

# 15

## Convergence Toward the Pan-Canadian Electronic Health Record

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New information and communications technologies strategically deployed in a pan-Canadian health information highway will provide Canadians with new opportunities to take greater responsibility for their own health and participate meaningfully in decisions about their health and their health system. This pan-Canadian health information highway, more commonly known as the Canada Health Infoway, will also improve the quality, accessibility, portability, and efficiency of health services across the entire spectrum of care.

The Canada Health Infoway refers not only to the use of information and communications technologies in health but also to the health information those technologies create, the policies and standards governing use of this information, and the people and organizations that create the information and use this infrastructure. It is not a single massive structure but will be built upon the existing and planned strategies and initiatives of all Canadian local, regional, provincial, territorial, and federal jurisdictions. While retaining their own identity and supporting their different legislations, it is the pan-Canadian vision which allows these diverse initiatives to complement each other in improving the health of all Canadians (Advisory Council on Health Infrastructure 1999).

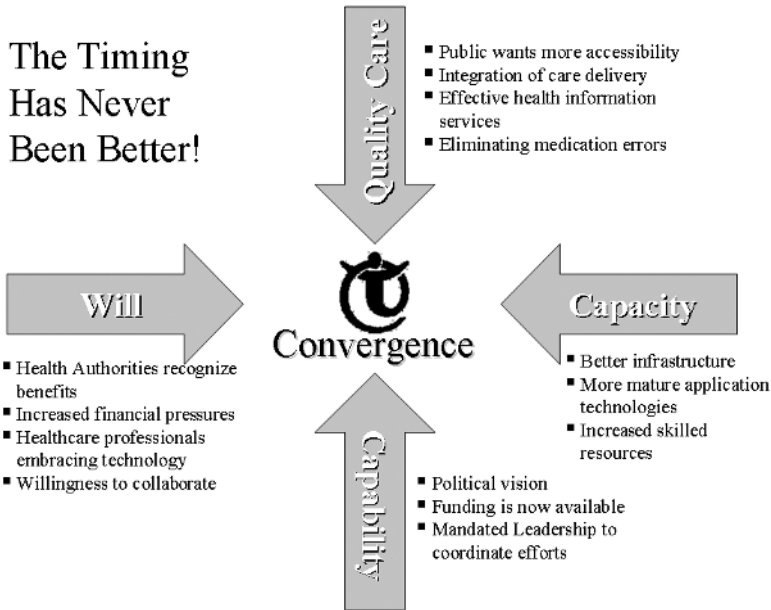
Three key strategic directions will move Canada towards this vision:

- Health information for the public
- Integrated provider solutions
- The electronic health record (EHR)

All three directions are priorities, but the EHR is the critical gap requiring immediate attention. Thus, Canada's First Ministers<sup>1</sup> have agreed to invest Canadian \$1.1 billion in the Canada Health Infoway to promote and facilitate the development of interoperable EHR and telehealth solutions. With this investment, along with investments by organizations, the provinces/territories, and previous federal initiatives, their goal is to have the basic elements of interoperable EHR solutions in place in half of all Canadian jurisdictions by 2010. This is a tall order, and gives rise to a series of questions: Can it be done? How will it be done? Why now? What is different from before? The answer is *convergence*.

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<sup>1</sup> Canada's First Ministers are the jurisdictional leaders of Canada, including the Prime Minister of Canada, along with the Premiers of the 10 provinces and 3 territories.



**FIGURE 15.1.** Convergence.

## 1. The Timing Has Never Been Better

According to many Canadians, the timing for the realization of the pan-Canadian EHR vision has never been better. The drivers of quality care, will, capability, and capacity have converged, as shown in Figure 15.1.

### 1.1. *Quality Care*

The needs to integrate care delivery across sectors, respond to global epidemics, and ensure patient safety all fuel the urgency to improve the quality of care. Adding to this urgency, the public is demanding greater and timelier access to quality healthcare services and information. As a result, many regional care delivery organizations now encompass all of acute, ambulatory, emergency, home, community, and continuing care. Some regional organizations encompass mental and public health care as well. Even where such services are not integrated in a single entity, local community-based organizations increasingly collaborate on service delivery. The benefits of integration are never more apparent than in treating infectious diseases, such as SARS or the West Nile virus, or in eliminating medication errors. Effective exchange of health information using a pan-Canadian EHR is key to quality care delivery.

### 1.2. *Will*

Faced by growing financial pressures, many healthcare organizations recognize the need for EHRs. A general shift in attitude has made healthcare providers more willing to consider and actually use technology and to understand its potential benefits.

Federal, provincial, and territorial jurisdictions are increasingly willing to collaborate and to compromise to achieve greater (and potentially more interoperable) benefits at lower, shared cost. The First Ministers' agreement on health includes the commitment to work collaboratively to develop common data standards to ensure compatibility of health information networks (Office of Health and the Information Highway 2000). More than ever, Canadians have the will to take action.

### 1.3. Capacity

Better infrastructures are being deployed and are increasingly available. Networked application technologies are mature and proven. More Canadian universities and colleges are providing undergraduate, graduate, and post-graduate degrees in health informatics, increasing the availability and capacity of skilled resources.

### 1.4. Capability

Canada's Ministers of Health, in the role of the Advisory Council on Health Infostructure<sup>2</sup> (ACHI), believed that the values for the Canada Health Infoway vision should be the same ones that underpin Canadians' support for Canada's health care system. "First and foremost, the Canada Health Infoway should strengthen Medicare as a single-payer, publicly funded health care system guided by the five principles of the *Canada Health Act*—universality, accessibility, comprehensiveness, portability and public administration—within the framework of a strong federal, provincial and territorial partnership. The values of fairness and compassion underlie these principles and will help shape the evolution of the Canada Health Infoway" (Advisory Council on Health Infostructure 1999).

In September 2000, the Canadian federal government announced that it would invest Canadian \$500 million in an independent corporation mandated to accelerate the development and adoption of modern systems of information technology, such as electronic health records, to help evolve the Canada Health Infoway. The corporation named after its mandate, Canada Health Infoway Inc., was announced in 2002 and is referred to as *Infoway*.<sup>3</sup> *Infoway* now has Canadian \$1.1 billion in investment capital. Along with the initial Canadian \$500 million in 2001, the federal government provided an additional Canadian \$600 million based upon the 2003 First Ministers' Accord on Health Care Renewal (Canada Health Infoway 2003d).

