



North Carolina Healthcare Information
and Communications Alliance, Inc.

DRAFT – White paper by the
North Carolina HIE Council
Technical and Operations
Committee:

A Proposed Architecture for
Statewide Health Information
Exchange Capability for the
State of North Carolina

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Preface

The Technical & Operations Committee of the North Carolina HIE Council began drafting this white paper on March 13, responding to a request from the NC HIE Council to study and recommend technical approaches to achieving secure, statewide, standards-based, electronic HIE among organizations and individuals involved in health and healthcare in NC and, when necessary, with organizations located outside of the State.

This document is being published in 2.0 form by NCHICA.

The Technical and Operations Committee of the NC HIE Council welcomes participants from the NC healthcare community. Details on this and other HIE Council Committees may be found at: <http://www.nchica.org/NCHIE/committees.htm>

A Glossary of many of the terms used in this white paper may be found at: <http://www.nchica.org/AcronymGuide.pdf>

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1 Executive Summary

The purpose of an electronic health information exchange (HIE) is to connect IT systems used in the delivery of healthcare, such as Electronic Medical Records (EMRs) or Hospital Information Systems (HISs), to each other in a such a way that users are able to view clinical data about their patients that has been created and still resides on other systems. The HIE facilitates the smooth flow of clinical data from one user-facing system to another. The HIE is a necessary part of any effort to share clinical patient information.

Technology is a necessary, but not sufficient, component of HIE. In addition to the technology, an HIE requires governance processes, a financial models, and policies for determining who may access healthcare information and for what purposes.

This white paper is a product of the Technical and Operations Committee of the North Carolina HIE Council. The NC HIE Council was convened by the North Carolina Healthcare Information and Communications Alliance (NCHICA), as part of the Nationwide Health Information Network(NHIN) Trial Implementations project, funded by the U.S. Department of Health and Human Services.

This white paper addresses the technology aspects of establishing and running an HIE. While some members of the Technical and Operations Committee are informed about the deliberations of the other committees of the NC HIE Council, including the Policy Development, Stakeholder Relations, and Finance & Administration committees, this document has not been reconciled with the adopted policies of these committees.

To be most useful to healthcare providers, the facilities of the HIE must be well-integrated into those user-facing systems to which the HIE connects. While not exactly transparent to the user, the ability to send and receive information through the HIE must not interfere with the primary purpose of the EMR system: to support various individual health-related uses including provider access to patient condition and history in balance with patient privacy needs and patient uses for the data.

This white paper has been prepared to provide a recommended technical architecture for a statewide HIE capability in North Carolina. The white paper does not explicitly address what entity should be responsible for operating such a statewide HIE, but it assumes that some entity will in fact assume that responsibility.

In considering the best approach to developing an architecture, the group first looked at existing standards for the exchange of health information and common architectural elements of HIEs from across the nation. The committee looked at the NHIN initiative and North Carolina's participation in that project through NCHICA. We also looked at the standards promulgated by Health Information Technology Standards Panel (HITSP) at the national level. We studied activities being followed by other states, some of whom are quite advanced in the implementation of HIEs.

The committee found that although the standards and practices for HIE are in the early stage of maturing, and there are a lot of open questions about the uses of HIE and the policies governing

HIE, there are nonetheless a set of use cases, policies, and common architectural elements that can be used in proposing a technical architecture for the exchange of healthcare information across North Carolina.

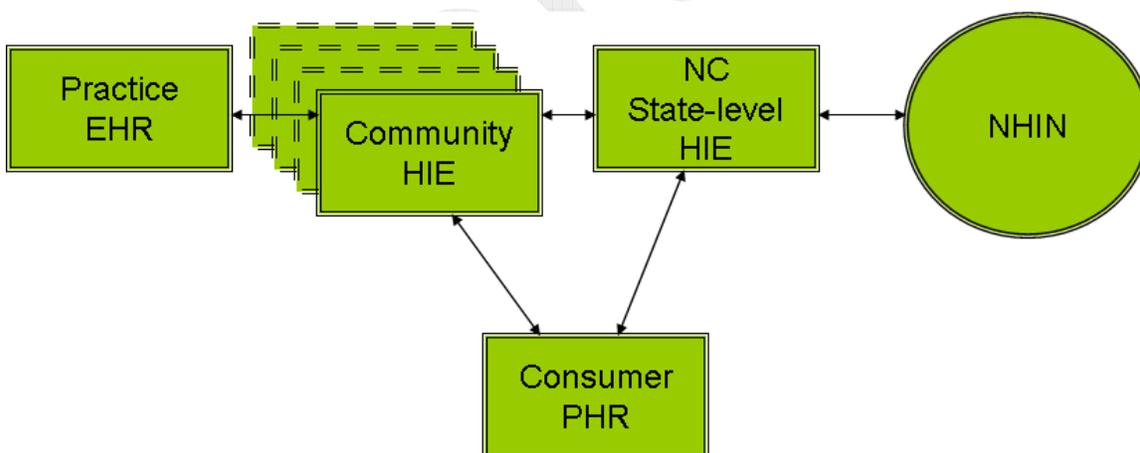
The key recommendations of this white paper are:

1. A single state-level HIE should be adopted in North Carolina to enable healthcare information to be exchanged among stakeholders that are associated with different Community HIEs, and among statewide entities that are directly connected to the state-level HIE. We use the term “NC HIE”, as used by NCHICA for the NHIN Trial Implementations, to represent this statewide HIE capability, though as mentioned, we do not make any assumptions about who will or should operate a statewide HIE.

We do not, however, assume that all healthcare providers in North Carolina will or should connect directly to the NC HIE. We propose a network of Community HIEs that organize based on geographic, organizational, clinical specialty, person-centric, or other interests.

This recommendation is partly based on the assumption that there will be a limited number of nodes allowed as part of the National Health Information Network -- although this is not an official policy of the NHIN at this time. The NC HIE would provide the gateway for Community HIEs to access the NHIN, and also provide a gateway from one Community HIE to another. The effort to retain the levels of conformity required to be a node on the NHIN would be shouldered by the NC HIE so that Community HIEs would not have to bear that burden.

Below is a simplified schematic of this organization of statewide and Community HIEs:



2. A single Community HIE (designated NC-CHIE) should be developed or sponsored by the agency that operates the NC HIE. This “default,” Community HIE would provide connections for entities that have no other way to connect, and would be operated, at least on an interim basis, as an adjunct capability of the NC HIE. The committee feels that while it is possible to establish a statewide NC HIE in a relatively short amount of time, it will take much longer for a comprehensive network of Community HIEs to be established in North Carolina. The NC-CHIE will help to eliminate the “chicken and egg” problem by giving healthcare providers who have the capability to exchange information in the short-term a way to connect to other sources of information without waiting for a Community HIE to spring up in their region.

3. In order to provide a statewide HIE capability, the NC HIE must operate a statewide Master Patient Index (MPI). This recommendation imposes not only a technology requirement to provide the capabilities for patient identity matching and cross-referencing, but also the operational requirement to manage the data quality issues and ambiguous and erroneous matching that inevitably will occur when attempting to reconcile patient identities across the population of North Carolina. The MPI entry for a given person would “point to” the Community HIE(s) that have records for the person.

4. The implementation of the NC HIE must accommodate patient control of their clinical data, Strong user authentication and HIPAA compliance as well as adherence to any North Carolina-specific regulatory and policy requirements. Although there are a wide array of privacy and security policies that must be established by the governing authority of the NC HIE, the committee strongly feels that the technology and architecture of the NC HIE must provide a basis for allowing all parties, most especially patients, to control access to their clinical data including being able to determine what actual access has taken place.

5. The NC HIE should, to the greatest extent practical, follow the standards of the NHIN for the exchange of healthcare information, including both the protocols to be used in exchanging information and the formats for the information content.

6. The committee recommends that the NC HIE select a small number of simple use cases to begin operations, so that early positive results can build success and interest which can in turn be used to fuel the development of additional use cases. We recognize that medication management and clinical messaging have consistently been prioritized by NC stakeholders.

This is a DRAFT document and reflects the charter of the Technical and Operations Committee of the NC HIE Council: to propose an overall technical architecture for a North Carolina HIE. We expect the paper to undergo revisions as other committees of the NC HIE Council publish the results of their deliberations, as lessons learned from the NHIN Trial Implementations and other HIE activities become known, and as we observe the reality of what is happening on the ground.

2 Background

2.1 Technical & Operations Committee Charter

This document represents the collaborative efforts of the Technical & Operations Committee of the NC HIE Council. The charter of the Committee included:

- Understanding the current state of HIE in North Carolina,
- Comparing the needs of North Carolina with available technology and potentially leveraging existing work products from NHIN-sponsored efforts,
- Establishing a plan for implementing an architecture that grows and extends as the existing exchanges in North Carolina mature and as others come online, and
- Expressing an opinion at the convergence of technical viability (i.e. will it work?) with practicality (will it actually be used?) with fiscal viability (can it be sustained?).

2.2 Assumptions and Constraints

The following items are some of the assumptions and constraints documented during the working sessions of the Committee:

- The landscape for HIEs will continue to evolve in ways that we cannot predict,
- The standards and existing architectures around the country will stabilize and converge,
- This paper make no assumptions about the financing or sustainability of the recommended architecture, though the fiscal viability of the architecture was a consideration, and
- This paper will not discuss fiscal viability or governance beyond any technical capabilities that might enhance or enable such “business” needs.

3 HIE

An HIE facilitates the communication of electronic healthcare information between stakeholders – patients, providers, hospitals, pharmacies, laboratories, radiology practices, medical researchers, population health researchers, public health, and Integrated Delivery Networks (IDNs). Typically, these stakeholders interact directly with other computer systems (EHR – Electronic Health Records for providers, PHR – Personal Health Records for consumers, HIS - Hospital Information Systems for Hospitals, LIS – Laboratory Information System for labs, RIS – Radiology information Systems for radiology practices) rather than directly with the HIE. An exchange can exist within a community, a state, or a region that crosses state boundaries. An exchange may not be defined by geography at all; various affinities or mere utility may define an HIE. It can extend the reach of such communications nationally by acting as a gateway to the emerging NHIN .

