with the PDS. Several systems need the NHS number for financials and physician assignments. Decoupling these systems is expensive, not budgeted, and not considered in the original plans. In addition, NHS Wales and NHS Scotland use the legacy NHS numbers to address the care needs of individuals that travel for their care and are in border regions. NHS Scotland uses a 10-digit number called the Community Health Index in addition to the NHS number<sup>41</sup>.

Connecting for Health has contracted with several National Service Providers (NSPs) and Local Service Providers (LSPs). The LSPs implement the local systems that interact with the national services via the messaging spine and the national care record. The local systems must be developed and deployed so there is a homogenous basis for health data to move into a national care record. As of July 2007, there were three LSP vendors involved in location specific “clusters” including CSC Alliance covering North, Midlands, and Eastern cluster and BT Health London covering London cluster<sup>42</sup>. Fujitsu Alliance was covering Southern cluster until the ten-year contract was terminated early in May 2008.

There are also several NSPs for services common to all users. As of October 2005, the NSP vendors included BT Health for NHS Care Records (national elements), Spine and the N3; Atos Origin and Cerner for ‘Choose and Book’; and Cable and Wireless for NHSmail<sup>43</sup>.

The minimal data set for clinical data involves HL7v3- local clinical statement pattern; SNOWMED CTHL7 v3 and early versions used a local variant of clinical statement pattern; now under redevelopment using CDA2<sup>44</sup>. SNOWMED CT is used for terminology<sup>45</sup>.

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<sup>39</sup> NHS. Connecting for Health. *Implementation Guide* July 2007.

[http://www.connectingforhealth.nhs.uk/systemsandservices/implementation/docs/national\\_programme\\_implementation\\_guide.pdf](http://www.connectingforhealth.nhs.uk/systemsandservices/implementation/docs/national_programme_implementation_guide.pdf)

<sup>40</sup>NHS Connecting for Health. *Systems and Services*. <http://www.connectingforhealth.nhs.uk/systemsandservices>

<sup>41</sup>NHS Scotland. *Strategy for Information 2001-2005*. <http://www.ehealth.scot.nhs.uk/imt2001strategy.pdf>

<sup>42</sup>Wikipedia. *National Programme for IT*. [http://en.wikipedia.org/wiki/National\\_Programme\\_for\\_IT](http://en.wikipedia.org/wiki/National_Programme_for_IT)

<sup>43</sup>Cable & Wireless Press Release. [http://www.cw.com/media\\_events/media\\_centre/releases/2007/06\\_07\\_2007.html](http://www.cw.com/media_events/media_centre/releases/2007/06_07_2007.html)

<sup>44</sup> Department of Health. *Delivering 21st Century IT Support for the NHS*

[http://www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digitalassets/@dh/@en/documents/digitalasset/dh\\_4071684.pdf](http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4071684.pdf)

Additionally, NHS has initiated agreements with Novell for open source software involving security management and infrastructure applications that enable centralized management of workstations<sup>46</sup>. This move is expected to save the NHS a total of \$133 million over three years.

Where information interchange is fully devolved, each participating system involved in delivering functionality to users, would receive information from each and every other participating system when required (i.e. through "point to point" information exchanges). Each participating system in this approach is also responsible for distribution of notifications to all legitimate interested parties.

The security model utilizes a Role Based Access Control (RBAC) which requires the maintenance of people, roles, and system capabilities<sup>47</sup>. Organizations that need to access patient information within Care Records and other National Programs set up Registration Authorities to manage this process. The Registration Authority is responsible for verifying the identity of health care professionals and workers who wish to register to use these services. Once authorized, individuals are issued a Smartcard by the Registration Authority. Individuals use their Smartcards and their Smartcard Passcode each time they log on. Job roles are used to verify content and access level. Audit trails of access are also captured. The user authentication model has not been well accepted by physicians and nurses who would be required to insert cards each time they want to use a system. Confidentiality of health records (for living people) is established through the Data Protection Act 1998. UK residents are also provided the Care Record Guarantee from NHS that outlines security and confidentiality measures taken.<sup>48</sup> The participation in the system is one of the current challenges of the project. The ethics committee of the Royal College of GPs recommends that patients 'opt in' for information sharing. However, the NHS Connecting for Health's Care Record Development Board (which closed in late 2007) has adopted and maintained an 'opt out' model. According to NHS, Detailed and Summary Care Records are protected through the Role Based Access System<sup>49</sup>.

