

Rural Regional Health Information Organization

Medical Informatics 405-DL
HIT Integration, Interoperability, and Standards
Section 52
May 27, 2009

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Introduction

As healthcare attempts to progress in the direction of complete interoperability, one solution that has been developed is the concept of the regional health information organizations (RHIO). The National Alliance for Health Information Technology (NAHIT) has been active in the development of standardizing terminology and defines RHIO as follows:

“A health information organization that brings together health care stakeholders within a defined geographic area and governs health information exchange among them for the purpose of improving health and care in that community.” (NAHIT, 2009)

The term RHIO is often used interchangeably with health information exchange or HIE. RHIOs can be classified as state, rural, local, or national (Wikipedia, 2009). For the purpose of this project, the RHIO is set in rural environment, meaning that it is a multi-stakeholder organization without a dominant purchaser, within one state, and it is anticipated that the subscriber base will be less than 100,000. The rural RHIO differs from the state and national RHIO by focusing on a specific region or geographic area while the state RHIO’s objective is to bridge the gap between the regional and national RHIO’s. (Wikipedia, 2009)

The RHIO will be key in promoting the improved use of patient information in meeting the federal objective to improve the quality of healthcare and the implementation of standards including addressing the issue of privacy and security. The participants in our rural RHIO that will be represented in this project are defined as follows:

- 5 Hospitals Spread throughout region
- 2 Laboratories
- 2 Radiology Centers
- 1 Surgery Center
- Physician offices (associated with the 5 rural hospitals, approximately 100+ offices)
- Information System Vendors
- Payers
- Patients
- Community
- Payers

Stakeholders

In the case of a RHIO, it is essential to understand who the stakeholders are and the role they play in the RHIO. Stakeholders are defined as a person, group or organization that may be effected by the project, in this case, the RHIO. (HIMSS, 2009) The stakeholders in a RHIO will participate at different levels based on the role they play in providing patient care. While some providers will require the ability to both send and receive information (push and pull) to the RHIO, others will only send information (push). The physician's office may choose to participate in the RHIO allowing them to send and receive information (push and pull) regarding the patient cared for in that office or clinic, while a laboratory would likely only send information (push) in the form of lab results. All stakeholders will have the choice to participate and at what level to participate. Participation will often be based upon the role the stakeholders plays. RHIO's are multi-stakeholder organizations that have numerous groups invested in the organization. Appendix 1 contains a complete list of the current stakeholders and future stakeholders along with their roles in the RHIO.

Business Need

The stakeholders listed in Appendix 1 have an interest in the clinical information that can be provided by a RHIO. Sharing of information can help the participants improve their care delivery systems by improving efficiency, eliminating redundancies, improving the flow of information, and increasing quality, safety, and patient satisfaction.

Electronic record exchange in the RHIO will allow timely access to patient information at the point and time of care and will eliminate the "pulling" of paper based records. It will allow the sharing of information between institutions, primary care physicians, specialists, and other providers from which a patient has received care. The exchange of the patient records within the RHIO allow for an accurate, up-to-date, and complete record of the patient to be available to all

approved participants. Electronic record data exchange will also allow rapid access to patient data for eligibility.

Electronic data exchange through the RHIO will collate information from different providers electronically which decreases the need for records personnel. This decrease in resources will be offset by the need for more IT personnel to maintain the information system. The availability of patient data will provide efficiencies in care due to decreases in repeated labs and x-rays. Patient visits will be more efficient and could be billed at higher levels of complexity due to the availability of more complete information from other physician visits and diagnostic testing results that are available within the RHIO.

Accurate billing for services will be another benefit of the RHIO. More complete billing information received from the RHIO will allow participants to submit more complete information and decrease incomplete claims filings. Accurate billing information will promote more rapid turnaround time for claims and fewer denials.

Patient satisfaction should be increased through participation in the RHIO. Patients will benefit by having fewer unsatisfactory visits due to missing test data both with their primary physician and with specialists. Patients will benefit from less repetition and recall of historical data with multiple providers, only needing to confirm data that is already present in their medical record. Patients and physicians will have more time to spend on current problems rather than repeating old information. Accurate and confirmable admission/discharge/transfer (ADT) data at each healthcare site will streamline the registration process.

The collation of data will provide caregivers with accurate lists of medications, allergies, and adverse reactions from a variety of sources. Testing results and problem lists will be widely available. Caregivers will be aware of others providing care for their patients and be aware of

care plans in place for the patient. Integrated care plans involving all providers can be developed and executed through the data exchange made possible by the RHIO. The RHIO will provide a mechanism to allow for more effective communication and collaboration between multiple providers.

There are other benefits to the RHIO, including the decreases in duplication of care and more complete patient data to be used in clinical decision support and guideline based care. Hospitals may also use the RHIO in a collaborative manner to help balance bed availability and admissions to appropriate settings in times of increased admissions or public health emergencies. Public health surveillance data will be more timely and accurate allowing the identification of health problems and emergencies. Constrained public health resources can be utilized effectively based on information obtained through the RHIO.

The RHIO will offer patients control over their information by allowing an opt-out clause. Patients will be encouraged to participate in the RHIO through educational initiatives. Brochures and media coverage will be presented prior to the rollout of the RHIO. The educational materials will be different based on the target audience, patients or providers, with a focus on the RHIO and its many benefits.

The RHIO will be available to all healthcare providers, hospitals, laboratories, radiology centers, vendors, payers, and patients who wish to participate. Standards for identification and access will allow information to be available to all who opt to participate. Finally, the RHIO functions as a backup, secure data storage site for all the participants in case of a natural disaster or a massive loss of data. (Schuerenberg, 2008)

Information Systems

There are two perspectives that should be considered when viewing the information systems that are to be used and integrated for a RHIO: the participants and the software that will run the RHIO. Each participant in the RHIO will have their own internal information systems, which only need conform to the data standards specified by the RHIO.

Participants Information Systems

Based on the stakeholders for the RHIO, the number of information systems that have to be integrated into the RHIO is quite large. Based on the current stakeholders, the information systems that must be integrated are: provider EMR/EHR, hospital information systems, lab systems, radiology and PACS systems, and local public health systems. Each information system will be provided by a different vendor requiring relationships to be developed with each vendor and a business case made to the vendor to encourage their participation in the RHIO. As the RHIO grows to include pharmacies, state and national public health organizations, and long term care facilities there will be additional information systems requiring integration within the RHIO.