The primary goal of a North Carolina HIE is to realize the following benefits:

- Improve the quality of care by reducing medical errors and improving safety.
- Reduce costs by eliminating unnecessary or duplicative procedures (such as additional lab tests or imaging exams).
- Assist in controlling healthcare costs for the state by aggregating population health statistics.
- Enable emerging healthcare trends such as Medical Home and Comparative Effectiveness.
- Create an environment that fosters innovation for 21st Century healthcare.
- Support consumers and lay providers in their roles in improving health and managing costs.
- Support the privacy and security of health information.

As pointed out by the State Alliance for E-Health, the United States spends more per capita on healthcare than any other developed country but achieves equal or lower results in terms of health outcomes and access to services. Administrative costs account for 31 percent of total healthcare spending in the United States, a level almost double Canada's rate. Information technology, including HIEs, can help promote faster information sharing and reduce fragmentation of care leading to improvements in health outcomes and efficiency

North Carolina has an aging population and a large group of citizens not covered by health insurance. Any movement towards reducing the price of care while at the same time improving its quality will benefit this state. The sustainability of HIE as a component of addressing these healthcare challenges has been addressed by the Finance & Administration Committee of the NC HIE Council in a report issued in January 2009:

<http://www.nchica.org/NHIN2/Sustainability%20Plan.pdf>.

The State Alliance recommended six actions to be taken by states to further the adoption and use of HIT and electronic HIE:

- Provide leadership and support for e-health efforts;
- Address privacy and security;
- Promote the use of standards-based, interoperable technology;
- Streamline the licensure process to enable cross-state e-health;
- Engage consumers to use HIT in managing their health and healthcare; and
- Develop workforce and agency capacity to support electronic HIE efforts.

3.1 Stakeholders

An HIE makes it possible for stakeholders (persons or entities involved in patient care and treatment, community health, and personal health) to carry out a conversation – this conversation is an exchange of information about a particular event (or lack of an expected event) or even a person's entire medical history.

The stakeholders identified by the Technical and Operations Committee include consumers, providers, payers, employers, vendors, medical researchers, academic institutions, state agencies, federal agencies, foundations and other HIEs.

3.1.1 Medicaid

Medicaid is the single largest payer in North Carolina, and indeed in most states. The Office of Rural Health manages a portal for the care and treatment of high-risk Medicaid recipients. Community Care of North Carolina and Medicaid use this portal as a quasi-case management system, not a formal HIE, as there is no MPI. CCNC has access to a Medicaid claims data file. This is typical of health information web portals around the state that are "home grown" and evolved over time to meet the basic business needs of an organization.

CMS is currently designing a set of architectures (business, information and technical) for the future Medicaid Management Information Systems (MMIS); such systems are used by Medicaid in every state. The overriding architecture for these systems is called MITA (Medicaid Information Technology Architecture). The MITA initiative envisions moving from traditional MMIS to web-based, patient centric systems that are interoperable within and across all levels of government. CMS has been working on MITA for approximately 5 years, and is estimated it will take another 5 to 10 years to arrive at a fully implemented and interoperable system. This system utilizes SOA (Service Oriented Architecture) and with the continued emergence of standards, could support EHR protocols such as CCD (Continuity of Care Document) information. NC Medicaid is now in the process of implementing a new MMIS that is aligned with the currently defined MITA Architecture. CMS has recently completed a joint initiative with HHS' Substance Abuse and Mental Health Administration (SAMHSA) to provide a SOA Framework for their trading partners. They are also working with the Office of the National Coordinator's Federal Health Architecture team to foster interoperability with the Centers for Disease Control and Prevention, the VA, and the Dept. of Defense.

Reference information available at:

http://www.cms.hhs.gov/MedicaidInfoTechArch/02_MITAWhitePapers.asp#TopOfPag

3.1.2 Existing HIEs

As defined by the Office of the National Coordinator (ONC), Health Information Exchange (HIE) is the electronic movement of health-related information among organizations according to nationally recognized standards. Please note HIE is a broad definition and NCHICA does not endorse or certify HIE's. The program descriptions below are examples of how data is shared within two North Carolina healthcare systems: the Western North Carolina (WNC) Health Network's Data Link Project, and the University Health Systems of Eastern Carolina HealthSpan Project and plans for an additional exchange in the Southern Piedmont.

Data Link is a collaboration between 16 hospitals and uses a federated model, which draws upon non-centralized repositories of patient data. This enables clinicians to view healthcare data that is stored on disparate software systems that are not owned or managed by their hospital. It is technology neutral, connects to a variety of health information systems using HL7 messaging, and utilizes an MPC (Master Patient Cache). The MPC queries back-end systems in real time, then stores the location of the permitted files, but not the actual information residing in them. An existing patient record at a specific hospital is retrieved from the cache by the use of up to 6 discriminators.

A central web portal allows authorized physicians to view patients' electronic records across all WNC hospitals by querying the 16 hospitals' EMR systems. At this time, Data Link serves as a portal for viewing and printing purposes only; no patient data is automatically downloaded or processed within a hospital's software. The physicians cannot update the patient clinical data on a disparate hospital system. Data Link does not transfer images at this time, however that functionality is scheduled to be added by the end of 2009. Access II Care (CCNC) does have access to Data Link.

For more information, please see <http://www.wnchn.org/datalink.aspx> or <http://medseek.com/body.cfm?id=187> .

HealthSpan is an enterprise software system that is managed by the University Health Systems of Eastern Carolina using a SaaS (Software as a Service) model, which is hosted by Pitt County Memorial Hospital. It is based on a consolidated model, which utilizes a central repository to manage the information exchange. HealthSpan runs on the Epic Enterprise software suite and users gain access to the Epic software via a web-based connection.

Currently, 6 hospitals and 3 clinics are members of HealthSpan. Clinicians use Epic to manage and access clinical data. There are approximately 1.2 million patient records in the system. The entire patient record is available to participating clinicians, including radiology/EKG images and results. Results from commercial labs are interfaced directly into the system.

In the coming months HealthSpan is planning to add: ePrescribing functionality to retail pharmacies, 5-10 ambulatory practices (owned or affiliated), and a patient portal.

In addition to these programs, the Southern Piedmont Partnership for Public Health is near the end of a planning phase for a person-oriented HIE called SoPHIE. The group's wiki with all of the background can be found at <http://tinyurl.com/NC-SoPHIE> . The group consists of the SPPPH, DMA, Duke and UNC researchers, First Health of the Carolinas, Cabarrus Health Alliance, Cabarrus Family Practice, the NC Institute for Public Health, CCNS reps, and others. This project is entering a pilot phase as of 6/09.

3.2 What are other states or regions doing?

A quick survey of other state efforts reveal a wide spectrum of development along the road to interoperability. A number of states, including North Carolina, have been participating in the NHIN trials. These states now enjoy the advantage of experience gained in building a node on the NHIN (HIEs that qualify to be a node on the NHIN are called NHIEs).

A few states have been able to fund large-scale projects to interconnect various entities within the state. Even these are mostly in the early stages of deployment. Some states are focusing on the

governance role only and are encouraging the formation of Community (or Regional) HIEs. Many states are just starting out, propelled by potential funding from the American Recovery and Reinvestment Act (ARRA) legislation. States are not the only entities performing in this space.

3.3 The Case for North Carolina

At this time, North Carolina has not yet identified the specific functional use cases to be supported by the NC HIE nor the priorities of implementation for those use cases. However, for the purposes of this white paper, we have identified several potential use cases that will help inform the overall architecture of the NC HIE. These are:

- An emergency department physician needs information about an unconscious patient from wherever there might be information
- A primary care physician would like to see information for a new patient from their previous primary care physician. The patient has just moved to North Carolina from another state.
- A specialist would like to see the report and the images from a CT scan that was performed a year ago at another hospital in the same region.
- A major laboratory wants to make lab results available to an ordering physician within the state. The physician has an interoperable EMR system connected to a Community HIE.
- The Department of Health and Human Services (DHHS) wants to collect immunization statistics across the state.
- A medical researcher wants to review deidentified data in search of potential clinical trial subjects.
- A consumer wants to review who has been accessing his records
- A consumer wants to change the permissions for exchange of and access to his health information.
- A consumer wants to review her blood pressure trends
- The Social Security Administration wants to determine if any treatment was given in North Carolina facilities to an individual who is applying for disability insurance.

4 Architecture of the NC HIE

4.1 Guiding Principles

The architecture of the NC HIE will conform to the following principles:

- Maintain compatibility with the NHIN standards for interoperability.
- Specifications should be vendor neutral, providing for implementation in the widest range of hardware, operating systems and programming languages possible.
- Utilize Services Oriented Architecture (SOA) design principles and Web Services wherever possible.
- Address privacy and security aspects of all transactions and databases used to ensure compliance with HIPAA requirements.
- Ensure strong authentication methods are used in transactions with all external entities.
- Honor consumer permissions, denials and directives regarding the sharing of their health information (though there may be limited exceptions to this guiding principle in cases governed by state or federal law, or for emergency access).
- Connection to the NC HIE will be by Community HIEs and state-level entities such as DHHS, Medicaid, statewide insurance companies and labs. In general, connection should be by established standard formats and mechanisms although non-standard connections will be considered.

4.2 General Structure of the NC HIE

The NC HIE would serve two basic roles:

1. A connection point for Community HIEs in North Carolina to enable them to interconnect with each other and to HIEs in other states, and
2. A connection point for state-level entities (such as DHHS and payers) to connect to regional NC HIEs and to HIEs in other states.

Figure 1 shows the environment of the NC HIE. The NHIN is at the top of the diagram. Around the edges of the bottom portion of the diagram are shown the variety of entities that may connect to the NC HIE:

- State agencies such as NC Medicaid and the Division of Public Health;
- An IDN or other large hospital system that may act as one type of “Community HIE”;
- Community HIEs (on the right side of the diagram) which are groups of healthcare providers organized based on regional or clinical specialty interests. Also included in this category is a “default” Community HIE provided as an associated service to the NC HIE; and
- Person-oriented HIEs offering combined PHR & HIE services, organized as communities of patients; and
- “Independent Provider Networks”, which is a catch-all term to refer to other types of networks, including such things as PHR networks, Independent Physician Associations, and home health networks.

