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FRAMEWORK FOR BUILDING A SHARED EHR

White paper

When asked to conjure an image of the typical physician, most people will imagine someone in a white lab coat armed with a stethoscope and patient chart. This simple image neatly captures three key activities performed by a health care provider to make clinical decisions: the collection of data using instruments such as the stethoscope; the recording of information, usually in a paper chart; and the analysis of the information, using training and experience.

To make effective decisions in the most cost-efficient manner, health care professionals need timely and accurate access to an ever-increasing amount of patient information. While many people might think of the patient chart as the repository of all their health care information, in reality, it is scattered across a myriad of different electronic and paper-based systems, often spread across multiple organizations and sometimes even regions and jurisdictions. The inability to quickly access an aggregated view of health care information on a patient's previous and current episodes of care has the potential to hinder diagnosis, prompt the unnecessary repeat of tests, jeopardize safety, and generally increase the cost of health care delivery.

> PATIENT INFORMATION IS SCATTERED ACROSS A MYRIAD OF DIFFERENT ELECTRONIC AND PAPER-BASED SYSTEMS.

As society has become increasingly mobile and health care has become further specialized, patients are more likely to interact with multiple health care institutions, particularly when specialized care is required. This movement of patients among health care providers is driving a need to share their health information so that care can be coordinated and integrated across the various care environments, a process that is very expensive and time-consuming when paper-based.

Putting the right information in the hands of health care providers – where they need it and when they need it – has become a strategic imperative for many health care institutions and the organizations that fund them. By employing information and communication technology to facilitate the capture and transfer of patient information, these organizations believe that they can:

- enhance patient safety by eliminating errors attributable to incorrect or incomplete patient information,
- improve access to health care services by streamlining processes, and
- reduce the cost of delivering care through productivity gains.

A variety of sometimes competing or contradictory terms have been developed to embody the concepts of capturing and sharing patient information in electronic form, including Electronic Patient Record (EPR), Electronic Health Record (EHR), and Electronic Medical Record (EMR) among others. While each of these terms may have a particular meaning within a given health care community and context, their indiscriminate use can create confusion among health care stakeholders. This alphabet soup of confusion is exacerbated by a spectrum of differing requirements in each jurisdiction that are driven by numerous factors such as the specific requirements of organizations involved, as well as constraints around data stewardship and legacy technology.

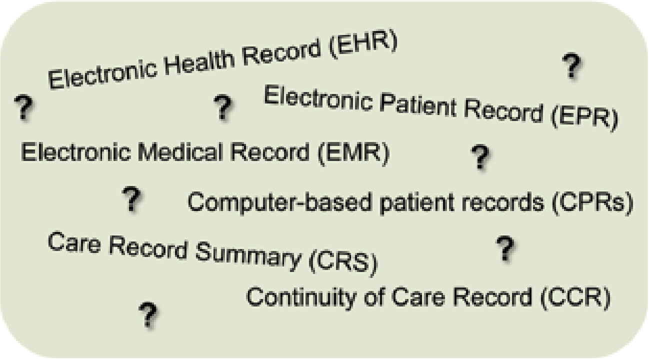

Figure 1 - e-Health Alphabet Soup of Terms

Emergis and Branham Group have prepared this white paper to cut through the confusion created by this "alphabet soup" of terms and to provide instead a practical framework for envisioning how patient information can be effectively shared in electronic format across the continuum of care. This framework views health information and the system architecture that supports an aggregated view of health information to be organized in two tiers: one tier comprises of point-of-care systems whose data are integrated by a second tier, which shares health data with other providers. The simplicity of this framework avoids the confusion of differing terminologies, yet provides the flexibility to adapt to the unique requirements of each jurisdiction that will drive the balance in investment needed between these two tiers.

A COMMON LANGUAGE

In its most general usage, the phrase 'electronic health record' is used to describe any digital representation of health information with little or no concern about how this information is stored or retrieved. The term is often used synonymously with other related phrases such as 'electronic medical record' and 'electronic patient record'. This indiscriminate use of 'electronic health record' and other apparent synonyms is sometimes causing considerable confusion among stakeholders.

As tempting as it can be to dismiss the lack of uniformity in terminology as semantics, one must recognize that each term has independently evolved for good reason – to address a specific underlying context and agenda. Confusion arises from the indiscriminate blurring of these contexts and agenda, which can hamper fruitful discussion among the key health care policy stakeholders who exert significant influence over funding and direction. As a result, progress towards implementing systems that put the right information in the hands of health care providers, where they need it and when they need it, is impeded.

EACH TERM HAS INDEPENDENTLY EVOLVED FOR GOOD REASON – TO ADDRESS A SPECIFIC CONTEXT AND AGENDA.

Many credible sources have adopted terminology to describe local EHR systems that collect data and support the care delivery processes during an encounter. Such examples include HIMSS' preference for electronic medical record (EMR) (Davis, Garets, 2006); Gartner's use of the term computer-based patient record (CPR) for systems in care delivery organizations and electronic medical record (EMR) in ambulatory (Edwards, Handler, Rishel 2006); and Canada Health Infoway's nomenclature for health care facility systems as electronic patient record (EPR) and physician office systems as EMRs (Canada Health Infoway, 2006).