Each of these information systems, regardless of origination, has to be able to export data transactions in a standardized format for the RHIO and must be able to import or read the patient data from the RHIO. For these systems to be integrated into the RHIO, they must use the interoperability standards put forth by the Health Information Technology Standards Panel (HITSP) standards specified by the RHIO such as HL7 DICOM and LOINC. The participant's information systems must be able to push and pull data. The RHIO will have a general viewer that can be easily integrated into a vendor's software package. The link from the vendor information systems into the RHIO must be easily integrated into each software system.

RHIO Software

The information system that will be used to implement and manage the RHIO can either be bought from a software vendor, built in-house, or be a hybrid system. Based on the organization's budget, time to implementation, long range objectives, and functional requirements (based on stakeholders' needs) a build versus buy decision can be made. (Murthi 2002) These criteria would take into account the functional requirements of the system needed to satisfy stakeholder needs. In Appendix 2, the advantages and disadvantages of the build, buy and hybrid systems are listed.

In the buy scenario the RHIO would purchase a product that is available from a vendor. Some of the advantages are speed to implementation and potentially lower costs. Infrastructure costs are limited to the servers, software, and databases required. Training of the staff and customization would be the responsibility of the vendor. Another advantage is that regulatory changes are typically the responsibility of the vendor. A few of the disadvantages are the ongoing license fees, which can add up over time; software upgrades are often done on the vendor's schedule not the organizations, high fees for customization, and purchasing more capabilities than are needed. Another potential disadvantage is financial stability of the software vendor.

In the build scenario the RHIO would develop a solution that is custom built from scratch. (McGowan 2004, Sears 2005) An advantage is the ability to build the functionality needed based on the business needs of the organization. The ability to quickly respond to changes in the market is an advantage that allows the RHIO to capitalize on opportunities or improve their competitive advantage. The organization would have the ability to fix, upgrade and add new functionality as it is needed by the organization. A disadvantage is the slower implementation time needed, due to hiring and training staff, creating business requirements,

coding and testing software, training users, and then rolling out the software. Another disadvantage is the organization must not only purchase the infrastructure to run the software (servers, software, and databases), but also the development staff infrastructure (personal computers, development software licenses, etc.) and pay for the overhead (office space, payroll, benefits, etc). Finally, it would be the organizations responsibility to maintain the software to meet regulatory standards.

A hybrid system would combine custom coded software with components purchased from other vendors. (Murthi 2002) In the healthcare software market, being able to buy components and seamlessly integrate them is challenging. The amount of work needed to get each component to work with the others would negate any time and cost savings. For the purpose of the RHIO described in this project, the build choice was chosen.

Requirements

The information system would now need defined functional requirements that include the basic architecture and security structure. The data model will be a relational database that sits in a central location utilizing a Master Patient Index to track the patients' records within the database. Access to the system would be based on security established and defined by the role of the participant. Any record that was accessed would be tracked allowing for auditing when necessary. Archiving processes would need to be established. The information in the RHIO is not considered a legal record but rather is a housing mechanism to bring records from multiple locations and providers together. The legal record will remain with the provider of service. Archiving processes would set a predetermined time frame for patient data to be moved into an archival system. The patient record would have to be available 24/7/365. Providers would have

access to a patient's record for 30 days, identified by ADT information being transmitted to the RHIO from any of the participants.

Patients would have the ability to opt-out of the RHIO. Due to the sensitivity of certain health information (minors, alcohol/drug abuse, HIV status, and mental health history), the patient would be required to make a choice of whether to include this information in their RHIO medical record snapshot. Finally, a disaster recovery plan and backup processes would need to be established and tested on a routine basis. These requirements are the basic building blocks of the information system. Business requirements and technical requirements would have to be created and agreed to by stakeholder representatives prior to development beginning.

Operational Structure

Data ownership, privacy, and inappropriate use of patient data are always concerns when patient data is being moved from one system to another. Standard operating procedures (SOPs) would have to be established to address these issues. Stakeholders should be involved in creating, approving, reviewing, and maintaining these procedures. Appendix 3 lists a few of the SOPs that should be developed at a minimum; others should be developed based on the recommendations of the management council. The management council should establish SOPs around these issues prior to going live. A communication and training plan would be established to ensure participants and patients are aware of the SOPs. It would be the responsibility of the RHIO management council to enforce compliance with the SOPs and to ensure they were updated as appropriate.

Standards

The challenges in developing a successful RHIO are numerous; however, none equal the impact that the lack of industry standards for data integration has on the fundamental

components of the organization. With the RHIO's very existence dependent upon data integration from multiple sources in support of clinical practice and patient treatment, the lack of healthcare data standards in support of this effort puts many RHIO's existence in jeopardy. Attempting to determine the developmental efforts and successful implementations of RHIO's across the nation, Harvard University completed a study with some very interesting findings. As of July, 2006, the total RHIO's in existence at that time, 54% were still in the planning stages as of early 2007. In addition, they found that 26% could be classified as defunct or no longer anticipated to be completed. Consequently, of the total number of RHIO's which were in existence in mid-2006, 80% were either still in the planning stages or defunct, thus resulting in only a 20% success rate for those communities which ventured into this arena. (Adler-Milstein, 2008) Adding to these challenges, a Washington-based technology think tank, Information Technology & Innovation Foundation released a report in November 2007 contending that most RHIO's are financial unsustainable. Further more, they found: "The strategy of building a National Health Information Network from the bottom up by establishing many regional health information organizations throughout the country is not working," the report states. "More than 100 s have been established across the country, but in the absence of clear national standards for sharing medical data, achieving system interoperability for RHIO's has been difficult." (Castro, 2007) The conclusion is that the lack of clear national standards is prohibitive to connecting members of a RHIO. Universally, it is clearly evident additional work is needed in this arena.

Although lacking the necessary health data standards for multiple system integration as noted above, a few standards do exist which would support development efforts; however, determination of appropriate standards for use are dependant upon the data distribution philosophy deployed. Currently, there are two philosophical principles utilized for this purpose, a

central database configuration or a distributive approach for data access. In looking at these two approaches (Appendix 4), the central database configuration is utilized in most active RHIO's at this point while the distributive approach has struggled to obtain traction. (Castro 2007) Due to the experience of active RHIO's at this time and the perceived direction of the data, we will utilize the centralized data approach as we develop our community database.

Having established a centralized database configuration for our RHIO, it is now imperative for the participating institutions, in conjunction with the RHIO administrators, to define the data elements which are essential to the vision and mission of the regional information organization. In utilizing an ADT transaction as the trigger to launch patient-specific data queries in obtaining all associated data sets as well as establishing RHIO access, all participating institutions must provide ADT transactions in support of this process. Additionally, focusing predominantly on those elements which are supportive to patient care and treatment, the institutions will be required to deliver all laboratory data including pathology reports and blood bank information. Transcribed documents surrounding history & physicals, surgical reports, discharge summaries and all other documents associated with patient care are extremely informative in defining patient treatment course, thus essential components of our RHIO. Radiology images including their diagnostic impressions as well as nuclear and MRI studies are necessary elements. Prescription and drug information, a core component in evaluating patient status will be included. As outlined above, these will be considered the minimum data sets which each participating institution will be required to provide; however, each institution will be encourage to provide any and all clinical data which they are willing to share and include in the RHIO. In this regard, the mission and vision of enhancing the clinical experience can be achieved.

