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Natasha Paynes   Date

Applying Public Health Informatics to Explore Emerging Technologies
In Systematic Data Reconciliation

By
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Degree to be awarded: Master of Public Health
Executive MPH

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Applying Public Health Informatics to Explore Emerging Technologies
In Systematic Data Reconciliation

By

Natasha Paynes

B. S., Spelman College, 2002

Thesis Committee Chair: Laura Gaydos, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health in Applied Public Health Informatics
2020

Abstract

Applying Public Health Informatics to Explore Emerging Technologies
In Systematic Data Reconciliation

By Natasha Paynes

This thesis explores emerging technologies in systematic data reconciliation. In the health ecosystem, interoperability furthers the goal of optimizing health by providing seamless access to the right information needed to more comprehensively understand and address the health of individuals and populations. (What is Interoperability?, 2019) HL7 is a data formatting standard used by healthcare providers to exchange clinical and administrative data. Interoperability of healthcare data from multiple sources through the use of an HL7 API (HAPI) is imperative to ensure that information is exchanged and communicated in a timely and effective manner. Unfortunately most reconciliation processes remain mainly manual which leaves room for error and missed opportunities.

The Emory Data Reconciliation and Validation (EDRV) solution will provide the ability to parse, query, and report on HL7 EHR data along with fatal and non-fatal interface errors. It will improve data analyses by providing access to consistent data in a format that can be utilized to query, parse, and examine records along with decreasing discrepancies in data reporting by decreasing large number of independent system errors. The system is needed as it will facilitate an increase in data accuracy and result in increased revenue by capturing potentially lost data. The system will provide confidence in the data received by providing reliable, credible reports along with the ability to parse and query HL7 data in a systematic format which is currently lacking in the existing environment.

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Contents

Introduction

This project proposes the creation of a new public health informatics capability which will involve the model organization known as the Emory Medical Care Foundation. The Emory Medical Care Foundation is committed to the health and well-being of our community members. Currently there is a small team of four analyst tasked with monitoring and tracking approximately 35,000 daily charges from 20 different EHR interfaces. These charges feed into a single billing system facilitated by HL7 logic, this is necessary in order to ensure accurate and effective collection of revenue. The reconciliation process remains mainly manual which leaves room for error and missed opportunities.

The proposed solution is to create an HL7 Data Reconciliation and Data Validation software tool. This tool is necessary to ensure the single billing office has the ability to reconcile HL7 interface outputs from various health system EHR(s). This is needed in order to ensure all charges, labs, and orders are captured and documented/billed appropriately. As Emory continues to acquire organizations due to acquisitions, we must be able to accurately account for all EHR data records in a timely, consolidated, and organized manner. In addition, as the organization continues to grow and absorb additional existing EHR systems, accurate adherence to CMS guidelines surrounding Health Information Exchanges become more difficult.

The EDRV system will assist in quickly identifying sources of inconsistencies and problems in areas such as duplicate procedures, missing diagnoses, provider charge capture, medication lists, and lab orders in one source system. The EDRV system will provide important information to support the core mission of our organization an integrated academic healthcare system committed to providing the best care for our patients, educating health professionals and leaders for the future, pursuing discovery research in all of its forms, including basic, clinical, and population-based research, and serving our community.

HL7 is a data formatting standard used by healthcare providers to exchange clinical and administrative data. An HL7 API (HAPI) is necessary in order to parse on consolidated records from 20 different EHR interfaces. Each interface has unique interface specs which can include custom segments. HAPI is an open-source, object-oriented HL7 parser for Java. HAPI is the most up to date in terms of supporting current and previous versions of HL7.

The EDRV system will be a web-based solution hosted in a cloud environment supported locally by the existing internal Emory Information Systems team. The EDRV system will provide the ability to parse, query, and report on HL7 EHR data along with fatal and non-fatal interface errors. The use of the Web API would facilitate interoperability.

Project Details:

<u>Executive Summary</u>
Emory Data Reconciliation and Validation (EDRV) Pilot Study

The core mission of the Emory Medical Care Foundation (EMCF) organization is an integrated academic healthcare system committed to providing the best care for our patients, educating health professionals and leaders for the future. We are committed to innovativeness, integrity and proficiency.   As EMCF continues to acquire organizations due to acquisitions, we must be able to accurately account for all EHR data records in a timely, consolidated, and organized manner. The Emory Data Reconciliation and Validation (EDRV) will provide the ability to consolidate the Emory Medical Care Foundation into one source of truth for all billings.
We would like to positon ourselves in front of the projected organizational growth as we continue to absorb additional entities with independent EHR systems, if not the problems will continue to grow as we scale this area of business.

Problem:
Today the HL7 data reconciliation and data validation is a manual process, involving a small team of analyst tasked with monitoring and tracking approximately 35,000 daily charges from 20 different EHR interfaces.
Due to the inconsistent implementations of EHR systems
Emory is experiencing the following:
Quality issues with data gathering and reporting
- Delays
- Inaccurate billing
- Additional support hours troubleshooting client issues

Solution:
The EDRV system will be a web-based solution hosted in a cloud environment supported locally by the existing internal Emory Information Systems team. The EDRV system will provide the ability to parse, query, and report on HL7 EHR data along with fatal and non-fatal interface errors. We will also design and provide repeatable process with includes implementation patterns and testing steps for to onboarding additional systems as we grow.

The technology will facilitate an increase in data accuracy and result in increased revenue by capturing potentially lost data. The system will provide confidence in the data received by providing reliable, credible reports along with the ability to parse and query HL7 data in a systematic format which is currently lacking in the existing environment.

Objectives:
The objectives of the Emory Data Reconciliation and Validation (EDRV) are as follow:
- Improve data analyses by providing access to consistent data in a format that can be utilized to query, parse, and examine
- Decrease discrepancies in data reporting by decreasing large number of independent system errors
- Decrease delays in receipt of data
- Enhance the quality, availability, and delivery of data
- Insure the accurate reception of data
- Eliminate missing charges
- Decrease Fatal and Non-Fatal interface errors

Funding:

The EDRV system will be a web-based solution hosted in a cloud environment supported locally by the existing internal Emory Information Systems team. The estimated total cost for implementation is between $500,000 and $650,000.

DECISION BRIEF OUTLINE

1. Problem Statement & Recommendation

In this area of healthcare, the HL7 data reconciliation and data validation is a mainly manual process, involving a small team of analyst tasked with monitoring and tracking approximately 35,000 daily charges from 20 different EHR interfaces. Due to the inconsistent implementations of EHR systems Emory is experiencing the following:

- Delays in billing
- Inaccurate billing
- Additional support hours troubleshooting client issues
- Discrepancies in data reporting by decreasing large number of independent system errors
- Delays in receipt of data
- Lower quality, availability, and delivery of data
- Problems with accurate reception of data
- Reoccurring missing of charges
- Less than desirable fatal and non-fatal interface errors

We recommend implementing a web based EDRV solution. The EDRV system will provide the ability:
- parse data
- query data
- report on HL7 EHR data
- Report fatal and non-fatal interface errors
- Identify issues with implementation patterns
- Aid in onboarding additional systems

The technology will facilitate an increase in data accuracy and result in increased revenue by capturing potentially lost data. The system will provide confidence in the data received by providing reliable, credible reports along with the ability to parse and query HL7 data in a systematic format which is currently lacking in the existing environment.