Use of the term electronic health record (EHR) seems to be more broadly used in describing jurisdictional information sharing systems. HIMSS describes EHR as a 'subset of each CDO's [care delivery organization's] EMR, presently assumed to include summaries, such as ASTM's Continuity of Care Record (CCR) and HL7's Care Record Summary (CRS)' (Davis, Garets, 2006) while Canada Health Infoway describes the EHR as a 'secure and private lifetime record of their key health history and care within the health system...available electronically to authorized health providers and the individual anywhere, anytime in support of high quality care' (Canada Health Infoway, 2006). The Certification Commission for Healthcare IT, however, uses EHR to describe both inpatient and ambulatory local systems (CCHIT, 2007).

Despite the interrelationships and common interests in the industry, we have not yet achieved a common language to describe the systems and data in the broader context of jurisdictional information sharing that is critical to supporting the coordinated care we seek to provide. Hence the challenge and alphabet soup of confusion that are sometimes present in the private and public sector health care discussions.

As patients, why do we really care about what we call each system and the data it manages? As recipients of health care, it should not matter whether our surgical care is recorded on an EMR or CPR or where our lab result physically resides in a region. What we do care about is that our caregiver has the information needed to make safe and effective clinical decisions.

There is no universal answer on what terminology is correct, however for the purposes of this discussion, it is useful to de-emphasize the focus on what systems are required in a given care context (e.g., physician office, hospital ward). Rather, it is helpful to look generically at patient health information, regardless of the systems that contains it, and to generically view the systems in the context of jurisdictional information sharing.

One of the best candidates to describe the pieces needed to achieve success in the e-Health agenda is the nomenclature proposed by the International Standards Organization in its technical report, ISO/TR 20514:2005. This document defines an electronic health record as a 'repository of information regarding the health status of a subject of care, in computer processable form.' It further defines an EHR with a 'commonly agreed logical information model' as a 'shared EHR', that when supporting integrated care across and between health care organizations in a jurisdiction becomes an integrated care EHR (ICEHR).

The ISO definition also distinguishes between clinical information and the systems that support its provision. It refers to systems where data is collected during an encounter by a care provider as 'local EHR systems', and systems that support an ICEHR as 'shared EHR systems'. It is all too easy to forget to separate the notions of a) the information upon which clinicians make decisions and b) the physical data, and manual and automated systems that generate that information.

This distinction between the data and the systems that process that data is crucial to maintaining a clear image of the EHR environment in which clinicians are operating. It is rare that the set of data upon which clinicians will make care decisions will originate from one place only. Local EHRs will almost always contain some form of paper records and clinicians will often also have to contend with multiple systems to find the information they require. Some organizations have achieved varying degrees of success in integrating this information through technologies such as single sign-on or through clinical data repositories. Less fortunate clinicians might have to interact with separate registration, laboratory, radiology, pharmacy and other departmental systems in addition to the day-to-day stream of hard-copy information.

E-HEALTH REQUIREMENTS

So what factors are driving e-Health requirements in various jurisdictions? Although the majority of regional e-Health projects are in the early stages, it is clear that many different approaches to sharing patient information electronically are emerging. There are, however, two key elements that are common across all jurisdictions. First, each jurisdiction has its unique set of governance structures that will drive both local and jurisdictional health care system requirements. Second, clinicians require two distinct, highly interdependent classes of health information to care for their patients. Each of these factors is describe in further detail in the following sections.

Governance

The electronic sharing of patient information across organizational boundaries will be heavily influenced by the governance structures in place within and across the organizations involved. Each organization, at the local, regional, or jurisdictional level in a health care system will have its own agenda and priorities whose history is reflected in its legacy of technology investment. Even in the most centralized of governance models, there will be a broad base of care delivery organizations, each with a distinct history and local agenda that will influence their information and communication technology decisions.

Systems that capture and manage local health care data are deployed in the context of the local organization, and each needs to fit into its organization's unique array of legacy applications. Spanning a common set of solutions across governance boundaries can be very challenging, if not unfeasible. Therefore, it is more typical that multiple governance structures yield to multiple systems that store and manage patient information.

In addition, there will always be an over-arching leadership at the jurisdictional level driving health care policy and practice, be it a single governance structure or a funding and policy body that provides the legal and regulatory framework within which health care services are delivered. It will be natural for stakeholders at this level to focus on how to share health care data throughout the jurisdiction. In addition to regulatory constraints such as data stewardship, decision-makers will be driven by local governance factors such as the specific requirements of stakeholder organizations, legacy technology, and the preferences of key influencers throughout the jurisdiction.

What is common across each jurisdiction is that their respective attributes, needs and preferences, which are reflective of their governance structures, will drive a relatively unique set of requirements and solutions that each fit on a continuum of deployment models from highly centralized to highly de-centralized, to be described later.