As noted, the lack of healthcare data standards has created tremendous challenges to any effort in developing successful RHIO's; however, a few standards exist which are valuable in moving these efforts forward. Starting with data transport, Transmission Control Protocol/Internet Protocol (TCP/IP) will be utilized to transport data packets through HL7 messages. TCP/IP is a set of communication protocols which provide direction in how information should be transported, specifically dealing with the internet layers of link, internet, transport, and application. HL7 v3 interface/data standards will be utilized for the movement of information between systems, institutions, and the RHIO. Utilizing a reference information model (RIM) and more well-defined techniques and messaging formats, thus offering very few options for message structure, version 3 provides a more structured and testable interface message which simply was not available in version 2. In addition, with the standardized structure, institutions will be provided better opportunities to validate data transfers, thus making it the interface message standard of choice. HL7 is an all-volunteer, not-for-profit organization recognized for the development of healthcare standards, in particular associated with exchange, integration, sharing, and retrieval of data within the electronic format. (HL7, 2009) Secure Socket Layer (SSL) will be utilized to provide security for this vital data transport across the internet. Providers of care will be identified utilizing the National Provider Identifier (NPI), a unique number assigned to each provider by the National Plan and Provider Enumeration System as mandated by the Administrative Simplifications provisions of HIPAA. (CMS, 2003) This provides a standardized approach for identification of all providers, thus preventing any need for manipulation of this information once it arrives to the RHIO database. One of the more important standards utilized in the development would be the use of Logical Observation Identifiers Names and Codes (LOINC) for mapping and standardizing clinical observations and laboratory values.

LOINC provides universal codes which can be mapped to various clinical observations and laboratory values from disparate systems across the community. (Regenstreif Institute, 2009) In this regard, although a specific result might be identified by a multitude of codes based on the systems involved, LOINC allows mapping to a single code in support of data integration, thus allowing all results to universally be displayed in a single data flow sheet. Consequently, clinicians are provided a comprehensive view of patient course in support of improved clinical practice.

Standards defined by the Digital Imaging and Communications in Medicine (DICOM) organization, a division of the National Electrical Manufacturers Association (NEMA) will be utilized for imaging transport. Prescription messages will be based on the standards developed by the National Council for Prescription Drugs Program (NCPDP), an ANSI accredited organization. RxNorm will be the standard utilized for drug identifiers, developed by the National Library of Medicine in providing a standardized nomenclature for this purpose. (NOTE: NDC is a coding structure for drugs while RxNorm utilizes a naming convention which would better serve the RHIO needs) In summation, much work remains in the further and expanding development of healthcare data standards; however, utilizing those available will provide the essential foundation for success in any efforts toward establishment of a fully functional RHIO.

While most experts advocate the need for additional standards for healthcare, others would argue standards compliance as a key component to successful RHIO development. For example, the HL7 interface message standard was developed with specific segments for various components of the message. More specifically, the HL7 Structured Observation Message Standard separate segments for value, unit of measure, abnormal flag, and normal range with the anticipation report writers would comply with these standards. Unfortunately, many times report

writers neglect to comply with these defined segmental divisions, consequently placing compound data elements within a single segment. (McDonald, 2005) Clearly standard compliance has value in determining the efforts and success RHIO development might incur.

Lacking standards associated with essential components required for data integration/interoperability within the RHIO, efforts must be put forth by the RHIO itself to fill the void. Patient identification number would fit into this realm of need. Developing a Master Patient Index within the RHIO database, will blend the unique patient identification numbers generated by each institution into a single identifier which will provide the foundation from which all data integration will flow. Additionally, a well designed, web-based user interface with intuitive navigation and well integrated search engine for patient capture promotes adoption and use. Finally, as defined by HIPAA standards, a dual level user authentication tool for access provides for necessary identification of user and maintains elements of data integrity which clinicians will expect in use of the RHIO. (CMS, 2003) With the creation of these additional components, in conjunction with defined existing healthcare standards, the RHIO is set for success.

Now that the infrastructure and data standards associated with the RHIO development have been defined, the security standards which will be utilized in obtaining access to the database must be evaluated and defined. As discussed previously, one of the major concerns by the participants universally is the perceived lack of control of their data. This is only further enhanced if some level of access criteria doesn't accompany the use of the RHIO. Consequently, the responsibility for defining appropriate personnel for access will reside solely with the participating institutions, thus they have the ability to determine workflows and supporting data needs in this regard. Failure of the institution to monitor and/or comply with these

responsibilities could result in the removal of participation dependant upon management council. Having embraced their role, the institution submits all requests for access via a password protected document, providing essential elements for user authentication and identification. The RHIO establishes access based on the request and corresponds accordingly with the institution, providing them an initial password which requires end users to change upon first access. Expiring in 90 day intervals, users are then responsible for maintain confidentiality of their access codes. In addition to end user access and authentication, the RHIO must also establish criteria for when it is appropriate for participants to access data. As noted above, participants are seeking assurance data will be utilized in the advance of clinical practice and treatment and not used as market tools or competitive advantages against other participants within the organization. Consequently, additional criteria must be established in outlining when access to the database or more specifically patient data is appropriate. Working from the RHIO vision of advancing patient care and treatment, access should begin with an indication the patient has engaged in seeking care. With the foundation of the RHIO solely dependent upon the input and distribution of participating institutions data, it is essential to establish an administrative structure which centers on the input and consensus of those providing the information. As previously mentioned, institutions are overall reluctant to release control of their data outside the confines of their institutional network and infrastructure, especially if they no longer have input into the uses and accessibility of this information. Consequently, a RHIO must establish an administrative hierarchy which will subsequently establish the guiding principles of the organization. This work not only involves uses of the data but also establishes the process for adding members, amending the organization principles, and setting forth expectations of the membership. In addition, decisions must be made surrounding data management, addressing such topics as uses for

treatment, biosurveillance, and research. In this regard, the RHIO administrative personnel serve as facilitators to the direction of the administrative structure of the participating institutions. By utilizing an institutional based administrative structure in this manner, the participating members are able to maintain control limits are their data and thus, able to obtain comfort in their decision surrounding the RHIO and its uses. (HIMSS 2007) Any identified data abuse and/or breaches in confidentiality will result in removal of participation in the RHIO pending management council review.

