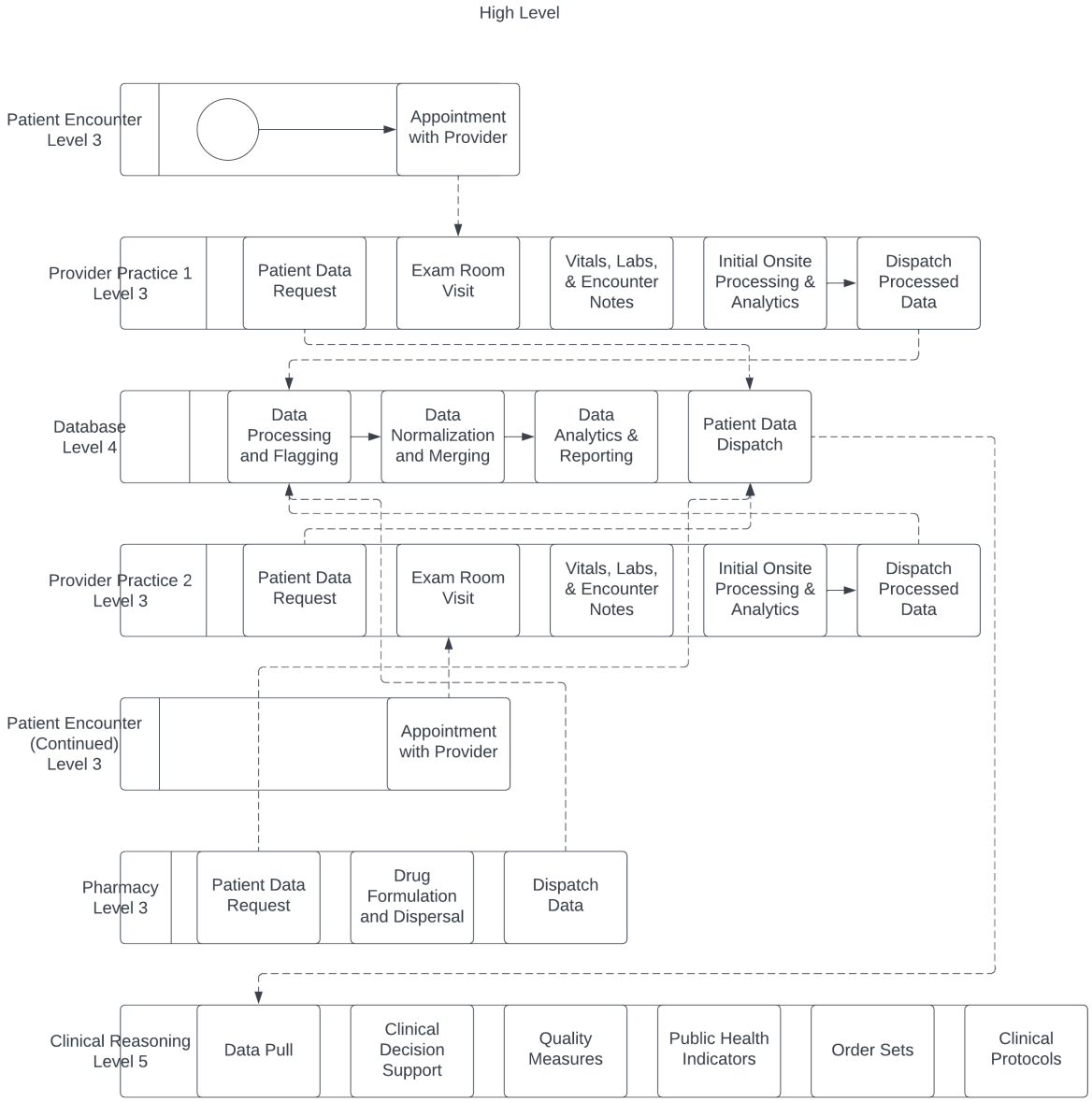
Proposal

In the world of modern-day healthcare, a patient may hop from one hospital/provider system to another. Where they can get diagnosed in one care network, other care networks may not be able to access this information as their systems of sharing information are different. The fragmentation of the US healthcare system plays a larger barrier in terms of being able to provide high quality care to patients as the lack of interoperability within these care networks leave many providers blind to the patient's charts and records from previous encounters with providers from other networks. The goal of the project is to implement an interoperability solution that allows for seamless exchange of patient data between the clinics, ultimately improving care coordination and patient outcomes.

To develop a system that allows for the exchange of patient data between different care networks, there will be 6 steps that would need to be taken. The first step would be to develop a standardized data exchange framework based on HL7 FHIR standards that would enable the clinics to securely share patient information across their EHR systems. The second step would be to create an implementation plan that lists the steps needed to integrate the standardized data exchange framework into each clinic's existing EHR system while also including a web server that follows the RESTful architecture. It would include timelines, resource requirements, and communication strategies to make the implementation smoother. The third step would be to provide necessary training and support to clinic staff as to ways they could use the standardized data exchange framework effectively. It would include training on data sharing protocols, privacy regulations, and troubleshooting common issues. The fourth step would involve defining key performance indicators (KPIs) to evaluate the success of the standardized data exchange framework. Examples of this includes the number of successful data exchanges and time saved in accessing patient information. The fifth step includes ensuring that the interoperability solution works with relevant regulations, to protect patient privacy and data security. The sixth and final step would be to design the interoperability solution to be scalable, allowing for future expansion to include additional clinics or data types.