Local vs. Shared

The second major factor that drives e-Health requirements in all jurisdictions is that there are two distinct and highly interdependent classes of patient health information that are needed to build an aggregated view for clinicians:

- **Local Data** is collected by the provider during the episode of care. Some of this information is more focused on the care processes and is of primary value to the provider of that encounter.
- **Shared Data** is collected by other health care providers that is of value in the current episode of care and is usually a subset of local data. Examples of shared data typically include allergies, medication history and current medications, previous surgeries, medical history, diagnosis and problem list, health habits, previous treatments and test results.

In a jurisdiction with a highly integrated information sharing architecture, shared data may be exchanged by abstracting the desired subset and migrating it to the point-of-care systems of other care delivery organizations. In less integrated environments, health information may be shared through access to multiple systems. There are many ways to successfully share information and deliver the aggregate view of local and shared patient data the clinician needs.

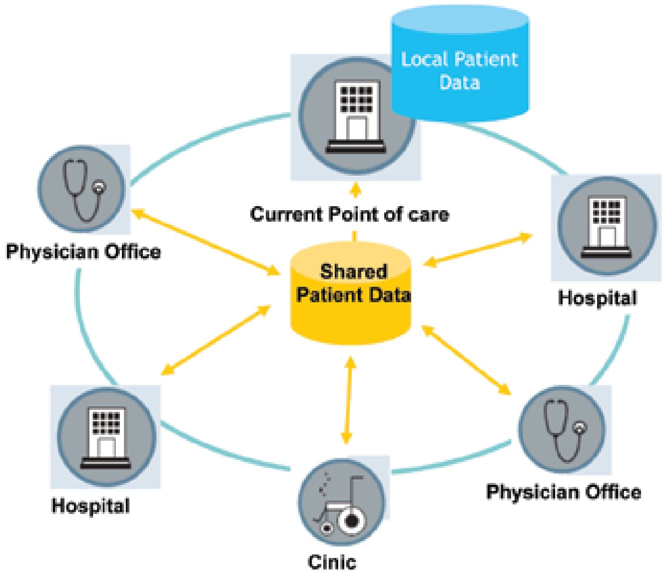

Figure 2 - Local vs. Shared Patient Information Structure

Access to both local and shared data is critical to enhancing patient safety, productivity and quality of care. Consider a physician ordering a medication for a patient. Many health care organizations use some form of drug interaction checking to alert the physician to potential medication conflicts. Without a complete medication history assembled from multiple care organizations, this decision support will be of little use when a previously prescribed medication has a serious interaction with that being ordered.

The commonalities of governance issues and the distinct sets of data needed by clinicians add up to a 'domino effect' that drives e-Health requirements. Governance drives the local legacy architecture and system requirements, which drive the data being collected, which drives the practical options available for governance. This domino effect suggests that:

1. A two-tiered approach will best accommodate the delivery of aggregate health information within and across jurisdictions; and
2. Balanced investment in both tiers will ensure that the unique attributes, needs and preferences of each environment will be addressed.

The two statements above may give cause for some to point out numerous examples of a common set of systems being deployed across a jurisdiction. Such an architecture does not mitigate the need to design and invest in the data it contains, so that clinicians have the accessible information they need to make safe, effective clinical decisions.

> A TWO-TIERED APPROACH WILL PERSIST... BALANCED INVESTMENT IS REQUIRED.

FLEXIBILITY IN THE FRAMEWORK

While the distinction between local and shared data and systems may seem simple, the needs of the specific jurisdiction may drive some practical level of overlap in functionality between local and shared EHR systems. Because a shared EHR has local EHR functionality does not mean it is a local EHR. It is the high-level function that defines the data and system.

To illustrate, local EHR systems typically have very detailed information on the episode of care with viewing, clinical documentation, and computerized provider order entry (CPOE) functionality. Jurisdictional shared EHR systems will typically populate user interfaces with view-only data, but may also provide extended functionality such as CPOE for those health care providers without the benefit of such functionality in their local EHR.

As a further example, there are many exceptions where a local EHR system is implemented across an entire jurisdiction. Although it continues to have all the attributes of a local system, it defacto becomes a shared EHR system by the very breadth of its implementation.

As previously stated, both local and shared EHR systems must have the flexibility to meet the differing needs of each environment.

We can see the tremendous clarity that is possible if e-Health stakeholders maintain a high-level, disciplined distinction between local and shared EHRs as well as a distinction between the information and the systems that provide this information. As discussed in the next section, there is a wide variety of deployment models that readily accommodate specific jurisdictional needs and constraints for implementing a shared EHR.

DEPLOYMENT MODELS

Although the term "shared electronic health record" may seem to imply a single, centralized database, there are actually multiple approaches to creating a shared EHR. These different options address the specific needs of the organizations involved and take into consideration possible constraints regarding data stewardship, technological differences, and organizational boundaries.