*Infoway* has adopted a strategic investor approach to fulfilling its mandate. *Infoway's* business is investing with partners to develop, replicate, and deploy robust, reusable interoperable EHR solutions faster, better, and more cost effectively than individual provinces or regions could do alone. Their strategic investment approach is intended to speed up implementation of the EHR across Canada while minimizing overall risk. *Infoway* focuses primarily on identifying investment opportunities with its partners. Once investment decisions are made, the partners lead the development, implementa-

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<sup>2</sup>The term *health infostructure* refers to the development and adoption of modern systems of information and communications technologies (ICTs) in the Canadian health care system which would allow the people of Canada to communicate with each other and make informed decisions about their own health, the health of others, and Canada's health system (Office of Health and the Information Highway 2003b).

<sup>3</sup>In this chapter Canada Health Infoway is the vision of Canada's health information highway described by ACHI in 1999. *Infoway* is the corporation announced in 2002.

tion, and deployment of the EHR solutions with *Infoway* providing oversight and support (Canada Health Infoway 2003d).

All these drivers—a shared vision, mandated leadership, and funding; the need to improve the quality of care delivery; increased capacity in infrastructure and resources; and the willingness and motivation to collaborate—are moving toward and converging on *Infoway*, which is acting as the catalyst to make it happen.

## 2. Evolution from a Local Focus to a Pan-Canadian Focus

In Canada, 19 jurisdictions are responsible for providing healthcare services to Canadians. These include 10 provinces, 3 territories, and 6 groups whose public health care responsibilities fall under the federal order of government (First Nations and Inuit Branch, Royal Canadian Mounted Police, Department of National Defense, Correctional Services of Canada, Veterans Affairs Canada, Citizenship and Immigration Canada). Canada's multi-jurisdictional federation covers a vast geographic area. As a result, EHR implementations have developed and continue to develop to support a variety of local, regional, and provincial and territorial needs.

### 2.1. Local/Regional Initiatives

One local/regional initiative is the electronic Child Health Network (eCHN). Based in the Greater Toronto Area (GTA), eCHN is a partnership of hospital and community providers working together to build an accessible, family-centered, high-quality, regionalized health system for mothers, newborns, children, and youth. Network membership currently includes 10 community care access centers (CCACs) and 20 hospitals that provide maternal/newborn, acute pediatric, and rehabilitative services in the GTA. Within eCHN are three major components. The first is an Internet web site that provides health-related information to consumers. The second is a password-protected Internet web site that allows healthcare providers to access healthcare information generated by various individuals and contained on the network. The third component, a system that allows healthcare providers to access a health record spanning across many institutions, is critical to integrating a patient's EHR across various systems. Called HiNet, this system makes information such as laboratory results, x-rays, visit information, doctor's notes, and personal information available electronically to healthcare providers when needed (Electronic Child Health Network 2001).

The following scenario has been adapted from the electronic Child Health Network web site:

At the age of 10, Jason Pinney was diagnosed with epilepsy. About six months later, he was diagnosed with a rare form of cancer that required an immediate operation at The Toronto Hospital for Sick Children (HSC). Originally, Jason was a patient at Toronto's St. Joseph's Health Centre (SJHC), where he was under the care of Dr. Mark Feldman, the hospital's Pediatrician-in-Chief. Dr. Feldman referred Jason to the specialists at HSC. At that time, Jason's mother had to go to St. Joseph's Health Centre to pick up Jason's health records, including his diagnostic images and charts, and personally delivered them to HSC.

Now: Dr. Feldman explains that "Jason is a kid whom I follow at SJHC with regard to epilepsy and school problems and was followed at HSC for cancer. Epilepsy drugs and cancer drugs may interact—I knew exactly what he was on. If the parents had questions about his cancer treatments, I could answer some of them. If HSC had questions about his epilepsy treatment—they could get the info immediately. If he presented to either ER with symptoms related to his cancer or its

treatment, his epilepsy or its treatment or unrelated problems requiring a treating MD to know his history in detail—HiNet made this possible.”

Jason’s mother, Ms. Gibson, explains that another reason she was happy to give consent to having Jason’s health records included in HiNet is for future reference. “If he is ever taken to an Emergency Room, whether he is conscious or unconscious, I want somebody there to know what that big scar (53 stitches) is all about. I want them to know that his epilepsy is gone. I want them to be able to get on with trying to figure out what may be wrong with him at that time, rather than trying to figure out what his history might be. That part is known and it’s all there for them to see.” (Electronic Child Health Network 2004).

Today, HiNet makes health records for about 115,000 children available to health-care providers at eight different healthcare organizations in Ontario (Electronic Child Health Network 2004).

## 2.2. Provincial/Territorial Initiatives

Many jurisdictions at the provincial and territorial level have their own EHR visions and strategies that they are aligning with the overall goal of a pan-Canadian EHR. Their different frameworks and blueprints share common elements such as privacy initiatives, EHR building blocks, and next steps to achieve the EHR.

British Columbia, for example, has an EHR framework that includes the key building blocks of systems or services required to fulfill the fully functional EHR and deliver value. That EHR framework, presented in Figure 15.2, with building blocks shown on the right, fits well with the *Infoway* Functional and Value Chain shown on the left and demonstrates how work done prior to *Infoway* has been effectively leveraged.

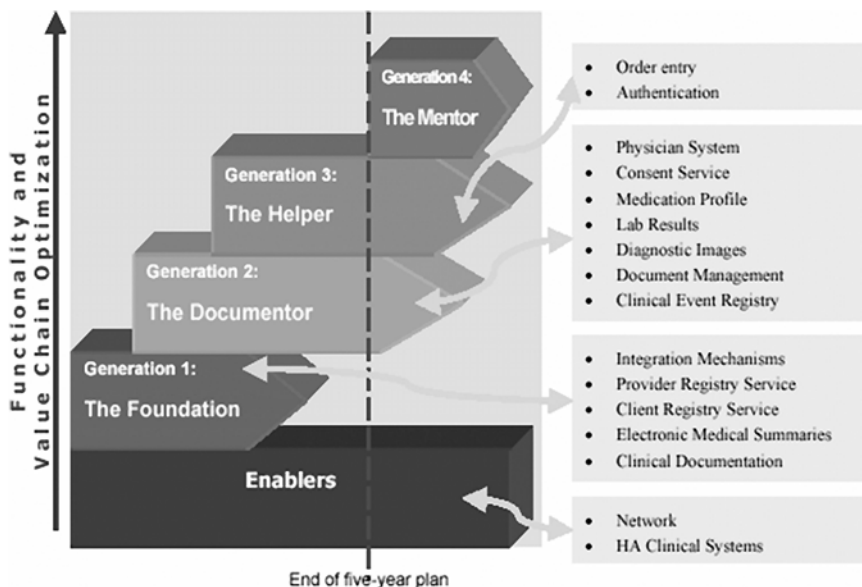


FIGURE 15.2. Example of aligning a provincial framework with the pan-Canadian model.