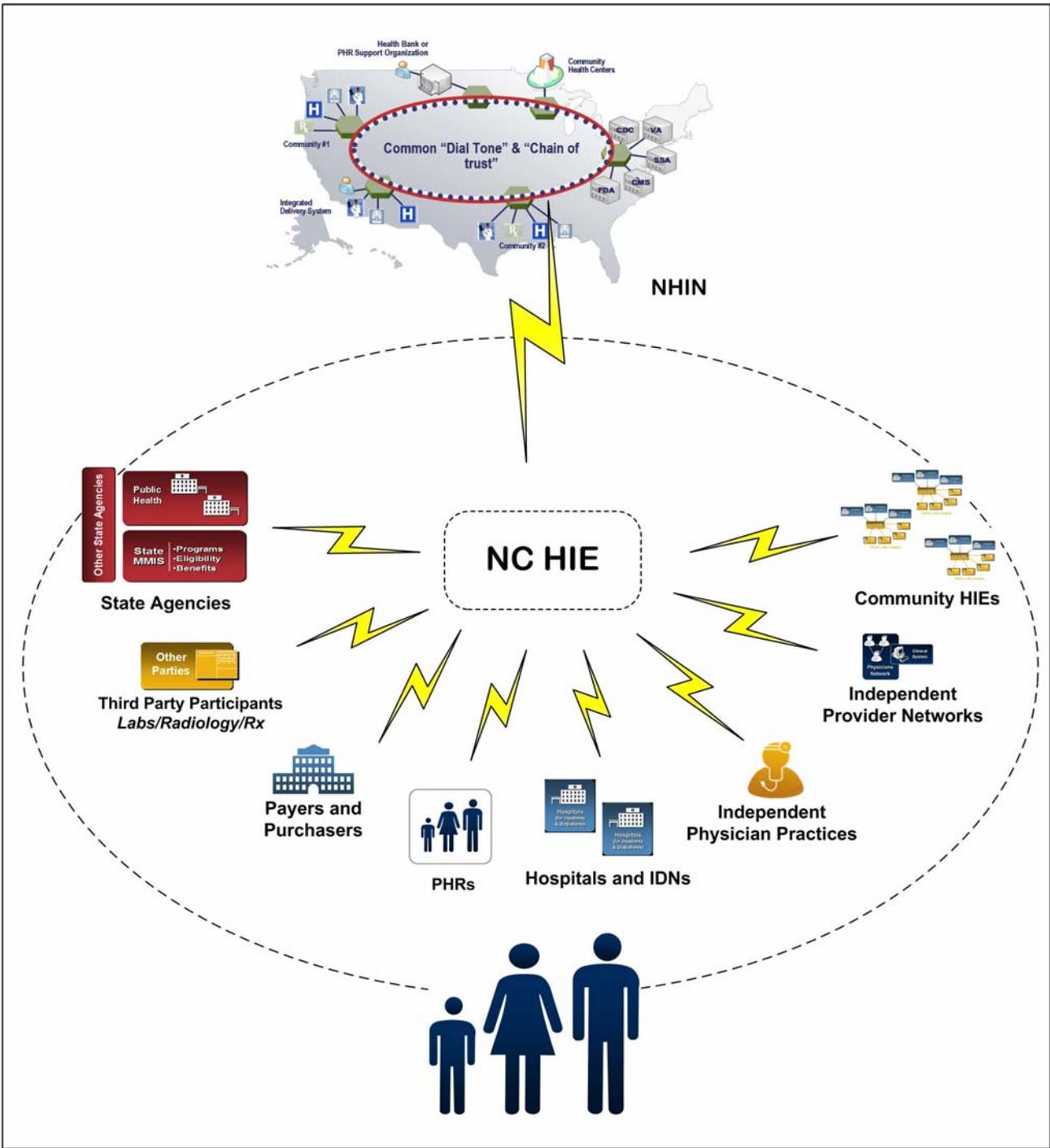


Figure 1 -- NC HIE Environment

Person-Centric HIEs.: The “Person Centric” HIE can be viewed as a combination of PHR and HIE functionality and is one form of a Community HIE. The PHR can be a tool for consumers to use to set their access consent permissions. PHR’s are an ancillary service that an HIE could provide. However, the architecture of the NC-CHIE described in the White Paper assumes that PHR functions and consumer access are separate from, and outside the scope of, the NC-CHIE. Both the NC-HIE and the NC-CHIE will allow or deny access to patient data based on consumer permissions but the exact mechanism is yet to be defined. It should be recognized that a “Person Centric” HIE may enforce permission controls locally and may supplement the controls provided by the NC HIE.

The NC HIE would offer the following services to Community HIEs:

- A statewide MPI, with services for querying and managing patient identities;
- A registry for identifying the location of patient information across Community HIEs within the state (in conjunction with the statewide MPI), and within entities directly connected to the NC HIE;
- A query gateway for identifying and retrieving patient information from out of state via the NHIN;
- A collection and routing mechanism from Community HIEs for statewide public health, biosurveillance and quality reporting; and
- A service for honoring the access consent permissions to patient information, including a mechanism to inform Community HIEs about patient data sharing decisions. Actual management of patient sharing selections by the consumer is out of scope of this paper

The state-level HIE would offer the following services to statewide entities:

- The basic services of patient identity cross-referencing, document storage, query and retrieval, centralized audit recording, and access consent management;
- The ability to connect in a non-standard, customized manner; and
- The ability to map or translate proprietary data and codes to a standard for NHIN interchange or interchange to a Community HIE

The subsequent sections describe more detailed recommendations for some specific functional areas that are critical to the operations of the NC HIE.

4.3 Supported Services

This list of services is roughly based on the list of HIE core services identified in the summary report of the NHIN Architecture Prototypes (see http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_10731_848093_0_0_18/summary_report_on_NHIN_Prototype_architectures.pdf). Based on this list of services, the Technical and Operations Committee has identified a set of capabilities for the NC HIE to promote the secure exchange of data amongst stakeholders in North Carolina.

The services to be available in the NC HIE are described in the following categories:

- Data Services
- Stakeholder Services
- Consumer Services
- Security Services

4.3.1 Data Services

One of the primary roles of the NC HIE is to facilitate the exchange of health information to fulfill the proposed use cases outlined later on in the document. The general structure of the data services is based on a suite of standards profiles defined by Integrating the Healthcare Enterprise (IHE).

These profiles include:

- Cross-Enterprise Document Sharing (XDS), for managing the exchange of clinical documents;
- Patient Identity Cross-Reference (PIX), for managing the cross-referencing of patient identifiers;
- Patient Demographics Query (PDQ), for performing demographics queries to match patient identities; and
- Audit Trail and Node Authentication (ATNA); for managing audit records about who has accessed patient records.

See <http://www.ihe.net> for details on the IHE Integration Profiles.

As part of the overall architecture, the NC HIE data services will contain the following items:

- The ability to register the location of documents to the NC HIE;
- The ability to store documents in the NC HIE. In general, entities connected to the NC HIE will be encouraged to store healthcare information within their own enterprise and make those documents available to authorized users of the NC HIE through standard document sharing protocols (via the “register” operation). However, the NC HIE may choose to offer a “Document Repository” capability for organizations that wish to have the NC HIE store documents on their behalf;
- The ability to query and retrieve documents;
- The ability to route laboratory or imaging results (and potentially other kinds of clinical information) to clinicians identified (as either the ordering or a “copy to” party) in the result. “Routing” in this context means delivering the results to the EMR application or secure in-box associated with the clinician in the NC HIE provider directory;
- The ability to automatically route laboratory results or other clinical information that identifies a reportable condition (as defined by the North Carolina Division of Public Health and applicable laws) to state and local public health agencies;
- The ability to maintain a short-term cache of clinical images to allow for the efficient retrieval of those images by authorized providers. Images that have “aged out” of the short term cache may still be retrieved from their source, but this process may be slower, less reliable, or require specialized software at the retrieving site;
- The ability to retrieve an individual's medication history from the Surescripts (and similar) pharmacy networks;
- Vocabulary validation and translation for non-standard coded terminology elements;
- Data de-identification services for trusted entities reporting requests;
- Audit logging of access to documents and other operations available to consumers; and
- Reporting of quality data for state and national stakeholders.

4.3.2 Stakeholder Services

Services in this category allow entities connected to the NC HIE to discover the identities of the other users and organizations with the network. Some of the services provided under this section would be:

- Entity identification services, including:
- A statewide patient registry, or Master Patient Index,

- A statewide provider directory, with an “endpoint address” to facilitate the routing of information to that provider.
- Entity registration services
- Discovery services

The “endpoint address” managed by the NC HIE provider directory must be flexible enough to support a variety of technology options for routing information to a provider. Currently, there are a variety of means (some standards-based, some not) for sending unsolicited information to an EMR, ranging from Web Services, to HL7 messages, to simple e-mail.

4.3.3 Consumer Services

Creating a patient-centric HIE requires services to allow patients to access their clinical data, and to control access to their clinical data. Patients can act through a variety of applications that can be generally referred to as a “PHR”, though there may be significant variation in the capabilities and user interfaces of these applications. In order to support these applications, the HIE must provide these services, in addition to the Data Services offered to other applications:

- Ability to opt in or opt out of the HIE
- Ability to honor consumer selections for who may access both PHR data and data from healthcare providers
- Ability to allow a delegate (such as a relative) to access their healthcare information and manage their permission
- Ability to access HIE audit records to determine who has accessed or attempted to access their clinical information

The Policy Development Committee of the NC HIE Council is currently studying significant policy decision that will be needed to support these services.

4.3.4 Security Services

The NC HIE must provide services to ensure that security is enforced in all operations of the HIE, including:

- User Identity Management
- User Authentication and Authorization
- Access control based on user role as well as individual patient permissions
- Credential services and access levels for all users connected directly and through other HIEs to the NC HIE
- Audit logging of all services
- Ability to manage digital certificates and certificate revocation
- The NCHIE will also meet data integrity and availability standards

4.4 NHIN Gateway Function

At the time of writing, the general consensus is that the NHIN is expected to support a limited number of nodes. This is due to a potentially large number of transactions moving between the nodes in a point-to-point, matrixed environment. Given this, one of the main functions that will be provided by the NC HIE will be to act as a gateway to the NHIN for Community HIEs. This does not imply that other HIEs operating within North Carolina are barred from becoming an NHIE if they qualify. If the assumption regarding the limited number of NHIN nodes proves false, the NC HIE would still provide NHIN connection services for HIEs that do not wish to or do not have the ability to conform to NHIE certification standards.

Although the mechanism does not exist today, it is expected that the Department of Health and Human Services Office of the National Coordinator for Healthcare IT (ONC) will establish standards that HIEs must meet to become and remain a Certified NHIE, that is, an HIE that has been certified by the ONC to be a registered member of the NHIN and thus designated as an NHIE.