There are many architectural options for implementing a shared EHR system. Each lies on a continuum with the following models at each end:

1. **Centralized model.** Shown in Figure 3, this model is based on a single, central data repository in which shared patient information is stored. Local EHR systems use this central data repository to store and retrieve an agreed upon subset of information about each patient. The shared EHR system includes components to authenticate the parties involved in each transaction, to authorize the transaction based on the credentials of these parties, and to record information about the transaction for audit and reporting purposes. Providers without a local EHR can access the central data repository with a web browser through a clinical portal.

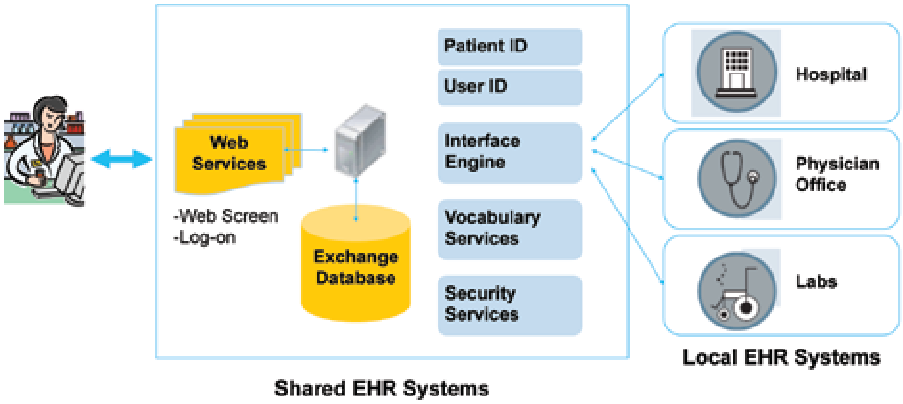

Figure 3 - Centralized Model

2. **De-centralized or federated model.** With this model, patient data is retrieved, at the time it is needed, from the system in which it is stored as shown in Figure 4. The local EHR systems are each responsible for maintaining all the information about the patients who visited the facilities at which these systems are located and for sharing selected patient information. As depicted in Figure 4 and Figure 5, the shared EHR system may include a mechanism to determine where all the shared information related to a specific patient is stored as well as some form of electronic messaging system for transmitting shared patient data and for conducting transactions between local EHR systems.

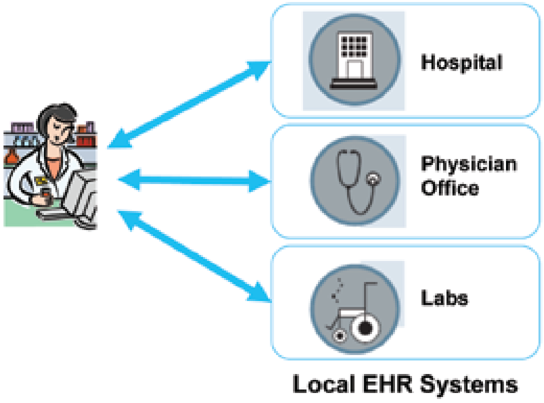

Figure 4 - Simple Federated Model

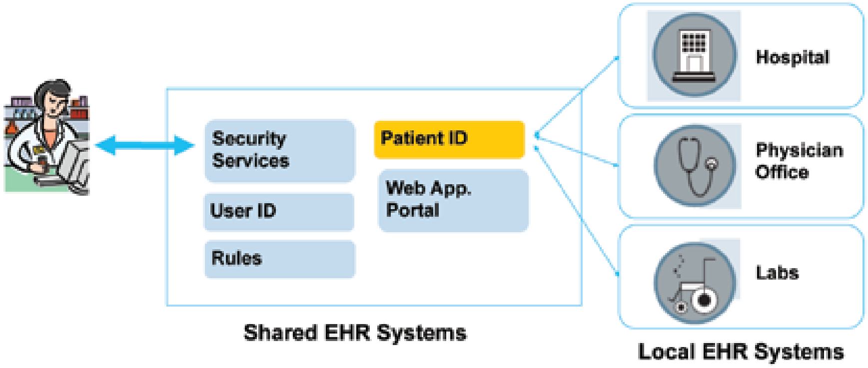

Figure 5 - Federated Model with Shared EHR System

The main difference between the centralized and federated model is the location in which the shared patient information is stored. In the federated model, shared patient data is stored and maintained in the local EHR systems in which it was created while in the centralized model, shared patient data is stored in a central repository. Setting up the infrastructure needed for the centralized model can make it more expensive and more complicated than the federated model to implement. However, when user convenience and overall performance are taken into consideration, there are a number of implementation options for the federated model that can make this model more complex and costly to implement. These options include:

- **Data push vs. data pull.** In the centralized model, shared patient data is pushed from the local EHR to a single, central repository. In the federated model, shared patient data can either be pushed from the source local EHR system, or pulled by the shared EHR system. In the simplest case, the user is left to connect with each local EHR and to search for and retrieve (pull) relevant patient data. More complex implementations include shared EHR system components that help locate patient information and that support the movement of patient data. A federated model can even have data pushed from the local EHR systems in which the patient data is stored to other local EHR systems that also store information about the patient.