2. Background Information

- In the health ecosystem, interoperability furthers the goal of optimizing health by providing seamless access to the right information needed to more comprehensively understand and address the health of individuals and populations. (What is Interoperability?, 2019)
- While standard HL7 messages provide a way to easily exchange data, there are gaps in interoperability due to many custom segments
- CMS aims to increase the seamless flow of health information, reduce burden on patients and providers, and foster innovation by unleashing data for researchers and innovators through its MyHealthEData initiative. Emory must continue to be innovative and break down barriers that prevent or inhibit the flow of seamless electronic health data.

3. Facts, Assumptions & Requirements

Facts- Current interfaces allow for interoperability and adherence to healthcare standards and facilitate adherence to CMS guidelines

Assumptions- Discrepancies in data reporting will be decreased, delays in receipt of data will be minimized significantly, and changes will lead to less missing charges

Requirements- Fully Functional Data Validation tool which uses Web API, data will be encrypted and secure, recovery and data flow will remain real time, data will be in a format that is reportable

4. Alternatives

4.1 System remains in current state with the adoption of separate deliverables into single phased approaches which include

- Implement QA process
- Implement interface implementation process

4.2 Purchase existing interface parser

5. Evaluation Criteria

Each alternative was measured based on the following evaluation criteria:

- Improve data analyses by providing access to consistent data in a format that can be utilized to query, parse, and examine
- Decrease discrepancies in data reporting by decreasing large number of independent system errors
- Decrease delays in receipt of data
- Enhance the quality, availability, and delivery of data
- Insure the accurate reception of data
- Eliminate missing charges
- Decrease Fatal and Non-Fatal interface errors
- Interoperability

6. Analysis of Alternatives

The strategies, goals, and infrastructure of EMCF were translated into criteria that would be used to evaluate the different types of technology used in the EAIS solution. Each technology was rated on scale from 1-5, with 1 being the worst and 5 being the best. The scores were totaled to indicate which solutions best aligned with the strategic initiatives of EMCF.

Evaluation Matrix:

Criteria	QA implementation process	Interface implementation process	Purchase Existing interface parser	EDRV tool
Improve data analysis	3	4	3	5
Decrease discrepancies	3	3	3	5
Decrease delays	2	3	3	4

Enhance quality in data	3	3	3	5
Improve accuracy	4	4	2	5
Decrease errors	4	4	1	5
Interoperability	2	5	2	4
TOTAL SCORE	21	26	17	33

7. Recommendation

The recommendation is to use the Emory Data Reconciliation and Validation (EDRV) tool to improve outcomes for our data gathering, processing and reporting. This initiative is critical for this business function. We would like to gain the competitive advantage by ensuring we are continuing to be innovative by promoting interoperability, reducing costs while increasing revenue, and identifying and closing any gaps through ongoing data reconciliation.

If not, the problem will continue to grow; potentially wreaking our already burdened project office.

Introduction to Project Charter

Purpose of Project Charter
The Emory Data Reconciliation and Validation (EDRV) project charter documents and tracks the necessary information required by decision maker(s) to approve the project for funding. The project charter includes the needs, scope, justification, and resource commitment as well as the project's sponsor(s) decision to proceed or not to proceed with the project. The intended audience of the EDRV project charter is the project sponsor and senior leadership.

Project and Product Overview
The overall purpose for developing the Emory Data Reconciliation and Validation (EDRV) software tool is to ensure the Emory Medical Care Foundation a single billing office representing a number of physicians, clinics, and hospitals, has the ability to reconcile HL7 interface outputs from health system EHR(s) in order to ensure all charges, labs, and orders are captured and documented/billed appropriately.
The EDRV system will be a web-based solution hosted in a cloud environment supported locally by the existing internal Emory Information Systems team. The EDRV system will provide the ability to parse, query, and report on HL7 EHR data along with fatal and non-fatal interface errors.
The estimated project duration is approximately 9 months and the estimated budget is between $500,000 and $650,000.

Justification

Business Need
A HL7 Data Reconciliation and Data Validation software tool is necessary to ensure the single billing office can reconcile HL7 interface outputs from various health system EHR(s). This is needed in order to ensure all charges, labs, and orders are captured and documented/billed appropriately. Currently there are gaps and

discrepancies in data reporting due to the large number of independent system errors and delays in receipt of data. As Emory continues to acquire organizations due to acquisitions, we must be able to accurately account for all EHR data records in a timely, consolidated, and organized manner. As the organization continues to grow and absorb additional existing EHR systems, accurate adherence to CMS guidelines surrounding Health Information Exchanges become more difficult.

Currently there is a small team of four analyst tasked with monitoring and tracking approximately 35,000 daily charges from 20 different EHR interfaces. The EDRV system will assist in quickly identifying sources of inconsistencies and problems in areas such as duplicate procedures, missing diagnoses, provider charge capture, medication lists, and lab orders in one source system. When successfully implemented, the EDRV system will provide important information to support the core mission of our organization an integrated academic healthcare system committed to providing the best care for our patients, educating health professionals and leaders for the future, pursuing discovery research in all of its forms, including basic, clinical, and population-based research, and serving our community.

1.1   Public Health and Business Impact

The EDRV system will assist in monitoring trends in errors which cause system data disruptions. The system will facilitate an increase in data accuracy and result in increased revenue by capturing potentially lost data. The system will provide confidence in the data received by providing reliable, credible reports along with the ability to parse and query HL7 data in a systematic format which is currently lacking in the existing environment.

2   Scope

2.1   Objectives

The objectives of the Emory Data Reconciliation and Validation (EDRV) are as follows:

- Improve data analyses by providing access to consistent data in a format that can be utilized to query, parse, and examine
- Decrease discrepancies in data reporting by decreasing large number of independent system errors
- Decrease delays in receipt of data
- Enhance the quality, availability, and delivery of data
- Insure the accurate reception of data
- Eliminate missing charges
- Decrease Fatal and Non-Fatal interface errors

2.2   High-Level Requirements

The following table presents the requirements that the project's product, service or result must meet for the project objectives to be satisfied.

Req. #	Requirement Description
1	Fully Functional Data Validation software tool with the following environments: Production, Test, Development.
2	Ability to Parse HL7 data into a reportable format
3	The system should be able to store 3 months of data

Req. #	Requirement Description
4	Real-time monitoring and alerting of key systems should be available to display and report on the loading and throughput of transactions. Thresholds & actions must be able to be set.
5	The system must be secure and available from 4 am to 11 pm everyday
6	Establish secure, scalable Cloud based hosting service

2.3   Risks

Risk	Mitigation
Unavailability of Project Analyst due to conflicting projects	Possibly hire outside consultant to utilize as a temporary resource
Accurate and updated interface specs may not be available or need to be replaced/updated	Work with existing resources to obtain documentation and assess impact and timeline to facilitate updates as soon as possible
Cost to maintain and expand system	Ensure the use of scalable cloud computing
Onboarding new interfaces	Build time into the schedule to allow the technical team 3-4 weeks to review the interface before scheduled implementation date
Stable test environments	Ensure backups are maintained for each environment before changes are made and we have version controls for each component

Major Deliverables

The following table presents the major deliverables that the project's product, service or result must meet for the project objectives to be satisfied.

Major Deliverable	Deliverable Description
Fully Functional Validation software tool	Fully Functional Data Validation software tool with the following environments: Production, Test, Development.
Ability to Parse HL7 data into a reportable format	Ability to store, or capture data in a table, column format.
Dashboard	Dashboard to display data trends, reports, alerts, errors and findings.