### ***Adoption***

The N3 is now the largest Virtual Private Network (VPN) in Europe. When complete it will be one of the largest VPNs in the world<sup>50</sup>. According to Connecting for Health website statistics from May 2008<sup>51</sup>:

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<sup>45</sup> NHS. *SNOWMED CT in the NHS Care Record*. November 2005.  
[http://www.kith.no/upload/2585/SNOMED%20CT%20in%20the%20NHS%20Care%20Records%20Service%20NORWAY%20Nov%202005.ppt#286,4,Simplified 'Spine' architecture](http://www.kith.no/upload/2585/SNOMED%20CT%20in%20the%20NHS%20Care%20Records%20Service%20NORWAY%20Nov%202005.ppt#286,4,Simplified%20Spine%20architecture)

<sup>46</sup> Healthcare IT News. *NHS contract backs open source applications*.  
<http://www.healthcareitnews.com/story.cms?id=4244>

<sup>47</sup> NHS Connecting for Health. *Implementation Guide* July 2007.  
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<sup>48</sup> NHS Connecting for Health. *The Care Record Guarantee*  
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<sup>49</sup> E Health Insider. *RCGP ethics committee recommends opt-in for NCRS*.  
<http://www.ehiprimarycare.com/news/item.cfm?ID=1489>

<sup>50</sup> NHS Connecting for Health. *N3 Story So Far*. <http://www.n3.nhs.uk/files/generalfiles/N3story.ppt>

- Over eight million appointments have been made on ‘Choose and Book’
- Over 87 million prescriptions have been transmitted
- Over 162,000 care records have been uploaded to the SPINE
- There are 486,498 Smartcard holders who are registered and approved for access to the Spine.
- Approximately 1.2 million NHS employees have access to the N3 broadband network.

The National Programme for IT in the NHS Benefits Statement 2006/07<sup>52</sup> indicated 14,200 National Programme systems were installed across the NHS. Of these, 12,150 provided vital foundations for ‘Choose and Book’ and the Electronic Prescription Service. In addition, over 18,000 locations were connected to the National Network for the NHS (N3), the secure broadband network. Over 1,400 front-line systems had also been installed by this date, however, challenges continue with privacy and security. There is a continued loss of public confidence. Recent information revealed that the nationwide electronic health record system will not be fully introduced until 2014 or 2015 – four years later than planned. The original plan to have the project completed by 2010 was described as ‘unachievable’, yet the project was reported to be on budget<sup>53</sup>.

Those involved with the project also learned that getting the support of the stakeholders before moving forward is paramount. Clearly, privacy and security concerns were never addressed appropriately at the start and have continued to plague the project. Additionally, the National Programme has moved away from a centralized system but emphasizes separate countries and exchange within the UK.<sup>54</sup> This is similar to one of the several problems with the Santa Barbara RHIO. The project management involving top down control has not proven to be the most effective governance structure.

### ***Applicability***

The applicability for this technology in the United States is limited. The UK’s national healthcare system with some inherent interoperability cannot be replicated as easily in the United States’ private sector market. Physicians are contracted to the NHS so adoption can be required. The United States has struggled with ways to increase and require adoption by physicians, hospitals, and payers. The President has set a mandate for most Americans to have electronic health records by 2014. However, many agree that the deadline is arbitrary and will not be met.

### ***Task Force Contributors***

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[www.connectingforhealth.nhs.uk/newsroom/latest/factsandfigures/deployment](http://www.connectingforhealth.nhs.uk/newsroom/latest/factsandfigures/deployment)

<sup>52</sup> NHS Connecting for Health. *Benefits Statement 2006/07*.