- **Automatic vs. manual user intervention.** In the centralized model, shared patient data is automatically placed in the central repository when it is created and is therefore available whenever it is needed. In the federated model, user intervention may or may not be required to retrieve the shared patient information. If data has been pushed to the local EHR systems then user intervention is generally not required. However, if shared patient data must be pulled from a local EHR system, the shared EHR system may automate this process or leave it to the user to retrieve the shared patient data from each local EHR system.

- **Local EHR system interaction.** In the centralized model, the user does not interact with any of the local EHR systems on which shared patient data is stored. In the federated model, on the other hand, users may need to interact with and have working knowledge of each local EHR system on which shared patient data is stored in order to retrieve this data. This process can be greatly simplified if the shared EHR system uses techniques such as single sign-on and patient context sharing to automatically connect to the local EHR systems and display the data associated with a specific patient.

CENTRALIZED MODEL

Following are three examples of deployment models that fall more to the centralized end of the continuum.

National Programme for Information Technology (NPfIT)

A highly publicized example of the centralized shared health record model is the National Programme for Information Technology (NPfIT) in the United Kingdom. The NPfIT is a comprehensive, fully integrated system consisting of shared and local electronic health records that will give health care professionals secure access to patient information whenever and wherever it is needed.

The NPfIT consists of a national, shared EHR system operated by the National Health System (NHS) Connecting for Health Agency and local EHR systems operated by hospital and primary care trusts.

A major NPfIT component supporting the exchange of patient information is the NHS Care Records Service (NHS CRS). The core of the CRS is the 'Spine', a national, centralized database of key information about patients' health that includes a summary of care encounters and clinical events. Summary patient information available through the spine includes:

- Personal health information such as drug allergies, lab results, and medication history is provided by the Personal Spine Information Service (PSIS).
- Demographic data such as address details is held nationally but is accessible through local EHR systems. This data is provided by the Personal Demographics Service (PDS).

As shown in Figure 6, the NPfIT consists of national applications common to all users and local systems which address the needs of specific institutions or communities. National applications are the responsibility of a national application services provider who provides software and support for the summary patient record along with the infrastructure services that supports a consistent set of patient confidentiality and security principles.

NPfIT

- **Year Initiated:** 2002
- **Area Served:** England
- **Governance:** Delivered by the Connecting for Health Agency, established in April 2005 as the single national IT provider for the National Health Service.
- **Services:**

  Care Records Service (CRS) – Enable clinicians to access patients' records securely, when and where they are needed.

  Electronic Booking Service (eBooking) - Enables general practitioners (GP) and other primary care staff to make appointments for patients with clinicians or other health care professionals.

  Electronic Transmission of Prescriptions (eTP) - Allows prescribers working in GP practices to generate and transmit electronic prescriptions using their computer system.

  National Network (N3) - Connects all NHS organizations and provides the IT infrastructure, network, and voice services and broadband connectivity to meet NHS IT needs.

  Email and Directory Service (NHSMail) - Provides a central, secure, email service that enables sensitive info to be exchanged securely between NHSMail accounts.

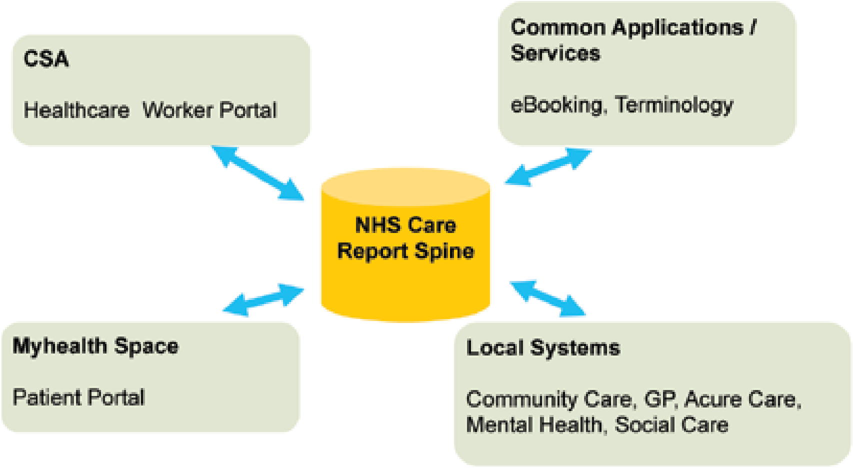

Figure 6 - Relationship between local systems and NPfIT Spine

Applications at the local level are the responsibility of the five local service providers (LSP). These LSPs ensure that existing local EHR systems are compliant with national standards and these systems facilitate data flow between local and national systems.

Electronic Child Health Information Network (eCHN)

A Canadian example of the centralized model is the electronic Child Health Information Network (eCHN), a not-for-profit, government funded organization dedicated to providing electronic solutions that permit the sharing of patient information across multiple health care organizations in the province of Ontario. Initially created in 1997 to facilitate the sharing of paediatric information among hospitals in and around Toronto, the provincial capital, eCHN now connects a growing number of hospitals and other health care organizations across the province.