To fulfill its role as a gateway to the NHIN, the NC HIE will be designed to conform to the established ONC standards, offering all core services required to obtain the NHIE Certification. It is expected that the requirements for certification will change over time as new use cases are proposed and fulfilled by the NHIN participants. The NC HIE will maintain an ongoing effort to continue to meet certification requirements as they evolve.

At the present time the NHIN Trial Implementation Framework has identified ten core service offerings¹:

- Message Platform Service Interface Specification
- Authorization Framework Service Interface Specification
- Subject Discovery Service Interface Specification
- Query for Documents Service Interface Specification
- Document Retrieve Service Interface Specification
- Audit Log Query Service Interface Specification
- Consumer Preferences Service Interface Specification
- Health Information Event Messaging Service Interface Specification
- NHIE Service Registry Interface Specification
- Authorized Case Follow-Up Service Interface Specification

These core services support the fulfillment of the following use cases:

- Authorized Release of Information to a trusted entity Use Case
- Biosurveillance Use Case
- Consumer Preference Registration Med History
- EHR Lab Scenarios Use Case
- Emergency Responder Use Case
- Quality Use Case

4.5 Community HIE Function

Although the Technical and Operations Committee believes that the principal activity of the NC HIE Council moving forward is to enable, advocate for, and assist in the establishment of independent Community HIEs, we also recognize the reality that there may not be an independent Community HIE available to a given practice or hospital within the timeframes under discussion.

For this reason, the committee is recommending that there be built, as a separate effort, a Community HIE that could be utilized by those who do not have ready access to any other HIE. The North Carolina Community HIE (or NC-CHIE) will provide the following services:

- Connect with individual EMR systems using standard protocols

¹ See NHIN Trial Implementations Service Interface Specifications (<http://healthit.hhs.gov>)

- Provide a non-standard connections to an EMR system if it is determined to be appropriate to do so
 - Provide the NHIN Core Services
 - Support the use cases listed above
 - Provide a Web Portal for providers or practices without a connected EMR
 - Provide a mechanism for consumers to direct the sharing of their health information by providing connections to PHR systems
 - Connect via standard mechanisms to the NC HIE, including:
 - IHE PIX and PDQ for patient identity queries (see next section)
 - IHE Cross-Community Access (XCA) for document query and retrieve operations
 - Secure transport using mutually-authenticated Transport Layer Security
 - Assertion of User Identity using Secure Access Markup Language
 - Audit Log Query using the NHIN-defined web service interface
- [Note: these standard mechanisms are drawn from the NHIN Technical Specifications, and details can be found there.]

The NC-CHIE can serve as a model for the capabilities of other Community HIEs to be established in North Carolina.

4.6 Patient Identity Management

Patient Identity Management is a key requirement for any HIE. We can define Patient Identity Management as the ability to ascertain a distinct, unique identity for an individual (a patient), as expressed by an identifier that is unique within the scope of the exchange network, given characteristics about that individual such as his or her name, date of birth, gender, address or prior addresses, and identifiers such as medical record numbers or driver's license number.

The Technical and Operations committee discussed two models for managing patient identities:

- The North Carolina HIE maintains an MPI covering all patients in the state; and Community HIEs update and query that statewide MPI to determine the unique identifier.
- The North Carolina HIE does not maintain an MPI, but instead discovers the unique identifiers by which an individual is known in other communities through a "broadcast query" mechanism to connected Community HIEs.

In either case, each Community HIE maintains an MPI for their community (with unique identifiers for each patient).

The Committee recommends the first approach for the following reasons:

- The broadcast query mechanism is likely to place a heavy computational burden on the systems of the Community HIEs, which may not be equipped to handle that burden, as compared to a statewide HIE.
- While we know that there are certain referral patterns in North Carolina that somewhat limit patient movement across the state, it is highly likely for patients to receive care from providers across the Community HIEs in North Carolina, because (1) Community HIEs in the state may not have a strong geographic focus, and (2) there are a few academic medical centers and tertiary care centers in North Carolina that attract patients with certain conditions from across the state. Therefore, a regional nexus for patient identification may not be strong enough to justify a highly distributed approach to patient identity management.

[Readers not familiar with the IHE Patient Identity Cross-Reference and Patient Demographic Query profiles may wish to read Appendix A. prior to reading this section.]

Based on this recommendation, the interactions among the Community HIEs and the NC HIE are as follows:

1. Community HIEs or connected organizations first issue a Patient Demographic Query to the NC HIE to determine if a given patient is already known on the NC HIE.
 - a. If the patient (who wishes to share information on the NC HIE) in the Community HIE or connected organization is not already known in the NC HIE, the HIE/organization must notify the NC HIE of the new patient identity using the Patient Identity Feed transaction.
 - b. If the patient in the Community HIE or connected organization is already known to the NC HIE, the HIE/organization must issue a Patient Identity Feed transaction to inform the NC HIE of the patient identifier used to represent that patient in the HIE/organization. This transaction contains both the Community HIE Patient ID and the NC HIE Patient ID for that patient.
2. Subsequent queries to the NC HIE for information about a patient must use the NC HIE Patient ID for that patient.
3. When a Community HIE or connected organization makes a material change to an entry in its patient registry (such as changing the patient's name or address, merging or unmerging records, or removing a record), it must notify the NC HIE of the change using the PIX Update Notification transaction.
4. When the NC HIE receives notification of an update (or initiates an update itself) that changes a patient ID assigned to an individual in the NC HIE MPI (such as a merge or unmerge), it must notify all Community HIEs/connected organizations who have previously sent a Patient Identity Feed for the patient of the change, using a PIX Update Notification. Updates that modify only the name or address attributes of an individual do not need to be propagated.

The NC HIE Policy Committee and/or Technical and Operations Committee must establish policies for performing deterministic matching of patient identities, such as confidence intervals for asserting a matched identity. These policies must include how ambiguous matches are handled, and how erroneous data can be corrected in the statewide MPI.

Patient Discovery requests on the NC HIE should at a minimum carry the following attributes about the requested patient:

- Name (including first name, last name, middle initial or name, and suffix)
- Date of Birth
- Gender
- Current address

Other attributes, such as telephone numbers, previous addresses and previous names, may be included if they are accommodated by the query specification. [FOR DISCUSSION AND CLARIFICATION: The NC HIE policies will include the capability of removing an identity record for a person upon their request.]

This recommendation implies that there will be an operational responsibility for the NC HIE to administer the NC HIE MPI, including resolving ambiguous records, correcting incorrect records, and performing merge and unmerge operations.

A "bulk-loading" of patient IDs may be required when a Community HIE or connected organization joins the NC HIE. In general, a patient's ID should be sent to the NC HIE when that patient has consented to have his or her information shared on the NC HIE and beyond. So the necessity of "bulk-loading" of an entire Community HIE patient registry will be dependent on a legal/policy

determination that those patients have consented (either explicitly or implicitly) to have their information shared on the NC HIE.

4.6.1 Linkage to NHIN

The standards to be used for Patient Identity Management on the NHIN are still being developed. An initial specification (called “NHIN Subject Discovery”) was created, but is currently being revised in response to lessons learned during the NHIN Trial Implementations. Since the specific operations and protocols that will be used to perform Patient Identity Management on the NHIN aren’t known, this section will describe the general approach to reconciling patient identities from the NC HIE to other nodes on the NHIN.

In general, when a Community HIE or connected organization uses the Patient Identity Feed to add a patient record to the NC HIE MPI, the NC HIE should query other nodes on the NHIN to determine if the patient is known in other connected HIEs (outside of North Carolina). The NC HIE MPI must store the results of this query, linking the patient’s NC HIE Patient ID with the Patient IDs from other NHIN-connected HIEs. The details about how this occurs will be determined by the NHIN Subject Discovery specifications.

This linkage between the NC HIE and out-of-state HIEs does not need to be directly reflected to the Community HIE or connected organization. Instead, when a query for that patient’s information is sent to the NC HIE, the NC HIE will refer to its MPI and determine whether the query must be propagated to out-of-state HIEs (based on the linked patient IDs) in order to get a complete set of records for that individual.

In addition to the technical complexities of gathering a nationwide record through this sort of mechanism, there are also a complex set of state laws that condition the transfer of such information in a third-party disclosure environment such as described here. These limitations of these laws will have to be reflected in this mechanism.

4.6.2 Identity Proofing

Following the guiding principles and recommendations in this document, patients will be users of the NC HIE and will have access to their own healthcare information (and potentially the information of others for whom they act as a “care manager”) through the HIE, using a PHR or similar application. Since this is the case, care must be taken when assigning user access to a patient to ensure that this user identity is correctly matched to the patient identity, and thus the patient is granted access to *his or her* records and not someone else’s. This process, referred to as “identity proofing”, is necessary to prevent accidental disclosure of a patient’s records to an unauthorized party, as well as to prevent fraudulent access by someone impersonating another patient.

The NC HIE must adopt policies describing the requirements for patients to be identity proofed before being granted access to the NC HIE. (A similar policy should describe the requirements for identity-proofing clinicians and other users of the HIE, though this is usually less problematic as the employers of these types of users can be expected to have procedures to verify the credentials of an individual before granting them access to systems containing patient records. It will also be necessary to support a de-credentialing process when a provider/employee change status.) Appendix D contains an example of such a policy, including a description of how the policy can be enforced by the HIE and its MPI, which was prepared for NCHICA during the NHIN Trial Implementations project.

4.7 User Management and Access Consent

The purpose of an HIE is to allow a set of individuals we refer to as “users” to access healthcare information about another set of individuals referred to as “patients.” These are not disjointed sets of individuals, since: a) doctors, nurses and other healthcare providers (“users”) may also be patients, and b) patients who are not healthcare providers have rights to access their own healthcare information (and those of their children), and may be granted rights to access information about others whose care they manage (such as an elderly parent). In this context, the person accessing the information would be considered a “user.”

The section Patient Identity Management describes a set of requirements for managing the identities of patients across a distributed North Carolina HIE, and a proposed technical architecture to meet those requirements. This section proposes a technical architecture for managing user identities in the NC HIE environment.

This paper also describes what can be considered the intersection between “users” and “patients”; namely: what restrictions can be placed on a user’s (or a class of users) ability to access information about a patient?