### **2.3. Federal Initiatives**

Through the Office of Health and the Information Highway (OHIH), Health Canada established the Canada Health Infostructure Partnership Program (CHIPP) in January 2000. This two-year, Canadian \$80 million funded cost-shared program was designed to advance the innovative use of information and communication technologies in the delivery of health care. In all, 29 inter-jurisdictional telehealth and electronic health record projects were selected for CHIPP funding (Office of Health and the Information Highway 2003a).

Current pan-Canadian initiatives are leveraging the work accomplished through CHIPP. One example of this is the development of a standards-based Provider Registry that will uniquely identify healthcare professionals within a pan-Canadian EHR system. Originally British Columbia led, this CHIPP initiative was undertaken by the four provinces and three territories that make up the Western Health Information Collaborative (WHIC). The registry is now being deployed in the neighboring provinces of Alberta, Saskatchewan, and Manitoba (Office of Health and the Information Highway 2002).

Many more EHR initiatives are underway at national, provincial/territorial, and local levels. It is now realized that, while each initiative is based on a distinct strategy, they must collectively contribute to the pan-Canadian vision of the EHR.

## **3. Pan-Canadian versus National Approach**

### **3.1. Pan-Canadian versus National**

At the Canada E-Health 2000 Conference, Dr. Tom Noseworthy described why a pan-Canadian approach is essential:

Many Canadians worry about the idea of having their personal health records stored on a single mainframe in a central location. It is equally untenable to accept an expensive, uncoordinated, piecemeal swirl of activity that will produce a sea of non-interoperability in health information systems. A pan-Canadian approach is essential for success, and the collective will to proceed will be a fundamental determinant of whether success is ultimately realized. (Office of Health and the Information Highway 2000)

While most Canadians inherently understand what pan-Canadian means and how it differs from a national approach, a formal definition of pan-Canadian is not commonly found in literature or dictionaries. The Cambridge and MSN Encarta (2004) dictionaries define national as “relating or belonging to, or representing a nation, especially a nation as a whole rather than any particular part of it or section of its territory; and owned, maintained, or controlled by the federal government” (Cambridge Advanced Learner’s Dictionary 2004). The same dictionaries define pan- as “including or relating to all the places or people in a particular group” and “involving all collectively or in cooperation with one another.” Both dictionaries define Canadian as “belonging to or relating to Canada”, “or its people or culture.” Therefore, pan-Canadian projects can be characterized as including or involving all places, people or culture in Canada collectively or in cooperation with one another.

A national EHR implies that there is only one solution to be implemented in the country that includes one large repository of an individual’s information, one architecture deployed in all jurisdictions, and one set of standards, which is controlled by one government. Although there are many benefits to implementing one standard, this approach implies that one standard fits all. In Canada’s case, it would fail to consider the differing business requirements, healthcare delivery models, and privacy legislations

in its different jurisdictions. Such an approach is often unattainable in a large multi-jurisdictional country. At best, it takes an unacceptable length of time to implement.

### **3.2. Pan-Canadian Approach**

The needed approach establishes pan-Canadian common infostructure standards for the EHR that simultaneously allow

- The exchange of information across jurisdictions, care settings, and disciplines
- The retention of local standards in operational systems that may or may not interact with the pan-Canadian EHR

One pan-Canadian infrastructure exchange requirement is to enable laboratory information, particularly test results, to be shared across jurisdictions. Work on this requirement was initiated at a workshop hosted by WHIC with participants from other provinces and several regions, as well as Health Canada and the Canadian Institute for Health Information (CIHI). This effort is demonstrative of the challenges involved in establishing the pan-Canadian infostructure (Western Health Information Collaborative 2002).

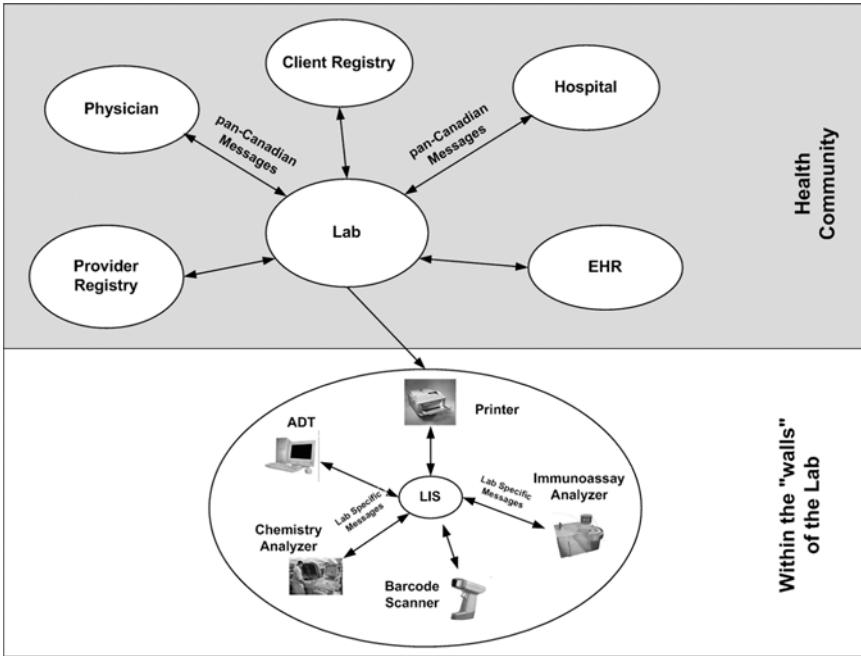
Currently, clinical laboratories in Canada use different data standards for the ordering, analyzing, and reporting of tests. This makes it difficult for an EHR to integrate orders and results from multiple laboratories either episodically or longitudinally over the lifetime of an individual. Similarly, although most laboratories have well-established interfaces (messaging system), these interfaces tend to be specific to the type of laboratory analyzer and the vendor application they use.

As illustrated in Figures 15.3 and 15.4, the strategy would use a pan-Canadian standard outside the laboratory and maintain the status quo inside the laboratory, facilitating the exchange of laboratory information in the health community or across jurisdictions. Laboratories that are upgrading or implementing new laboratory information systems would be encouraged to use common messaging and nomenclature where possible. This strategy would allow a physician to order one or more laboratory tests from a common test nomenclature without having to know multiple nomenclatures used in the various laboratories. The laboratory could perform the test and report the tests and results to the health community by mapping back to a common nomenclature. The physician reviewing a patient's EHR could view cumulative orders and results over time, regardless of which laboratory performed the analysis (Western Health Information Collaborative 2002).

