

2010

## WellCare Health System: The ATM Model of Patient Centered Care

A network strategy focused on patient-centric connectivity

Consider the lowly and ubiquitous automated teller machine (ATM). It is a readily accessible and always available portal to the client's financial accounts. Information on multiple accounts is available and by a connection to multiple financial networks, it is possible to conduct transactions at a financial institution other than the clients' primary bank. Now imagine that one's medical information is as readily available and manageable as our financial accounts are in the ATM. Ready access to this information and the ability to make real time additions and subtractions—much like a financial ledger—would clearly enhance health care and eliminate considerable time and effort that is currently spent reviewing exactly the same information and reconstructing the same story over and over again.

Northwestern University, Chicago, IL  
DL-405 , HIT Integration, Interoperability and Standards  
Allison Foil, MLS(ASCP)<sup>CM</sup> , Gordon Bleil, M.D., Sharron Lee and Timothy Brown, M.D.

Winter 2010



## Contents

1	Introduction .....	2
2	Vision.....	3
3	Stakeholders .....	6
4	WellCare Market Analysis and Application Inventory .....	8
5	Interoperability Options.....	9
6	The RelayRecord Creates an ATM Model of Patient-Centric Care .....	13
7	Patient Matching & Network Identity Management .....	4
8	WellCare Patient Centric Information Architecture .....	6
9	Workflow.....	10
10	Metrics of Success.....	12
11	Conclusion.....	13
	Cited Works.....	14
	References .....	14
	Appendices.....	16
	Appendix A.....	16
	Appendix B.....	17
	Appendix C.....	18
	Appendix D.....	19
	Appendix E.....	20
	Appendix F.....	21
	Appendix G.....	22
	Appendix H.....	23
	Appendix I.....	32
	Appendix X.....	33
	End Notes.....	34



## Figures

Figure 1 Objectives, Outline, and Keywords developed in the paper .....	1
Figure 2 Diagram showing the financial network structure. ....	4
Figure 3 Current and Future State .....	5
Figure 4 Garner’s Hype Cycle for Healthcare Provider Applications and Systems, 2009 .....	7
Figure 5 Physician Market Analysis.....	8
Figure 6 WellCare Health System Current Application Inventory.....	9
Figure 7 Snapshot from the IFR on HIT Vendor Criteria for a Certified EHR.....	10
Figure 8 Pros and Cons of Various Interoperability Options.....	12
Figure 9 WellCare Patient Centric System Architecture .....	6
Figure 10 WellCare Patient Centric System Architecture encompassing HITSP C32 Version 2.3 Continuity of Care Document .....	8
Figure 11 An example of a CCD Returned: View Only. ....	16
Figure 12 An example of a CCD in XML.....	17
Figure 13 Diagram of process flow for Routine Authorization for Data Interoperability.....	18
Figure 14 Diagram of process flow for Urgent Authorization for Data Interoperability. ....	19
Figure 15 Screen capture of Patient Web-based Portal .....	20
Figure 16 Screen capture of Physician Web-based Portal .....	21

LEARNING OBJECTIVES
Understand the defining characteristics of HIE in the ATM model
Identify the goals and expectations for the ATM network strategy
Identify challenges facing ATM based healthcare model implementation
Need to add rows for ...
TOPICAL OUTLINE
Financial ATM financial network structure and characteristics
Project Stakeholder goals, expectations and requirements
HIE issues and concerns
HIE Integration and interoperability definition and characteristics
HIE Integration and interoperability issues and concerns
Recommendations: applying change management principles to foster technology implementation in healthcare
KEYWORDS
end user, electronic medical data, data communication, device source, cloud computing, HIE, ARRA HITECH, LOINC, CCD/CDR, Garner Hype Cycle, KLAS...we can build this as we go... eMPI, RelayHealth

**Comment [GRB1]:** I think what, why and how are covered – no more needed

Figure 1 Objectives, Outline, and Keywords developed in the paper



- Founded in 1947
- Non-for profit health system
- Location: Atlanta, GA
- Facilities: 350-bed acute care hospital
- Payor Mix: 45% Medicare, 25% Commercial, 15% Medicaid, 10% Self Pay
- Employed Physicians: WellCare Medical Associates (WMA) – 27 physicians
- Affiliated Physicians: 375

## 1 Introduction

Who is WellCare Health System? WellCare Health System is a large integrated delivery network (IDN) located in Atlanta, Georgia. As in any large health system, we have a variety of physician offices in our community that operate independently from the hospital. With four other large hospital systems and a physician-owned for-profit hospital in our marketplace, the families in our community and the affiliated physicians have many options, In order to stay competitive, increase our referrals, and make it easy to conduct business with WellCare Hospital, it is important that we provide a connectivity solution to our physicians to establish a closer alignment and working relationship with our hospital that will

ultimately offer benefit to the patient. By connecting our physicians, we connect our patients, increase our referrals, increase our revenues, and increase patient safety by having pertinent history, allergies, medications, etc., available at all access points in the WellCare system, and position ourselves for HITECH funding.

The WellCare Health System has identified four strategic initiatives to enable it to maintain its preeminent position in the greater Atlanta medical community.

- Engage the consumer by creating a positive patient-centered experience and community presence. Our goal is to win the “Consumer Choice Award” as “Most Preferred Hospital.” Consumers who wish to use our system can be a powerful incentive for increased physician utilization.
- Align community physicians and create strong bonds with our medical staff to increase physician loyalty and patient referrals.
- Improve clinical quality and operational effectiveness and enable and facilitate medical education.
- Demonstrate “meaningful use” to capitalize on ARRA HITECH Act funding and avoid penalties.

Of these four initiatives, it is the fourth which is the prime driver and the single major influence on our decisions. The Health Information Technology for Economic and Clinical Health (HITECH) portion of the

American Recovery and Reinvestment Act of 2009 (ARRA) economic stimulus package allotted \$19 billion just for health information technologies (HIT). Its main goal is to encourage the adoption of electronic health records (EHR's) through incentive payments to physicians and hospitals, which can amount to up to \$44,000 per physician and a base amount of \$2 million up to \$8 million per hospital. Failure to comply will incur penalties after the incentive period has passed [3]. The key to eligibility for this funding will be the demonstration of "meaningful use."

In December, 2009, the government released two documents: the Notice of Proposed Rule Making (NPRM) on Electronic Health Record Incentive Program (Meaningful Use and Payment Process) and the Interim Final Rule (IFR) on Initial Set of Standards, Implementation Specifications, and Certification Criteria for EHR Technology (HIT Vendor Criteria for certified EHR). The official publication was in the Federal Register (FR) on January 13, 2010, with a 60 day public comment period to follow. The IFR is effective February 13, 2010, and acts as the Final Rule unless modified, and the Final Rule is expected in Spring 2010.

We must improve care coordination by:

- *"Exchange meaningful clinical information*
- *Exchange key clinical information (problem list, medication list, allergies, dx test results)*
- *Perform medication reconciliation at relevant encounters & each transition of care*
- *Provide summary care record for each transition of care or referral"[4]*

**The bottom line is everyone is going to have to be certified. The carrot is do it now and get funding or wait and be penalized.**

The key element in our success will be a significant investment in health information technology, which we have characterized as "The ATM Model of Patient-Centered Care."

## 2 Vision

The healthcare industry is often compared to the banking industry, and creating a patient-focused healthcare experience is much like how automated teller machines are used in modern banking. ATMs have been around since the 1960s and we take them for granted. Consumers authenticate themselves

**Comment [GRB2]:** We are on page 8 and just getting to Stakeholders, depending on the total length, it might be appropriate to shorten the background section up a bit.

**Comment [TB3]:** The actual paper doesn't start until page 5

to the system using the combination of a card with a magnetic strip + a 4 digit PIN. We use ATMs every day to:

- access and manage our accounts
- make cash withdrawals and deposits
- print bank statements
- and when traveling, they are one of the most convenient ways to make currency exchanges at a fair wholesale exchange rate. The ATM is smart enough to handle transactions even when different countries and currencies are involved, so it does not matter whether the client is dealing in American dollars or Japanese yen, for example. ATM's work on a common framework that allow them to effectively communicate in different "languages."

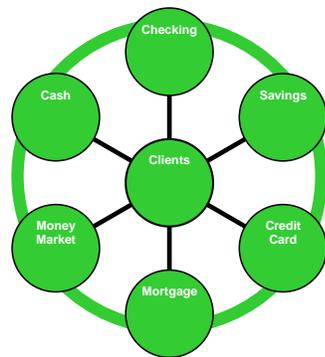


Figure 2 Diagram showing the financial network structure.

What makes the ATM so successful is **standardized network access**. Not only can a client perform transactions at their primary bank, but they can also go to a networked ATM and perform a transaction:

- Interbank **networks** operate much like healthcare provider networks (examples include PULSE, PLUS, Cirrus, Interac, Interswitch, STAR, and LINK) – for example, a Wells Fargo customer can make a withdrawal from their account from a Bank of America ATM. Furthermore, clients can make withdrawals from an ATM in a country different than where their accounts are held. Banks must interoperate to make these transactions
- Data in ATM's must conform to particular **standards** and is "codified" using ISO 8583 messaging . . . the financial data is encrypted. This is currently a particular issue in healthcare IT. We have

**Comment [GRB4]:** There was a comment on this in the chat – I think that most people don't see these machines as translators because they don't get out a different coinage from the machine. Instead they deal in the currency of their own country and the system translates that to the coinage of the country where the purchase is made. I'm not sure how to get that point across.

**Comment [GRB5]:** Alternative?

**Comment [GRB6]:** Can we emphasize the standards here, especially in respect to these 3 paragraphs – Network, Standards, Access?

approached our current vendor about encrypting patient data in the case that a PC or device is lost or stolen in order to comply with the new HIPAA security and privacy rules

- Consumers have web-based **access** to their accounts at multiple disparate institutions, and tools to manage them, like Quicken Online, act like Personal Health Records.

The ATM model has a lot of similarities with healthcare, but this doesn't represent the current state of our own healthcare network. There is currently no single source of truth or connectivity strategy across the WellCare system and our physician's offices, making it difficult to "conduct business" at WellCare. Take the aging baby boomer patient population that has increasing health issues and sees multiple specialists, takes 15+ medications, and has labs and other diagnostic and therapeutic studies performed routinely and regularly. Patients have great difficulty managing their records and paying their healthcare bills—patients are not in control of their care. Patients are questioned by each care provider about their allergies, medications, problems, and family history. Physicians cannot access their records in their office/practice from inside WellCare Hospital. The admission process and patient access is a challenge, with patients having to register at each location and dealing with multiple bills from the hospital and their specialists as well as the pharmacy and the lab. There is no such thing as a consolidated clinical or financial record that is longitudinal and a source of truth. Until we complete this step, we don't have a level of readiness where we could efficiently participate in a health information exchange (HIE).