Finally, it would be negligent to not address funding in some manner. Early work in the development of RHIOs has predominantly been funded through grant money from various governmental agencies and organizations. Looking for opportunities to improve patient care and outcomes as well as control costs, money has been dedicated in support of developmental efforts toward the realization of these goals. However, as the proliferation of RHIOs increases and the focus moves toward the creation of national databases, the available money will shift its attention accordingly, thus RHIOs will be forced to become self sustaining in nature. Consequently, they will have to define financial parameters which are somehow based off of quantifiable benefits associated with the use of comprehensive data across systems. This benefit can be expanded as the RHIO encompasses larger geographical areas; however, the ability to truly quantify these benefits to the level which will entice institutions to dedicate limited resources to their continued support will be difficult to say the least. In summation, the ability of RHIOs to define payment structures which will be palatable to the participating institutions will be difficult to say the least.

Needless to say, other considerations must come into play as the progression and development of the RHIO takes shape. Such considerations will present challenges to the defining principles and the evolution of the database; however, they will be important to address

if adoption is expected. Such challenges can range from simple process definition for user requested access to much more complex issues surrounding database design and location.

However, with the driving force toward improved clinical practice and patient care, the course for success is sure to come.

Summary

As the healthcare system moves towards complete interoperability, RHIOs are expected to provide the foundation for connecting providers, hospitals, ancillary services, payers, and public health organizations. RHIO participants will improve their care delivery systems by improving efficiencies and effectiveness surrounding treatment parameters, increase medical record availability, eliminate duplications, improve the flow of information, and increase patient safety, leading to increased patient satisfaction and lower costs. Critical to the success of the RHIO is the identification of the stakeholder and engaging them early in the process of software development to ensure their needs are met. For the RHIO to be successful participants' information systems will need to push and pull data to and from the RHIO in the standards set by the RHIO management council. The management council must also address data ownership, access, security, inappropriate use, research use, data model and architecture, and funding. When well planned and fully implemented, RHIOs will bring healthcare a step closer towards interoperability.

References

- Adler-Milsein, J., McAfee Andrew P., Bates David W, Jha, Ashish K (2008). The State Of Regional Health Information Organizations: Current Activities And Financing. *Health Affairs*, 27(1), 60-69.
- AHIMA. Surveying the RHIO Landscape: A Description of Current RHIO Models, with a Focus on Patient Identification *HIM Body of Knowledge FORE library* Retrieved 4-2-09, from http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_028980.hcsp?dDocName=bok1_028980
- AHIMA (2009). Health Information Exchange Consensus Project Retrieved April 20, 2009, 2009, from <http://www.slhie.org/index.asp>
- Avocare (2008). *Connecting Healthcare Whitepaper*. Tallahassee.
- Avocare (2008). RHIM Product and Concept Presentation. Tallahassee.
- Avocare (2008). Products What is a RHIN Retrieved April 25, 2009 2009, from <http://www.avocarehealth.com/productsRHIN.html>
- Bartschat, W., Burrington-Brown, J., Carey, S., Chen, J., Deming, S., Durkin, S., et al. (2006). Surveying the RHIO landscape. A description of current RHIO models, with a focus on patient identification. *Journal of AHIMA*, 77(1), 64A-64D.
- Blair, R. E. (2006). *Health Management Technology* Retrieved 4-2-2009, from http://archive.healthmgttech.com/archives/0206/0206rhio_nation.htm
- CMS (2/12/03). HIPAA.ORG Retrieved May 21, 2009, from <http://www.hipaa.org/>
- Castro, D. (2007). *Improving Health Care: Whay a Dose of IT May Be Just What the Doctor Ordered*: Information Technology and Innovation Foundation.
- Committee on Quality of Health Care in America, I. o. M. (2001). *Crossing the Quality Chasm" A New Health System for the 21st Century*: Institute of Medicine.
- DbMotion (2009). Retrieved April 25, 2009 from <http://www.dbmotion.com/>
- DeBor, G., Diamond, C., Grodecki, D., Halamka, J., Overhage, J. M., & Shirky, C. (2006). A tale of three cities--where RHIOS meet the NHIN. *Journal of Healthcare Information Management*, 20(3), 63-70.
- Dolan, P. L. Mass. RHIO spins off for-profit subsidiary. *amednews.com* March 11, 2009. Retrieved 4-2-2009, from <http://www.ama-assn.org/amednews/2009/03/09/bisf0311.htm>
- Halamka, J., Overhage, J. M., Ricciardi, L., Rishel, W., Shirky, C., & Diamond, C. (2005). Exchanging health information: local distribution, national coordination. *Health Affairs*,

- 24(5), 1170-1179.
- HIMSS (2009). RHIO/HIE Retrieved 4/2/09, from http://www.himss.org/ASP/topics_rhio.asp
- HIMSS, (2008). HIMSS State Dashboard Retrieved April 29, 2009, 2009, from <http://www.himss.org/StateDashboard/RHIOList.aspx?Status=Active>
- HIMSS, (2008). *Evaluation Open Source Software for Health Information Exchange*.
- HL7. What is HL7? Retrieved May 21, 2009 from <http://www.hl7.org/>
- Iatric. IatriConnect for RHIO's for Health Information Exchange (HIE) Retrieved April 25, 2009 2009, from <http://www.iatric.com/software/cs/cs-iatricconnect.asp>
- Initiate (2007). *A Recipe for RHIO Success and Improved Patient Care*.
- Initiate (2008). *Integrating Patient Medical Records in Pursuit of the EMR*.
- McDonald, C. J., Overhage, J. M., Dexter, P. R., et al (1999). *The Regenstrief Medical Record System 1999: Sharing Data Between Hospitals*. Indianapolis: Regenstrief Institute.
- McDonald, C. J., Overhage, J. M., Barnes, M., Schadow, G., Blevins, L., Dexter, P. R., et al. (2005). The Indiana network for patient care: a working local health information infrastructure. An example of a working infrastructure collaboration that links data from five health systems and hundreds of millions of entries. *Health Affairs*, 24(5), 1214-1220.
- McGowan, J. J., Overhage, J. M., Barnes, M., & McDonald, C. J. (2004). Indianapolis I3: the third generation Integrated Advanced Information Management Systems. *J Med Libr Assoc*, 92(2), 179-187.
- Medicity. Health Information Exchanges Community Based Clinical Data Exchange and Acces Retrieved April 25, 2009 from http://infosite.medicity.com/rhiohie_main.htm
- Medseek. Highway to Health Information Exchange The Race has already begun Retrieved April 25, 2009 2009, from <http://www.medseek.com/body.cfm?id=316&fr=true>
- Murthi, S. (2002). Build versus Buy – making the right decision Retrieved April 25, 2009 2009, from <http://www.developer.com/mgmt/article.php/1488331>
- National Alliance for Health Information Technology, N. (2009). HIT definitions Retrieved April 1, 2009, 2009, from http://www.nahit.org/pandc/press/pr5_20_2008_1_33_49.asp
- Office of the National Coordingator for Health Information Technology, Goals of Strategic Framework, from <http://www.hhs.gov/healthit/goals.html>
- Overhage, J. M., Tierney, W. M., & McDonald, C. J. (1995). Design and implementation of the

Indianapolis Network for Patient Care and Research. *Bulletin of the Medical Library Association*, 83(1), 48-56.