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## **France - The Dossier Médical Personnel (DMP)**

### *French Healthcare System Overview*

The French healthcare system was classified the “best health system in the world” by the World Health Organization (WHO) in June 2000.<sup>55</sup> For more than 96 percent of the 64.5 million French citizens, medical care is either entirely free or is reimbursed 100 percent<sup>56</sup>. They also have the right to choose among healthcare providers, regardless of their income level and can consult a variety of doctors and specialists in any public, private, university or general hospital. Moreover, waiting lists for surgeries found in other government supported healthcare systems do not exist in France.

A branch of the Social Security system, health insurance is funded by workers’ salaries (60 percent of the fund), indirect taxes on alcohol and tobacco and by direct contribution paid by all revenue proportional to income, including retirement pensions and capital revenues. Taxes also fund universal healthcare for the poor. Additionally, the treatment costs for those who suffer from chronic illnesses are completely reimbursed.<sup>57</sup> Jurisdiction in terms of health policy and regulation of the healthcare system is divided between the state, statutory health insurance funds and, to a lesser extent, the local communities.

The medical care establishment is made up of three types of institutions: public hospitals, private clinics and not-for-profit healthcare organizations. All provider institutions are subject to the same regulations. For instance, the Ministry of Health nominates the heads of all hospital services.

The one thousand and thirty-two public hospitals are financed primarily by endowment funding that is paid for by health insurance funds. Private hospitals evolved from private clinics, started by surgeons and obstetricians. The not-for profit hospitals were originally denominational and currently make up 14% of the inpatient services among French Medical Care Institutions. They are financed through endowments like public hospitals, but have the right to privacy like private clinics.

The cooperation between the public and private sector in the French healthcare system allows citizens to avoid waiting lists for surgeries, which are often associated with socialized medicine. The unique combination of government financed medical care and private medical services produces a health care system that is open to all and provides the latest in medical technology and treatment.<sup>58</sup>

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<sup>55</sup> The world health report 2000 - Health systems: improving performance  
[http://www.who.int/whr/2000/en/annex01\\_en.pdf](http://www.who.int/whr/2000/en/annex01_en.pdf)

<sup>56</sup> National Demographic Studies Institute, 1 Jan 2008

<sup>57</sup> <http://www.sante.gouv.fr>

<sup>58</sup> <http://ambafrance-us.org>

## *Technical Overview*

In order to facilitate the coordination and information-sharing between healthcare professionals among the provider institutions, the Dossier Médical Personnel (DMP) or Personal Health Record (PHR) project was decreed by law on August 13<sup>th</sup>, 2004.<sup>59</sup> The DMP will be accessible on-line and include a patient's demographic data, medical and surgical histories, current treatment and test results as well as imaging data. The DMP, set to be launched in mid-2008, will be a unique national portal centralized into a national data center.

The DMP is administered by a central government agency, the Groupement d'Intérêt Public-Dossier Médical Personnel (GIP-DMP) responsible for planning the program, selecting vendors and supplier management.<sup>60</sup> The GIP-DMP was established in 2005 to oversee the design and implementation of the DMP. Comprised of healthcare professionals, patients and government representatives the group consisted of 38 members in 2006.

The GIP-DMP is responsible for steering the entire project including designing the deployment strategy, clinician engagement, public communications, determining access and hosting conditions, steering and monitoring the implementation of experiments among pilot sites as well as overseeing the design and production of the supporting information technology (IT) systems for the DMP.

The DMP is also overseen by the National Council for Information and Liberty (CNIL), a government body concerned with civil liberties and data protection. A third agency, the Groupement d'Intérêt pour la modernisation du système d'information hospitalier (GIP-MISH) coordinates at a national level the modernization and adaptation of hospital information and patient information systems to ensure they meet the national DMP interface standards.