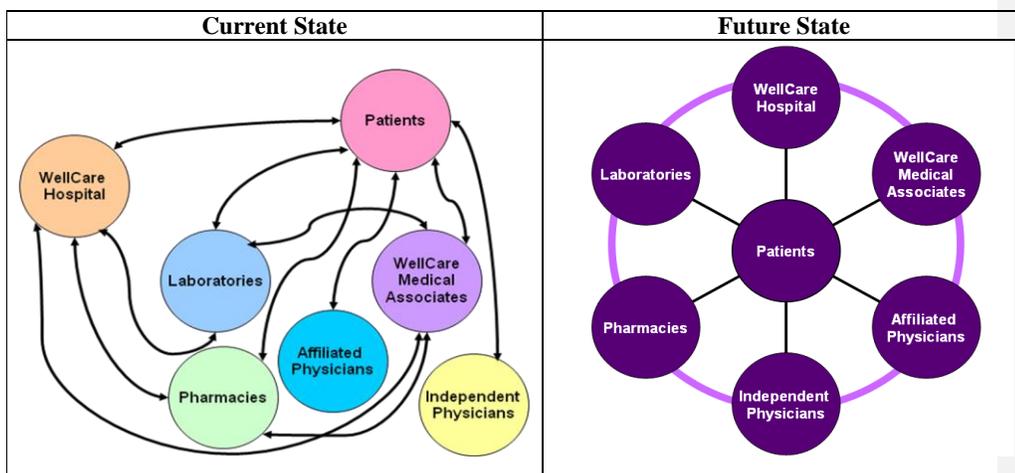


Figure 3 Current and Future State

With a connected and interoperable health system, patients and physicians at WellCare would benefit from a streamlined, patient-centered strategy that is consistent across our marketplace, making WellCare the provider of choice in our community. Specifically, for the clinicians we are investigating offering:

- Electronic orders, results and referral management
- Electronic prescribing and network medication management
- Interoperability between their office EMRs and the hospital systems so that patients' pertinent history, problems lists, allergies, and medications are available in all care settings (ED, inpatient, clinic, etc.)
- Connectivity to the patients through technology such as PHRs which provides the consumer the ability to manage their healthcare and obtain education on relevant health issues

Further, we could expand upon our clinical interoperability initiatives to streamline the financial picture, to include:

- On-line pre registration for the patient
- Insurance eligibility management
- And consolidated account management and online bill pay options for patients.

By connecting to and interoperating with physician's office EMRs and exchanging data with our inpatient systems, we will connect and empower the patient at the center of their healthcare. Our vision is to operate much like the networked ATM with the patient's pertinent history and records available across the continuum of care. By taking this step to make these systems interoperable, we are well-positioned to achieve our strategic goals of engaging the consumer, aligning with our community physicians, improving clinical quality, and we will meet interoperability requirements that position us for both HITECH funding as well as participation in an HIE.

### 3 Stakeholders

Our primary and principle stakeholder is always the patient, who is ultimately the beneficiary of improved care, and their physicians, both inside and outside our system, who will benefit both directly and indirectly. However, all levels of our system leadership ~~has~~ have a stake in this project as not only will it affect patient flow and management within the hospital, but we are very much looking at

**Comment [GRB7]:** We are on page 8 and just getting to Stakeholders, depending on the total length, it might be appropriate to shorten the background section up a bit.

**Comment [TB8]:** The actual paper doesn't start until page 5

continued viability and survival. Our project team is fully supportive of this project and believes it is vital for the continuing health of the system. We hope to obtain the commitment from our CEO and CFO are essential, without which there is little hope for success, and we will need active participation from the Chief Nursing, Quality & Safety, Corporate Marketing, and the Chief Privacy Officers. We feel that there is some urgency, since in terms of the Gartner Hype Cycle [figure 1], which describes the life cycle of disruptive innovation from a “trigger”, though a peak of “hyped” expectations, to a trough of reality hitting home, then finally gaining traction as real change, that we are in the general region of “patient portals” and already on the “slope of enlightenment.” We don’t want to concede ground to our competitors.

Figure 1. Hype Cycle for Healthcare Provider Applications and Systems, 2009

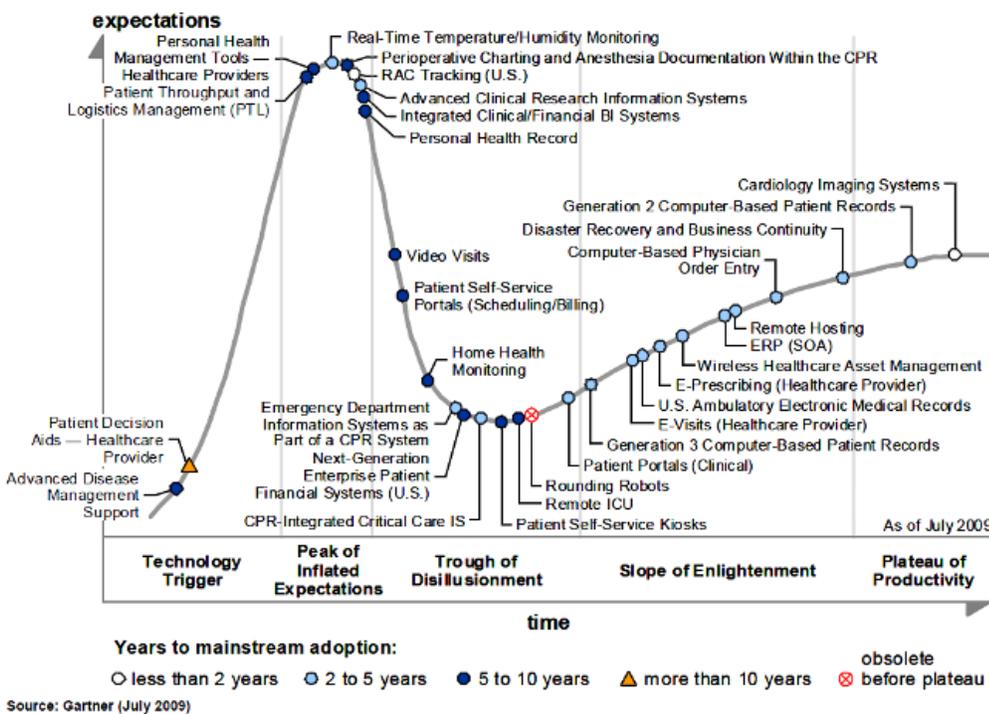


Figure 4 Garner’s Hype Cycle for Healthcare Provider Applications and Systems, 2009

## 4 WellCare Market Analysis and Application Inventory

We conducted an analysis of our physician market and grouped our partners into 3 categories: employed, strategic, and independent physicians. There are four possible EMR scenarios.

- WellCare Health System sponsored EMR: Horizon Ambulatory Care™
- Niche, independent full-featured EMR
- homegrown or partial EMR
- no EMR

We encountered 3 of the 4 scenarios in our physician market analysis as depicted in figure 5 below. We currently rely on fax machines, snail mail and telephone calls to share patient data, making it a **disconnected** clinical and financial experience for those physicians and patients to get healthcare at WellCare. In order to increase our referrals and stay competitive in the marketplace, developing an interoperability strategy with these stakeholders is a key component of our strategic initiatives to align with and employ more physicians.

**Comment [GRB9]:** Consider emphasis here?

Physician Market Analysis				
Name	MDs	Financial/Practice Mgt	EMR	PHR*
WellCare Medical Associates (WMA)	27	Horizon Practice Plus	Horizon Ambulatory Care	Relay Health
Harrison Clinic (strategic)	150	Medical Manager	Allscripts Touchworks	None
Medical Health Partners (strategic)	125	A4	eClinical Works	eCW
Pine Hill Physicians (independent)	75	NextGen	NextGen	None
Peachtree Clinic (independent)	15	A4	None (manual)	None
Apple Hill Physicians (independent)	10	Practice Partner	Practice Partner	Relay Health

\*All markets have patients using MS HealthVault, Google Health, and RelayHealth as PHR.

Figure 5 Physician Market Analysis

Figure 6 outlines the current application inventory in the WellCare Health System. It is a comparatively advanced and sophisticated system which provides a base for broader integration to the surrounding community.

Industry Classification	System Name/Type	Notes
Inpatient EMR (acute care: CPOE, CDS, provider documentation, care alerts, care planning, med admin, EDIS, etc.); Clinical data repository and infrastructure	McKesson – Horizon Clinicals™ Suite McKesson – Horizon Care Record™ McKesson – Horizon Infrastructure™	oracle database; discrete data elements; ICD9; HL7; supports CCD; SNOMED-CT; NIC/NOC/NANDA; LOINC; RxNORM
Interface engine	Lawson Healthvision Cloverleaf Integration Suite (formerly Quoavadx Cloverleaf)	HL7
Health Information Exchange	None/not automated	HL7; HITSP c32 Continuity of Care Document (CCD); .XML
Web Based Access	McKesson – Horizon Physician Portal™	CCOW; Java J2EE; HTML
Owned Physician Practice Management System	McKesson – Horizon Practice Plus™	*Varies by physician office / interoperability opportunity
Owned Physician Office EMR	McKesson – Horizon Ambulatory Care™	*Varies by physician office / interoperability opportunity
Personal Health Record/Consumer Access + EMR lite for paper-based offices	None / not automated	*Varies by physician office & patient population / interoperability opportunity
EMPI	Initiate Interoperable Health	*HIE vendor will have their own EMPI/patient matching schema

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Figure 6 WellCare Health System Current Application Inventory

## 5 Interoperability Options

Any discussion of interoperability options and the necessary standards and nomenclature required to support them must first look to what the constraints are likely to be via the HITECH meaningful use criteria. Figure 7 shows a detail from the IFR on HIT Vendor Criteria for a certified EHR. The ARRA HITECH Act is the single factor that's currently driving the industry towards interoperability. In the federal regulations, the bottom line is an HL7 message string is not good enough, the next level of HL7 standard is needed that shows the entire patient summary. The CCD (form of HL7) has non-discrete and discrete data capabilities and shows the entire patient summary from their last visit/encounter.