Boundaries

The system will not provide a tool to replace patient bills or statements. The system will not allow for receipt of denial information. The system will not be available outside of a secure environment. The

system will not be compatible with non HL7 interfaces.

Estimate

Object Code	Budget Item	Qtr1	Qtr2	Qtr3	Qtr4	Total
11/12	Personnel…….	$ 70,000.00	$ 70,000.00	$ 70,000.00	$ 70,000.00	$280,000.00
20	Contractual	$ 120,000.00	$ 120,000.00	$ 120,000.00	$ 90,000.00	$450,000.00
21	Travel……	$ 2,500.00	$ 3,500.00	$ 2,500.00	$ 1,000.00	$9,500.00
22	Transportation of	$ -	$ -	$ -	$ -	$0.00
23	Rent, Telecom, Other Comm &	$ -	$ -	$ -	$ -	$0.00
24	software license	$ 25,000.00	$ -	$ 5,000.00	$ -	$30,000.00
26	Supplies……	$ -	$ -	$ -	$ -	$0.00
31	Equipment……	$ -	$ -	$ -	$ -	$0.00
41	Grants/Cooperative	$ -	$ -	$ -	$ -	$0.00
	Total	**$147,500.00**	**$123,500.00**	**$127,500.00**	**$ 91,000.00**	**$489,500.00**

3   Enterprise Architecture Impact

HL7 Data Flow Diagram:

Below are two sample Data Flow Diagrams that demonstrates how interface data is currently flowing within two of the 20 EHR subsystems.
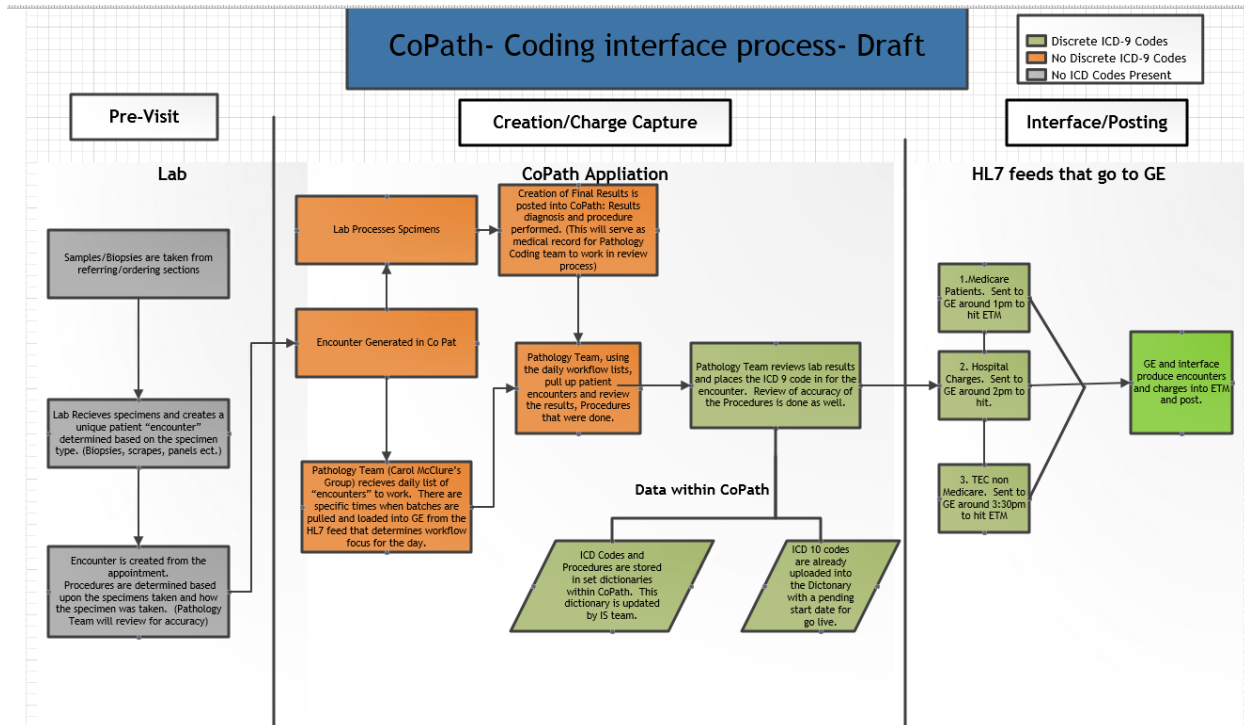
Data Flow Diagram:

Below is a sample Data Flow Diagram that demonstrates how interface data is currently flowing securely from one information resource to another.

GHS(Local) Vendor(Remote)
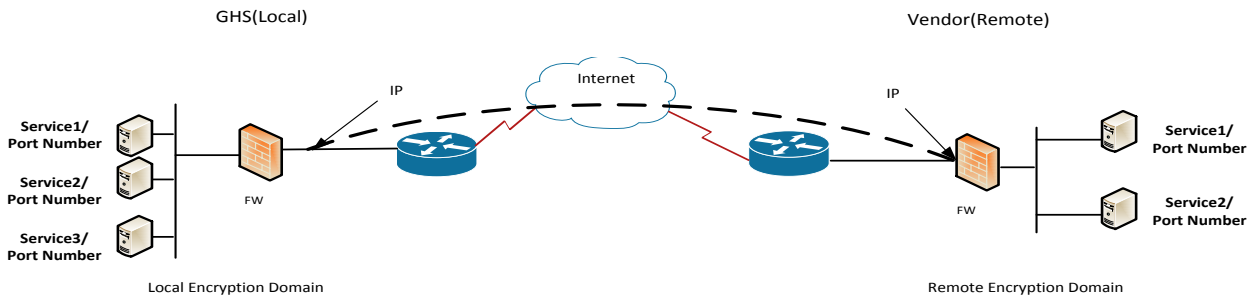
EMCF ORGANIZATIONAL INFRASTRUCTURE

High level block diagram showing EMCF organization infrastructure
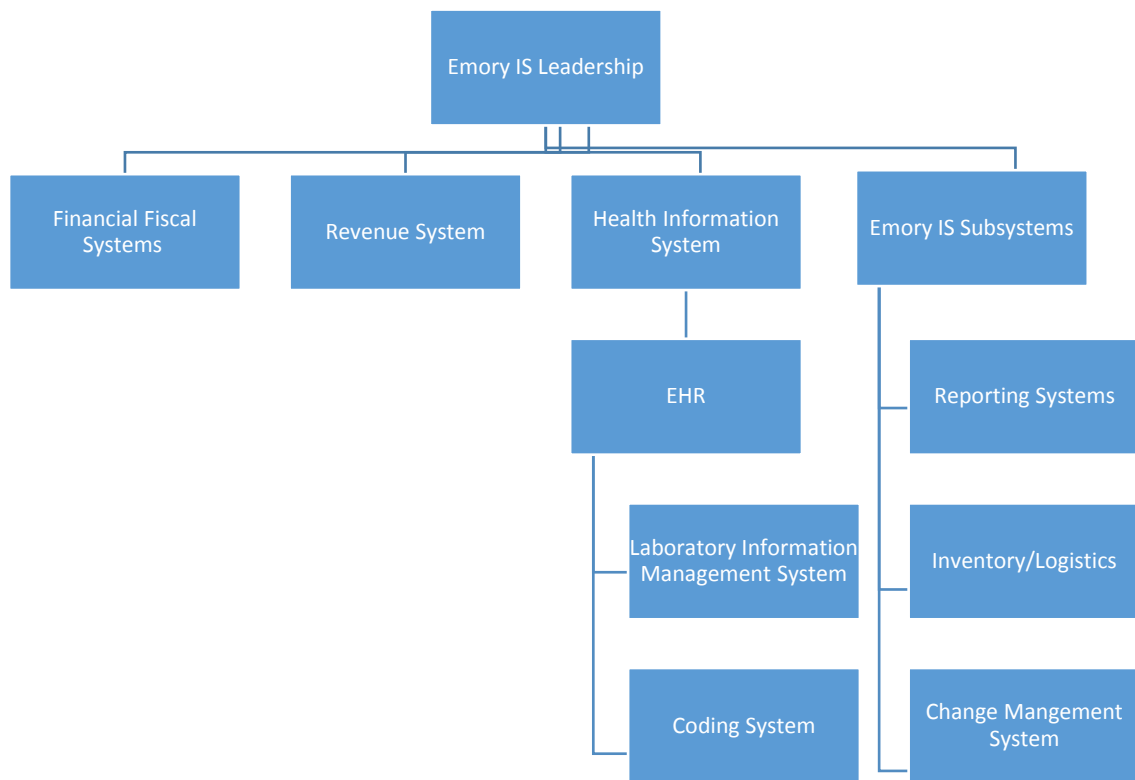
The EMCF Systems impacted by the implementation of the EDRV solution are:

Financial Fiscal Systems- Utilized to facilitate financial reporting. Quality of data should be improved.

Revenue System- Utilized to ensure timely billing of claims, new EDRV solution will ensure more accurate and timely claim data.

Emory IS Subsystems-

- Reporting – EDRV software tool will be utilized to conduct data reconciliation and data analysis. This will provide a new way of reporting data.
- Inventory/Logistics- Resources will be impacted. New database will need to be established.
- Change Management System- Exist to ensure changes are communicated and implemented across the enterprise.

Health Information Systems-

EHR (s) – i.e. EPIC, ALIFE, Coderyte, LIMS, Coding – Optum
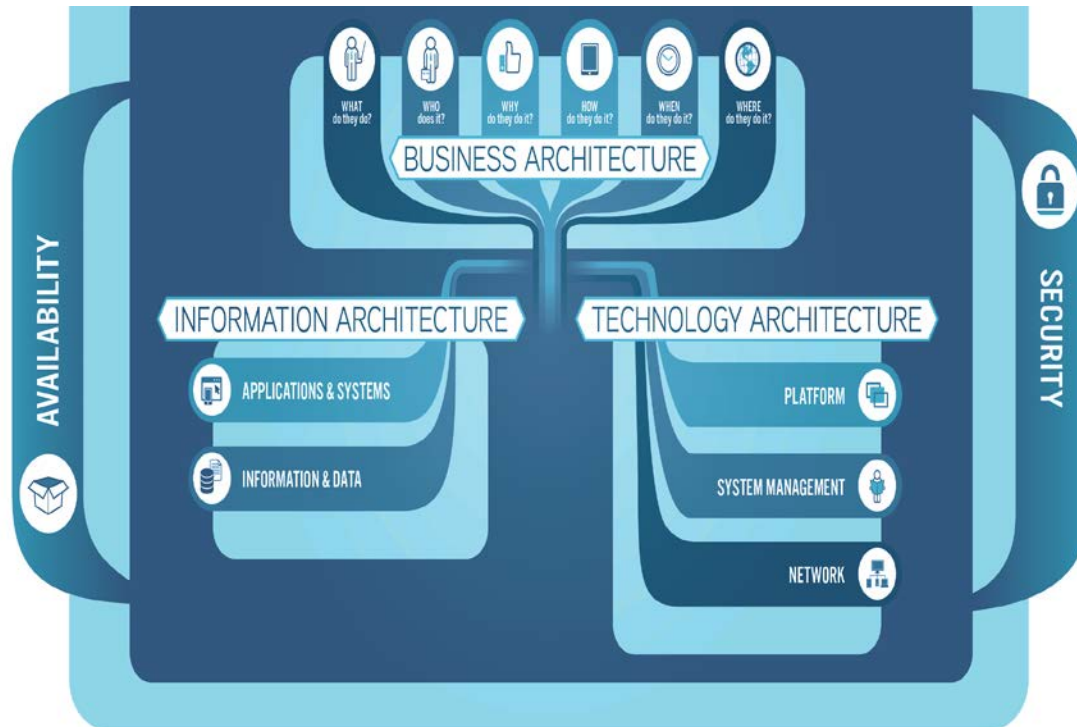
3.1   Enterprise Architecture

Below is an example of an enterprise architecture from an organization that is similar to the Emory Medical Care Foundation. At Emory we utilize a project office that helps ensure we are considering cost, business impact, and strive for interoperability across applications and systems as we continue to expand our business.

http://ocio.byu.edu/images/EA_infographic_200k.png

3.2   Business Processes

Process	Description
Create Database	Fully Functional Data Validation software tool with the following environments: Production, Test, Development.
Query	Ability to query data in the EDRV database
Send data	Ability to send data in a downloadable readable format
Dashboard	Dashboard to display data trends, reports, alerts, errors and findings

Receive data	EDRV must be able to receive data from 20+ interfaces
Generate report	The Generate Reconciliation Analysis/Report process begins with a request for information The process includes defining the required reports format, content, frequency and compiling the retrieved data, and formatting into the required data set
Data Reconciliation	EDRV will facilitate the ability to reconcile data received from various vendors
Data storage and retrieval	The system should be able to store 3 months of data
Data purging	Data should be auto-purged and archived after 90 days
Real-Time monitoring	Real-time monitoring should be available to display and report on the loading and throughput of transactions. Thresholds & actions must be able to be set.
Alerting via email notification	Alerting of availability of key systems
Duo-factor security	The system must be secure and available from 4 am to 11 pm everyday
Data Parsing	Ability to Parse HL7 data into a reportable format
HAPI	Establish HL7 API
Procurement	Establish secure, scalable Cloud based hosting service

MITA BUSINSESS PROCESS TEMPLATES

MITA BUSINESS PROCESS TEMPLATE 1

Receiving HL7 data from an independent EMR interface into the EDRV system

Description	Ability to receive data into EDRV database
Trigger Event	Receiving HL7 data from an independent EMR interface into the EDRV system
Result	Ensure receipt of encrypted secure data Authenticate transactions
Business Process Steps	1. Start: Ensure secure connection has been established 2. Define interface spec guidelines 3. Retrieve data from inbound interface Authenticate transactions 4. Send message back from receiving system to indicate receipt of HL7 data (encrypted data) 5. Load/File data into EDRV database 6. End:

	a. End Data is filed into database
Shared Data	Data received and stored in EDRV database
Predecessor	Receive inbound HL7 message
Successor	Send message back from receiving system to indicate receipt of HL7 data (encrypted data)
Constraints	Transactions and process must adhere to specific laws, regulations, and requirements.
Failures	Errors during sending/receiving and when loading data
Performance Measures	Real-time data is captured and loaded in a timely fashion