Regenstrief Institute, I. (2009). LOINC Retrieved May 21, 2009, from <http://loinc.org/>

Schuerenberg, B. K. (February 1, 2008). RHIOs Struggle to Find a map to Success Retrieved April 29, 2009, from http://www.healthdatamanagement.com/issues/2008_45/25619-1.html?page=1

Wikipedia (2009). Regional Health Information Organization Retrieved April 1, 2009, 2009, from http://en.wikipedia.org/wiki/RHIO#Rural_RHIOs

Workgroup on Health Information Management in Health Information Exchange e-HIM®
Appendix to: HIM Principles in Health Information Exchange (AHIMA Practice Brief)
RHIO Checklist. *Journal of AHIMA*, 78(8), 69-74.

Appendix 1

RHIO Current Stakeholders

STAKEHOLDER	STAKEHOLDER DETAILS	ROLE
Hospitals	5 Hospitals	Pull and Push Information
Laboratories	2 Reference Labs	Push Information
Radiology Centers	2 Radiology Centers	Pull and Push Information
Surgical Center	1 Surgery Center	Pull and Push Information
Physician Offices	100+, all have established relationships with hospitals	Pull and Push Information
Patients		Pull Information
Community		Management Council
Payers	Local payers	Pull and Push information Management Council Financial Support
Vendors	Information system vendors for EMR/EHR, hospital information systems, lab systems, radiology systems	Financial Support Technology Support
Public Health Agencies	City and County agencies	Pull Information Management Council

RHIO Future Stakeholders

STAKEHOLDER	STAKEHOLDER DETAILS	ROLE
Employers	Local and Regional employers	Push Information Financial Support
Pharmacies	Local pharmacies National Chain pharmacies Hospital pharmacies	Pull and Push Information
Long Term Health Facilities	Nursing homes, hospice, assisted living	Pull and Push information
Public Health Agencies	State and National agencies	Pull Information Management Council
First Responders Fire Police EMS Military	Fire Police EMS Military	Pull Information Management Council
Additional Payers	Medicare Medicaid	Pull and Push information Management Council Financial Support

Appendix 2

*Build vs. Buy RHIO Software*¹

	Build	Buy	Hybrid
What it means	A complete or nearly complete solution by a vendor (for example: dbMotion ² , MedCity ³ , MedSeek ⁴ , IatriConnect ⁵ , AvocareHealth ⁶)	A solution that is custom built from scratch that has few external components.	An intermediate solution that uses different components from multiple vendors as well as custom code to integrate into a solution.
Benefits	<ul style="list-style-type: none"> • Cheaper • Higher Quality if widely implemented • Easier upgrade process • Vendor responsible for regulatory updates 	<ul style="list-style-type: none"> • Will better fit business needs • Control over functionality • Customized for maximum business advantage 	<ul style="list-style-type: none"> • Best of both worlds • More customization to business needs possible • Usually cheaper than custom built solution
Risks	<ul style="list-style-type: none"> • Vendor financially unsound • Product is immature • Expensive customization 	<ul style="list-style-type: none"> • Technology platform is immature • Resources with appropriate skills are difficult to find • Bugs and enhancements can become expensive 	<ul style="list-style-type: none"> • Vendor financially unsound • Technology platform is immature • Resources with appropriate skills are difficult to find • Integration difficult • May not be possible to purchase a la carte
Costs to consider	<ul style="list-style-type: none"> • Ongoing license fees • Infrastructure costs • Training fees • Customization fees • Quality Assurance 	<ul style="list-style-type: none"> • Infrastructure costs • Operational costs • Development costs • Training development/QA resources • Quality Assurance 	<ul style="list-style-type: none"> • Ongoing license fees • Infrastructure costs • Development costs • Training development/QA resources • Quality Assurance

¹ Murthi, S. (2002) *Build versus Buy – making the right decision* Retrieved April 25, 2009 from <http://www.developer.com/mgmt/article.php/1488331>

² *DbMotion* (2009) Retrieved April 25, 2009 from <http://www.dbmotion.com/>

³ *Health Information Exchanges Community Based Clinical Data Exchange and Access* Retrieved April 25, 2009 from http://infosite.medicity.com/rhiohie_main.htm

⁴ *Highway to Health Information Exchange The Race has already begun* (2009) Retrieved April 25, 2009 from <http://www.medseek.com/body.cfm?id=316&fr=true>

⁵ *IatriConnect for RHIO's for Health Information Exchange (HIE)* (2009) Retrieved April 25, 2009 from <http://www.iatric.com/software/cs/cs-iatricconnect.asp>

⁶ *Products What is a RHIN* (2008) Retrieved April 25, 2009 from <http://www.avocarehealth.com/productsRHIN.html>

Appendix 3

Minimum Standard Operating Procedures for RHIO

SOP Type	Details
Data	Data resides in central database “owned” by RHIO.
Data	Data cannot be sold for commercial purposes to pharma, hospitals, providers, pharmacies, etc.
Data	Data can be sold to research agencies if de-identified and purpose of research is approved by management council. All monies received will be used for expanding capabilities of RHIO.
Data	Data can be transmitted to public health agencies and other registries in accordance with local/state/federal law.
Data	Data cannot be used to gain a competitive advantage.
Audit	Each record accessed will be tracked by user and date/time stamp.
Breach	Patients notified immediately through written communication.
Inappropriate Use	<ul style="list-style-type: none"> ▫ 1st offense results in 30-day suspension and fine ▫ 2nd offense results in 1-year suspension and fine ▫ 3rd offense results in lifetime suspension and fine
Emergency Access	Guidelines established for emergency use