The basis for eCHN's centralized shared electronic health record is HiNet, (Health Information Network) a secure system in which a child's medical records are available electronically to a health care provider when and where they are required. As shown in Figure 7, patient information from participating health care organizations stored in this central repository includes laboratory results, doctor's notes, x-rays, visit information, and personal demographic information. HiNet has proven to be so successful in actual operation that the Ontario Ministry of Health and Long Term Care is now considering this same technology as the basis for a pan-provincial, population-wide shared electronic health record system for all Ontarians.

eCHN

1997	A conglomerate of all the organizations providing paediatric care in the Greater Toronto Area (GTA) form the Child Health Network of Toronto to share health information and practices in paediatric care.
1999	HiNET is deployed and health care providers have access to records generated at any one of five sites in the GTA. Toronto area physicians can also access patient information from their office computers.
2002	eCHN begins expansion beyond the GTA with the addition of two new members.
2003	eCHN expands to northern Ontario and the Ottawa area. The Children's Hospital of Eastern Ontario as well as many new community hospitals, more doctor's offices and northern Community Care Access Centres are added.
2006	Growth of eCHN continues as three more tertiary paediatric centres are added. In addition, the remaining Community Care Access Centres, Children's Treatment Centres, more physicians and many more community and teaching hospitals join eCHN.

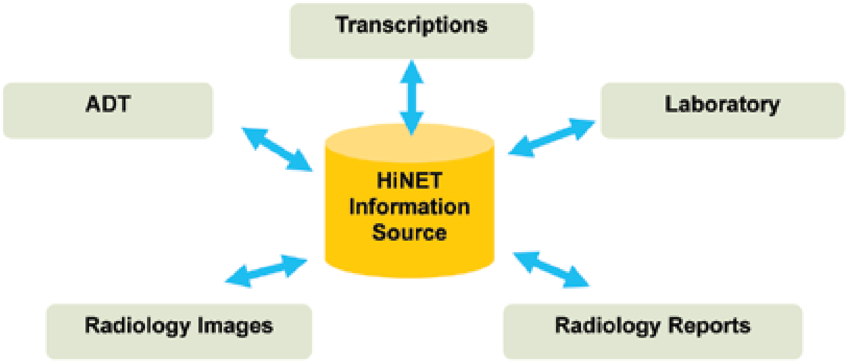

Figure 7 - HiNET Information Sources

Careconnect.sa

In cases where a number of organizations are governed by the same entity, a centralized shared electronic health record can be used to store all patient information, thereby eliminating the distinction between a local and shared EHR. A good example of this approach is the Careconnect.sa program in South Australia. Since all publicly funded organizations are governed by the state Department of Health, a single EHR system has been deployed and will, over time, be used by all health care organizations in South Australia.

The careconnect.sa EHR system integrates with disparate clinical systems in each health care organization and stores the patient data generated by these systems in a single repository. Data stored in this repository includes patient demographics, encounters, outpatient appointments, medications, laboratory results and radiology reports. The careconnect.sa Clinical Display application provides a single point of access to this integrated on-line patient record. To date, South Australia has integrated the centralized EHR with the clinical systems in the eight largest hospitals serving approximately 80% of the state's residents.

Careconnect.sa

- **Year Initiated:** 1997 for an initial pilot in renal units of four urban hospitals in Australia
- **Area Served:** South Australia with a population of 1.5M people, 1.1M of whom live in Adelaide
- **Governance:** A program of the Government of South Australia Department of Health
- **Functionality:**
  - Clinical Display
  - Order Entry
  - Separation Summary
  - Nursing Discharge Letter
- **Utilization Statistics:**
  - 6,125 active users
  - Patient record reviewed every 9 seconds
  - Electronic order placed every 53 seconds
  - Separation summarized every 5 minutes

FEDERATED MODEL

Following is an example of a deployment model that falls more to the de-centralized end of the continuum.

HealthBridge

An example of a federated shared electronic health record model in which data is pushed to the local EHR systems is HealthBridge. Created to streamline the distribution of clinical documents from member hospitals to physicians whose patients go to these hospitals for outpatient services (such as lab tests and diagnostic imaging), HealthBridge collects and delivers the clinical documentation associated with these services to the "physician of record" for each patient.

When HealthBridge was initially conceived, the member hospitals did not want to store their patient data in a centralized repository nor did they want to deal with the data stewardship issues associated with a centralized model. Hence, HealthBridge is based on a clinical messaging architecture that "pushes" patient information to physicians.

A critical element of this federated architecture is the local HealthBridge server that resides at each member hospital site. The local EHR systems at each hospital send a copy of relevant clinical information for each patient to the local HealthBridge server which in turn transforms this information as necessary to conform to standard data formats. The local HealthBridge server periodically uploads aggregated patient data to a central distribution server which collates the information from all member hospitals to create patient specific reports. Each report is distributed electronically to the "physician of record" for the specified patient.