TABLE 2A—ADOPTED CONTENT EXCHANGE AND VOCABULARY STANDARDS				
Row No.	Purpose	Category	Adopted standard(s) to support meaningful use stage 1	Candidate standard(s) to support meaningful use stage 2
1	Patient Summary Record	Cx	HL7 CDA R2 CCD Level 2 or ASTM CCR.	Alternatives expected to be narrowed based on HIT Standards Committee recommendations.
	• Problem List	V	Applicable HIPAA code set required by law (i.e., ICD-9-CM); or SNOMED CT <sup>®</sup> .	Applicable HIPAA code set required by law (e.g., ICD-10-CM) or SNOMED CT <sup>®</sup> .
	• Medication List	V	Any code set by an RxNorm drug data source provider that is identified by the United States National Library of Medicine as being a complete data set integrated within RxNorm <sup>™</sup> .	RxNorm.
	• Medication Allergy List	V	No standard adopted at this time	UNII.
	• Procedures	V	Applicable HIPAA code sets required by law (i.e., ICD-9-CM or CPT-4 <sup>®</sup> ).	Applicable HIPAA code sets required by law (i.e., ICD-10-PCS or CPT-4 <sup>®</sup> ).
	• Vital Signs	V	No standard adopted at this time	CDA template.
	• Units of Measure	V	No standard adopted at this time	UCUM.
	• Lab Orders and Results	V	LOINC <sup>®</sup> when LOINC <sup>®</sup> codes have been received from a laboratory.	LOINC <sup>®</sup> .
2	Drug Formulary Check	Cx	Applicable Part D standard required by law (i.e., NCPDP Formulary & Benefits Standard 1.0).	Applicable Part D standard required by law.
3	Electronic Prescribing	Cx	Applicable Part D standard required by law (e.g., NCPDP SCRIPT 8.1 or NCPDP SCRIPT 8.1 and NCPDP SCRIPT 10.6).	NCPDP SCRIPT 10.6.
		V	Any code set by an RxNorm drug data source provider that is identified by the United States National Library of Medicine as being a complete data set integrated within RxNorm <sup>™</sup> .	RxNorm.
4	Administrative Transactions	Cx	Applicable HIPAA transaction standards required by law.	Applicable HIPAA transaction standards required by law.
5	Quality Reporting	Cx	CMS PQRI 2008 Registry XML Specification <sup>#,*</sup> .	Potentially newer version(s) or standards based on HIT Standards Committee Input.

<sup>®</sup>The CDC's National Center of Immunization and Respiratory Diseases (NCIRD) maintains the HL7 external code set CVX <http://www.cdc.gov/vaccines/programs/iis/stds/cvx.htm>.

Figure 7 Snapshot from the IFR on HIT Vendor Criteria for a Certified EHR

Table 2A displays the applicable adopted standards for each exchange purpose specified. “Cx” and “V” are shorthand for “content exchange” and “vocabulary,” respectively, to identify which standard category applies to the exchange purpose. Where a cell in table 2A includes the reference “no standard adopted at this time” it means that a complete EHR or EHR Module would not be required to be tested and certified as including a particular standard. As a result, any local or proprietary standard could be used as well as the standard(s) listed as candidate meaningful use Stage 2 standards. [Unless marked with the following superscripts, all of the adopted standards are from the Office of the National Coordinator (ONC) process that took place prior to the enactment of the HITECH Act or are required by other HHS regulations.

- A number sign “#” indicates that the HIT Standards Panel recommended this standard to the National Coordinator but it was not part of the prior ONC process.

**Comment [GRB10]:** This is not defined before this point - I don't know if you put the Office of the National Coordinator in the Key Words block yet or not.

- An asterisk “\*” indicates that the standard was neither recommended by the HIT Standards Panel nor part of the prior ONC process.
- A plus sign “+” as mentioned above indicates a standard that is not a voluntary consensus standard.]

As part of our analysis, we found that there was no “one size fits all” solution and therefore conducted an evaluation of multiple interoperability options. Options included installing the WellCare Health System sponsored EMR (Horizon Ambulatory Care™), establishing point-to-point HL7 interfaces with each physician office, establishing interfaces with each physician office through our Lawson Healthvision Cloverleaf Integration Suite, sharing data via a CDA/CCD that is published and consumed across a cloud computing HIE vendor model, and/or implemented a SaaS-based EMR supplied by RelayHealth for those offices that are not automated. It became readily apparent that a higher level of integration with the Harrison Clinic (Allscripts Touchworks) and Medical Health Partners (eClinical Works) was desirable, therefore a direct connection through our Cloverleaf integration is the ideal method of interoperability. For the remaining physicians’ offices the main vehicle of interoperability is the CDA/CCD which will allow the transfer of structured patient data that can be viewed and imported into the EMR in use.

Interoperability Options			
Method	Pros	Cons	Recommendations
WellCare Health System sponsored EMR	Maximum data exchange (discrete data exchange on same infrastructure as hospital Horizon EMR)	Physicians office must implement the Horizon Ambulatory Care solution	Use with WellCare-owned physicians’ offices
Point-to-Point HL7 Interface	Maximum interoperability; increased data sharing compared to CCD	Multiple interfaces are costly & labor intensive	Use with hospital owned practices that are not on Horizon EMR
Interface Engine (HL7)	Maximum interoperability; more manageable than P2P, increased data sharing compared to CCD	Step-up in expense from CCD	Use with practices motivated to increase interoperability

CDA/CCD Published & Consumed across a cloud computing HIE vendor model	Easy to publish/consume and transport on removable media (USB drive); readiness for participation in regional HIE or NHIN	Workflow challenges with multiple versions of CCD	Use with practices that have EMR's but do not want to interface. All EMRs must comply to demonstrate "meaningful use."
SaaS-based EMR supplied by RelayHealth	Available to all via cloud vendor; quick solution for practices that are not automated	Limited data sharing	Entry level interoperability

Figure 8 Pros and Cons of Various Interoperability Options

Interoperability is described in terms of its ability to communicate. Both Data and Function require standardized methods to be effectively interfaced. The technical portion of data interfacing will be done using SOAP and XML for actual transmission of data, but it will be organized using a CDA format (which would include CCD). Within that format, the terminology will be defined using a multiplicity of standards depending on the data source.

The Functions of the system will be established within a Web Services framework using RESTful. This interoperability will be tested using the protocols set forth by IHE prior to implementation. It is expected that the software vendor will have already run their product through an IHE Connectathon to verify functionality of their products with each of the vendors in our system prior to installation. In the context of the Gartner Hype Cycle for Healthcare Provider Technologies and Standards 2009, the CCD/CCR is still in the trough of disillusionment, HL7 v3 is still emerging and sliding into the trough, SNOMED and IHE are moving towards the slope of enlightenment, and HL7 v2.x is to the far right on the plateau of productivity as it has been a well adopted "standard" for years.

Beyond the need for semantic interoperability is the need to assure reliable access and accountability. Standard tools for security will be used, focused appropriately to the mechanism of contact--SSL for web access, VPN for direct server access by trusted sources--with written agreements and vetting of partners. Each of these areas will comply with industry best practices and be monitored by the agency managing the data repository.

**Comment [GRB11]:** We talked about putting in information about the mechanism of connection to include VPN and T1 lines. Do we want to include that here or in some of the IA discussion?

## 6 The RelayRecord Creates an ATM Model of Patient-Centric Care

In the KLAS February 2010 report ranking of HIE vendors for Acute to Acute and Acute to Ambulatory connectivity options, Medicity (formerly Novo Innovations), Axolotl, and RelayHealth (a McKesson subsidiary) are the top 3 vendors providing connectivity options for acute to ambulatory. As part of our analysis, we evaluated these three to support our community interoperability strategy and to provide a

The **RelayRecord** is a “centralized management of patient health records across all RelayHealth customers and solutions. The RelayRecord is aggregated with data from all points of a patient’s care and patients can come online and connect to this record.”<sup>1</sup>

cloud computing solution. While we felt that each of the three vendors were very strong contenders, we ultimately chose RelayHealth as our vendor of choice due to our existing application inventory, the total cost of ownership, and the ability for RelayHealth to help us achieve our strategic initiative and untimely create an ATM-like model for patient centered care.

RelayHealth “places the patient in the center of the solution, surrounded by a set of practice and hospital workflow and interoperability capabilities that can provide a complete connectivity solution.<sup>1</sup> Patients can sign up through [www.relayhealth.com](http://www.relayhealth.com) or through their physician office’s website and create a personal health record (PHR) that gives them the ability to schedule appointments, request prescription refills, review lab results, access patient education materials, conduct a webVisit® with their physician, sync their RelayHealth PHR with their Google Health and/or Microsoft HealthVault PHRs, communicate with their physicians office, manage a family member’s care, link to additional physicians, update demographic information, request a referral, and update medical information including allergies, medications, health conditions, family history, immunizations, surgeries, procedures, tests, and attach files. Patients can also export a CCD that can be provided to a physician to upload their history into the physician’s EMR. By partnering with RelayHealth we will be able to solve our interoperability problems such as, “linking patients to multiple providers, dependents, pharmacies, and health plans, patient authentication and consent, and patient education.”<sup>1</sup>

By partnering with RelayHealth, the center of our interoperability strategy lies in the creation of a RelayRecord that lies in a cloud computing model which is hosted by RelayHealth. The RelayRecord “can be managed by practices, in support of clinical and administrator workflows and can contain documents, notes, and structured data based on interoperable terminology and data representations.”<sup>1</sup> Patients are given control and have the ability to “connect and unify their RelayRecords and explicitly participate

in the management of their health care through PHR, secure messaging, education, and financial workflows.”<sup>1</sup>