Appendix 4

Centralized vs. Decentralized RHIO models

CENTRAL	DECENTRALIZED
Neutral site	Small central RHIO
Centralized database	Data stored at each site
Staff members belong to RHIO	Staff employed by participants
Separate files within central database	Files maintained at sites
Data integrity by participant	Data integrity by participant
Data retention	Data retention determined by individual member
Network response times	Variable response by individual networks that belong to RHIO
Security	Security schema by individual participant
Consistent end user experience	Segregated flow sheets different appearances
Supports biosurveillance/Public health	Biosurveillance/public health implemented by each site
Supports research	Researchers need permission from each participant
Cost of central RHIO	Cost at each participant site

Appendix 5

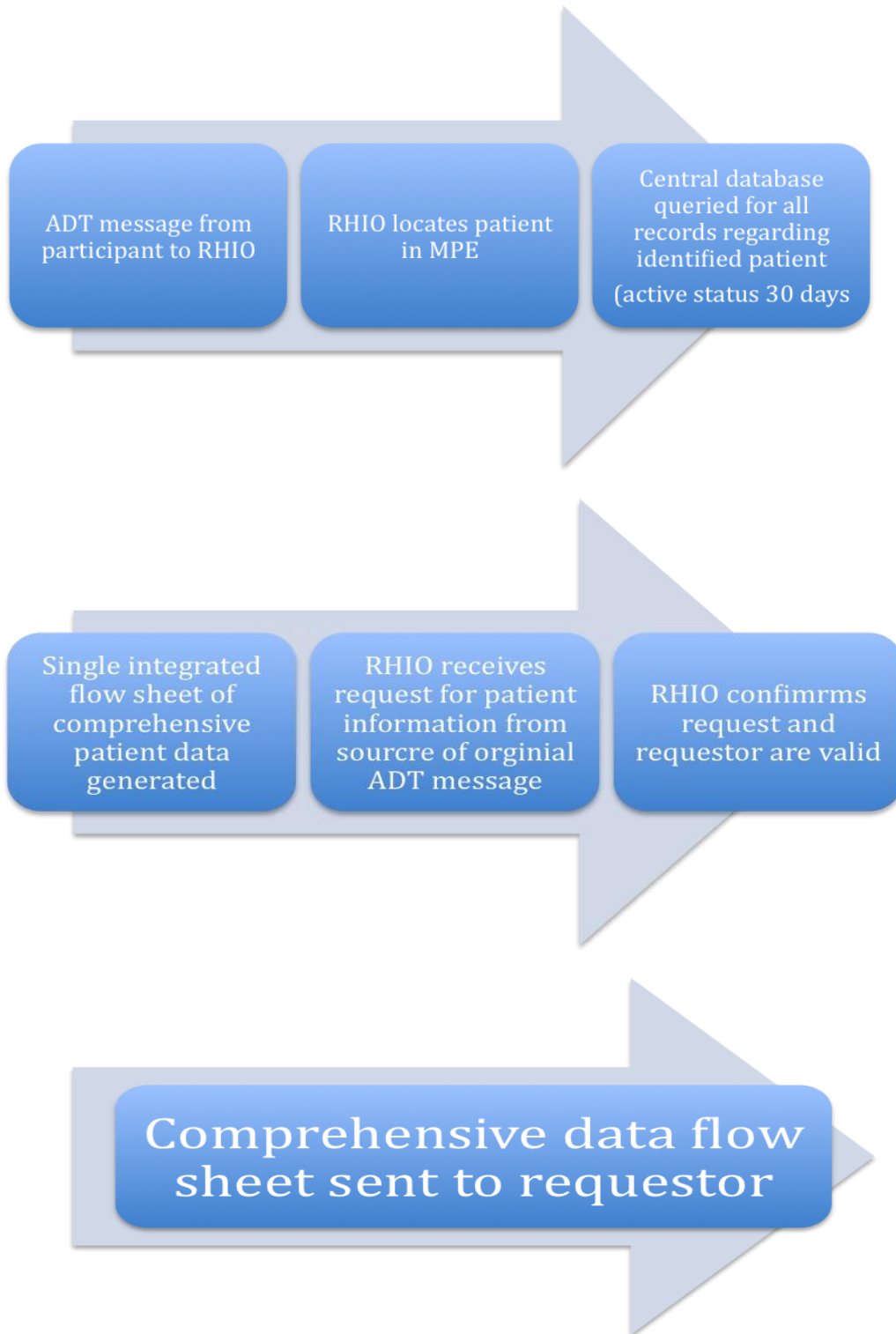
Definitions

TCP/IP is a set of communication protocols which provide direction in how information should be transported, specifically dealing with the internet layers of link, internet, transport, and application.

SSL is a cryptographic protocol which encrypts segments of the network from end-to-end at the transport layer provides security and data integrity for transporting healthcare data across the internet. In utilizing true 128-bit SSL certificates, the strongest available data encryption will accompany data transfers between end users and the data encapsulated within the RHIO.