HealthBridge

- **Year Initiated:** 1997
- **Area Served:** Southwest Ohio, northern Kentucky, and southeastern Indiana
- **Governance:** Not-for profit organization whose members include hospital corporations in and around the Cincinnati, Ohio area
- **Services:** Distribution of clinical documents to area physicians, physician access to member IT systems, physician transcription, and Internet connectivity

In addition to transmitting patient clinical data, HealthBridge also provides a portal through which physicians can access numerous databases and applications housed and controlled by the member hospitals. The portal does not enable single sign-on to these applications. Instead, each member hospital maintains security over its own internal applications that are accessed through HealthBridge. Physicians must therefore enter several passwords, a process that does prove cumbersome at times.

Prior to the advent of HealthBridge, a physician would not know when a test had been completed or even to which hospital a patient went to have the test performed. Physicians and hospital staff routinely exchanged phone calls to locate test results. Today, patient data is automatically delivered to the physician in various formats (electronic, fax, and paper), some of which can be consumed by the local EHR systems in the physician's office.

HYBRID MODEL

A shared EHR generally contains data from multiple domains including but not limited to laboratory results, medication history, encounter history, diagnostic imaging reports and images, and patient demographic data. The data associated with each of these domains can be shared using either a centralized or federated model. Shared EHR systems that use both models – the centralized model for some domains and the federated model for the remaining domains – are classified as using a hybrid model.

CareConnect

A good example of a hybrid model is CareConnect, the shared EHR for Vancouver Coastal Health (VCH) and Providence Health Care (PCH). Created through the amalgamation of several small health authorities in the lower mainland of British Columbia, VCH delivers a wide range of acute, continuing, and community care in urban and rural settings. PHC, a Catholic health community serving residents of Vancouver, British Columbia, receives funding from and works in partnership with VCH.

When VCH was created, the health authority inherited a diverse suite of clinical, financial, and administrative systems. Consolidating these systems, while appealing, was considered impractical in the short term. Yet, clinicians working at the different sites had a pressing need to access patient data stored across these multiple systems. Taking a very pragmatic approach to this problem, VCH decided to forego the time-consuming and difficult task of integrating the data across the various systems. Instead, VCH opted to implement what they call "visual integration" and provide easy access to each system. The clinician, instead of the system, is responsible for integrating the data from the various systems to get a composite picture of the patient's health status.

As shown in Figure 8, the CareConnect clinical portal is the main tool that health care professionals use to access patient information. This tool controls access to patient information and allows professionals to search for a particular patient. For each selected patient, the portal displays demographics, encounter history, and other key clinical data. Having selected the patient of interest, health care professionals can use the portal to access other clinical systems. They are automatically logged on to each of these systems, with information on the selected patient stored in that system automatically retrieved and displayed. Professionals still need to know how to use each system and may have to access several of these systems in order to gather a complete set of patient information.

Several of the systems that health care providers can access, notably PathNet (laboratory results) and PharmaNet (medication history), are provincial systems based on a centralized model for the specific domain in which they operate. Hence, CareConnect uses both a federated and a centralized model for shared health information.

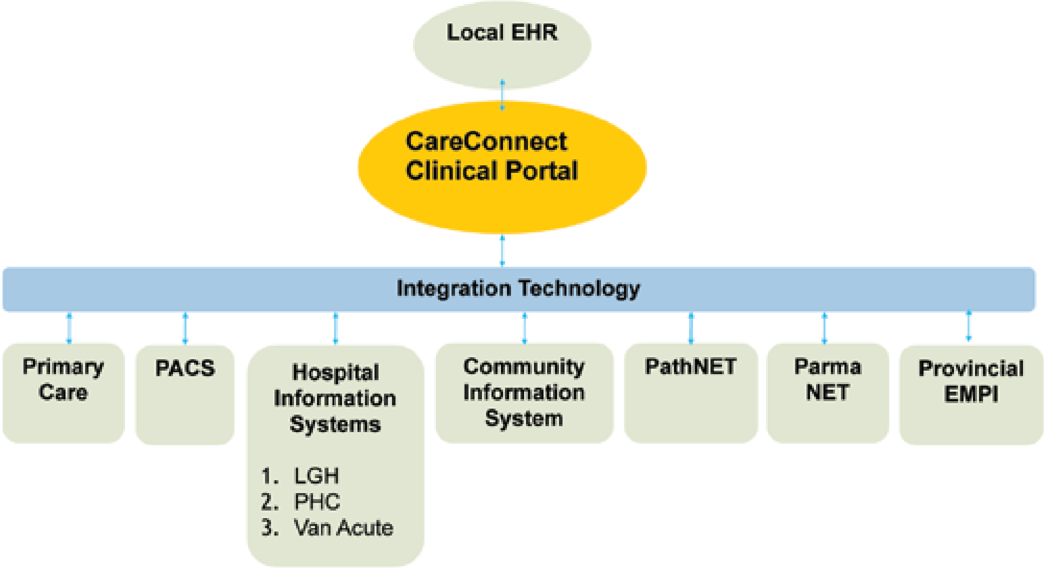

Figure 8 - Care Connect

MANY POINTS ON A CONTINUUM

As the examples cited in this white paper illustrate, there are considerable variations in the architectural approaches used to implement a shared EHR. These variations are driven by a number of factors including:

- Governance model, which drove the choice of a federated model for HealthBridge vs. a centralized model for South Australia.
- Technical constraints, which led to the choice of a simple federated model for the clinical domain at Vancouver Coastal Health vs. a centralized model for eCHN.