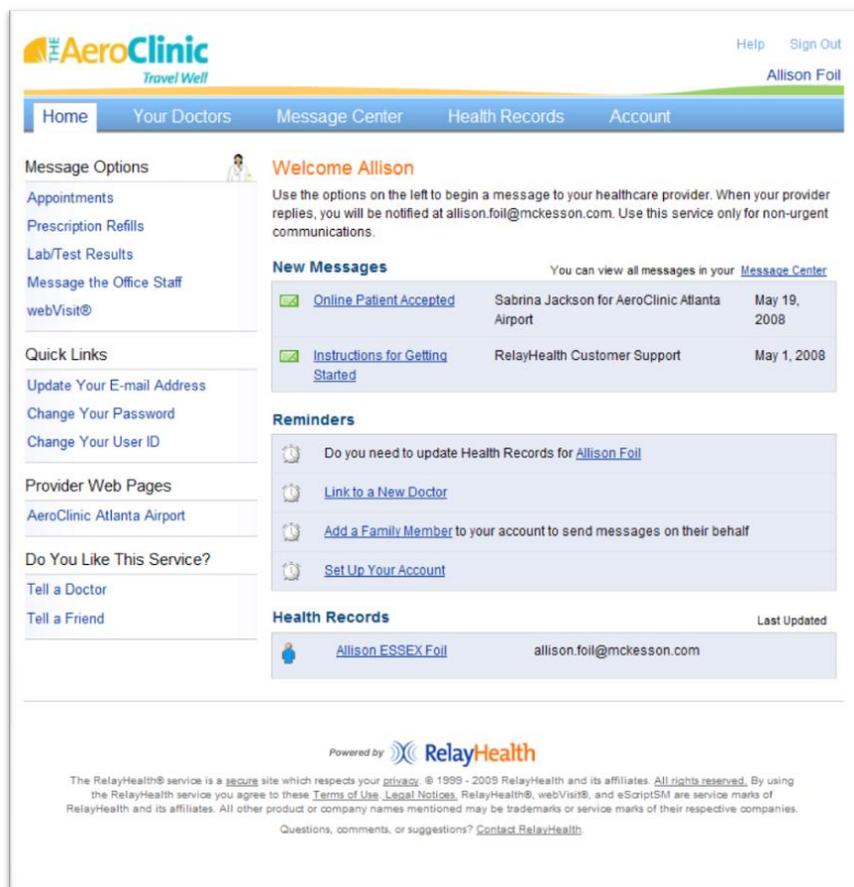


Figure 9: Home page of the patient's view of their RelayRecord or PHR

**THE AeroClinic** *Travel Well* Help Sign Out Allison Foil

Home Your Doctors Message Center **Health Records** Account

**Allison ESSEX Foil**

View **Allison Foil - Medical Information** [Start the Update Wizard](#)

**Medical Information** Keep your medical information up-to-date by periodically adding or changing information in your health history.

Prescription Refills

Personal Information

Health Habits

Access History

Tracking Results

HealthVault

Import/Export Health Data

Actions

Add a Family Member

View/Print Health Record

**Allergies: Medication**

No allergies specified

[Add a Medication Allergy](#)

**Allergies: Environmental or Food**

No allergies specified

[Add an Environmental or Food Allergy](#)

**Medications**

Drug	Medication Details	Currently Taking?	Source	Edit
No medications specified				
<a href="#">Add a Medication</a>				

**Health Conditions**

No conditions specified

[Add a Health Condition](#)

Figure 10: Patients can update pertinent medical information and history in the RelayRecord

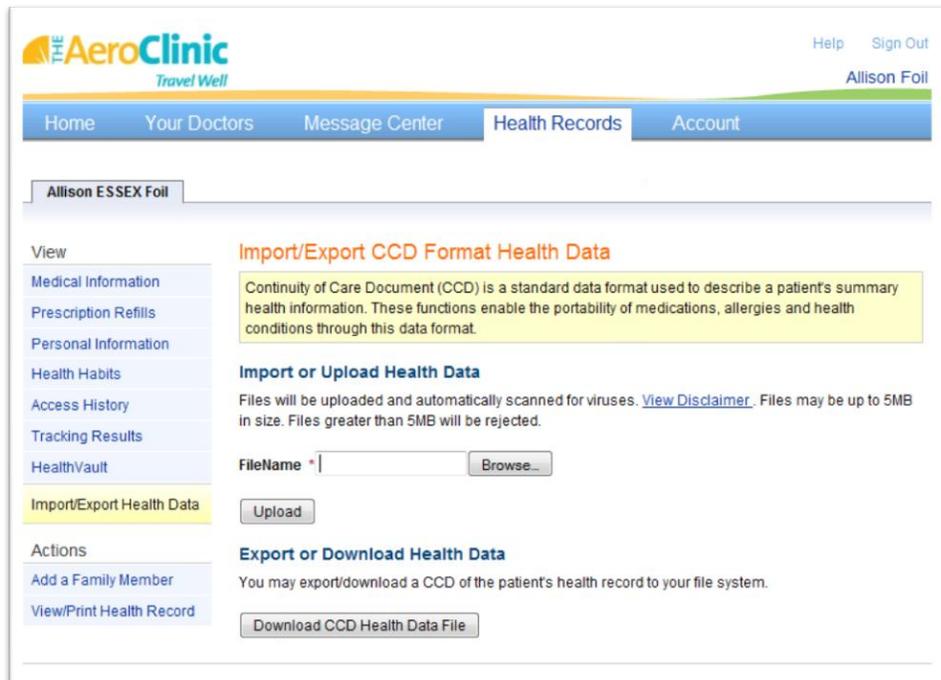


Figure 11: Patients can import and export health data via the CCD standard

## 7 Patient Matching & Network Identity Management

The ability to appropriately identify a patient in an electronic health record (EHR) database is paramount. Documenting clinical findings, prescribing medications, and posting diagnostic testing results to the wrong patient record *is*are detrimental and a patient safety concern than can cause serious errors and lead to a sentinel event. Records management is challenging and requires proper training of personnel on electronic databases to understand the patient matching algorithm. Information systems or other designated personnel should be trained on record merging and ideally, the systems used in a healthcare environment would have the ability to reverse a record merge in the case that records were merged inappropriately. This problem is exasperated when multiple systems with multiple databases are in use within a health system.

Wellcare Health System uses the Initiate Interoperable Health enterprise master patient index (EMPI) software in house with our acute care solutions. As we embark on the journey to interoperate with the physician offices in our community, each of the ambulatory EMRs also have EMPI capabilities that are inherit in each ambulatory EMR system. When we connect the acute care environment to the ambulatory environment across a cloud computing model to interoperate, an additional patient matching and EMPI strategy is necessary. We have relied on our vendor of choice, RelayHealth, to supply this functionality.

Patient data, no matter if it originates from the acute care hospital or ambulatory environment, needs to be aggregated into a single patient record—in our case the RelayRecord—and matched so that records are filed under the appropriate patient record in the database. Through our partnership with RelayHealth we are able to leverage our native identity schema that is supplied by Initiate Systems in-house today and scale our operations through the RelayHealth-supplied Network Identity Management. Through RelayHealth, various identity schemes that are present in both the ambulatory and acute care environments are enabled. RelayHealth “exposes the correct identities depending on the context of the connected user or system which applies to patients and identification of physicians, practices, health systems, users, and health plans.”<sup>1</sup> RelayHealth does not require the physician to search the entire patient database that resides in the cloud, instead a “matching scenario must have an arbitrator that can resolve possible matches so searching only happens with the set of patients associated with a practice or health system.”<sup>1</sup> Furthermore, patient “matching happens when data is added to a practice or hospital in RelayHealth, such as an ADT upload, results feed, referral receipt, or online patient joining a practice. Matching resolution and patient merging functions are built into the standard workflows of RelayHealth applications.”<sup>1</sup>

The RelayHealth solution “combines probabilistic demographic matching with user-friendly workflows that enable resolution of potential duplicates quickly and easily – usually by a single click.”<sup>2</sup> Users of the system are alerted to any potential duplicate patients while reviewing clinical results in RelayHealth and can “quickly view the associated demographic data and simply choose whether or not to merge the patient records.”<sup>2</sup> “In addition, RelayHealth maintains a full electronic audit trail of all merged records, including the ability to disaggregate the records if required.”<sup>2</sup>

Specifically, “when a practice sets up a patient upload into RelayHealth, the practice’s internal patient identification scheme is also established. This includes the HL7 assigning authority and ID Type that specify the practice’s identity domain. As patient records from one practice are merged with records from other sources, the practice’s identifier is aggregated along with the other sources’ identifiers on the unified patient record. In this manner, unified patient records in RelayHealth exist within the multiple identity domains of the practices and hospitals that provide care. All data and workflow interfaces enable this same identifier to be used to reference patients. When a prescription is copied into an EMR or a one-click “start patient message” link is built into a practice management system, these identify patients using the same identity domain established in the practice’s patient upload.”<sup>2</sup>

## 8 WellCare Patient Centric Information Architecture

Our basic architecture is illustrated below.

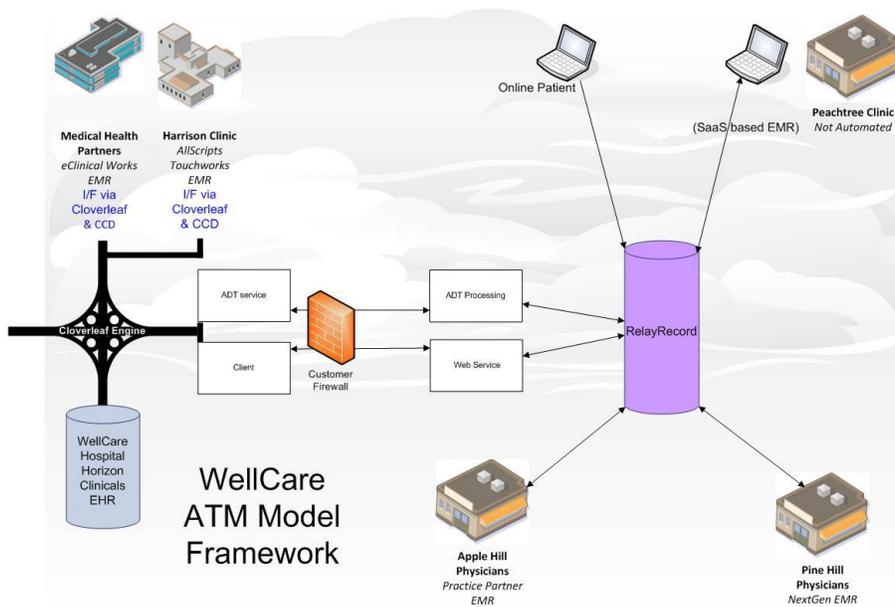


Figure 9 WellCare Patient Centric System Architecture

The framework for these connections is based on a cloud based data repository connected to our system's interface engine. The engine allows for full interoperability between the hospitals and its clinics, as well as to the two larger provider organizations in our community. The cloud allows for a lower level of interoperability between the engine and the smaller organizations in our community. We will be using both T1 and VPN connections to assure both speed and security. Overlaying the data flow and sources of the data elements onto this framework gives a clearer picture of how this plan will work.