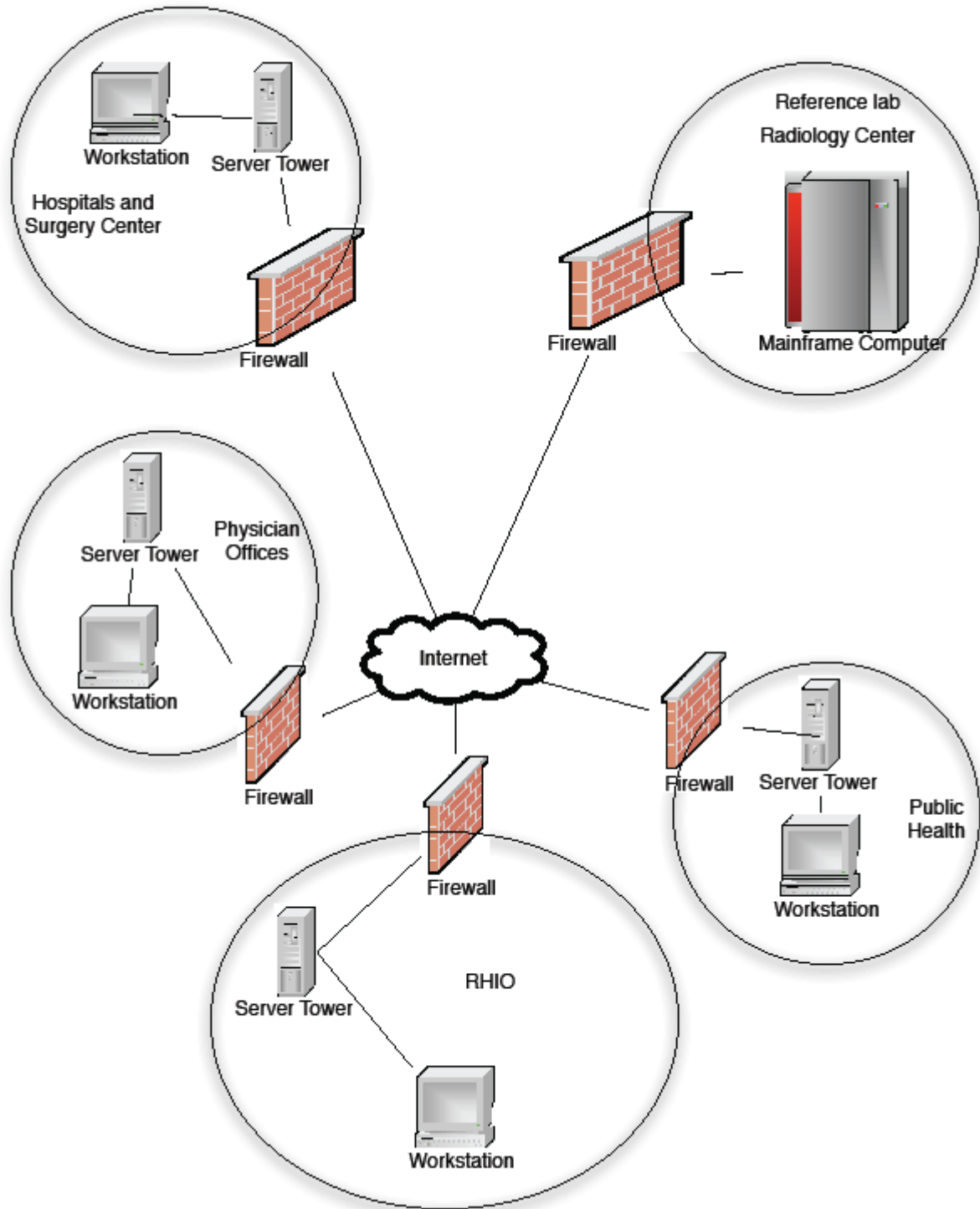
LOINC version 2.26 is the new version provides improved functionality to enhance accuracy and ease in code mapping. Although a very important set of standardization codes, their use requires committed resources by the staff in completing the necessary mapping of codes, a labor-intensive process. Despite the use of a mapping tool such as RELMA, it is imperative to recognize the resource commitments required in determining the use of this code for your RHIO.