4.7.1 Identity Management

The issues associated with managing user identity in a widely distributed environment such as the NC HIE have been addressed in many other electronic commerce applications. The subject is often referred to as “federated identity management.” Some of the topics that must be addressed in a federated identity management scenario are:

1. Establishment of one or more “identity providers” who are allowed to create user IDs and assign them to users.
2. The definition of identity attributes, including the user’s name and the role or roles they are allowed to assume in the systems being connected.
3. User account management and provisioning, the processes by which user accounts are created and information about those accounts is sent to connected systems.
4. Establishment of a “chain of trust,” enforced through digital certificates that describe the level of trust that organizations give each other when accepting user credentials from outside their own security domain.

The North Carolina Identity Service (NCID) is a standard identity management and access service operated by the North Carolina Office of Information Technology Services and provided to state, local government, business and citizen users. The service allows organizations to use a common identity across connected applications for purposes of controlling access to online resources.

NCID acts as an identity provider for the federated identity management domain being established in state government. NCID handles user account provisioning by sending account updates (including password changes) to affiliated applications.

NCID provides the ability for administrators to manage user IDs for users within their organizations. So an administrator within one organization (the NC Department of Agriculture, for example) has the authority to create or modify user IDs for employees of the Department of Agriculture, but not for employees in the Department of Corrections.

4.7.1.1 NHIN Standards

The NHIN Cooperative Technical and Security Committee has defined a common security header for all transactions on the NHIN. This security header (defined in the NHIN Trial Implementations Authorization Framework specification) requires the use of the Secure Access Markup Language (SAML) version 2 specification to carry information about the user that is the originator of the transaction. The following identity attributes about the requester must be present on a request:

1. User ID
2. The method by which the user was authenticated
3. The time of the user authentication
4. The user's name in plain text (for audit purposes)
5. The user's organization in plain text (for audit purposes)
6. The role that the user is assuming when making the request, using a coded vocabulary defined in the specification
7. The purpose of the request, using a coded vocabulary defined in the specification

These assertions about the originating user are included in the security header, and digitally signed using an X.509 certificate from an authority designated by the NHIN. This digital certificate from a trusted authority provides a "chain of trust" that allows the receiving HIE to trust that the originating user is the user described in the security header. The receiving HIE can then apply certain types of security, such as role-based access control and auditing of transactions, even though the HIE was not previously aware of the user.

4.7.1.2 Recommended Approach for User Identity Management

The Technical and Operations Committee recommends an approach that is a combination of NCID and the NHIN Authorization Framework:

1. Users who access information through the NC HIE must have an NCID.
2. Many users who are state employees or healthcare providers will already have an NCID
3. Since it is likely that patients will have the capability to access information through the NC HIE, patients (i.e. consumers/patients) must have the ability to obtain an NCID. This can be facilitated by an administrator in a Community HIE or other connected organization (such as NC Medicaid). FOR DISCUSSION: If the primary means of communication with consumers is the PHR, if the consumer authenticates to the PHR, is it necessary to use the NCID mechanism?
4. When a transaction is issued from a Community HIE to the NC HIE, the transaction must carry a security header containing the same information as defined in the NHIN Authorization Framework standards.
5. If the Community HIE uses a user ID other than the NCID, it must map those user IDs to the NCID for each user, so the NCID can be inserted on request to the NC HIE.
6. The NC HIE should identify one or more trusted certificate authorities to issue X.509 certificates to Community HIEs and organizations connecting to the NC HIE. (Alternatively, the NC HIE may issue certificates itself.)
7. Transactions issued to the NC HIE must be digitally signed as described in the NHIN Authorization Framework.
8. Each Community HIE or other organization on the NC HIE may apply its own security restrictions on transactions and requests, using the information asserted by the requester in the security header, including the user's role and the purpose for use of the transaction.

4.7.2 Access Consent

The discussions of the Policy Development Committee of the NC HIE Council indicate a desire to establish an information exchange in North Carolina that is "person-centric." A precise definition of

this term may not exist, but for our purposes, we can assume that this means (in part) that consumers/patients have significant control over who may access their healthcare information and for what purpose.

There are a number of factors that may influence the degree to which the concept of a “patient-centric” HIE may be put into practice, however. These include:

1. State or federal laws that may compel access or deny access in certain situations
2. Healthcare providers may have strong desires to restrict access to certain information until they have reviewed that information with consulting specialists or with the patient
3. The hierarchical architecture of the NC HIE envisions some amount of autonomy for Community HIEs and other connected organizations; these Community HIEs and organizations may choose to give patients differing rights to participate in the HIE network.

Given these sometimes competing factors, the task for a technical architecture is to provide a framework that allows a wide variety of access consent policies to be implemented. That is the goal of these recommendations:

1. Allow patients, healthcare providers, and connected organizations to establish access consent policies, subject to restrictions derived from federal or state law, policy decisions of the NC HIE, or policy decisions of Community HIEs or connected organizations.
2. Access Consent Policies may be established in a Community HIE or in the NC HIE or both.
3. Access Consent Policies must be enforced where they are established.
4. Access Consent Policies may grant or deny access to information based on these attributes:
 - a. the patient’s identity
 - b. the requester’s identity
 - c. the requester’s role
 - d. the specific document
 - e. the class of document
 - f. the purpose for use of the request
 - g. the time of the request (that is, the policy may have a start and end date)
5. The facilities and protocols to exchange policies between Community HIEs and the NC HIE, or among the Community HIEs, must be developed. Where applicable, the standards developed by the NHIN Trial Implementation should be followed (recognizing that these standards are still under development).
6. Both the NC HIE and Community HIEs must have the ability to reconcile potentially conflicting access consent policies that have been created in different settings. This includes establishing a priority among policies created by different actors (for example patients and providers), and reconciling policies created by the same actor in different settings (for example, a patient creating access consent policies in a PHR and through their physician)

Any Community HIE may choose to address access consent by incorporating PHR functions such as direct consumer logins and the ability to view and edit access consent permissions. The standards to exchange access consent policies between a PHR application and an HIE are not well established, but work is proceeding to define the structure of access consent policies and the protocols for their exchange in several bodies, including OASIS, HL7, HITSP, and the NHIN Cooperative.

Access consent can be managed through PHRs or by other means. For example, the NC HIE or a Community HIE may provide a web-based application that allows both consumers and providers to establish access consent policies. The technical architecture of the NC HIE proposed in this White

Paper will accommodate the use of PHR applications to perform this function, but does not require the existence of a PHR.

The vocabularies adopted for specifying “user role” and “purpose for use” by the NHIN are presented in Appendix B.

4.8 Clinical Data Content

4.8.1 Background

This section will describe the Clinical Data Content requirements for HIE capability in North Carolina. It is narrowly focused on the content to be exchanged among healthcare providers and made available to consumers/patients; while the overall structure and architecture of a healthcare information exchange is important, these considerations are addressed elsewhere. The clinical content requirements were influenced by the proposed overall architecture based on the exchange of Clinical Documents, rather than a message exchange model. Thus, the clinical content requirements documented in this paper refer to Clinical Document standards.

While adherence to standards adopted by the federal government for the NHIN program is not a requirement for HIE in North Carolina, these standards provided a starting point for analysis of HIE content requirements. The committee adopted a posture of a presumption in favor of utilizing the content standards of the NHIN program unless an analysis of the particular needs and uses of HIE in North Carolina resulted in a recommendation for a different approach.

In general, the committee looked at clinical use cases to be accomplished through HIE, and described the content required to support these use cases in a general sense. Then, various Clinical Document standards were examined to determine the fit against the use case.

Clinical Document standards that were considered originate with four primary sources:

1. HL7
2. Integrating the Healthcare Enterprise (IHE)
3. HITSP, a public-private partnership established by the Office of the National Coordinator to harmonize standards for interoperability among clinical systems
4. The NHIN Cooperative, a collective working group made up of the 15 HIEs that participated in the NHIN Trial Implementations project.

4.8.2 Data Content Recommendations

The committee recommends that the following Clinical Document content types be considered a “basic starter set” of content for exchange in North Carolina. This should be interpreted to mean that organizations should share information among themselves and with consumers/patients in these formats when they have such information available, and they should be prepared to receive information in these formats from other organizations in North Carolina.

1. Patient/Encounter Summary Records. This is the broadest category, and is intended to subsume a variety of clinical documentation that may be used to document an episode of care for a patient, including (among others) a hospital discharge summary, a referral note, a history and physical note, a consultation note and an evaluation note.
2. Medication History and Allergies. While information about a patient’s medication history and allergies can be expected to be found in certain patient or encounter summary records, the committee recommends that it also be included as a separate content type so that this information can be more easily located when searching a patient’s available documents.
3. Laboratory Results.

4. PHRs. The information contained in a PHR may overlap greatly with that contained in a patient or encounter summary record, but it is important to distinguish this as a separate document type with clear identification of its origin and chain of custody in order that this information remains a reliable input to the well care and sick care of the patient. .
5. Scanned Document. This may include any non-XML format, including plain text, images, or PDF. The committee felt it was important to accommodate these document types as a way to facilitate the exchange of information with organizations that use scanning of paper records.
6. Radiology/Imaging. The committee believes that it is important to address both radiology report and image exchange capabilities.

4.8.2.1 Document Standards

Corresponding to the six clinical content types identified above, the following standards are recommended for representing clinical information to be exchanged in North Carolina.

1. Summary Documents. The recommended standard for Summary Documents is the Continuity of Care Document (CCD), defined by HL7, and profiled by HITSP and the NHIN Cooperative.

The committee recommends that CCD documents be created to encapsulate information from a single “patient encounter.” Generally speaking, a “patient encounter” refers to a single hospital stay or ambulatory clinic visit. This CCD Document Format can be used to encode documents that are created for more specific purposes, such as documenting a patient summary for a transfer or referral.

2. The Medication History and Allergies document can also be encoded using the HL7 CCD.
3. Laboratory Results should be encoded as described in the IHE XD-Lab Document standard. Although Lab Results can be included in the CCD, the XD-Lab document has specific profile elements that describe how to encode unique elements related to the laboratory domain, such as the origin of specimens and the relationship between the specimen and the results.
4. PHR documents should be encoded using the HL7 CCD and the other formats listed here when the corresponding data type is being presented. This capability should be developed to support the ARRA requirement that health information about a person in electronic form be transmitted to that person in electronic form upon request.
5. Scanned Documents should be encoded as described in the IHE XDS-Scanned Document profile. This profile describes encoding a PDF document or plain text document as binary-encoded data inside the “non-structured” section of a CDA document. This standard calls for the use of the same structured metadata that applies to other document types to apply to scanned documents, allowing for robust searching and management of this inherently unstructured data.
6. Radiology reports and images will follow the content standards prescribed by the standards of the Digital Imaging and Communications in Medicine (DICOM), including the DICOM Structured Reports standard for reports. The format for images may follow the DICOM standards, or may simply use images viewed in a web browser, depending on the protocols used for exchanging these images.