Our principle interoperability approach is the HITSP C32 Version 2.3 Continuity of Care Document (CCD). The data elements, as noted in the central text box, will be extracted from each of the contributing EHR's, combined into a single document utilizing the HITSP CCD standard, and transmitted to the needed locations based on the HITSP standards for Managing Sharing of Documents. The details of data flow are within the HITSP standards. Transaction package 13, for example, used to Manage Sharing of Documents, supports the sharing of patient records as attested objects called documents. Consistent with our desire for semantic interoperability, this document is a composite of structured and coded health information, both narrative and tabular, that describes acts, observations and services for the purpose of exchange. This detailed structure allows for the construction and delivery of a consistent product. No assumption is made by this construct in terms of the format and structure of the content of documents shared.

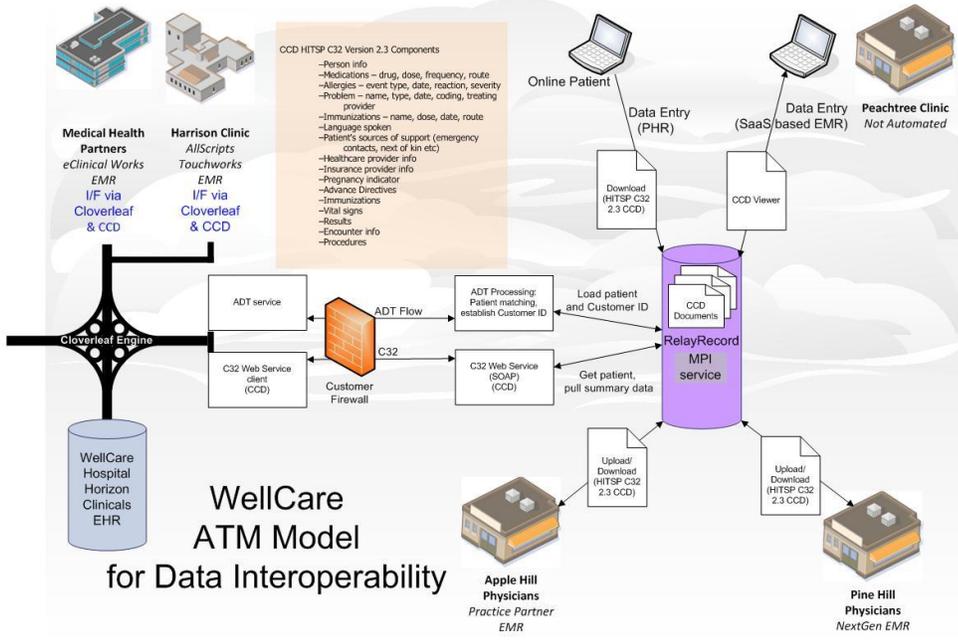


Figure 10 WellCare Patient Centric System Architecture encompassing HITSP C32 Version 2.3 Continuity of Care Document

All of the data elements as shown in the central text box should be present in each of the EHR's. These elements represent the critical information needed to provide appropriate medical care. The content of the document consists of a mandatory textual part (which ensures human interpretation of the document contents) and optional structured parts (for software processing). Appendix A and Appendix B show respective examples of these two forms. These components are identified within the document by XML tags and this structure will allow users to move patient records between facilities across the network.

The specific data flows/message segments that are supported across the cloud, based on RelayHealth's open API are:

HL7 Segments (version 2.x)

- MDM = Medical Document Management message

- ORU = Unsolicited Transmission of an Observation. For each patient order (OBR segment...One of several segments that can carry order information more results may be transmitted depending upon the number of observations generated by the order) more results may be transmitted depending upon the number of observations generated by the order.
- RDE = Pharmacy Encoded Order message
- ADT = Admission, Discharge and Transfer (ADT) message.

Semantic mapping, vocabularies and Clinical Decision Support Engines that are supported by RelayHealth interoperability model:

- NDC = National Drug Code (not HL7)
- RxNorm = RxNorm provides normalized names for clinical drugs and links its names to many of the drug vocabularies commonly used in pharmacy management and drug interaction software, including those of First Databank, Micromedex, MediSpan, Gold Standard Alchemy, and Multum. By providing links between these vocabularies, RxNorm can mediate messages between systems not using the same software and vocabulary.
- First DataBank = First DataBank drives patient safety and healthcare quality by providing drug databases within information systems. Drug-drug and drug-allergy checking, etc.
- Medi-Span®, a part of Wolters Kluwer Health, is the leading provider of prescription drug information and drug interactions databases for thousands of health care professionals worldwide. Drug-drug and drug-allergy checking, etc.

HITSP C32 CCD = Continuity of Care Document, based off of the HL7 Clinical Document Architecture whereas C32 is the numbered HITSP standard

Problem (SNOMED-CT) – name, type, date, coding, treating provider

Each time a health event occurs, the data will be formatted and reports generated. Reports will NOT be made available to providers however, until the patient has authorized transfer of the record. In most cases the patient authorization to publish and transfer a record at the time of major events is embedded into the consent for treatment, such as an ER or hospital stay. For more common and less comprehensive care, such as an outpatient event, the patient will need to provide a more separate and explicit authorization, and the CCD will not be published automatically. There will be some routine

triggers to help assure currency of data. For example an outpatient provider's EHR might be queried to update the system one year after the last update provided.

Consumption of the documents represents their meaningful use. A variety of tools will be made available to allow users to search and select the data of significance. Administrative controls will be set to limit access to specific users based on clinical privileges. This process will be refined based on user feedback to assure that we are meeting our goals and the ARRA requirements. The expectation is that this approach will be easier and faster to implement than full integration with the interface engine, and more acceptable to our community of providers. In this patient-centric model there are two expected authorization workflows. In the routine workflow, the patient uses a PC to view appointments and request records transfers. After authorization, the reports are sent from the data repository to the appropriate providers EHR for consumption. In the urgent authorization workflow the provider identifies the patient within the system, requests and receives the reports, and a security message is sent to the patient. Graphical representations of these two authorization workflows can be found in Appendix C and Appendix D.

This first phase of development of the system will begin to allow the publication and consumption of CCD's through the cloud. EHR's will import and extract these records based on their individual capabilities. There will be Audit Trail and Node Authentication available as a result of this process. Immunizations will be added after integration with the statewide immunization database is completed, which is scheduled to occur within the next six months.

## 9 Workflow

In the end, the goal of the user is to have discrete ACTIONABLE data. The user wants this to be simple – getting the right records, to the right provider, at the right time. The RelayRecord “ATM” system will allow us to accomplish this. However as an IT community we MUST understand the clinical workflow that such technology imposes on our clinicians. Despite all the technology options available, if it's not easy, if it doesn't fit, clinicians won't choose to use it. As we have diagrammed, from a technical standpoint our core concept is a central data repository (CDR) of HITSP C32 2.3 CCD documents accessible by any authorized clinician but controlled by the patient. To make this work as a useful tool it

will be extremely important to configure it so that it, at the very least, does not impede clinical workflow, and hopefully will facilitate it.

There are three distinct viewpoints of system users. From the patients point of view things are fairly simple. The patient uses a computer with Internet access and a web browser to access to their Personal Health Record (PHR) home page, an example of which can be found in Appendix E. This is our “ATM model.” From this screen that patient can schedule appointments, request prescription refills, view test results, message physician’s office, etc. Patients also have the ability to update their medical information including allergies, medications, problems, procedures and surgeries, family history and much more. This gives the patient that centered control and allows them ownership of their health. Lastly, the patient can upload/download a CCD. They have the ability to manually export a CCD into other CCD-compliant systems and to even save it on a USB thumb drive and take it to a provider. If the provider is connected to the RelayHealth cloud, the provider can request that CCD automatically.

From the hospital point of view a hospitalization is almost by definition a significant and major health care event that should be added to the cumulative record. Hospital discharges, whether inpatient or outpatient, will automatically generate a CCD for delivery to the CDR. The system could also be configured to automatically generate an updated CCD in the instance of specified significant events, for instance intensive care unit (ICU) transfers, major drug reactions, new complication problems. Notifications to the designated primary care provider would be part of the process. Consumption of a CCD would largely be at the discretion of the managing clinicians who will normally look to access only those specific to the problem at hand as well as, for instance, a more general one to assist them in meeting hospital and JCAHO requirements for a complete admission history and physical on the chart within 24 hours. These clinicians would be required to be authorized users prior to the time of the records request, and any request not initiated by the patient would trigger a message to the patient notifying them of the event. Participation by the patient in routine records transfer would be simplified, but the patient would always have the ability to “opt out”.

From the clinician point of view, access to the system is also via a web-based physician portal. Clinicians have the option to review and decide whether or not to import the data from a CCD, which accomplishes the goal of providing clinicians with discrete actionable data that complements their workflow. An example of a physician portal can be found in Appendix F. The physician can easily browse

to a list of CCD's available for review and will be able to select from the records that are available. This will allow them to import the data that they feel is most likely to be helpful without filling their EMR's with extraneous information. The users of the system will either get an image of the CCD which they will be able to index based on date of publication and source, or those that have EMR's with import capability will be able to review and accept data they consider appropriate to their records. The default will be to not accept data in order to limit the risk of duplicate information. Visual indicators will highlight duplicate entries with an option available to reconcile. Data differences will be highlighted to make it easier to pinpoint mismatched data. With regard to publishing a CCD in the ambulatory setting, every clinical encounter need not and should not generate a new CCD as the system would quickly become clogged with redundant information. Although any clinician may choose to initiate a CCD at any time, most of the time they will be provided in response to predefined criteria, for instance hospital admission or surgery bookings, that will be handled by the office staff with only a simple sign off required of the clinician. The office would also respond to specific requests from other facilities or the patient. The key elements are to maintain flexibility, respond to clinician feedback, and maintain ease of access and speed of response.

## **10 Metrics of Success**

Our vision is to improve care coordination and exchange meaningful clinical information. As a result of the metrics we will use, the return on investment will be easily identified. The most dramatic change will be access to records. At present, the time needed to get records ranges from minutes to days. We are expecting to standardize the time from when the patient gives permission, to task completion, to be less than a minute. Patient perception will be that we are communicating clearly when their hear providers ask for confirmation of data, rather than asking for a fresh recall, but redundant data entry will continue to be an issue until there is complete interoperability. Although the basic system will allow some data to be extracted from summaries of care, providers will still need to manually move data from specific fields for calculations, and to assimilate data into current patient care documents so that specific review of records can be demonstrated.