Task Flow Diagram
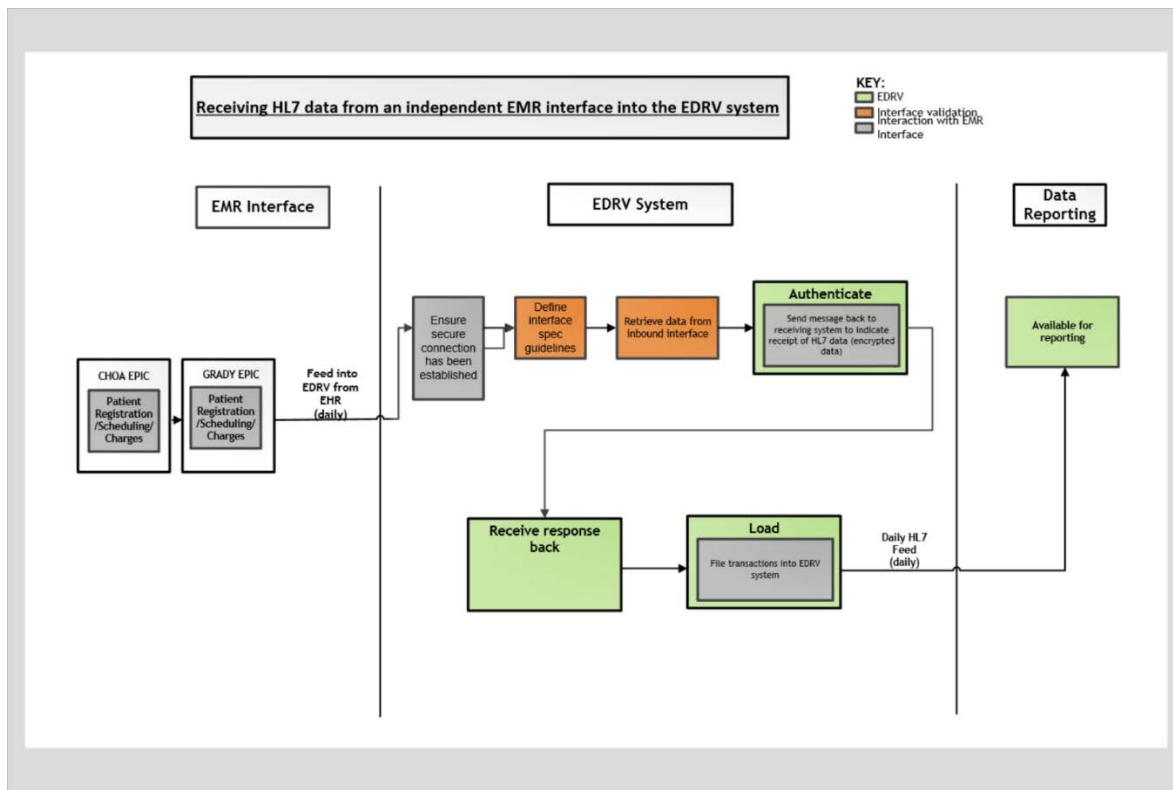
Business Process Matrix

Objective	Ability to receive data into EDRV database
Business Rules	• HL7 formatted data • Transactions and process must adhere to specific laws, regulations, and requirements.

Trigger	Data received from receiving system
Task Set	1. Start: Ensure secure connection has been established 2. Define interface spec guidelines 3. Retrieve data from inbound interface Authenticate transactions 4. Send message back from receiving system to indicate receipt of HL7 data (encrypted data) 5. Load/File data into EDRV database
Input	HL7 formatted data in appropriate segments
Output	• Authenticate transactions • Send message back from receiving system to indicate receipt of HL7 data (encrypted data)
Measurable Outcomes	• Real-time data is captured and loaded in a timely fashion • Errors in data receipt and data load are captured appropriately

Requirements

ID	BUSINESS PROCESS	REQUIREMENT	COMMENTS
1	Miscellaneous	Enable a test environment separate from operational applications	
2	Security	Allow for secure data encryption	
3	Recovery	Be made available within a designated timeframe (i.e. 15 minutes) in the event of a system failure	
4	Recovery	Be restored to condition that existed as of no more than 1 hour before corruption or system failure occurred	
5	Privacy	Adhere to national and local privacy policies	
6	Security	Terminate user log-in screen after determined number of unsuccessful attempts to log in	
7	Security	Create an audit trail of which specific users logged in, when, where and what functions they accessed	

8	Technical Design	Provide ability to receive data from various interfaces	
9	Event Identification & Validation	Support interoperability with other data systems	

Task Flow Diagram
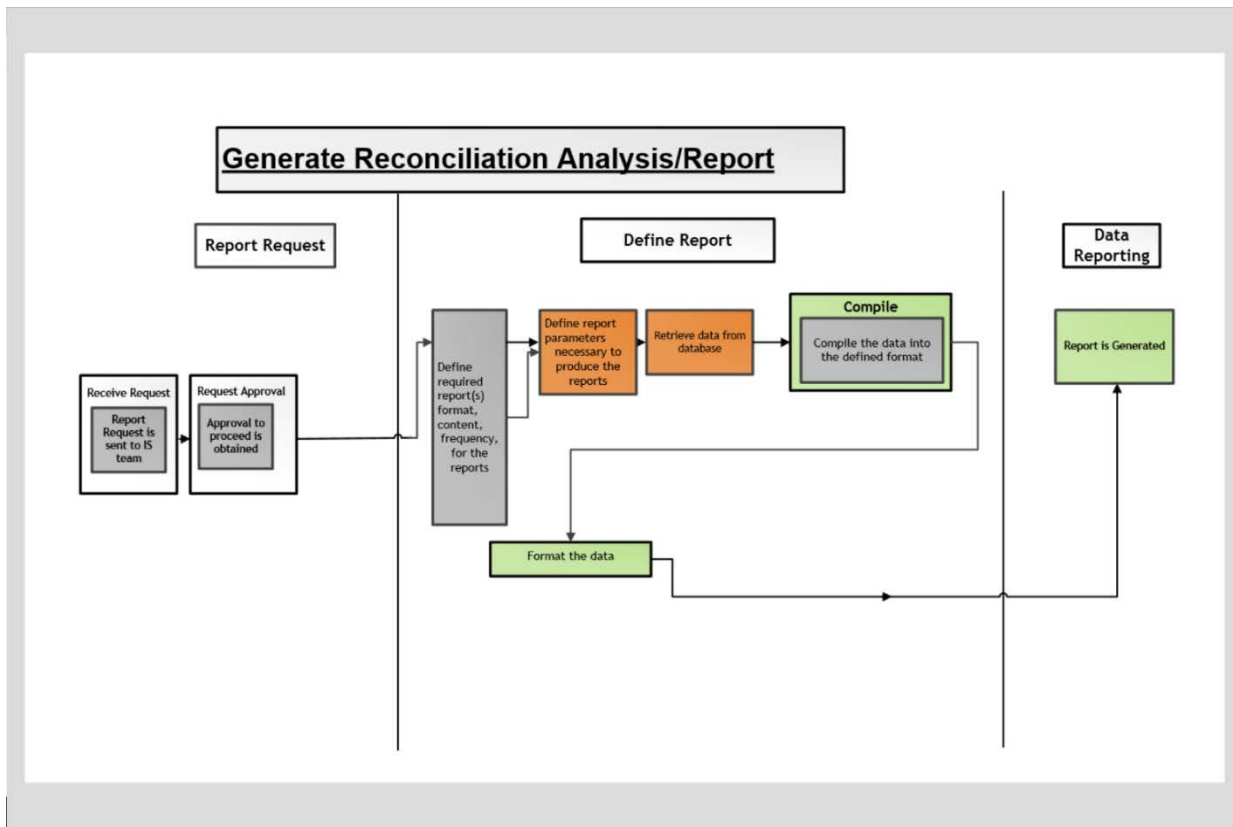
3.3 Information Architecture (IA)