The following table presents links to detailed information about the referenced document standards.

Standard	Link
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HL7 Continuity of Care Document	http://www.hl7.org/library/General/HL7_CCD_final.zip
HITSP Summary Documents using HL7 Continuity of Care Document	http://www.hitsp.org/ConstructSet_Details.aspx?&PrefixAlpha=4&PrefixNumeric=32
IHE XD-Lab Document	http://www.ihe.net/Technical_Framework/upload/ihe_lab_TF_rel2_1-Vol-3_FT_2008-08-08.pdf
NHIN Cooperative profile of both CCD and XD-Lab (Document and Spreadsheet in the “Data Specifications” section)	http://healthit.hhs.gov/portal/server.pt?open=512&objID=1194&parentname=CommunityPage&parentid=4&mode=2&in_hi_userid=10741&cached=true
XDS-Scanned Documents (See Section 5.2 of this document)	http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_5-0_Vol2_FT_2008-12-12.pdf
DICOM (See specifically the Appendix of Document 03)	ftp://medical.nema.org/medical/dicom/2008/

4.8.3 Coded Healthcare Vocabularies

Providing healthcare data in a common structured format is the first step in enabling an EMR system to process and understand information created in a different EMR system. To enable complete “semantic” interoperability, a common vocabulary must be used between the two systems. Standard healthcare vocabularies, often referred to as “coded” vocabularies, because of their use of alpha-numeric codes rather than English words or mnemonic phrases, are used to represent such concepts as symptoms, diagnoses, laboratory tests and results, admission types and medications.

A set of standard vocabularies have been published by the same standards agencies that defined the document formats. The Technical and Operations Committee endorses the vocabulary standards adopted by the NHIN Cooperative, referred to in the table above.

The committee acknowledges that 100% compliance with these vocabulary standards is not achievable in the short term. Nonetheless, the NC HIE should set a target for the use of standard healthcare vocabularies wherever possible, and should assist providers, their vendors and Community HIEs in achieving compliance with these vocabulary standards. The use of these common coded vocabularies is necessary to move beyond the mere exchange of healthcare information towards a more robust use of healthcare information in both treating individual patients and in analyzing population data to discover trends, track outcomes and improve quality.

The NC HIE should offer a healthcare vocabulary service that can be accessed by Community HIEs, consumers, and providers. This service can serve as a centralized “reference” repository for the vocabulary standards recommended for use in the NC HIE, and can also provide translation services to map non-standard vocabularies to the recommended standards. There is an operational expense associated with establishing and maintaining translations between code systems, but having this service provided by the NC HIE can allow that expense to be shared across all providers in North Carolina that require this service.

4.8.4 Document Metadata

In addition to the data standards for the content of clinical documents exchanged in the NC HIE, it is necessary to have data standards for the “metadata” used to describe those documents. This metadata is used to catalog the documents in the Document Registry of the NC HIE (and also in Community HIEs), to enable searches for information to be more selective than simply “find all documents for this patient.” The Document Sharing protocols adopted by HITSP and the NHIN define a number of metadata elements, but only a half-dozen or so are useful as search parameters.

The NHIN Cooperative adopted an initial specification for the data standards to be used for document metadata in the NHIN. However, this specification was recognized as being incomplete due to the lack of suitable coded vocabularies for several key elements. The NHIN Cooperative is expected to revise the specification for document metadata during 2009.

The Technical and Operations Committee recommends that the NC HIE adopt the same document metadata standards as used by the NHIN, recognizing that these standards are a work in progress.

Appendix C is a description of the existing document metadata standards adopted by the NHIN Cooperative.

4.8.5 Discussion of Alternatives

Considering alternatives for standards has resulted in the following points:

1. Medication History from SureScripts or other pharmacy networks. An HIE should not act as a routing or transport mechanism for a prescription between a clinician's EMR and a Pharmacy system. An HIE should not attempt to duplicate the functionality of existing ePrescribing systems (i.e. Surescripts); however, an HIE should be able to retrieve information from those networks. Most existing EMR applications provide this capability, and the committee felt that it was best to not have the HIE interfere with the mechanism for obtaining medication history and reconciling medications that these applications provide. However, where Use Cases support independent retrieval of medication history the Statewide and Community HIEs should implement this interface. Community HIEs may choose to offer an EMR functionality and where that functionality is offered, ePrescribing and Medication Management should be well supported by the Community HIE program. The NC HIE will have to determine what event should be used to trigger the retrieval of medication history from Surescripts, and how to administer transaction fees.
2. Message-based exchange. The committee did not extensively discuss exchanges based on HL7 messages. Generally, the committee wished to remain compliant with national standards and data sharing architectures, which are focused on the sharing of Clinical Documents.
3. Other Document Types. There are a wide variety of other document types that could be considered for exchange on the NC HIE. Some of these document types that have been profiled by the IHE Patient Care Coordination technical committee are:
 - Referral Summary
 - ED Referral
 - Triage Note
 - ED Nursing Note
 - Composite Triage/Nursing Note
 - ED Physician Note
 - Antepartum Summary
 - Functional Status Assessment

It is the committee's belief that HIE will be facilitated by having fewer document standards, rather than more, and that all of the information intended to be carried in these other document formats can also be represented in the HL7 CCD. Therefore, we have recommended using only the CCD to

carry various kinds of patient summary data. The document metadata can be used to distinguish among documents that were created for various purposes in various settings.

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5 Moving Forward

As mentioned in the Executive Summary, this paper is a proposed architecture based on a snapshot of the current state and national HIT efforts. The ARRA has energized and accelerated change in the whole HIT world. With this paper, we have put a stake in the ground. However, the ground is made of sand. It is quite probable that the proposed architecture will be revisited and changed as we begin to better understand the environment that we will find ourselves in. Uncertainty and rapid change, however, is no reason not to proceed. As someone once said, "The best way to predict the future is to help build it."

Some aspects will remain, such as the use of SOA and Web Services as the basis for the architecture and the importance of citizen control of their health records. Other aspects may evolve over time such as the number of Community HIEs that will be built by independent organizations, and whether those HIEs will connect to the NHIN through the state-level HIE or more directly, qualifying as NHIEs themselves.

We believe that the next steps should be non-technical in nature, the application of these architectural constructs to the activities of other NC HIE Council committees, particularly the Finance & Administration and Policy Development committees. At some appropriate point, the NC HIE Council and State of North Carolina will need to prioritize a set of initial use cases to be implemented, along with governance, funding and sustainability plans to support them. At that point in time, this white paper (after being revisited and revised) should provide overall guidelines for the implementation of the North Carolina HIE.

6 Appendix A – Background Information on Object Identifiers, Patient Identifiers, PIX and PDQ

6.1 Object Identifiers and Patient Identifiers

An Object Identifier, or OID, is an identifier in a hierarchically assigned namespace, where each node in the identifier is an integer that represents an object such as an organization or individual. For example, the OID that represents the Mayo Clinic is 2.16.840.1.113883.3.2, where each node is defined as follows:

2 : ISO/International Telecommunication Union
2.16 : Country
2.16.840 : United States
2.16.840.1 : organization
2.16.840.1.113883 : HL7
2.16.840.1.113883.3 : organization
2.16.840.1.113883.3.2 : Mayo Clinic

Conceptually, each successively longer node in the OID is “owned” by the previous node; that is, each entity except the last node in the OID must have a mechanism for assigning additional nodes in such a way that each complete OID distinctly and unambiguously represents the intended object. This notion of owning and assigning OIDs is generally accomplished by an OID “Registry.” In the healthcare domain, HL7 acts as an OID Registry and assigns OIDs to organizations (and also to healthcare terminologies and other objects) under the OID “2.16.840.1.113883.” An organization, such as the NC HIE or a Community HIE, could apply to HL7 and be assigned an OID that is guaranteed to be globally unique. That organization would then have to establish a scheme for assigning identifiers (extending that “base” OID) to represent entities within the HIE.

HL7 messaging and document standards and the IHE Cross-Community Document Sharing profile provide explicit definitions of how patient identifiers are to be represented in various message and document contexts in an HIE. A Patient Identifier (Patient ID) consists of two parts:
Patient Identity Assigning Authority in the form of an OID
An identifier in the above Assigning Authority domain.

This two-part Patient ID will be encoded differently depending on the context. Consider a Patient ID of “MRN12345” assigned by Mayo Clinic using the OID given above.
In an HL7 version 2 message, this Patient ID would be represented as:

```
MRN12345^^&2.16.840.1.113883.3.2
```

In a CDA Document, this Patient ID would be represented as:

```
<id root="2.16.840.1.113883.3.2" extension="MRN12345"/>
```

In a XDS Document Query, this Patient ID would be represented as:

```
<Value>MRN12345^^&2.16.840.1.113883.3.2&ISO</Value>
```

The meaning of each of these is the same: The Mayo Clinic asserts that the identifier “MRN12345” uniquely represents some patient within the Mayo Clinic. Some other organization may use “MRN12345” to represent a different patient (or indeed, to represent a nurse or a laboratory test result or a heart-rate monitor), but the combination of “MRN12345” and the OID “2.16.840.1.113883.3.2” unambiguously represents one and only one patient.

6.2 IHE PIX and PDQ

The widely accepted standard for exchanging information about patient IDs are the Patient Identity Cross-Reference (PIX) and Patient Demographic Query (PDQ) profiles defined by Integrating the Healthcare Enterprise (IHE). These profiles describe the use of HL7 messages (with supported variations for both HL7 version 2 and version 3) to provide the operations necessary to manage patient IDs across organizations. The operations defined by PIX and PDQ are:

- Patient Identity Feed: used to inform another entity about a patient identity
- PIX Update Notification: used to inform another entity about changes to a patient identity
- PIX Query: used to query another entity about Patient IDs that are linked (that is, assumed to be the same individual) as a given Patient ID
- Patient Demographics Query: used to query another entity about individuals who have the same or similar attributes (such as name, date of birth, gender or address) as the given attributes

The NC HIE Technical and Operations Committee recommends that the NC HIE maintain and operate a statewide MPI and provide an interface to Community HIEs and directly connected organizations using the IHE PIX and PDQ operations. At this time, the committee does not feel it is necessary to specify whether the HL7 version 2 or HL7 version 3 (or both) of the PIX and PDQ operations should be supported.