A major aspect of this project will be the public health and research benefit of aggregated de-identified data. It is unknown at what point we will be able to effectively connect to other systems within the

region, but if we are prepared with a versatile community network, the time and effort required to complete this task should be minimized. Finally, we will be able to obtain results for the strongest driver for this project – Meaningful Use. Having medication reconciliation capability for at least 80% of all relevant encounters and transitions of care, and a summary of care record for at least 80% of transitions of care and referrals will be possible.

## **11 Conclusion**

Our goal overall is to provide access to actionable healthcare data in a timely, non-redundant, and secure fashion. This project will move WellCare Health Systems toward four of its key strategic initiatives, and the expectation is that we will gain not only immediate benefit but that these gains will continue to demonstrate value in the years ahead. In addition to the many reasons already discussed for us to fund and move forward with this interoperable, patient-centered model for sharing health information, but let us consider three additional reasons that will continue to fuel the importance of implementing this model in the future. Accountable Care Organizations will require alignment and coordination between the hospital and community providers to an ever increasing degree. Changing reimbursements from fee for service to a lump sum for the Episode of Care will require coordination and increased involvement between the inpatient and ambulatory services. And lastly, the Patient-Centered Medical Home will require a patient-centered IT platform that coordinates care across multiple settings. We feel that we are quickly meeting our goals and objectives and are well on our way to creating a patient-centered connected care model.

## Cited Works

P.N.Gilbert (personal communication, February 26, 2010)

## References

Automating the maintenance of problem list documentation using a clinical decision support system. Jao C, Hier D, Galanter W. AMIA Annu Symp Proc. 2008 Nov 6:989.

<http://www.cms.hhs.gov/apps/media/press/factsheet.asp?Counter=3466>

Department of Health and Human Services. 45 CFR Part 170. *Health Information Technology: Initial Set of Standards, Implementation Specifications, and Certification Criteria for Electronic Health Record Technology.* Federal Register. Vol. 75, No. 8.

Wednesday, January 13, 2010. Available online:

<http://www.regulations.gov/search/Regs/home.html#documentDetail?R=HHS-OS-2010-0001-0002>

Automated Teller Machine, Wikipedia. Available online:

[http://en.wikipedia.org/wiki/Automated\\_teller\\_machine](http://en.wikipedia.org/wiki/Automated_teller_machine)

Thomas J. Handler MD, et al. (23 July 2009). Hype Cycle for Healthcare Provider Applications and Systems. Gartner.

Barry Runyon, et al. (28 July 2009). Hype Cycle for Healthcare Provider Technologies & Standards. Gartner.

*Health Information Exchanges: The Reality of HIE Adoption.* KLAS February 2010. [www.klasresearch.com](http://www.klasresearch.com) ©2010 KLAS Enterprises, LLC. All rights reserved.

*Top 20 Best in KLAS Awards. Software and Professional Services.* KLAS December 2009. [www.klasresearch.com](http://www.klasresearch.com) ©2009 KLAS Enterprises, LLC. All rights reserved.

Interoperability: Supplying the Building Blocks for a Patient-centered EHR. CCHIT.

Available online: <http://www.docstoc.com/docs/5228048/CCHIT-White-Paper-Interoperability>

[http://www.hitsp.org/ConstructSet\\_Details.aspx?&PrefixAlpha=2&PrefixNumeric=13](http://www.hitsp.org/ConstructSet_Details.aspx?&PrefixAlpha=2&PrefixNumeric=13) ; HITSP Manage Sharing of Documents Transaction Package Released for Implementation 20071213 V2.2; pg 17

Formatted: German (Germany)

*RelayHealth Virtual Information Exchange: A SaaS Model for Health Information Exchange.* ©RelayHealth. 2009.

*Virtual Information Exchange™ Ambulatory Interoperability Toolkit Release 9.2.*  
©RelayHealth. 2009.

HITSP Summary Documents Using HL7 Continuity of Care Document (CCD) Component  
Version:2.3. Available online:  
<http://www.hitsp.org/Handlers/HitspFileServer.aspx?FileGuid=06507814-5906-42e3-b40f-f040c5426a4e>

Practice Brief: Master Patient (Person) Index (MPI)—Recommended Core Data Elements  
[http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1\\_000073.hcsp?dDocName=bok1\\_000073](http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_000073.hcsp?dDocName=bok1_000073)

Data Elements for EHR Documentation:  
[http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1\\_034460.hcsp?dDocName=bok1\\_034460](http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_034460.hcsp?dDocName=bok1_034460)

270/271 Health Care Eligibility Benefit Inquiry and Response For Independence  
Administrators

*Webster's New World Medical Dictionary*

<http://www.aafp.org/fpm/20070900/17icd9.html>

## Appendices

### Appendix A

An example of a CCD Returned: View Only.

<b>Date Created:</b>	Fri Jan 08, 2010 at 03:16 AM UTC				
<b>From:</b>	Test Patient Solventus CEND/PHR V1.0				
<b>To:</b>	Test Doctor ( Primary Provider)				
<b>Purpose:</b>	CEND PHR				

Patient Demographics					
Name	Date of Birth	Gender	Identification Numbers	Address / Phone	
Test Patient	Apr 12, 1964	F	SSN: 154-23-6598	<b>Home:</b> 1234 Main Street Disney, FL45126  <b>Home:</b> 222-115-1425 <b>Alternate:</b> 222-114-6589 <b>Mobile:</b> 222-114-6548 <b>Fax:</b> 222-165-8974	

Alerts						
Type	Date	Code	Description	Reaction	Source	
Allergy	Start date: 25 Years	9080 (FDB ALLERGY)	129696000 (SNOMED CT)	C1268626 (UMLS Concept)	Latex	Hives- Moderate <a href="#">Test Patient</a>
Allergy	Start date: 8 Years	245 (FDB ALLERGY)	294513009 (SNOMED CT)	C0571425 (UMLS Concept)	Penicillins	Anaphylaxis- Life Threatening <a href="#">Test Patient</a>

Support Providers	
Role	Name
Emergency Contact	<a href="#">Emergency Test Contact</a>

Problems					
Type	Date	Code	Description	Status	Source
Problem	Date Updated: Jan 08, 2010	C0004096 (UMLS Concept)	195967001 (SNOMEDCT)	Asthma	<a href="#">Test Patient</a>
Problem	Date Updated: Jan 08, 2010	C1384666 (UMLS Concept)	389.9 (ICD9CM) 15188001 (SNOMEDCT)	Hearing Loss	<a href="#">Test Patient</a>
Problem	Date Updated: Jan 08, 2010	C0020538 (UMLS Concept)	997.91 (ICD9CM) 194794002 (SNOMEDCT)	High Blood Pressure	<a href="#">Test Patient</a>

Procedures										
Type	Date	Code	Description	Location	Substance	Method	Position	Site	Status	Source
Lab	Date Updated: Jan 08, 2010 Start date: 12132009	82465 (CPT)	CHOLESTEROL, SERUM OR WHOLE BLOOD, TOTAL						Completed	<a href="#">Test Patient</a>

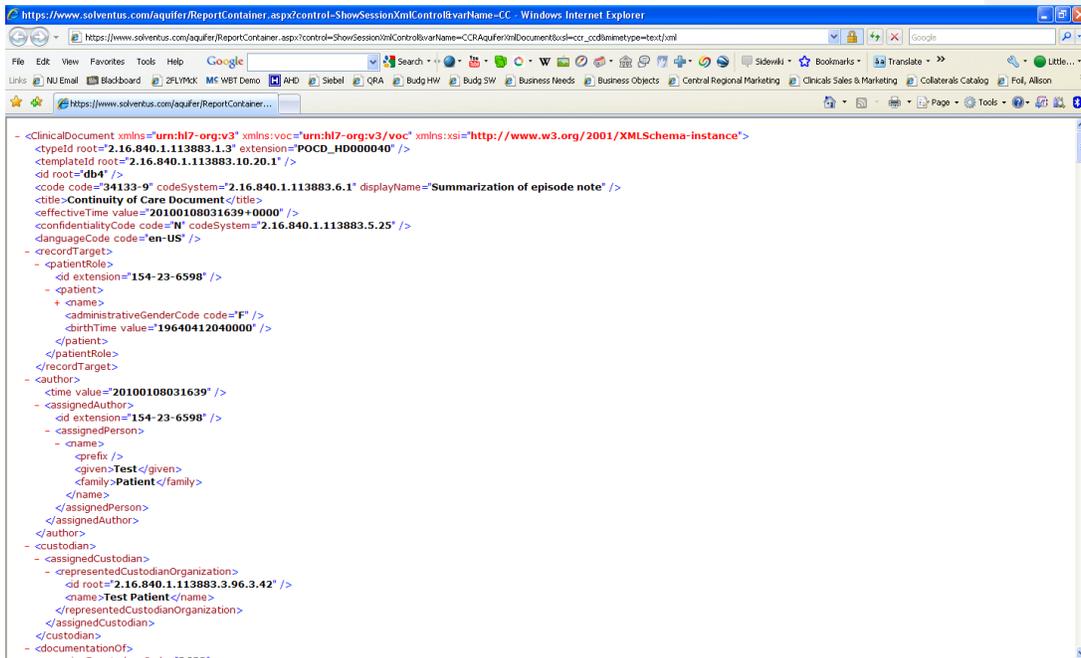
  

Medications										
Medication	Date	Status	Form	Strength	Quantity	SIG	Indications	Instruction	Refills	Source
aspirin (Aspirin)	Date Updated: Jan 08, 2010	ACTIVE	tablet, dispersible	81 mg		1 PO 1 time per day				<a href="#">Test Patient</a>

Figure 11 An example of a CCD Returned: View Only.