The classification of a shared health record system as either centralized or federated is not always clear. There is a continuum of architectural choices, with points along this continuum having more in common with one model than the other. Perhaps the most notable example is the highly successful and much publicized Indiana Health Information Exchange (IHIE) which has been classified in published literature as federated, centralized, and federated centralized. As shown in Figure 9, the IHIE shared EHR architecture is not based on a single repository in which all patient data is stored. Instead, patient data is converted from the format in which it is stored in each local EHR and stored in a separate repository (Edge Proxy) at a central location. Information for each specific patient is gathered from the separate repositories using information stored in a central master patient index (MPI) to cross-reference patients across all participating organizations.

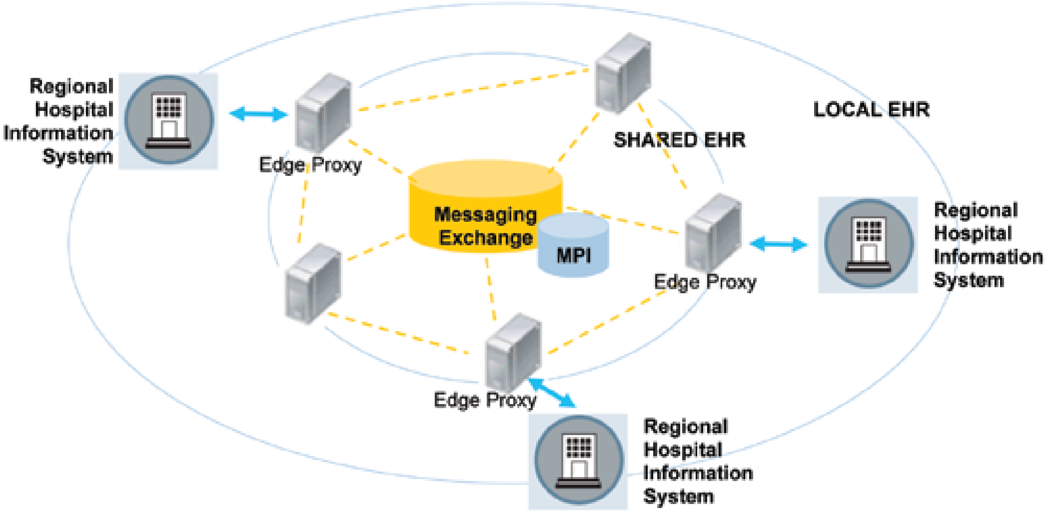

Figure 9 - IHIE Architecture

Like the use of terms such as EMR, EHR, and EPR, the architectural classification is of less importance than the understanding that shared EHR architectures can be designed to meet the specific needs of the participating organizations. Further, there is no absolute "best" or "right" architecture. Rather, it is a matter of what is the "best" fit for the organizations involved that will lead to clinical use and long-term financial sustainability.

SUMMARY

The information the clinician needs is often from both the current episode of care and from one or more episodes with other providers. In each jurisdiction, there are many parts of the puzzle needed to provide this composite picture, and we depend on multiple stakeholders to put all the required pieces together. The indiscriminate use of differing terminology to describe the data, systems and architectural choices for implementing these systems has created confusion among these key stakeholders. Within the confusing array of terminology and requirements, there are two key notions that stakeholders need to keep in mind to achieve success in e-Health.

First, there are two tiers of health information systems that will persist in jurisdictional EHR systems: local electronic health record systems and shared electronic health record systems. Balanced investment in both tiers is required to meet the strategic goals of enhanced patient safety, improved health care provider productivity, and greater patient access to health care services.

Second, the basic concept of electronically sharing patient information is quite simple, but how it is accomplished will be influenced by a complex and interdependent set of factors such as governance, local requirements, legacy systems, referral patterns, and data stewardship concerns. Information can be moved between the two levels of EHR systems using a spectrum of centralized to de-centralized deployment models, the choice of which will depend upon the specific needs of the jurisdiction.

As one of the most information-rich industries, the health care sector can realize substantial benefits from adopting information and communications technology to make patient information electronically available to the health care provider where and when they need it. We all rely at one time or another on a professional to make a clinical decision that can have a significant impact on our well-being, and hope all the information required for that decision is available. By thinking about electronic patient information using this two-tier framework and differing deployment approaches, health care stakeholders can avoid the debate over confusing terminology and focus instead on developing an electronic health record strategy and architecture that meets their specific needs.

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