7 Appendix B: NHIN User Role and Purpose for Use Vocabularies

The User Role for transactions on the NHIN must be specified using one of the values in the following table.

Description	SNOMED CT Code
Audiologist	309418004
Dental Hygienist	26042002
Dentist	106289002
Dietitian	159033005
Complementary Healthcare worker	224609002
Professional nurse	106292003
Optometrist	28229004
Pharmacist	46255001
Chiropractor	3842006
Osteopath	76231001
Medical doctor	112247003
Medical pathologist	61207006
Podiatrist	159034004
Psychiatrist	80584001
Medical Assistant	22515006
Psychologist	59944000
Social worker	106328005
Speech therapist	159026005
Medical Technician	307988006
Orthotist	309428008
Physiotherapist AND/OR occupational therapist	106296000
Veterinarian	106290006
Paramedic/EMT	397897005
Minister of religion AND/OR related member of religious order	106311007
Philologist, translator AND/OR interpreter	106330007
clerical occupation	159483005
Administrative healthcare staff	224608005
Infection control nurse	224546007
insurance specialist (health insurance/payor)	307785004
Patient	116154003
Patient advocate	429577009
Profession allied to medicine (non-licensed care giver)	309398001
IT Professional	265950004
law occupation	271554005
Public health officer	307969004

The Purpose for Use for transactions on the NHIN must be specified using one of the values in the following table:

Purpose for Use vocabulary	Code
Treatment	TREATMENT
Payment	PAYMENT
Healthcare Operations	OPERATIONS
Fraud detection	FRAUD
Use or disclosure of Psychotherapy Notes	PSYCHOTHERAPY
Use or disclosure by the covered entity for its own training programs	TRAINING
Use or disclosure by the covered entity to defend itself in a legal action	LEGAL
Marketing	MARKETING
Use and disclosure for facility directories	DIRECTORY
Disclose to a family member, other relative, or a close personal friend of the individual,	FAMILY
Uses and disclosures with the individual present.	PRESENT
Permission cannot practicably be provided because of the individual's incapacity or an emergency	EMERGENCY
Use and disclosures for disaster relief purposes.	DISASTER
Uses and disclosures for public health activities.	PUBLICHEALTH
Disclosures about victims of abuse, neglect or domestic violence.	ABUSE
Uses and disclosures for health oversight activities.	OVERSIGHT
Disclosures for judicial and administrative proceedings.	JUDICIAL
Disclosures for law enforcement purposes.	LAW
Uses and disclosures about decedents.	DECEASED
Uses and disclosures for cadaveric organ, eye or tissue donation purposes	DONATION
Uses and disclosures for research purposes.	RESEARCH
Uses and disclosures to avert a serious threat to health or safety.	THREAT
Uses and disclosures for specialized government functions.	GOVERNMENT
Disclosures for workers' compensation.	WORKERSCOMP
Disclosures for insurance or disability coverage determination	COVERAGE

8 Appendix C – NHIN Document Metadata specification

[Note: The contents of this appendix were prepared by a 2008 working group of the NHIN Cooperative.]

Contributors

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This document contains a listing of the allowed values for coded elements found in the document metadata defined by the IHE XCA protocol, which forms the basis for the document sharing standards to be used in the NHIN (NHIN) Trial Implementation Project. Metadata elements that do not require coded elements are not described here.

Recent discussions among a sub-group of the NHIN Cooperative Technical and Security working group and HITSP technical committee members have led to proposed revisions and extensions to the value sets for XCA metadata originally defined in the Query for Documents specification. The members of this “metadata subgroup” are identified in the “Contributors” table above. The group has identified areas where further investigation and discussion needs to occur to recommend a value set for certain metadata elements. This investigation will not occur in time for implementers to incorporate the value sets into their products by the September, 2008 demonstrations of the NHIN Trial Implementations.

This document serves as a snapshot of the requirements for the XCA metadata for September 2008. Implementers should expect that revisions to the recommended value sets for XCA metadata will be forthcoming. It is expected that eventually HITSP will adopt value sets for XCA (and XDS) metadata as part of its specifications.

This document will be incorporated into and should be considered a part of the Query for Documents specification. It is presented as a stand-alone document to facilitate discussion around the metadata elements and to draw the attention of NHIN implementers to the requirements.

Document metadata elements (including non-coded elements defined by the XCA profile) are used in several ways in a document sharing environment such as is being developed for the NHIN Trial Implementations. The primary uses of the metadata are:

1. To facilitate efficient searches for documents,
2. To provide detailed information that users can review to determine which documents they wish to retrieve and view, and
3. To provide information that computer systems can use to determine if they are capable of displaying and/or parsing the document, and to determine if the requesting user has permission to access the document.

Each of the metadata elements may contribute to some or all of these uses. Efficient document searches can best be facilitated by limiting search parameters to a few elements, each with a coarse granularity. For document searches on the NHIN, it is recommended to use the following elements as the primary search parameters:

- Class Code
- Practice Setting Code
- Healthcare Facility Type Code
- Document Creation Time (not a coded element and thus not further described in this document)

8.1 Class Code

Class Codes should be drawn from a limited set of LOINC document codes. For the NHIN Trial Implementations, this list should be restricted to those in the following table.

The coding scheme for LOINC is 2.16.840.1.113883.6.1.

Code	Display Name	Additional comments
34133-9	SUMMARIZATION OF EPISODE NOTE	Used for Summary Patient Record (CCD)
11502-2	LABORATORY REPORT.TOTAL	Used for Laboratory Reports
10160-0	History of Medication Use	Used for documents containing only a consumer's medication history
44943-9	Self management: ^Patient	Used for patient-provided documents, such as from a PHR

8.2 Practice Setting Code

Practice Setting Code refers to the clinical specialty that performed the act or encounter that resulted in the document creation. No suitable existing value set has been identified that would meet the goal of providing for efficient searches. The value set in the following table has been defined to act as a "provisional" value set (drawing from some medical specialties relevant to the NHIN Use Cases) until a more complete value set is defined. The primary purpose of specifying this incomplete value set at this time is to remind implementers of the importance of practice setting as a document search parameter.

Where possible, NHIes should support these codes on Document Queries and return one of these codes on Document Query responses.

These codes are taken from SNOMED CT; the coding scheme for these codes is 2.16.840.1.113883.6.96.

Code	Display Name
394802001	General Medicine
408478003	Critical Care Medicine
410001006	Military Medicine
408440000	Public Health Medicine

8.3 Healthcare Facility Type Code

Healthcare Facility Type Code refers to the location of the act or encounter that resulted in the creation of the document. The value set is the same as the value set defined by HL7 for Service Delivery Location, and used in the Continuity of Care Document (CCD) Implementation Guide for specifying location types.

This value set is perhaps too large to facilitate efficient searches, and the “metadata subgroup” will consider consolidating these values into a smaller list.

The list presented in the table below has removed some logically duplicate values present in the HL7 ServiceDeliveryLocationRoleType value set.

The coding scheme for these values is 2.16.840.1.113883.5.111.

Code	Display Name
281PC2000N	Hospitals; Chronic Disease Hospital; Children
282NC2000N	Hospitals; General Acute Care Hospital; Children
282NR1301N	Hospitals; General Acute Care Hospital; Rural
282NW0100N	Hospitals; General Acute Care Hospital; Women
283XC2000N	Hospitals; Rehabilitation Hospital; Children
2865C1500N	Hospitals; Military Hospital; Community Health
2865M2000N	Hospitals; Military Hospital; Medical Center
2865X1600N	Hospitals; Military Hospital; Operational Component Facility
ACC	accident site
ALL	Allergy clinic
AMB	Ambulance
AMPUT	Amputee clinic
BMTC	Bone marrow transplant clinic
BMTU	Bone marrow transplant unit
BREAST	Breast clinic
CANC	Child and adolescent neurology clinic
CAPC	Child and adolescent psychiatry clinic
CARD	Ambulatory Healthcare Facilities; Clinic/Center; Rehabilitation: Cardiac Facilities
CATH	Cardiac catheterization lab
CCU	Coronary care unit
CHEST	Chest unit
CHR	Chronic Care Facility
COAG	Coagulation clinic
COMM	Community Location
CRS	Colon and rectal surgery clinic
CVDX	Cardiovascular diagnostics or therapeutics unit
DADDR	Delivery Address
DERM	Dermatology clinic
DX	Diagnostics or therapeutics unit
ECHO	Echocardiography lab
ENDO	Endocrinology clinic
ENDOS	Endoscopy lab
ENT	Otorhinolaryngology clinic
EPIL	Epilepsy unit
ER	Emergency room
ETU	Emergency trauma unit

FMC	Family medicine clinic
GACH	Hospitals; General Acute Care Hospital
GI	Gastroenterology clinic
GIDX	Gastroenterology diagnostics or therapeutics lab
GIM	General internal medicine clinic
GYN	Gynecology clinic
HAND	Hand clinic
HD	Hemodialysis unit
HEM	Hematology clinic
HOSP	Hospital
HTN	Hypertension clinic
HU	Hospital unit
ICU	Intensive care unit
IEC	Impairment evaluation center
INFD	Infectious disease clinic
INV	Infertility clinic
LYMPH	Lymipedema clinic
MGEN	Medical genetics clinic
MHSP	Military Hospital
MOBL	Mobile Unit
NCCF	Nursing or custodial care facility
NCCS	Neurology critical care and stroke unit
NEPH	Nephrology clinic
NEUR	Neurology clinic
NS	Neurosurgery unit
OB	Obstetrics clinic
OF	Outpatient facility
OMS	Oral and maxillofacial surgery clinic
ONCL	Medical oncology clinic
OPH	Ophthalmology clinic
ORTHO	Orthopedics clinic
PAINCL	Pain clinic
PC	Primary care clinic
PEDC	Pediatrics clinic
PEDCARD	Pediatric cardiology clinic
PEDE	Pediatric endocrinology clinic
PEDGI	Pediatric gastroenterology clinic
PEDHEM	Pediatric hematology clinic
PEDHO	Pediatric oncology clinic
PEDICU	Pediatric intensive care unit
PEDID	Pediatric infectious disease clinic
PEDNEPH	Pediatric nephrology clinic
PEDNICU	Pediatric neonatal intensive care unit
PEDRHEUM	Pediatric rheumatology clinic
PEDU	Pediatric unit
PHARM	Pharmacy
PHU	Psychiatric hospital unit
PLS	Plastic surgery clinic
POD	Podiatry clinic
PRC	Pain rehabilitation center
PREV	Preventive medicine clinic
PROCTO	Proctology clinic
PROFF	Provider's Office
PROS	Prosthodontics clinic
PSI	Psychology clinic
PSY	Psychiatry clinic
PSYCHF	Psychiatric Care Facility

PTRES	Patient's Residence
RADDX	Radiology diagnostics or therapeutics unit
RADO	Radiation oncology unit
RH	Rehabilitation hospital
RHEUM	Rheumatology clinic
RHU	Rehabilitation hospital unit
RNEU	Neuroradiology unit
RTF	Residential treatment facility
SCHOOL	School
SLEEP	Sleep disorders unit
SNF	Skilled nursing facility
SPMED	Sports medicine clinic
SU	Surgery clinic
SURF	Substance use rehabilitation facility
TR	Transplant clinic
TRAVEL	Travel and geographic medicine clinic
URO	Urology clinic
WND	Wound clinic
WORK	work site

8.4 Event Code

Event codes are not required to be supported on NHIN Document Queries or responses.