Appendix 6



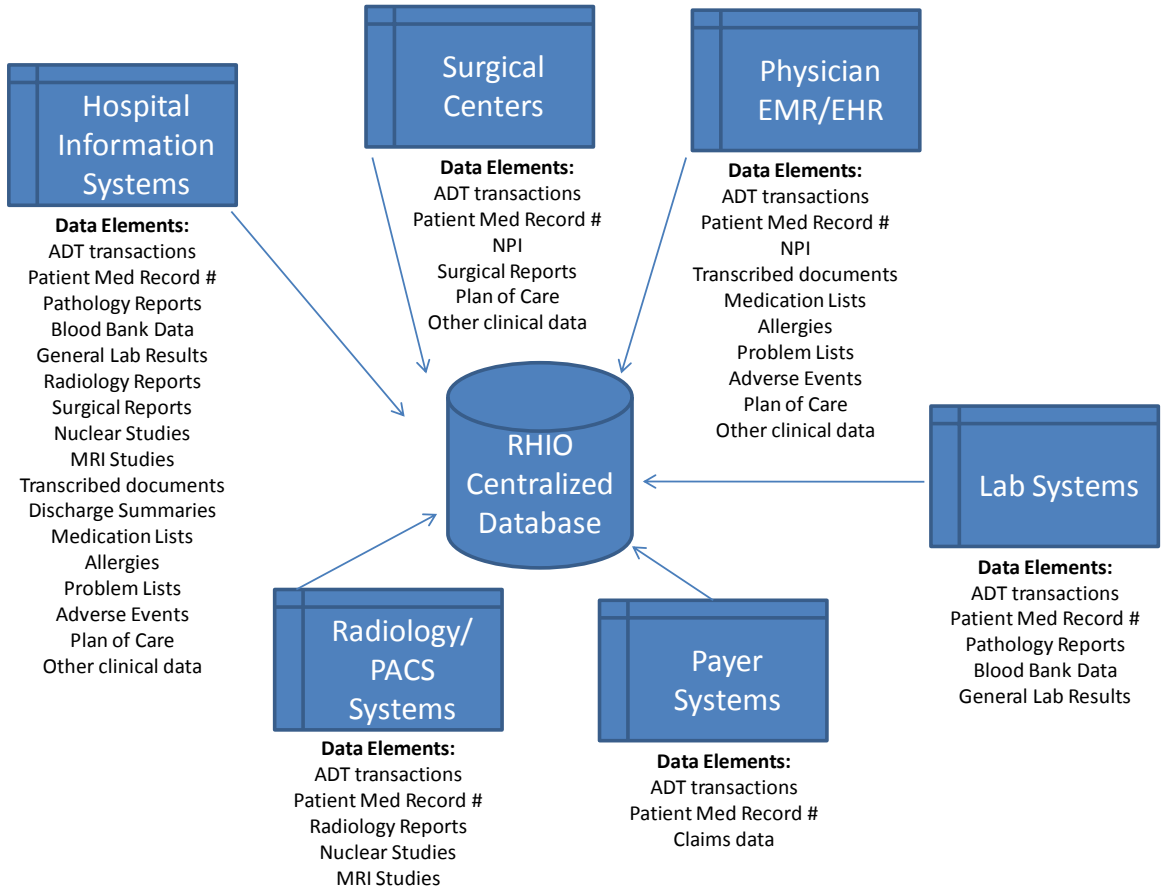
Appendix 7

Information System Architecture

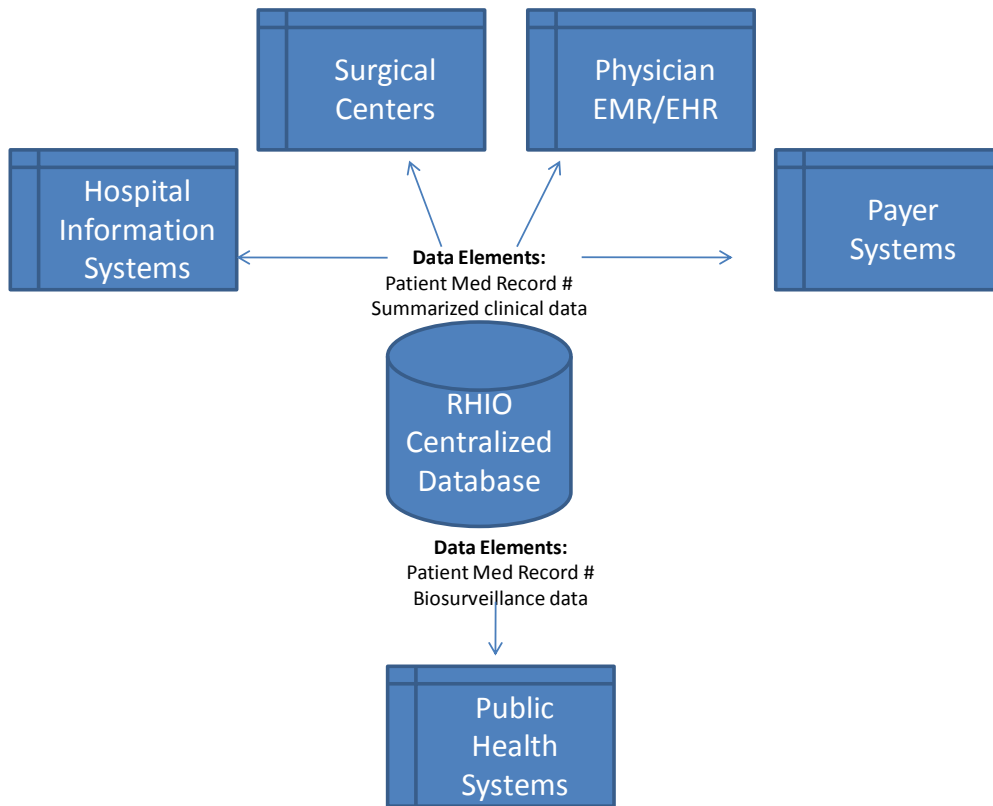


Origin of Data Elements

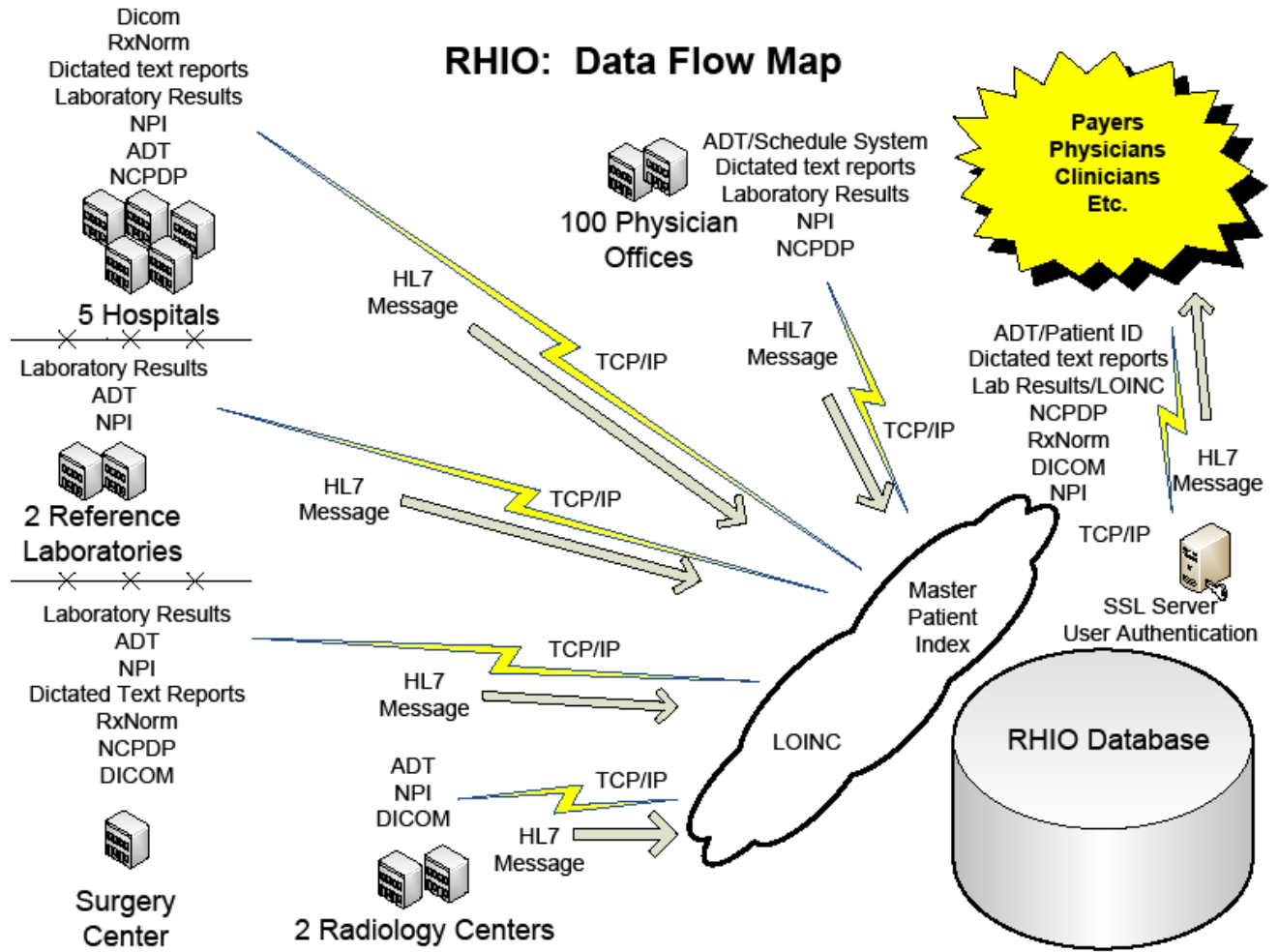
Data Elements to be Pushed to the RHIO Central Database



Data Elements to be Pulled from the RHIO Central Database



Data Flow



Appendix 8

Team Participation

The following table provides information regarding each team member’s primary responsibilities. It should be noted that each team member participated in all aspects of the project. For example, stakeholders were presented by Kary but the entire team participated in preparing the presentation through sharing research, assisting with slide preparation, editing documents, and providing feedback. The right-hand column reflects the members and their primary role while the task boxes reflect the activities the team members assisted with.

Member Name (Role)	Research	Slide Prep	Presented Week 4	Presented Week 6	Presented Week 9	Contributed to Pater	Edited Paper	Participated in Weekly Meetings
K. Mason (Paper Coordinator)	X	X	X		X	X	X	9/9 Meetings
C. Nichols (Research Coordinator)	X	X	X		X	X	X	9/9 Meetings
M. Neumeister (Presentation & Meeting Coord)	X	X		X	X	X	X	9/9 Meetings
M. Rittenhouse (Research Coordinator)	X	X		X	X	X	X	9/9 Meetings