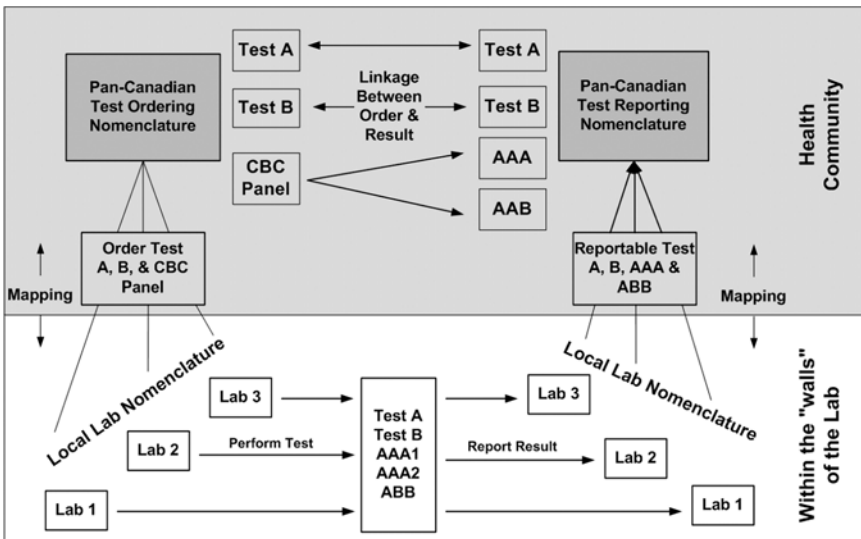
This strategy of using common standards during the information exchange to enable integration and interoperability is not a reality today but is a fundamental component of the *Infoway* pan-Canadian Electronic Health Record Solution (EHRS). Within the EHRS, the services required to support mapping between the local and pan-Canadian standards are provided by the Health Information Access Layer (HIAL), which handles the receiving and sending of messages between any two systems.

## **4. The Pan-Canadian Electronic Health Record and the Health Level Seven Draft Standard**

The preceding scenario assumes that the EHR supporting systems are interoperable from the point of view of both information exchange and of information management (entry, collection and accumulation, storing, normalization, etc.). Although the pan-Canadian EHR addresses interoperability largely at the information level, a fully



**FIGURE 15.3.** Strategy for pan-Canadian messaging standards. *Source:* Modified from Western Health Information Collaborative (2002).



**FIGURE 15.4.** Strategy for pan-Canadian data standards.

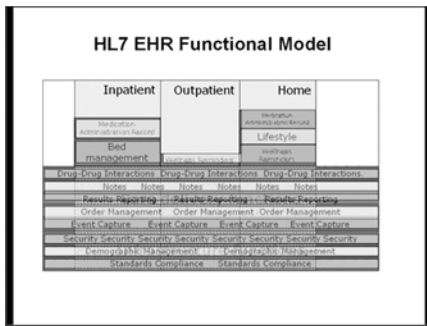


functional EHR, capable of supporting integrated care delivery and quality and safety needs, is essential to efforts to accelerate the EHR’s implementation and adoption.

Exactly what a fully functional EHR involves has yet to be determined. Canada has been actively involved in the development of the Health Level Seven (HL7) EHR Functional Specification. The hope is that participation in this international standards work will provide opportunities to reduce costs by reducing vendor customization and improving compatible access to the technology of global vendors. More importantly, adoption of international standards will result in interoperability with Canada’s neighboring country in the future.

More immediately, there are specific pan-Canadian needs, limited federal investments of Canadian \$1.1 billion, and the commitment to have basic EHR solutions in place in half of Canadian jurisdictions by 2010. Thus, work on a pan-Canadian EHR is proceeding while international participation continues. The approach is to develop the pan-Canadian EHR based on a common information model and then leverage the international initiative of the functional specification.

The drivers behind the pan-Canadian EHR and the HL7 EHR Functional Draft Standard for Trial Use (DSTU) are illustrated in Figure 15.5. The pan-Canadian EHR is foremost healthcare driven, based upon the desire to improve the quality of health of Canadians. The catalyst for acceleration of the HL7 EHR DSTU was a request by the Center for Medicare and Medicaid Services (CMS) in the United States to improve clinical information. The Center for Medicare and Medicaid Services believes that use of an EHR system has the potential to improve the quality of care, lower costs, and provide better clinical data upon which to base future policy and research. The Center for Medicare and Medicaid Services plans to offer incentives for physician participation by tying fee payments to the implementation of an EHR that meets specific functional specifications, thereby improving the quality of reportable clinical information.



**HL7 EHR Functional DSTU**

- Quality Clinical Information
- Functional Model
- Direct Care, Supportive & Information Infrastructure
- Minimum Functional Set
- Realm Specific Profiles



**Pan-Canadian EHR**

- Quality Health Care Driven
- Information Model
- Primary/Secondary Use of Information
- Maximum Data Set
- User Views of Info

**FIGURE 15.5.** Comparison of functional and information-based EHR models (functional and information-based).

The pan-Canadian EHR is based upon an information model with a goal to provide the right information, to the right people, at the right time while respecting privacy. The HL7 DSTU is a general model of an EHR's functions, which can be applied to various care settings and realms.

The direct healthcare functions in the HL7 EHR DSTU are used for providing direct health care to, or direct self-care for, one or more persons. The supportive functions use existing EHR data in the management of healthcare services and organizations and the conduct of population health and research activities. This division of focus between the individual and the health system is similar to the difference between primary and secondary use of information in the pan-Canadian EHR:

Primary Use of the EHR refers to usage of the EHR data to directly contribute to the provision of care for a patient/person for a given encounter or episode. In most provinces today, primary uses are conducted under some form of implied consent with or without notification.

and

Secondary Use of the EHR refers to usage of the EHR data for activities that are not directly related to the care of a specific patient/person for a given encounter or episode. In most provinces today, secondary uses of the data are done via anonymized data and require some form of consent. Secondary uses may also be pertain to identifiable data and in that case always require explicit consent from the patient/person. (Canada Health Infoway 2003b)

The HL7 EHR DSTU is essentially a minimum functional set. The functional outline has an extensive list of functions, each of which is evaluated as essential now, essential in the future, optional, or not applicable. Grouped under direct care, supportive, or information infrastructure, these functions are applied to realm specific profiles such as various care settings, providers, or organizations. The goal of the pan-Canadian EHR is to have available all the necessary information to provide care to an individual. This maximum data set of information would be filtered as views of information specific to the needs of the provider regardless of the care setting or organization where the information originated.