The DMP's user base is comprised of patients and healthcare professionals. It is free for patients, and has no specific requirements with regards to the Electronic medical records (EMR)/electronic health record (EHR) systems used by the 600,000 providers. The latter only need to be able to upload medical data to the DMP, using the IHE Cross-Enterprise Document Sharing (XDS) profile<sup>61</sup>.

The patients access the DMP via a portal which authenticates the user and determines his or her access rights. A unique national identifier (ID) is used for each patient. That ID is different from the Social Security number, mostly for privacy and security reasons<sup>62</sup>. Information about the kinds of patient identification services or algorithms (such as an electronic master patient index (EMPI) that will be used is not available at this point, but it is likely that the use of a unique ID at the national level will greatly facilitate that process.

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<sup>59</sup> Le GIP-DMP <http://www.d-m-p.org>

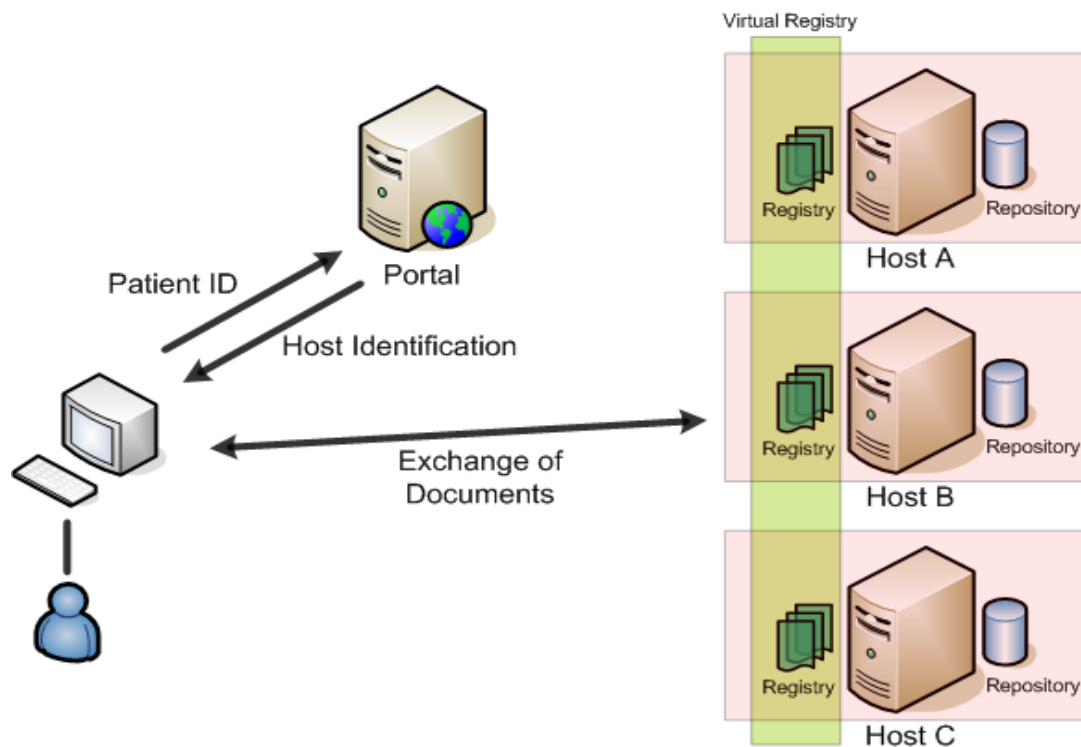
<sup>60</sup> Le GIP-DMP <http://www.d-m-p.org>

<sup>61</sup> IHE-DMP Workshop presentation, Montréal, 16 Oct. 2007 – Manuel Metz

<sup>62</sup> From interview with Manuel Metz, January 2008

The portal itself does not store any data – medical information is stored in remote systems called “hosts”. Data about a single patient is stored in one host only, and the portal redirects the requests to retrieve the information from or store it in the designated host.