8.5 Confidentiality Code

Confidentiality Code is intended to provide some information about the sensitivity of the data contained in the document to assist systems in determining if the requesting user should be allowed to access the document.

The only value set widely used for confidentiality code today does not provide sufficient information to be very useful in fulfilling this intended purpose. The “metadata subgroup” will look to identify a richer value set that can be used in conjunction with a NHIN Consumer Preference Profile to allow consumers to control access to their sensitive information.

In the meantime, NHIes should return a confidentiality code from the HL7 Confidentiality Codes value set on Document Query responses. NHIes are not required to support Confidentiality Code as a query parameter. The coding scheme for these values is 2.16.840.1.113883.5.25.

Code	Display Name
N	Normal
R	Restricted
V	Very restricted

8.6 Format Code

According to the IHE profiles, the Format Code “should provide sufficient information to allow any potential XDS Document Consumer to know if it will be able to process the document.” There is little additional guidance to follow in selecting a value set to accomplish this purpose. The IHE Patient Care domain defines a format code of “urn:ihe:pcc:xds-ms:2007” for medical summary documents, and the IHE Laboratory domain specifies the use of the document template identifier as defined by the CDA schema for a lab document (1.3.6.1.4.1.19376.1.3.3).

For the NHIN Trial Implementation, in order for an NHIE to process (i.e. display) the Patient Summary Record, it must know that it conforms to the HL7 CCD implementation guide. For web-based viewers, an XML Stylesheet can then be applied to display the document in a web browser. For this reason, the use of the template identifier defined by HL7 for CCD documents (2.16.840.1.113883.10.20.1) seems appropriate.

Those NHIEs supporting unstructured documents using the XDS-Scanned Document profile may use the format types for PDF and text as defined by that profile.

The value set for Format Type to support the document types identified by the Core Services Content working group for the NHIN Trial Implementations is shown in the following table. Since these values are globally unique, no coding scheme attribute is required.

Code	Description
2.16.840.1.113883.10.20.1	HL7 CCD Document
1.3.6.1.4.1.19376.1.3.3	IHE XDS-Lab Document
urn:ihe:iti:xds-sd:pdf:2008	PDF embedded in CDA per XDS-SD profile
urn:ihe:iti:xds-sd:text:2008	Text embedded in CDA per XDS-SD profile

8.7 Document Type Code

Document Type Code is intended to provide a fine-grained classification of the document type. It is not primarily intended to be used as a search parameter, but rather for a user to review in a list of documents returned from a query.

For NHIN Query Document responses, NHIEs should provide a LOINC document code as the document type code. If no other (more granular) code is available, the Document Class Code may be returned.

The complete list of LOINC document codes is over 500 codes and is not reproduced here. LOINC is inconsistent in defining document codes using the six primary LOINC attributes; however, choosing codes whose CLASS attribute begins with "DOC" or "ATTACH" gives a usable subset of LOINC codes for Document Type.

9 Appendix D – A Proposed Method for Identity Proofing Patients to the NC HIE

[Note: this memo was prepared for the NC HIE during the NHIN Trial Implementations project by IBM in their role of providing HIE services to NCHICA to support the NHIN project. The memo contains references to the “IBM HSP Solution.” In the context of the NC HIE, this can be equated to the “NC HIE MPI.”]

9.1.1 Summary of Issue:

The core requirement of the Consumer Access to Clinical Information (CACI) Use Case is that a PHR user may access clinical documents from their care providers through a NHIN-enabled HIE (NHIE). This means that the NHIE needs a highly accurate and secure method for correlating a PHR user's identity (the user ID from the PHR system) to his or her identity on provider documents maintained by the NHIE. This patient correlation method should be secure enough to prevent a fraudulent attempt to access a person's medical records by impersonating that person through a PHR.

9.1.2 Recommendation:

The method recommended for the North Carolina HIE to correlate PHR users to their clinical data from providers is to have the staff of the provider members of the NC HIE issue a secure “personal identification number” (PIN) to patients when they visit the provider facility. The patient then enters that secure PIN into the PHR application, which issues a request to the NC HIE to correlate the PHR user to the registered patient in the NC HIE.

This approach is based on a method used and demonstrated by CapMed, where pharmacists at the Kerr Drug pharmacy chain were utilized as a trusted entity to verify the patient's identity and issue the secure PIN. By following this recommendation, it will be possible to expand the types of people who can issue secure PINs (to include, for example, pharmacists, a representative of a payer organization, or anyone else who has a trust relationship with the patient and can verify his or her identity) without changing the implementation required by the NC HIE and the PHR applications.

9.1.3 Alternatives:

The alternative to using a secure PIN and trusted entity is to use the probabilistic matching algorithms of Initiate Identity Hub to correlate a PHR user to an existing entity in the NC HIE to a PHR user based on personal and demographic information, such as date of birth, gender, name, address and phone number. This method is used to correlate patient information from multiple clinical providers in North Carolina and across the nation through the NHIN. In this scenario, the Initiate software may return several possible matches, with a “confidence score” to indicate the algorithm's judgment of the accuracy of the match for each candidate. When multiple matches are returned, the user who initiated the request must choose between the multiple matches to select the correct patient, a process that may involve asking the patient for additional information, such as a former address or name.

This method is not suitable for PHR users, for two reasons:

1. The PHR user is not an “authorized” NC HIE user and should not see information about other people that the matching algorithm has identified as possible matches.
2. This method is susceptible to intentional fraud, where a patient provides false information in an attempt to access someone else's medical records.

9.1.4 Detailed Description of Proposed Solution:

The proposed solution for the NC HIE utilizes the following steps:

1. A patient is registered to the NC HIE by an authorized user. Registration to the NC HIE is only done by logging on to the NC HIE secure web site and accessing the “Patient Registration” screen. (Other methods may be utilized in the future, such as sending a registration request from an EMR system.) Only administrative users of the NC HIE have permission to register new patients. There are three types of administrative users in the IBM HIE Service Provider (HSP) solution:
 - a. HSP Administrator – this is generally an IBM team member
 - b. HIE Administrator – a user representing NCHICA
 - c. Data Source Organization (DSO) – an administrative user (i.e. IT administrator or registration clerk) of an NC HIE provider member
2. The administrator asks if the patient either has a PHR through one of the NC HIE preferred PHR applications, or is interested in obtaining one. If so, the administrator accesses another screen to create a “one-time use PHR PIN” for this patient. This step may be performed at the time of registration, or at a later time. When performing this function, the administrator must also verify the identity of the person by checking a photo identification.
3. The IBM HSP creates a “one-time use PHR PIN,” which is a two-part identifier.
 - a. The “root” portion of the PHR PIN is a constant: 1.3.18.103.4.1. (This is an extension of the Object Identifier assigned to represent the NC HIE.)
 - b. The “extension” portion of the PHR PIN is a random number between 1,000,000 and 9,999,999; the HSP must ensure that the PIN chosen does not already exist as a PHR PIN. (A seven-digit number is sufficiently long to not be guessed by an intruder, but not too long to present difficulty for the user to enter it on the screen.)
 - c. Only one PHR PIN may be recorded for a patient at a time.
4. The IBM HSP records the PHR PIN, linked to the patient’s “Community ID” (CAD ID) in its Patient Identity Cross-Reference Manager component (Initiate Identity Hub). If possible, this patient ID should be valid only for a limited time-period, such as one week.
5. The administrator prints the page showing the “extension” portion of the PHR PIN and information about how to access the NC HIE preferred PHR applications. The administrator gives the patient the printout.
6. The patient accesses the PHR application of his or her choice, using the information provided. After creating a PHR account (if one does not already exist), the patient can access the function of the PHR to “link” the PHR to the NC HIE. The patient is prompted to enter the “extension” portion of the PHR PIN.
7. The PHR application executes a Patient Identity Cross-Reference Query (PIX Query) operation – as defined by the IHE PIX profile and using an HL7 message. The PHR application supplies the “root” portion of the PHR PIN: 1.3.18.103.4.1, and the “extension” portion entered by the user.
8. The IBM HSP (Initiate Identity Hub component) responds to the PIX Query by providing the linked Community ID. The IBM HSP also removes the PHR PIN from its Patient Identity Cross-Reference data store.
9. The PHR application associates the Community ID with the patient’s PHR account, and uses this Community ID on all future operations with the HSP.
10. The patient may also access the NC HIE web application to set access consent permissions and other user options. Single sign-on between a PHR and the NC HIE web application is the subject of another work item.

10 Appendix E – Authors

The people listed in the following table contributed to this white paper.

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The North Carolina Healthcare Information and Communications Alliance, Inc. (NCHICA) is a nationally recognized nonprofit consortium that serves as an open, effective and neutral forum for health information technology (HIT) initiatives that improve health and care in North Carolina. Members include leading organizations in healthcare, research and information technology.

Working closely with its members, NCHICA has the unique ability to convene and form partnerships to advance HIT adoption. NCHICA's leadership in conducting demonstration projects, hosting educational sessions and fostering collective efforts within North Carolina helps position the state at the vanguard of national HIT acceleration efforts.

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