These two models are not mutually exclusive. At the Fall 2003 Conference of the Partnership for Health Information Standards,<sup>4</sup> participants were asked: With regards to the HL7 EHR Functional Specification, how can a functional model and an information model fit together? Their response was that the information model encompasses more than just data; it is an object-based model that uses modern object-oriented techniques, resulting in more easily adaptable systems. Adaptability is key, because changes to traditional EHR models are expensive and difficult to implement. Thus, participants suggested overlaying the two models. The information model needs to accurately reflect the functional model, and vice versa. The information model needs to cover all necessary data for every decision that might be made in the functional model. Each new element (information or function) in one model must be validated against the other. Elements from the two models can be mapped using a matrix structure, making the two models somewhat self-validating. As one model changes, so does the other.

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<sup>4</sup>In 1996, the Canadian Institute for Health Information (CIHI) formed the Partnership for Health Information Standards initiative to respond to the need for standards in health information systems in Canada. The Partnership brings together key players from the public and private sectors to discuss and promote universal and efficient standards for managing and exchanging health data and information. The Partnership provides the forum for the standards community to learn about, influence, and build consensus on pan-Canadian standards for health information.

## 5. The Canadian Conceptual Health Data Model

Canada's approach includes a focus on populating the information model with data commonly defined and understood across organizations and jurisdictions. In 1997, members of the Partnership for Health Information Standards developed the Canadian Conceptual Health Data Model (CHDM) to manage the capture of common health information and facilitate interoperability. The CHDM covers major healthcare entities and their relationships (people, governance, events, resources, and roles), creating a comprehensive picture of the Canadian health system. Use of the CHDM enables stakeholders to ensure common definitions are used across an organization and/or jurisdiction in collecting and exchanging data. Through the creation of common meaning, the CHDM supports the production of consistent and reliable information that can be used to populate the pan-Canadian EHR (Canadian Institute for Health Information 2001a).

Modeling of the CHDM began with the HL7 Reference Information Model (RIM). Starting with the RIM, chosen because it is considered a de facto, internationally recognized standard, and enhancing it with Canadian content produced a validated CHDM that represents the information requirements for the health system in Canada, including the pan-Canadian EHR (Canadian Institute for Health Information 2001a).

Success of the pan-Canadian EHR depends on capturing common data definitions to populate the EHR Information Model. *Infoway* plans to leverage the CHDM as it continues to work on the conceptual models for the EHR. Specifically, *Infoway* is recommending a model that will

- Allow integration of concepts and data models from *Infoway's* domain-centric program investments
- Allow integration of external information and data models into the interoperable EHR, particularly integrating constructs and patterns from the CIHI/Partnership Canadian Conceptual Health Data Model, and from the HL7 reference information model
- Provide the basis for the logical data model specification for the interoperable EHR (Canada Health Infoway 2003c)

## 6. The Pan-Canadian Electronic Health Record

*The EHRS Blueprint: An Interoperable EHR Framework* describes the Electronic Health Record (EHR), the Electronic Health Record Solution (EHRS), and the EHR Infostructure (EHRI) that supports the EHRS. The section that follows is excerpted, with permission, from this document (Canada Health Infoway 2003b).

### 6.1. Pan-Canadian Electronic Health Record

*Infoway* defines the concept of the pan-Canadian EHR as follows:

An electronic health record provides each individual in Canada with a secure and private life-time record of their key health history and care within the health care system. Today, health records are largely paper-based and often not easily accessible to the right healthcare professional at the right time. An EHR would be available electronically to authorized healthcare providers and the individual anywhere, anytime in support of high-quality care. (Canada Health Infoway 2003b)

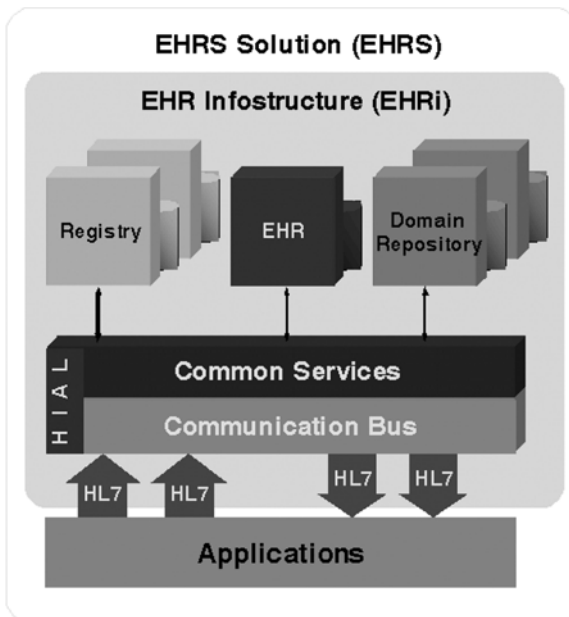
## 6.2. *Electronic Health Record Solution*

*Infoway* defines the electronic health record solution (EHRS) as “a combination of people, organizational entities, business processes, systems, technology and standards that interact and exchange clinical data to provide high quality and effective health-care.” It includes:

- Mechanisms to find and uniquely identify people, providers, and locations
- Patient-centric EHR
- Presentation solutions and intelligent agents
- Common services and standards to enable integration and interoperability
- Workflow and case management
- Decision support services
- Services to support health surveillance and research
- Services to ensure privacy and security
- Physical infrastructure to support reliable and highly available electronic communications across Canada

## 6.3. *Electronic Health Record Infostructure*

As illustrated in Figure 15.6, the EHR Infostructure (EHRi) is a collection of common and reusable components that support a diverse set of health information management applications. Consisting of software solutions, data definitions, and messaging standards for the EHR, the EHRi includes the following:



**FIGURE 15.6.** Key EHR system architecture components.

- Registry systems to manage and provide peripheral information required to uniquely identify the actors in the EHR. Specifically, these are the patient/person, the provider of care, and the location of care. Registries that hold patient/person consent information are also part of the EHRI.
- Domain repositories that manage and persist subsets of clinical data that pertain to the EHR domain. A picture archiving and communications system (PACS) is an example of a domain repository.
- An EHR system to manage and persist person-centric clinical information.
- Standardized common services and communication services to sustain the interoperability of the different components within the infostructure, as well as to sustain the interoperability between infostructures and with feeder or application systems.
- Standardized information and message structures as well as business transactions to support the storage and exchange of information in and out of the EHR.

#### **6.4. Health Information Access Layer**

The Health Information Access Layer (HIAL) is an interface specification for the EHR Infostructure (OSI Layer 7) that defines service components, service roles, information models, and messaging standards required for the exchange of EHR data and the execution of interoperability profiles between EHR services. The HIAL is broken down into two layers of services: the common services and the communication bus services. The common services layer is an aggregation of services that accomplish generic functions potentially reusable for any registry, domain repository, or EHR system available in a given EHRI. The communication bus services layer is an aggregation of services that pertain specifically to enabling communication capabilities in a peer-to-peer, highly distributed network of EHRI systems. This layer handles the receiving and sending of messages between any two systems in an EHRS.