The Integrating the Healthcare Enterprise (IHE) Cross Enterprise Document Sharing (XDS) profile is used for the health information data exchange. The remote hosts each contain a physical registry and repository, and a “virtual” registry contains the meta-data to route any requests coming from the portal or health care professionals.



**Figure 1: The DMP's health information exchange and storage design<sup>63</sup>**

The GIP-DMP is extensively leveraging some of the latest interoperability profiles developed by IHE, including:

- Cross Enterprise Document Sharing( XDS)
- Patient Identifier Cross-Reference Consumer (PIX)
- Audit Trail and Node Authentication (ATNA)
- Cross Enterprise User Authentication (XUA)
- Basic Patient Privacy Consents (BPPC)
- Notification of Document Availability (NAV)
- Document Digital Signature(DSG)

<sup>63</sup> Adapted from IHE-DMP Workshop presentation, Montréal, 16 Oct. 2007 – Manuel Metz

These profiles leverage established standards such as HL7, DICOM, and LOINC. The GIP-DMP is actively involved and invested in IHE's work, by either re-using the profiles, adapting them to the specific needs of the French system, or by leading some of the IHE workgroups and committees. This will give them a unique opportunity to be a front runner with regards to using the latest and greatest standards healthcare IT has to offer. A tender was launched on March 31, 2008 and various vendors as well as system integrators have been invited to submit their proposals. The documents can be found on <http://www.achatpublic.com><sup>65</sup>.

The final technology infrastructure that is implemented will partially depend on the vendors selected at the end of the bid process. A comprehensive paper outlining the technical strategy is set to be released later this summer. This explains why many technical details are not provided here because at press time, it is still a work in progress.

In accordance with French legislation, the DMP is the patient's property. As such the DMP system predicts the use of hosting services in order to provide safe storage of all DMP's, allowing the patient to choose the storage provider. The GIP-DMP is responsible for selecting a set of hosting suppliers.

To protect patient privacy, French regulations only allow clinicians to view areas strictly relevant to their professional interests; they do not have access to a patient's overall medical record.

	HCP type 1		HCP type 2		HCP type 3	
	Reading	Writing	Reading	Writing	Reading	Writing
Document type A	X	X				
Document type B	X	X	X	X	X	
Document type C	X		X		X	X

**Figure 2: Patient records access level rights**

As shown above, the types of documents and healthcare providers are what define a provider's ability to read or write patients' records. In addition, patients will be able to hide or mask certain data in their profile from certain providers, with the exception of the document's author and possibly the primary care provider.

### **Challenges**

Among the main challenges and obstacles encountered in the development of the DMP, the GIP-DMP listed defining the technical specifications, understanding the legal ramifications as well as developing the economic model to sustain the project in an environment without precedent.<sup>66</sup> On the public side, plans to centralize patients' information to be held on central computer servers

<sup>64</sup> Le DMP <http://www.d-m-p.org>

<sup>65</sup> Le DMP <http://www.d-m-p.org>

<sup>66</sup> Le DMP <http://www.d-m-p.org>

has come under attack from a range of patient's rights, civil liberties and trade union organizations who have argued that this will leave personal data vulnerable to abuse.

From the technical standpoint a number of issues have also emerged<sup>67</sup>. The software systems (EMR, EHR, Practice Management, etc.) used by the providers do not all support the IHE XDS profile. It will take time before the market catches up. In the meantime, the basic content-neutral XDS profile will be used, and over time, the XDS content profiles will be introduced as appropriate. They will provide a uniform way of looking at medical data such as scanned documents, images, labs, medical summaries and so forth. In addition, there is existing medical information which cannot be exchanged through the XDS profile. Integrating that information remains a challenge. The third issue revolves around patients being able to erase certain medical data from their records. Today, there are no standards which allow such transactions. Finally, patients should be able to change the host where their data is stored. It is not clear how will that be accomplished at this point.