## Appendix B

An example of a CCD: XML (Computer Readable).



```
- <ClinicalDocument xmlns="urn:hl7-org:v3" xmlns:voc="urn:hl7-org:v3/voc" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040" />
  <templateId root="2.16.840.1.113883.10.20.1" />
  <id root="db4" />
  <code code="34133-9" codeSystem="2.16.840.1.113883.6.1" displayName="Summarization of episode note" />
  <title>Continuity of Care Document</title>
  <effectiveTime value="20100108031639+0000" />
  <confidentialityCode code="N" codeSystem="2.16.840.1.113883.5.25" />
  <languageCode code="en-US" />
  - <recordTarget>
    - <patientRole>
      <id extension="154-23-6598" />
      - <patient>
        + <name>
          <administrativeGenderCode code="F" />
          <birthTime value="19640412040000" />
        </patient>
      </patientRole>
    </recordTarget>
  - <author>
    <time value="20100108031639" />
  - <assignedAuthor>
    <id extension="154-23-6598" />
    - <assignedPerson>
      - <name>
        <prefix />
        <given>Test</given>
        <family>Patient</family>
      </name>
    </assignedPerson>
    </assignedAuthor>
  </author>
  - <custodian>
    - <assignedCustodian>
      - <representedCustodianOrganization>
        <id root="2.16.840.1.113883.3.96.3.42" />
        <name>Test Patient</name>
      </representedCustodianOrganization>
    </assignedCustodian>
  </custodian>
  - <documentationOf>
```

Figure 12 An example of a CCD in XML.

## Appendix C

Diagram for Data Interoperability - Routine Authorization.

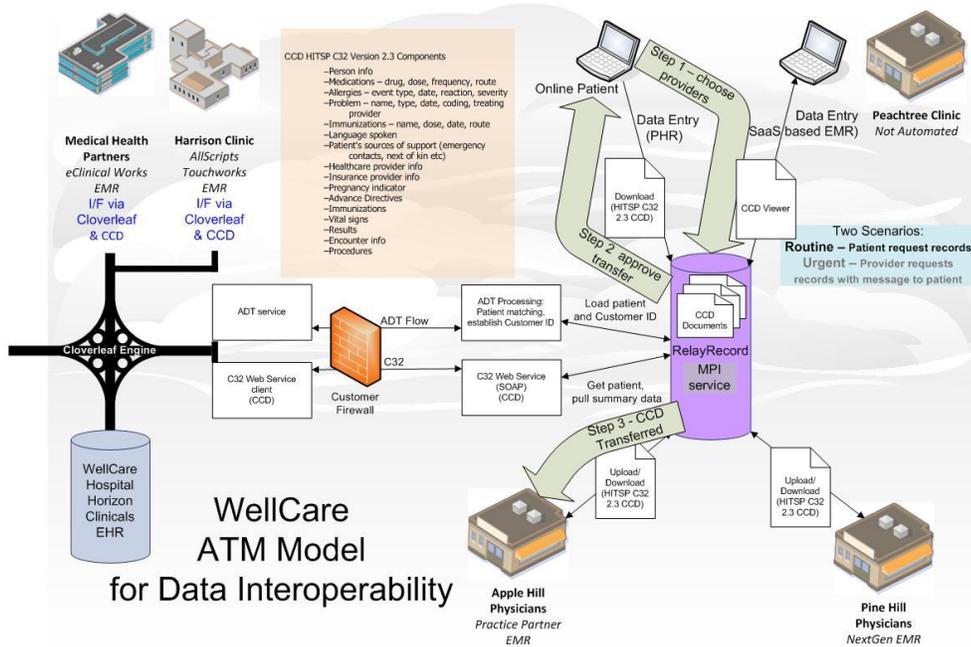


Figure 13 Diagram of process flow for Routine Authorization for Data Interoperability.

## Appendix D

Diagram for Data Interoperability - Urgent Authorization.

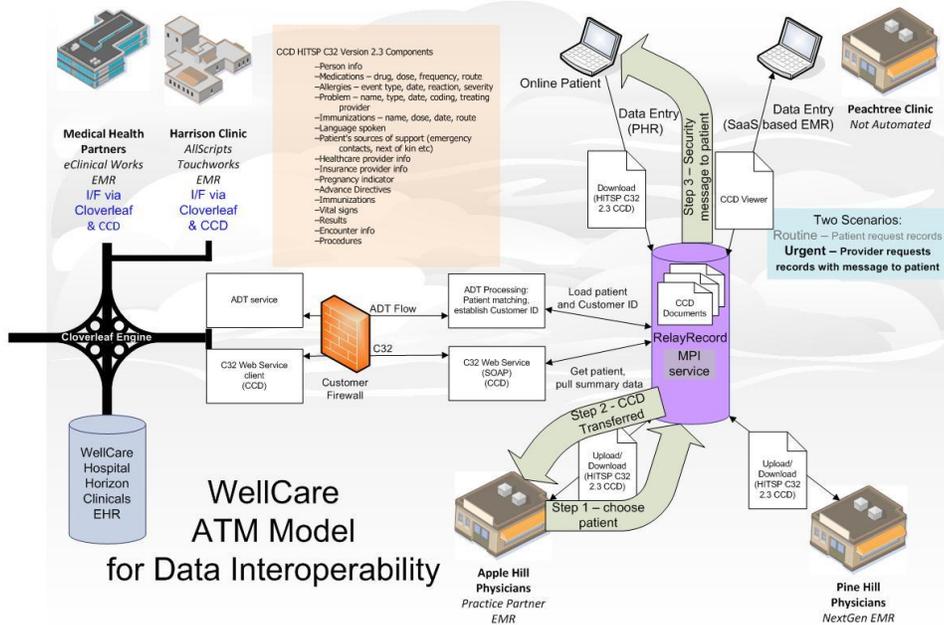


Figure 14 Diagram of process flow for Urgent Authorization for Data Interoperability.

## Appendix E

Screen capture of Patient Web-based Portal or PHR

The screenshot displays the AeroClinic patient portal interface. At the top left is the logo for 'THE AeroClinic' with the tagline 'Travel Well'. On the top right, there are links for 'Help' and 'Sign Out', and the user's name 'Allison Foil'. Below the logo is a navigation bar with tabs for 'Home', 'Your Doctors', 'Message Center', 'Health Records', and 'Account'. The main content area is divided into several sections: 'Message Options' with links for appointments, refills, and lab results; 'Quick Links' for updating email and passwords; 'Provider Web Pages' for the Atlanta Airport location; and 'Do You Like This Service?' with options to tell a doctor or friend. The central 'Welcome Allison' section provides instructions on using the messaging service. Below this is a 'New Messages' section with a table of recent messages. A 'Reminders' section lists tasks like updating health records and adding family members. The 'Health Records' section shows a table with the user's name and email. At the bottom, there is a 'Powered by RelayHealth' logo and a privacy policy notice.

**THE AeroClinic**  
Travel Well

Help Sign Out  
Allison Foil

Home Your Doctors Message Center Health Records Account

**Message Options**

- Appointments
- Prescription Refills
- Lab/Test Results
- Message the Office Staff
- webVisit®

**Quick Links**

- Update Your E-mail Address
- Change Your Password
- Change Your User ID

**Provider Web Pages**

- AeroClinic Atlanta Airport

**Do You Like This Service?**

- Tell a Doctor
- Tell a Friend

**Welcome Allison**

Use the options on the left to begin a message to your healthcare provider. When your provider replies, you will be notified at [allison.foil@mckesson.com](mailto:allison.foil@mckesson.com). Use this service only for non-urgent communications.

**New Messages** You can view all messages in your [Message Center](#)

<input checked="" type="checkbox"/>	<a href="#">Online Patient Accepted</a>	Sabrina Jackson for AeroClinic Atlanta Airport	May 19, 2008
<input checked="" type="checkbox"/>	<a href="#">Instructions for Getting Started</a>	RelayHealth Customer Support	May 1, 2008

**Reminders**

- Do you need to update Health Records for [Allison Foil](#)
- [Link to a New Doctor](#)
- [Add a Family Member](#) to your account to send messages on their behalf
- [Set Up Your Account](#)

**Health Records** Last Updated

	<a href="#">Allison ESSEX Foil</a>	<a href="mailto:allison.foil@mckesson.com">allison.foil@mckesson.com</a>
--	------------------------------------	--

Powered by RelayHealth

The RelayHealth® service is a [secure](#) site which respects your [privacy](#). © 1999 - 2009 RelayHealth and its affiliates. All rights reserved. By using the RelayHealth service you agree to these [Terms of Use](#), [Legal Notices](#), RelayHealth®, webVisit®, and eScriptSM are service marks of RelayHealth and its affiliates. All other product or company names mentioned may be trademarks or service marks of their respective companies. Questions, comments, or suggestions? [Contact RelayHealth](#).

Figure 15 Screen capture of Patient Web-based Portal

## Appendix F

### Screen capture of Physician Web-based Portal

Status	Generic	Charted Medication	Since	Indication	Source	Confirmed	Type
Active	Acetamin...	Tylenol Oral 1				Confirmed 09/06/2009 13:57 HHS, MCKESSON (HHS)	Needs Review
Discontinued	Acetamin...	Tylenol Oral 1				Confirmed 09/06/2009 13:57 HHS, MCKESSON (HHS)	
Active	Acetamin...	Tylenol Oral				Confirmed 09/04/2009 11:11 8889 - HBOC, INSTALL (CI)	Vitamin
Active	Albuterol	Albuterol Inhal		Acute Bronchitis(466.0)		Confirmed 09/06/2009 13:57 HHS, MCKESSON (HHS)	
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Active	Albuterol...	Albuterol Sulfate 2 mg Tablet			Self	Confirmed 09/04/2009 11:09 8889 - HBOC, INSTALL (CI)	
Active	Aspirin	Aspirin Oral				Confirmed 09/06/2009 13:57 HHS, MCKESSON (HHS)	
Active	Atorvast...	Atorvastatin Oral				Confirmed 09/06/2009 11:10 8889 - HBOC, INSTALL (CI)	
Active	Diazepam	Diazepam Oral 2 mg Tablet 1 - 2 mg/ml, 3 times a day	03/25/2009	Generalized Nonconv...	Parent	Confirmed 06/24/2009 07:58 HHS, MCKESSON (HHS)	Vitamin
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Active	Diliazem...	Diliazem HCl 30 mg Tablet 1 - 2 Tablet Sustained Release 24 hr 2 times a day			Self	Confirmed 09/04/2009 11:10 HHS, MCKESSON (HHS)	
Active	Diliazem...	Cardizem 100 mg Tablet 2 tablet Before meals & at bedtime PRN...	2000		Dr. Phil S...	Confirmed 07/23/2009 12:11 HHS, MCKESSON (HHS)	
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Active	Flecainide	Flecainide 100 mg Tablet			Self	Confirmed 09/04/2009 11:04 HHS, MCKESSON (HHS)	
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Active	Furosemi...	Furosemide 100 mg Tablet 7 - 2 mg Before meals & at bedtime PRN...	2000		Self	Confirmed 09/04/2009 11:10 8889 - HBOC, INSTALL (CI)	
Active	Ibuprofen	Motrin Oral Tablet				Confirmed 09/06/2009 13:58 HHS, MCKESSON (HHS)	
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Active	Irbesartan	Irbesartan 150 mg Tablet			Self	Confirmed 09/06/2009 13:58 HHS, MCKESSON (HHS)	Needs Review
Discontinued	Levonorg...	Levonorgestrel-Ethinyl Estradiol Oral Tablet 1 - 2 drops				Confirmed 09/04/2009 11:12 8889 - HBOC, INSTALL (CI)	
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Discontinued	Meloxicam	Meloxicam 100 mg Tablet 8 mg Before meals & at bedtime PRN...	2000		Self	Confirmed 09/04/2009 11:12 8889 - HBOC, INSTALL (CI)	