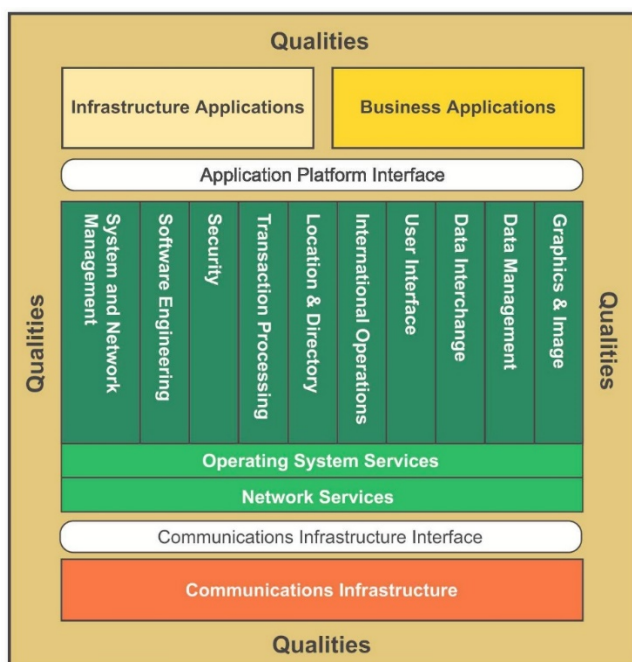**Information Architecture Artifact**

Figure 1. Example Application Platform

The following service categories will be impacted by the solution:

- **System and Network Management-** Will have the ability to store, forward, send, receive, and display transactions. Software Engineering System will utilize Graphical User Interface to include defining the appearance, function, behavior, and position of graphical objects. Object Code Linking services provide the ability for programs to access the underlying application and operating system platform through APIs that have been defined independently of the computer language. It is used by programmers to gain access to these services using methods consistent with the operating system and specific language used.
- **Security** - Since this will be a standalone software application which will contain protected health information (PHI), Identification and authentication services along with data encryption will be necessary in order to ensure only the appropriate parties are able to access the data. Security services are necessary to protect sensitive information in the EDRV system.
- **Transaction Processing**

  The EDRV system will assist in monitoring transaction status

- **User Interface-** This is a big component of the EDRV system, HAPI will help facilitate easy navigation when parsing and querying data.
- **Data Interchange -**Since there will be an exchange of electronic information between various Emory IS applications and various EHR interfaces.
- **Data Management-** The EDRV database will allow for procedures, guidelines, and methods for effective data planning, analysis, standards, modeling, configuration management, storage. Query processing functions that provide for interactive selection, extraction, and formatting of stored information from HL7 EHR file. Report Generation functions that provide the capability to define and generate hardcopy reports composed of data extracted from the EDRV database.

3.4 Technical Architecture (TA)

Technical Architecture Artifact

Service Access and Delivery			
Access Channels	**Delivery Channels**	**Service Requirements**	**Service Transport**
Web Browser	Internet	Legislative / Compliance	Supporting Network Services
Wireless / PDA	Intranet	Authentication / Single Sign-on	Service Transport
Collaboration / Communications	Extranet	Hosting	
Other Electronic Channels	Peer to Peer (P2P)		
	Virtual Private Network (VPN)		

Service Platform and Infrastructure		
Support Platforms	**Delivery Servers**	**Hardware / Infrastructure**
Wireless / Mobile	Web Servers	Servers / Computers
Independent Platform	Media Servers	Embedded Technology Devices
Dependent Platform	Application Servers	Peripherals
	Portal Servers	Wide Area Network (WAN)
Software Engineering		Local Area Network (LAN)
Integrated Development Environment (IDE)	**Database / Storage**	Network Devices / Standards
Software Configuration Management	Database	Video Conferencing
Test Management	Storage	
Modeling		

Component Framework			
Security	**User Presentation / Interface**	**Business Logic**	**Data Management**
Certificates / Digital Signatures	Static Display	Platform Independent Technologies	Database Connectivity
Supporting Security Services	Dynamic Server-Side Display	Platform Dependent Technologies	Reporting and Analysis
	Content Rendering		
	Wireless / Mobile / Voice	**Data Interchange**	
		Data Exchange	

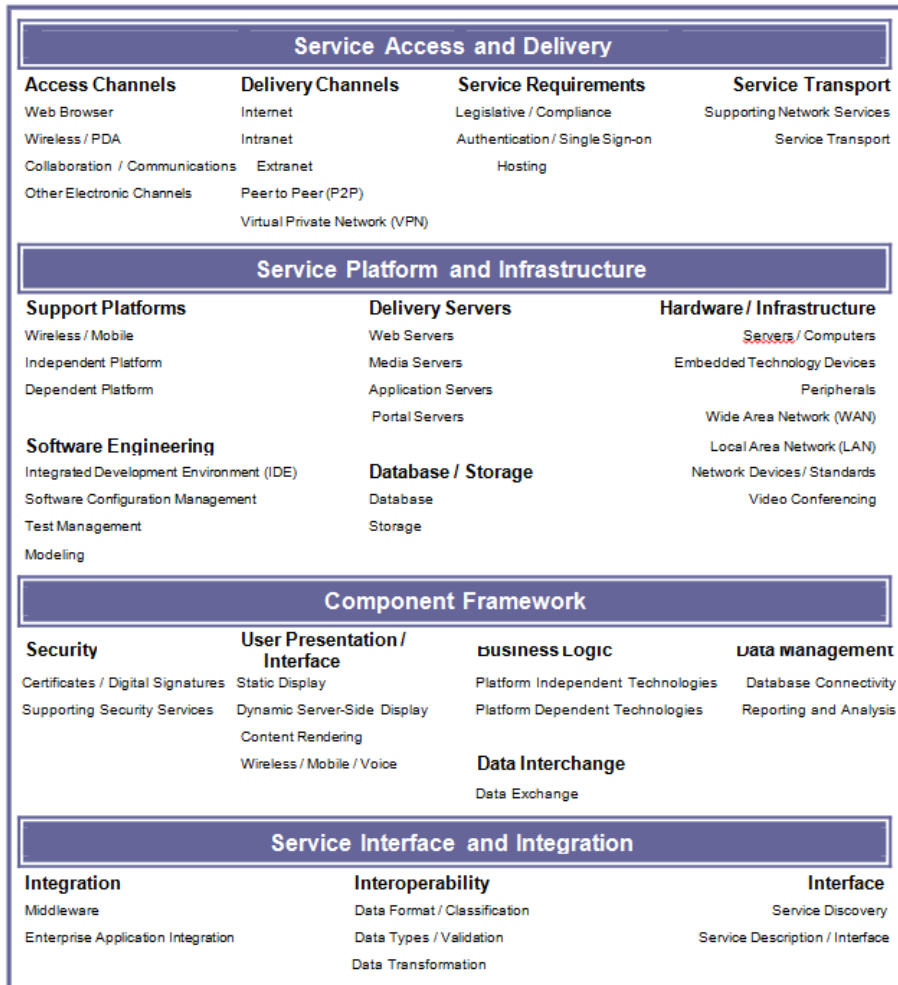| Service Interface and Integration		
Integration	**Interoperability**	**Interface**
Middleware	Data Format / Classification	Service Discovery
Enterprise Application Integration	Data Types / Validation	Service Description / Interface
	Data Transformation	

Figure 2. Example High Level Technical Architecture Options

Each of the 4 categories will be affected by implementation of the Solution

- **Service Access and Delivery**
  - Access Channels – Wireless, remote access will be utilized.
  - Delivery Channels- A VPN will be established to facilitate secure data flow from HL7 EHR interface systems to EDRV system.
  - Service Requirements – System must meet Emory's current duo-authentication requirements. User access will be established and controlled at the user level by the Emory IS Security team.