### ***Adoption***

In 2006, six different consortia were chosen as hosts for the testing phase including D3P (RSS-Microsoft-Medcost/Doctissimo); France Telecom (France Télécom-IBM-Capgemini-SNR); InVita (Accenture France and SMME (Société Mutuelle Mieux-Être), including La Poste, Neuf Cegetel, IntraCall Center, Jet Multimédia and Sun Microsystems); Santeos (Atos-Unimédecine-HP-Strateos-Cerner) Santénergie (Siemens, Bull, EDS) and Thalès Cegedim (Cogedim and Thalès). The test phase included the participation of 2500 healthcare professionals, 100 organizations (private and public) and 37 clinical networks.<sup>68</sup>

By mid-2007, 38,200 experimental DMP records had been opened, with 5,000 being used actively.<sup>69</sup> In January 2008, 13 regional and 5 national DMP projects had been implemented involving 451 point of care establishments and 24,000 healthcare providers.<sup>70</sup> In mid 2008 all beneficiaries of the health insurance system will be able to open their own DMP record, though its acquisition will not be mandatory.<sup>71</sup>

### ***Section References***

The official website of the DMP <http://www.d-m-p.org>

1. Technical information was obtained from presentation materials used by the French Ministry of Health.

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<sup>67</sup> IHE-DMP Workshop presentation, Montréal, 16 Oct. 2007 – Manuel Metz

<sup>68</sup> Le Projet DMP : Rapport d'activité 2006/2007 p.23 <http://www.d-m-p.org>

<sup>69</sup> Le Projet DMP : Rapport d'activité 2006/2007 p. 23 <http://www.d-m-p.org>

<sup>70</sup> Annuaire des Contacts <http://www.d-m-p.org/index.php>

<sup>71</sup> Documental (2006), Le Dossier médical personnel (DMP) : La gouvernance des grands projets en question [http://www.documental.fr/v2/audio\\_4416.php](http://www.documental.fr/v2/audio_4416.php)

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## **Summary of Findings**

While there are some technological similarities between the United States based and international HIEs there does not seem to be one underlying technology that promises success across the board for all entities. Regardless, there are several factors that appear to be inherent to all of the HIEs based on the research from this whitepaper:

- **Standards Based:** While this seems obvious it should not be unstated. Every successful implementation has based data transfer on an approved standard
- **Clearly Defined Record:** A clearly defined record must be identified that has been scrutinized by all key stakeholders
- **Web Based:** Technology must be based on the web. Web based tools are essential for ease of record access and reduced training requirements
- **Single Sign on:** This is necessary for simple and quick data access which will also sustained adoption
- **Technologies:** There appears to be several products have been used successfully across organizations even though not deployed exactly the same.
- **Data Centric Models/Virtual Record Access Methods:** Both of these strategies have appeared to be successful.

What has been learned in this whitepaper comparison is that a strong governance process and project management is key to a project's success. Technology plays a critical role in success; however it is the 'people' part of the project that ultimately determines success or failure.

A central theme became apparent in this research when comparing other countries with United States based HIEs. The United States would have a very difficult time modeling their HIE after one of these successful countries. The reason is twofold: First there is typically no long term secure funding mechanism to support the United States based projects. In the foreign counties, the government has completed initial and ongoing/long term funding for the HIE. Secondly, there are only limited requirements, now through the American Recovery and Reinvestment Act of 2009, that supports an HIE in the United States. The other countries have had to comply with their government mandates which provides strict requirements on implementation of an HIE. Both of these factors are key to a successful implementation in the United States.

In conclusion, there is still much to be learned from the current United States based projects. Funding, while difficult to obtain, can be available and the underlying technologies are slowly proving themselves. While a small country does not have the same massive infrastructure and competing parties as found in the United States, the accomplishments that have been made abroad are truly impressive.



## Credits

Special acknowledgment and appreciation is extended to Joseph Wagner, Chair of the HIE National International Technology Guide Task Force, for his time, leadership and content contribution in the development of this white paper.

Special acknowledgement is given to those organizations that provided information towards the content of this white paper. Members of the HIMSS 2007 – 2008 HIE National International Technology Guide Task Force, who spearheaded the development of this white paper, include:

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