Figure 15.6 depicts the previously defined key concepts and illustrates how they assemble into the *Infoway* architecture for an EHRS. The information stored in the EHR and in domain repositories is patient/person-centric and longitudinal. Logically, this information forms a womb-to-tomb health history for the patient/person. Together, these systems and their associated databases form the complete EHR for a patient/person.

As depicted in Figure 15.7, an individual has one EHR with a network of EHRs across Canada. Because of the way health care is delivered, there must be flexibility in the solution architecture as to the location of a person's physical EHR data. For example, all of an individual's EHR data may be in the province where she resides or the province where she receives care, often but not always one and the same. Thus, the clinical data for any given encounter are in only one EHR. From the perspective of the system and its users, the person's data are located logically in one EHR.

Finally, *Infoway* defines interoperability as the capability of computer and software systems to communicate seamlessly with each other. As such, it is central both to making clinical data available across the continuum of care and across health delivery organizations and regions, and to promoting reusable and replicable solutions that can be aligned with jurisdictional priorities and deployed across the country more cost efficiently. Without the creation and acceptance of a common framework and sets of standards, EHR systems across Canada will continue to be a patchwork of incompatible systems and technologies (Canada Health Infoway 2003b).

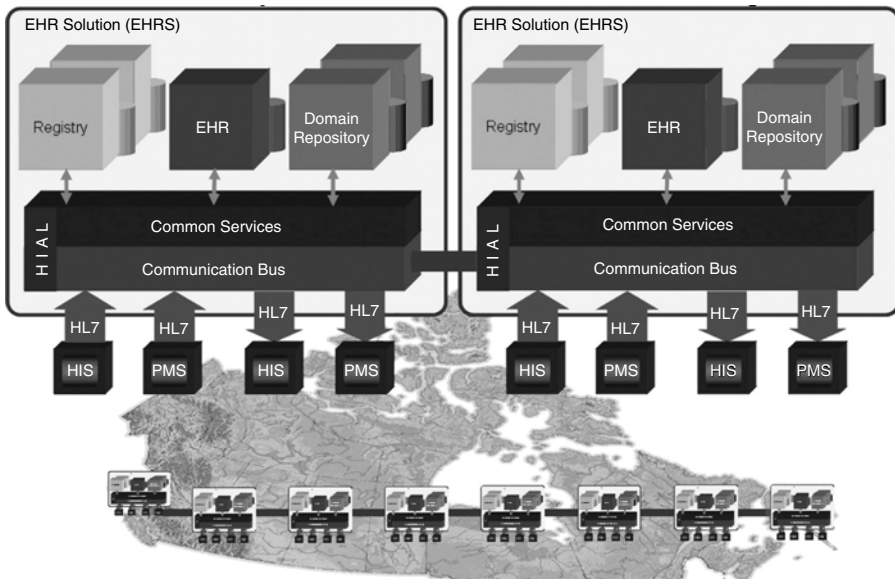


FIGURE 15.7. Network of EHR systems across Canada.

## 7. Standards

The case is clear: Without implemented pan-Canadian standards, there will be no meaningful exchange of health information. While there are many health infostructure standards, very few of those critical to the interoperable EHR have been implemented or can be considered pan-Canadian standards. So critical are standards to achieving the interoperable EHR that *Infoway* is investing a fourth of the Canadian \$1.1 billion in infostructure, including standards. The intent is to leverage the work from previous and current standards initiatives and organizations.

Coordinating and promoting the development and maintenance of national health information standards is a core function of the CIHI. An independent, pan-Canadian, not-for-profit organization, CIHI is working to improve the health of Canadians and the healthcare system by providing quality, reliable, and timely health information. At a pan-Canadian level, CIHI has lead efforts to develop and/or adopt data and information standards for coding of diagnosis and interventions, minimum data sets, and health data messaging. Implementation of the International Statistical Classification of Diseases and Related Health Problems—Tenth Revision, Canada, (ICD10-CA), Canadian Classification of Health Interventions (CCI) and the Client Registry HL7 Message standards has demonstrated that pan-Canadian collaboration can result in the adoption of significant new standards. So too does the National E-Claims Standard Initiative (NeCST). In working toward the goal of a national electronic claims messaging standard, NeCST has demonstrated that the public sector, private entities, and provider associations can collaborate to develop and implement HL7 Version 3 messaging standards at a pan-Canadian level.

Canada's participation in international standards development is bi-directional: a top-down approach of adopting globally and implementing locally, and a bottom-up

approach of working to influence development, as illustrated in Figure 15.8. Canada’s National Standards System is overseen by the Standards Council of Canada (SCC), which also accredits standards development organizations in Canada. Another group, the Canadian Advisory Committee/Technical Committee (CAC/TC), was formed to present Canadian positions on health informatics standards to the International Standards Organization Technical Committee 215 (ISO TC215) and ultimately to serve the domestic need for standards through adoption and adaptation of the ISO standards. The CAC/TC is jointly administered by CIHI and the Canadian Standards Association (CSA). Canadian delegates play active roles and leadership roles on ISO Working Groups.

The Canadian Institute for Health Information also sponsors HL7 Canada, an international affiliate of HL7 Inc., as a forum to review and adopt HL7 standards for use globally and in Canada. It is through this affiliate that the HL7 Canada membership, including *Infoway*, contributed to the HL7 EHR DSTU.

In addition, CIHI is the Canadian liaison to the World Health Organization (WHO) and the North American Collaborating Center (NACC) for classification standards, as well as the domestic liaison to the joint American College of Radiology/National Electrical Manufacturers Association (ACR/NMEA) on imaging standards. The Canadian Institute for Health Information’s Partnership for Health Information Standards brings together public and private sector experts to influence and develop consensus on health information standards that serve pan-Canadian needs. The goal of the Partnership is to leverage provincial, national, and international activities to contribute to the adoption and tailoring of existing standards for the Canadian health system. The Canadian