- **Service Platform and Infrastructure**
  - Delivery Servers – A unique dedicated Application server will be utilized for the EDRV software.
  - Hardware/Infrastructure - Fully Functional Data Validation software tool with the following environments Production, Test, Development.
  - Software Engineering
  - Database/Storage – Database will be scalable, and storage will be monitored.

- **Component Framework**
  - Security - The system must be secure and available from 4 am to 11 pm every day. Real-time monitoring and alerting of key systems should be available to display and report on the loading and throughput of transactions. Thresholds & actions must be able to be set.
  - User Presentation/Interface - Dashboard to display data trends, reports, alerts, errors and findings.
  - Data Interchange – Insure the accurate reception of data by monitoring errors and expected data totals.
  - Data Management - Ability to store, or capture data in a table, column format. Improve data analyses by providing access to consistent data in a format that can be utilized to query, parse, and examine.

- **Service Interface and Integration**
  - Integration – EDRV software will need to integrate with the existing billing system to ensure accurate dashboard metrics are obtained.
  - Interoperability – Implementation of HAPI will facilitate interoperability.

3.5 Risk Management

Risk mitigation refers to the identification, planning, and conduct of actions that will reduce the risk to an acceptable level. (TOGAF p316)

1. System Failure

Risk Description	Project Impact	Risk Area	Mitigation Strategy	Contingency Plan
Disaster Recovery, ability to restore system database in the event it crashes or is jeopardized.	The system would be unusable if this risk was to occur. The impact will be lost of data/valuable billing records	Overall Project Failure	Expand the project architecture to allow periodic backups to another cloud service provided in another geographic region	Daily backups stored in two separate locations. If there's a system failure and a fire; the fire would have to take down both backup locations

2. Resource Issue

Risk Description	Project Impact	Risk Area	Mitigation Strategy	Contingency Plan
Unavailability of Project Analyst due to conflicting projects	Time, resources, operations would be compromised.	Delays to project timeline and accuracy of delivery	Possibly hire outside consultant to utilize as a temporary resource	Extend project timeline to allow proper analyst

3. Lack of data

Risk Description	Project Impact	Risk Area	Mitigation Strategy	Contingency Plan
Accurate and updated interface specs may not be available or need to be replaced/updated.	Improper system inputs, garbage data captured, missing data; causing the need for manual interactions and additional support	High support values; lack of system confidence in the user community	Work with existing resources to obtain documentation and assess impact and timeline to facilitate updates as soon as possible Enforce interface standards before allowing integrations into the system	Plan staged rollouts and supports of a few interfaces at a time. To allow proper testing of the specs provided

4. Funding Issues

Risk Description	Project Impact	Risk Area	Mitigation Strategy	Contingency Plan
Cost to maintain and expand system	System could go unsupported; causing a lost in current investment	Overall Project Failure	Ensure the use of scalable cloud computing	Decommission systems replaced by this new system and roll the budget and resources into this system

5. Interoperability Issues

Risk Description	Project Impact	Risk Area	Mitigation Strategy	Contingency Plan
Components provided by different vendors and clients may have problems working together	System could produce undesirable results and system outages	Overall Project Failure	Build into the schedule time to test components and data before allowing into the system	Phased integration approach while continuing to support manual process for component or vendor

6. HIPPA compliance and data protection

Risk Description	Project Impact	Risk Area	Mitigation Strategy	Contingency Plan

HIPPA compliance and data protection	Privacy and Security Breach	Overall Project Failure	Enforce systematic data validation and security reviews	Manual review of data and workflows until automation is in place

4   Analysis of Alternatives

Alternatives

- System remains in current state with the adoption of separate deliverables into single phased approaches which include
  - Implement QA process
  - Implement interface implementation process
- Purchase existing interface parser

Describe the pro and cons of each of the alternatives
If nothing is done and we continue to utilize the existing reconciliation process, we will continue to lack confidence that we are capturing correctly and in totality all interface charges which means loss revenue and inconsistent reports. Our current plan to adopt separate deliverables into single phased approaches will ensure at a minimum we are implementing a quality assurance process along with a formal interface implementation process to incorporate and learn from lessons learned, saving time, resources, and money.
 If we purchase an existing interface parser we will need to customize to some extent. The customization could be costly and we will need to rely on another organization to facilitate upgrades. The existing parser might allow us to free up internal resources and be implemented sooner.

4.1   Evaluation Matrix

The strategies, goals, and infrastructure of EMCF were translated into criteria that would be used to evaluate the different types of technology used in the EAIS solution. Each technology was rated on scale from 1-5, with 1 being the worst and 5 being the best. The scores were totaled to indicate which solutions best aligned with the strategic initiatives of EMCF.
Each alternative was measured based on the following evaluation criteria:
- Improve data analyses by providing access to consistent data in a format that can be utilized to query, parse, and examine
- Decrease discrepancies in data reporting by decreasing large number of independent system errors
- Decrease delays in receipt of data
- Enhance the quality, availability, and delivery of data
- Insure the accurate reception of data
- Eliminate missing charges
- Decrease Fatal and Non-Fatal interface errors
- Interoperability

Evaluation Matrix:

Criteria	QA implementation process	Interface implementation process	Purchase Existing interface parser	EDRV tool

Improve data analysis	3	4	3	5
Decrease discrepancies	3	3	3	5
Decrease delays	2	3	3	4
Enhance quality in data	3	3	3	5
Improve accuracy	4	4	2	5
Decrease errors	4	4	1	5
Interoperability	2	5	2	4
TOTAL SCORE	21	26	17	33

4.2 Strategic Goals

The strategic goals of the EDRV solution include:
1. Improving the quality of health services
2. Improve the economic and social well-being of individuals, families, and communities, especially those most in need
3. Achieve excellence in management practices
4. Provide a secure and trusted IT environment
5. Enhance the quality, availability, and delivery of HHS information and services to citizens, employees, businesses, and governments
6. Achieve excellence in IT management practices, including a governance process that complements program management, supports e-government initiatives, and ensures effective data privacy and information security controls
7. Improve financial performance
8. Elimination of Error and lost data through increased reconciliation capabilities

Outcome Objectives
When successfully implemented, the Emory Data Reconciliation and Validation (EDRV) will ensure the following requirements are met.