Figure 16 Screen capture of Physician Web-based Portal

## Appendix G

### Patient Master Index

Data Element	Associated Transactions (if known)	Associated Systems/Data Stores
Internal patient identification		Patient Master Index
Person name		Patient Master Index
Date of birth		Patient Master Index
Date of birth qualifier		Patient Master Index
Gender		Patient Master Index
Race		Patient Master Index
Ethnicity		Patient Master Index
Address		Patient Master Index
Extended address		Patient Master Index
Alias/previous name		Patient Master Index
Social Security number		Patient Master Index
Facility identification		Patient Master Index
Person location		Patient Master Index
Account number		Patient Master Index
Admission or encounter date		Patient Master Index
Discharge or departure date		Patient Master Index
Encounter or service type		Patient Master Index
Patient disposition		Patient Master Index
Marital status		Patient Master Index
Telephone number		Patient Master Index
Mother's maiden name		Patient Master Index
Place of birth		Patient Master Index
Advance directive and surrogate		Patient Master Index

decision making		
Organ donor status		Patient Master Index
Emergency contact		Patient Master Index
Allergies/reactions		Patient Master Index
Problem list		Patient Master Index
Marital status		Patient Master Index
Telephone number		Patient Master Index

## Appendix H

### Electronic Health Record (EHR)

#### Clinical Data

Account number		EHR
Admission or encounter date		EHR
Discharge or departure date		EHR
Encounter or service type		EHR
Patient disposition		EHR
Date of birth qualifier		EHR
Gender		EHR
Marital status		EHR
Telephone number		EHR
Mother's maiden name		EHR
Place of birth		EHR
Advance directive and surrogate decision making		EHR
Organ donor status		EHR

Emergency contact		EHR
Allergies/reactions		EHR
Problem list		EHR
Marital status		EHR
Telephone number		EHR
Chief complaint		EHR
Reason for visit		
Symptom(s)		EHR
Onset of symptom(s)		EHR
Duration of symptom(s)		EHR
Over-the-counter (OTC) treatment		EHR
Condition type		EHR
Date diagnosed		EHR
Age of onset		EHR
Treatment		EHR
Condition status		EHR
Drug		EHR
Dosage		EHR
Route		EHR
Quantity number		EHR
Quantity form		EHR
Frequency		EHR
Start date		EHR
Stop date		EHR
Prescribed by		EHR
Prescription date		EHR
Prescription number		EHR
Pharmacy		EHR

Allergic reaction		EHR
Source of medication list		EHR
Allergy or sensitivity type		EHR
Reaction		EHR
Severity		EHR
Date last occurred		EHR
Treatment		EHR
Marital status		EHR
Occupation		EHR
Home environment		EHR
Daily routine		EHR
Dietary patterns		EHR
Sleep patterns		EHR
Exercise patterns		EHR
Coffee consumption		EHR
Tobacco use		EHR
Alcohol use		EHR
Drug use		EHR
Child health history		EHR
Adult health history		EHR
Hereditary diseases		EHR
Mother health status		EHR
Mother age of death		EHR
Mother cause of death		EHR
Father health status		EHR
Father age of death		EHR
Father cause of death		EHR

Sibling(s) health status		EHR
Sibling(s) age of death		EHR
Sibling(s) cause of death		EHR
<b>Review of Systems</b>		EHR
General		EHR
Skin		EHR
Head		EHR
Eyes		EHR
Ears		EHR
Nose and sinuses		EHR
Mouth and throat		EHR
Neck		EHR
Breasts		EHR
Respiratory		EHR
Cardiac		EHR
Gastrointestinal		EHR
Genitourinary		EHR
Gynecologic		EHR
Musculoskeletal		EHR
Peripheral vascular		EHR
Neurologic		EHR
Hematologic		EHR
Endocrine		EHR
Psychiatric		EHR
<b>Vital Signs</b>		EHR
Pulse		EHR
Respiratory rate		EHR

Systolic blood pressure		EHR
Diastolic blood pressure		EHR
Body temperature		EHR
Height		EHR
Weight		EHR
Body mass index		EHR
Head circumference		EHR
Crown-to-rump length		EHR
Pulse oximetry		EHR
Pulse		EHR
Respiratory rate		EHR
<b>General Appearance</b>		EHR
Appearance		EHR
Body build		EHR
Demeanor		EHR
Hygiene		EHR
<b>Physical Findings</b>		EHR
Skin		EHR
Head		EHR
Eyes		EHR
Ears		EHR
Nose and sinus		EHR
Mouth and throat		EHR
Neck		EHR
Thorax, anterior, and posterior		EHR
Breasts		EHR
Lungs		EHR

Cardiovascular		EHR
Abdomen		EHR
Male genitourinary		EHR
Female reproductive organs		EHR
Ano-rectal		EHR
Musculoskeletal system		EHR
Extremities		EHR
Lymphatics		EHR
Peripheral vascular		EHR
Neurologic		EHR
Mental status		EHR
Skin		EHR
Head		EHR
Eyes		EHR
Ears		EHR
Nose and sinus		EHR
Mouth and throat		EHR
Neck		EHR
Thorax, anterior, and posterior		EHR
Breasts		EHR
<b>Diagnostic Findings</b>		EHR
Test		EHR
Result/finding		EHR
Result/finding date		EHR
Interpretation		EHR
<b>Assessment</b>		EHR
Diagnoses		EHR

Disposition		EHR
<b>Plan</b>		EHR
Treatment goals		EHR
Procedures		EHR
<b>Procedure History</b>		EHR
Procedure		EHR
Date		EHR
Physician		EHR
Institution/location		EHR
Result		EHR
<b>Childhood Immunizations</b>		EHR
Vaccine		EHR
Vaccine type		EHR
Dose		EHR
Age administered		EHR
Date administered		EHR
Lot number		EHR
Physician		EHR
<b>Adult Immunizations</b>		EHR
Vaccine		EHR
Vaccine type		EHR
Dose		EHR
Date administered		EHR
Lot number		EHR
Physician		EHR
<b>Problem(s)</b>		EHR
Problem		EHR

Date of onset		EHR
<b>Payers</b>		EHR
Source of payment		EHR
<b>Request for consultation</b>		EHR
Requesting provider		EHR
Consulting provider		EHR
Reason for consultation		EHR
<b>Discharge Summary</b>		EHR
Admitting diagnosis		EHR
Other diagnoses		EHR
Principal operation/procedure		EHR
Symptom(s)		EHR
Onset of symptom(s)		EHR
Duration of symptom(s)		EHR
Over-the-counter (OTC) treatment		EHR
Result/finding		EHR
Result/finding date		EHR
Procedures performed		EHR
Date procedure performed		EHR
Physician		EHR
Institution/location		EHR
Result		EHR
<b>Medications at Discharge</b>		EHR
Drug		EHR
Dosage		EHR
Route		EHR
Quantity number		EHR

Quantity form		EHR
Frequency		EHR
Start date		EHR
Stop date		EHR
Prescribed by		EHR
Prescription date		EHR
Prescription number		EHR
Pharmacy		EHR
<b>Patient's Condition on Discharge</b>		EHR
Final diagnosis		EHR
Condition on discharge		EHR
<b>Discharge Instructions</b>		EHR
Disposition patient instructions		EHR
Follow-up action		EHR
Follow-up target date		EHR
<b>Operative Report</b>		EHR
Surgeon		EHR
Assistant		EHR
Anesthesiologist		EHR
Preoperative diagnoses		EHR
Postoperative diagnoses		EHR
Operation/procedures performed		EHR
Operation description		EHR
Findings		EHR
Sedation/anesthesia		EHR
Complications		EHR
Drains		EHR

Estimated blood loss		EHR
Packs		EHR
Sutures		EHR
Patient condition		EHR
Discharge from recovery care		EHR

## Appendix I

### X12 Data

<b>GS Functional Group Header</b>		X12 270
App Sender Id Code		X12 270
App Receiver Id Code		X12 270
<b>Information Source Name</b>		X12 270
Entity Identifier Code		X12 270
Identification Code Qualifier		X12 270
Identification Code		X12 270
<b>Information Receiver Name</b>		X12 270
Identification Code Qualifier		X12 270
Identification Code		X12 270
<b>Subscriber Name</b>		X12 270
Identification Code Qualifier		X12 270
Identification Code		X12 270
<b>Service Type Code</b>		X12 270
Insurance Type Code		X12 270

## Appendix X

### Team Members Contributions

#### Team Contributions: (alphabetical by first name)

Allison Foil – primary idea development for the project; 1<sup>st</sup> presentation; 3<sup>rd</sup> presentation; networking and business perspective

Gordon Bleil – idea development; 2<sup>nd</sup> presentation; 3<sup>rd</sup> presentation; medical perspective – hospital/ER

Sharron Lee - idea development; 2<sup>nd</sup> presentation; collation of final paper; paper formatting; software engineering and presentation skills

Timothy Brown - idea development; 1<sup>st</sup> presentation; collation of final paper; primary editing; medical perspective – outpatient

As a team we all worked very well together, being respectful of each others' thoughts, work and difficulties. We paid particular attention to attribution regarding the thoughts and products of others. We utilized a combination of email, phone calls, conference calls, and Adobe Connect for communication. We utilized a combination of several software tools with different versions to share ideas and develop presentations. One of the most difficult things to do actually is to define where the work of one team member stops and another begins. In reviewing the products of our group, they are all very clearly team efforts.

## End Notes

3

---

<sup>1</sup> RelayHealth Virtual Information Exchange: A SaaS Model for Health Information Exchange. ©RelayHealth. 2009.

<sup>2</sup> Virtual Information Exchange™ Ambulatory Interoperability Toolkit Release 9.2. ©RelayHealth. 2009.