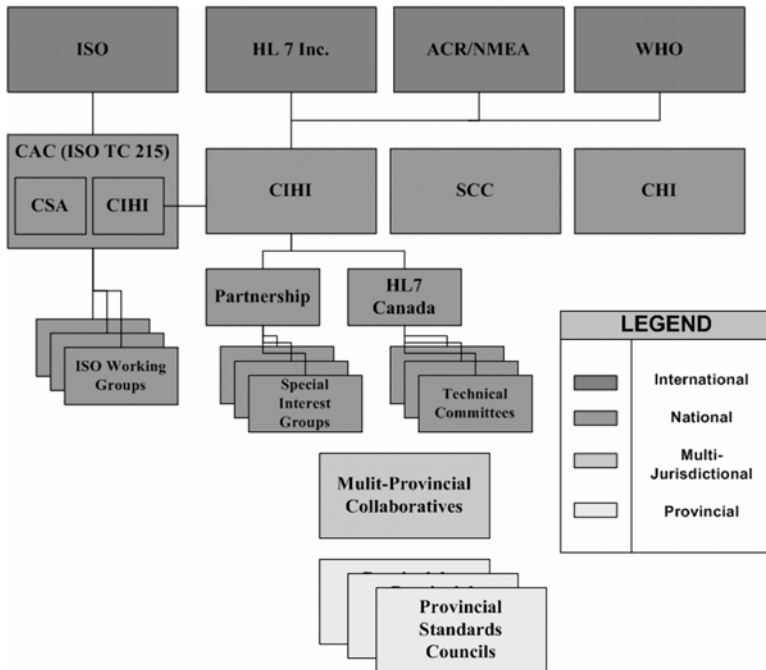


FIGURE 15.8. Health information standards organizations in Canada.

Conceptual Health Data Model (CHDM), discussed earlier, is an example of a Partnership initiative.

In May 2003, *Infoway* and CIHI announced a memorandum of understanding that formalized their relationship for the development and maintenance of standards required in support of EHR data definitions and standards. Under the agreement, *Infoway* is the catalyst for the development of EHR solution standards and the overall program manager for EHR standards-related work, while CIHI acts as Preferred Partner in the development of these standards. This partnership allows both organizations to take advantage of their collective expertise, ensuring a cost-effective and consistent approach to standards development. The organizational objectives of *Infoway* and CIHI are mutually beneficial, and their relationship furthers the goal of interoperable EHR solutions.

There is no pan-Canadian mechanism to mandate the use of health information standards. Constitutionally, the responsibility for the delivery of health lies at the provincial level, but even there the mandating of standards alone is not sufficient. Standards are effective only when their uptake is mandated or supported locally and when conformance and compliance are measured. Accordingly, a number of provinces have or are now establishing standards committees and councils. These councils oversee the development, coordination, adoption, and dissemination of health information and technology standards in their respective jurisdictions. To facilitate the interoperability, consistency, and comparability of health information and systems across Canada, the councils collaborate to share experiences, resolve common issues, and contribute to the pan-Canadian uptake of standards.

## 8. Standards Gaps and Priorities

The Canadian Institute for Health Information, the provinces, and other standards organizations have begun to develop some pan-Canadian EHR standards, such as methods of uniquely identifying clients, providers, and service delivery locations. Nonetheless, significant gaps remain. With convergence comes the opportunity to establish implementable and sustainable standards for the EHR. The key term is *establish*. This involves the use of existing standards, whether local, national, or international in origin, whenever possible. The strategy is to adopt first, adapt second, and develop when no other options exist. In short, we use the term *standards development*, but we mean:

- *Adoption* of existing standards (the preferred method for standards implementation)
- *Adaptation* of existing standards, preferably where the standard provides for localization to meet varied business requirements, or where the standard has a solid foundation but must be modified to suit Canadian requirements
- *Development* of standards, preferably through active participation in established Canadian and international standards development organizations and processes (Canada Health Infoway 2004)

In 2002, to address gaps in standards, *Infoway* initiated the Electronic Health Records Data Definitions and Standards Project. The goal was to define the strategy for key initiatives to develop and implement the interoperable EHR. A collaboration with CIHI, the project consulted standards experts and the stakeholder community through structured focus group workshops across Canada. Thus, the project identified key issues, priorities, and gaps in the establishment of EHR health information standards in Canada, and set out principles for collaborating with stakeholders in the selec-



**TABLE 15.1.** Principles identified by stakeholders in the Electronic Health Records Data Definitions and Standards Project.

- 
1. Development of standards is driven primarily by the business of health care and must meet a clearly defined business need.
  2. Standards development will be project based, with standards tested, refined, and evaluated as integral components of projects. This ensures a vital connection between the business need and the imperative to standardize, and facilitates re-use in successive projects.
  3. The development, implementation, and maintenance of standards must be coordinated at a pan-Canadian level, and success will demand strong leadership coupled with broad support from all stakeholders.
  4. Adoption and use of standards will succeed only if promoted by compelling incentives.
  5. Efforts to develop and implement standards must focus on those standards that can be best sustained over the long term.
  6. Two key components for successful standards implementation are management of change and the transition from current state to desired state. Tools and processes must accompany implementation, so as to minimize any negative impact while maximizing every opportunity for success.
  7. Existing work will be leveraged wherever possible and practical. The process must always first encourage adoption, or adaptation, of existing standards, before development of new standards is considered. Additionally, development of new standards will be done through participation with and sponsorship of existing standards development organizations.
  8. Standardized methodologies and tools will be a key consideration for any standards development model or process.
  9. Vendors will be actively involved throughout the establishment of standards.
  10. Provincial standards councils must play an integral coordination and communication role between various jurisdictions and pan-Canadian standards processes.
  11. A commitment to building capability and capacity for standards work must be a key consideration in any standards development model or process. Stakeholders will need constant and ongoing education about standards initiatives and how they should be engaged.
  12. Jurisdictions must be prepared to provide the leadership and resources needed to establish and implement standards.
  13. Canada should increase its commitment to playing a leadership role in international standards. While developing pan-Canadian EHR standards represents an ambitious goal, it is also necessary to ensure that standards are harmonized with similar initiatives internationally. Canada's participation in international development activities will directly enhance efforts to adopt national standards. At a minimum we will be aware of international standards initiatives and participate and influence those that are relevant to Canada's needs.
  14. Electronic health record standards development must be coordinated on a pan-Canadian basis. A clear stakeholder engagement strategy will be needed to foster appropriate representation in every aspect of development.
  15. Alignment with standards, and with standards-development initiatives, will be key considerations in guiding *Infoway's* investment decisions for new projects. Project development lifecycles and standards lifecycles should be specifically coordinated.
  16. Incentives will be available to existing projects to encourage alignment with standards or standards-development initiatives. In some instances, current projects will be mandated (and funded) to comply with the emerging standards vision.
  17. Where applicable, *Infoway* projects will incorporate a standards component and will contribute to the evolution of a robust set of pan-Canadian standards for the EHR.
  18. A mechanism must be established to encourage and engage non-*Infoway* projects to contribute to and align with the emerging standards vision.
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Source: Canada Health Infoway (2004).

tion and implementation of standards on a pan-Canadian basis. Those principles, shown in Table 15.1, form the basis for the proposed strategy for EHR health information standards.