- Improve data analyses by providing access to consistent data in a format that can be utilized to query, parse, and examine

- Decrease discrepancies in data reporting by decreasing large number of independent system errors

- Decrease delays in receipt of data

- Enhance the quality, availability, and delivery of data

- Insure the accurate reception of data

- Eliminate missing charges

- Decrease Fatal and Non-Fatal interface errors

Facts, Assumptions, Requirements

> Facts- Current interfaces allow for interoperability and adherence to healthcare standards and facilitate adherence to CMS guidelines
> Assumptions- Discrepancies in data reporting will be decreased, delays in receipt of data will be minimized significantly, and changes will lead to less missing charges
> Requirements- Fully Functional Data Validation tool which uses Web API, data will be encrypted and secure, recovery and data flow will remain real time, data will be in a format that is reportable

As the Transforming a Company, Project by Project: The IT Engagement Model stated, IT organizations have long struggled with achieving companywide strategies while simultaneously responding to urgent request from business units to implement solutions for local projects. Currently at my organization we have a limited number of analyst capable of understanding the needs of the business but also the customizations and requirements needed to make the applications work. In order to ensure analyst are not working in silo, weekly and monthly meetings with the company-wide governance is needed. The benefits of communicating in this manor are that each area is more aware of what the other is doing. There is an opportunity to communicate how companywide goals can be accomplished, and by engaging various stakeholders and resources everyone may feel like they are a part of a cohesive team. Alternatively, some meetings can be a waste of valuable time so the use of linking mechanisms is also important. The evaluation framework that I am proposing is similar to the CDC Approach to Evaluation.

Figure: Centers for Disease Control and Prevention. Framework for program evaluation in public health. MMWR 1999;48 (No. RR-11)

1. Engage stakeholders at Emory including those within the IT project office and those involved in company-wide IT governance ensure that all parties are aware of project
2. Describe the project, including the need, expected effects, activities, resources, stage
3. Focus the evaluation design to assess the issues of greatest concern to stakeholders while using time and resources as efficiently as possible. Consider the purpose, users, uses, questions, methods and agreements.
4. Gather credible evidence to strengthen evaluation judgments and the recommendations that follow.
5. Justify conclusions by linking them to the evidence gathered and judging them against agreed-upon values or standards set by the stakeholders. Justify conclusions on the basis of evidence using these five elements: standards, analysis/synthesis, interpretation, judgment and recommendations.
6. Ensure use and share lessons learned with these steps: design, preparation, feedback, follow-up and dissemination

4.3 Strategic Planning Project Plan

Strategic Planning Project Plan

Action or Step to be Completed Method for Completion	Timeline	Milestones	Person(s) Responsible	Status/ Completion Date
Identify Stakeholders	Weeks 1-2	1. Obtain stakeholder commitments	Strategic Planning Committee Chair	Complete 3/1/2019
Review / Organizational level requirements and budget	Weeks 3-4	1. Obtain requirement approvals 2. Obtain budget approval	CTO / Executive Director	Complete 3/15/2019
Review / Emory Project office requirements and Governmental needs	Weeks 4-5	1. obtain phase Project office signoff 2. obtain approval for technical staff	Chief Technology officer	Complete 4/1/2019
Design communication plans	Weeks 6-7	1. Circulate communication plan to teams 2. Obtain plan feedback	Strategic Planning Committee Chair	4/15/2019
Compile relevant Information gained from feedback	Weeks 8-9	1. Timeline approved by CTO 2. Information and data identified 3. Summarize data	IT Product Manager / Senior System Analyst	5/1/2019
Analyze Results	Weeks 10-11	1. circulate docs 2. SWOT/SWOC identified	Data Analyst	5/15/2019
Development of Action Plan	Weeks 11-12	1. timelines 2. goals and objectives specified 3. full action plan delivered	Strategic Planning Committee Chair	5/21/2019
Implement/Monitor	Weeks 12-14	1. Ongoing measurement and monitoring of process and outcome data	Strategic Planning Committee Chair	6/15/19

4.4 Mission Statement

The core mission of the Emory Medical Care Foundation organization is an integrated academic healthcare system committed to providing the best care for our patients, educating health professionals and leaders for the future, pursuing discovery research in all its forms, including basic, clinical, and population-based research, and serving our community.

4.5 Vision

The Emory Medical Care Foundation inspires to enhance the quality, availability, and delivery of medical information and services to citizens and employees. We aim to achieve excellence in medical informatics and research by providing the greatest most innovative care possible. We are committed to innovativeness, integrity and proficiency.

Goal and Objective

Priority: Improve data analyses **Strategy:** Improve data analyses and reconciliation **Goal:** Provide access to consistent data in a format that can be utilized to query, parse, and examine				
Outcome Objective 1 A: By December 2020, employees that have the ability to use the EDRV system to perform date reconciliation and data validation				
Programs Activities Interventions	Person/Group Responsible	Timeline	Process Indicator	Outcome Indicator
Assess data analysis reporting capacities	Analyst staff and Systems Management	April 2019-June 2019	1. Conduct review of existing reporting capabilities to use as a baseline of comparison upon implantation of system 2. Analyze reporting capabilities 3. Executive Management approval of employee allocations	1. Produce quality timely reports
Validate results of 2019 interface reports and identify reporting trends.	Staff Managers and Directors	June 2019	1. Measures reconciliation needs and goals	1. Reporting annual reconciliation verification

Priority: Decrease discrepancies in data reporting **Strategy:** By decreasing large number of independent system errors identifying input flaws **Goal:** Reduce system errors and efficiency				
Outcome Objective 1 A: By December 2020, reporting efficiency will improve by 40%				
Programs Activities Interventions	Person/Group Responsible	Timeline	Process Indicator	Outcome Indicator
Develop Errors reporting capabilities	Technical Product manager	March 2019-June 2019	1. conduct review of errors tool and incorporate feedback from all departments	1. Improve metrics key performance indicators

Discussion:

The EDRV project would deliver a Fully Functional Data Validation software tool. Scope, time, and cost make up potential project constraints. A quality and cost-effective solution can be achieved with the use of a well thought out and executed project plan. The proposed EDRV system will be a web-based solution hosted in a cloud environment supported locally by the existing internal Emory Information Systems team. The use of cloud technology would ensure a scalable, secure, and cost-effective solution.

The EDRV system will provide the ability to parse, query, and report on HL7 EHR data along with fatal and non-fatal interface errors from numerous internal EHR systems into one central database. The use of the Web API would facilitate interoperability with the ability to add upon and quickly modify the application as needed. As the Emory organization attempts to make good use of the data received, the system will facilitate an increase in data accuracy and result in increased revenue by capturing potentially lost data. As organizations move towards interpreting large data sets, tools such as the EDRV solution will provide confidence in the data received by providing reliable, credible reports.

Conclusion:

There are currently initiatives such as the Centers for Medicare and Medicaid Services (CMS) Promoting Interoperability (PI) Programs that aim to encourage and promote interoperability of health care data along with improving patient's access to health information.   It is imperative that public health objectives of facilitating the best care, increasing collections, streamlining processes, and ensuring compliance with various standards and formats continues by guaranteeing we are making the best use of resources through internal collaborations and communicating with overall governance in mind.

Big data, information security and privacy, interoperability between systems, organizations, and resources and cloud technology is the way of tomorrow. Technology has provided an increasingly efficient way to share and store data and it has become ever important to be able to use the date in a trusted and secured manner. Unfortunately, many organizations such as Emory still utilize many disparate systems, many times due to the cost of replacing the existing technology. New technology such as the use of a data validation repository will allow organizations to continue to utilize existing technology while having a centralized place to reconcile and report on data.

Organizations must be able to speak to and utilize the data they receive in order to improve financial performance and ensure quality improvement metrics are being achieved. Elimination of errors and lost data through increased reconciliation capabilities will only add to Emory's overall goal to enhance the quality, availability, and delivery of HHS information and services to citizens, employees, businesses, and governments.

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