Findings from the project inform how *Infoway* invests in its programs and standards and resulted in a number of recommendations to address the gaps and priorities identified by Canadian stakeholders. These initiatives are listed in Table 15.2.

**TABLE 15.2.** Recommendations of the Electronic Health Records Data Definitions and Standards Project.

- 
1. Methods for uniquely identifying clients, providers, and service locations on a pan-Canadian, cross-jurisdictional basis
  2. Pan-Canadian vocabulary standards for diagnostics and interventions
  3. Pan-Canadian messaging standards, including those for operational systems, registries, and those specific to the EHRs/EHR
  4. Definitions for encounters, episodes of care, and health service delivery programs in Canada
  5. Catalog of publicly available EHR Information/Data Models proposed or in use globally
  6. Catalog of information use-cases for the interoperable EHR
  7. Development of the EHR conceptual and logical data model
  8. Development of EHR metadata and evaluation of data normalization services
  9. Evaluation of HL7's CDA standard for semi-structured data
  10. Development of a methodology or measurement system for applying standards criteria to determine if an existing standard is appropriate for adoption, an existing standard requires adaptation, or a new standard should be developed
  11. Online catalog of standards implemented across various jurisdictions
  12. Strategy for licensing standards in Canada
  13. Tools to support the implementation and maintenance of standards in both official languages
  14. Strategy to easily facilitate the transition of standards from implementation to maintenance
  15. Establishing a mechanism in Canada that ensures quality and demonstrates conformance and compliance of EHR standards
  16. Supporting participation in international standards development processes and organizations
  17. Building of standards capability and capacity in Canada through knowledge management of standards
  18. The need for a structured change management and transition processes as a critical component of data definitions and standards initiatives moving forward.
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Source: Canada Health Infoway (2004).

Privacy protection is one of the four strategic goals and a key design feature for the Canada Health Infoway. For an EHR to be acceptable to the public, the privacy of patients and the physicians' duty of confidentiality must be adequately safeguarded. Fortunately, technologies like public key infrastructure and encryption offer the potential for a higher level of privacy protection in a well-developed EHR environment than in the paper-based world.

For an EHR to be effectively deployed in a pan-Canadian context, there must be a level of consistency in the privacy principles and policies on which the EHR is based. To this end, the Canadian Standards Association (CSA) Model Code is used extensively to formulate privacy legislation in Canada at the provincial and federal levels. Recognized as a Canadian national standard in 1996, the CSA code was modeled after the *Guidelines on the Protection of Privacy and Transborder Flows of Personal Data* developed by the Organization for Economic Cooperation and Development in 1980 and was developed by Canadian businesses, consumer groups, and governments (Canadian Institute for Health Information 2001b).

The CSA Code is comprised of 10 principles:

- Accountability
- Consent
- Limiting Use, Disclosure, and Retention
- Safeguards
- Openness
- Identifying Purposes
- Limiting Collection

- Accuracy
- Individual Access
- Challenging Compliance (Canadian Institute for Health Information 2001b)

By design, a successful pan-Canadian EHR will contain information that can be, when required, shared across organizations and jurisdictions in a controlled manner. Because of differing provincial legislation, however, there is no uniform process across the country to support the sharing of electronic health record data. “The issues that revolve around privacy and security do not pertain to the technologies and processes required to implement them, they pertain to the absence or lack of normalization of policies, laws, rules and regulations around privacy and security” (Canada Health Infoway 2003b). Efforts are underway to promote harmonization of policies and procedures specific to health information privacy across Canada.

## 9. Next Steps

The development of electronic health records in Canada has evolved from local individual independent systems to the current vision of a pan-Canadian interoperable EHR solution. The Canada Health Infoway vision is not a single massive national structure, but will be built by involving all people, places, and jurisdictions in Canada collectively in cooperation with one another. Convergence is the answer. As the drivers of quality care, will, capability, and capacity converge, *Infoway* will play the role of catalyst and strategic investor in the components that will make up the pan-Canadian EHR.

Consistent with Canada’s goals, *Infoway* intends to have the basic components of EHR solutions in place in half of Canadian jurisdictions by 2010. To accomplish this, *Infoway* defined a three-year plan for investment in EHR component programs, as shown in Table 15.3.

**TABLE 15.3.** *Infoway* investment plans, 2003–2006: Targeted EHR components.

Program	Actions
Infostructure	<ul style="list-style-type: none"> <li>• Infostructure components and services available in 50% of country</li> <li>• Further development of EHRS Blueprint, e.g., messaging standards, integration tools, etc.</li> </ul>
Registries	<ul style="list-style-type: none"> <li>• Provider Registry Application releases</li> <li>• Client Registry releases</li> <li>• Plans to deploy</li> <li>• Install country-wide</li> </ul>
Drug information systems	<ul style="list-style-type: none"> <li>• Interoperable system(s) implemented in one jurisdiction</li> <li>• Replicate system in second jurisdiction</li> <li>• Plans to deploy elsewhere</li> <li>• National messaging standards for dispensed drugs</li> </ul>
Diagnostic imaging (DI) systems	<ul style="list-style-type: none"> <li>• Regional DI operation to provide shared PACS and storage to 12 hospitals</li> <li>• Partnership and a regional DI operation to 8 hospitals</li> <li>• Replication of solution in 4 jurisdictions</li> <li>• Plans to develop Canada-wide</li> </ul>
Laboratory information systems	<ul style="list-style-type: none"> <li>• Approved investment strategy</li> <li>• Initial investment in one jurisdiction</li> </ul>
Telehealth	<ul style="list-style-type: none"> <li>• Approved investment strategy</li> <li>• Initial committed investment in three projects</li> </ul>

Source: Canada Health Infoway (2004).

In 2003, 22 projects were underway or completed Canada-wide. These projects focused on developing solutions, and on the standards and architecture required to deploy these solutions quickly and comprehensively.

According to Francis (2004), “Within just a few short years, *Infoway* [and its project partners at the local, regional, provincial and pan-Canadian levels] will have developed the tools that provide Canada’s health care community with more timely and accurate patient information so necessary for improved diagnosis, treatment, and health outcomes.”

With those tools, Canada will be well on its way to achieving its vision of the pan-Canadian EHR.

*Acknowledgments.* On behalf of the Canadian Institute for Health Information, the authors wish to thank all those who contributed to this chapter. Special thanks go out to Brenda Shestowsky (Health Canada), Don Newsham (Sierra Systems), Grant Gillis (Canadian Institute for Health Information), Joan Roch (Canadian Institute for Health Information), Pat Jeselon (Pat Jeselon & Associates Consulting Inc), and Ron Parker (Canada Health Infoway), who reviewed and provided invaluable input into this chapter.

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