Model Workflow



HL7 FHIR Resources

An example of a data exchange element that could be used in my project includes the usage of HL7 FHIR to exchange a patient's medication information between two healthcare organizations.
We use 5 different resources including Patient resource, MedicationRequest resource, Medication resource, Organization resource, Bundle resource.

A Patient resource may look like:
ID: 12345
Name: Random Name
Gender: Male

Date of Birth: 1980-01-01
Sexual Orientation: Straight
Preferred Language: Spanish

The Patient resource would contain important values such as the patient's ID, name, gender, date of birth, sexual orientation, preferred language (which could indicate whether there needs to be a translator or not), etc.

A MedicationRequest resource would look like:
ID: 54321
Patient Reference: Patient/12345
Status: Active
Medication Reference: Medication/98765
DosageInstruction: Take two tablets daily

The MedicationRequest resource would contain the medication request ID, a reference to the patient ID, a current status of the request, a reference to the medication ID, and a dosage instruction.

A Medication resource could look like:
ID: 98765
Name: Aspirin
Code: 123456
Form: Tablet
Manufacturer: ABC Pharmaceuticals

The Medication resource would contain the medication ID, the name of the medication, the medication code, the form the medication is in such as tablet, pill, liquid, etc., and the manufacturer company.

An Organization resource can look like:
ID: 11111 (Organization A)
Name: Hospital A
ID: 22222 (Organization B)
Name: Clinic B

The Organization resource would include all of the IDs and names of the organizations involved with the patient data transfer.

A Bundle resource would look like:
Type: Message
Entry:
  Full URL: http://example.com/fhir/Patient/12345
  Resource: Patient Resource
  Full URL: http://example.com/fhir/MedicationRequest/54321
  Resource: MedicationRequest Resource

Full URL: http://example.com/fhir/Medication/98765
Resource: Medication Resource
Full URL: http://example.com/fhir/Organization/11111
Resource: Organization Resource (Organization A)
Full URL: http://example.com/fhir/Organization/22222
Resource: Organization Resource (Organization B)

The Bundle resource would include a type section that specifies the purpose of the bundle such as document, message, transaction, etc. The entry would include that of what is going inside the type. In this case, the entry contains URLs for each specific resource and the resources themselves. One thing to note is that each organization within the Organization resource is listed with a separate URL and name.

Terminology & Vocabulary

-SNOMED CT (Systematized Nomenclature of Medicine - Clinical Terms): SNOMED CT is a comprehensive clinical terminology that provides codes for clinical terms used in healthcare. It is chosen for its extensive coverage of clinical concepts, which is crucial for accurately representing patient data in a standardized manner.
-LOINC (Logical Observation Identifiers Names and Codes): LOINC is a standardized vocabulary to identify laboratory and clinical observations. It is used for its specificity in defining laboratory tests and clinical measurements, which is important to accurately record and exchange patient data related to lab results.
-RxNORM: RxNorm is a standardized naming convention for clinical drugs and drug delivery devices. It is chosen for its wide coverage of drug names and codes, which is important for accurately representing medication information in patient records.
-HL7 Value Sets: HL7 provides a set of standardized value sets for various clinical concepts, such as administrative gender, marital status, and race. These value sets are important for ensuring consistency in the representation of patient data across different systems.
-ICD-10-CM (International Classification of Diseases, 10th Revision, Clinical Modification): ICD-10-CM is a standardized coding system for diseases, signs, symptoms, abnormal findings, complaints, social circumstances, and external causes of injury or diseases. It is chosen for its specificity and wide coverage of clinical diagnoses, which is necessary to accurately record and exchange patient diagnosis information.
-CPT (Current Procedural Terminology): CPT is a standardized coding system used to report medical, surgical, and diagnostic procedures and services. It is used for its specificity and comprehensive coverage of healthcare procedures, which is important for accurately recording and exchanging information about medical treatments and services provided to patients.
-HL7 Clinical Document Architecture (CDA): HL7 CDA is a document markup standard that specifies the structure and semantics of clinical documents for exchange. It is useful for its ability to provide a standardized format to exchange complex clinical documents, such as discharge summaries, progress notes, and referral letters, between different healthcare organizations.
-DICOM (Digital Imaging and Communications in Medicine): DICOM is a standard for handling, storing, printing, and transmitting information in medical imaging. It has the ability to provide a standardized format for exchanging medical imaging data, such as X-rays, MRIs, and CT scans, between different healthcare organizations.

Post-coordinated expressions may be required in the implementation to represent complex clinical concepts that cannot be fully captured by a single code. For example, a post-coordinated expression may be used to represent a diagnosis with specific qualifiers or modifiers/adjustments or to represent a complex procedure involving multiple components.

Challenges

Some challenges and potential problems that come with developing a system that allows for the exchange of patient data between different care networks includes technical challenges, data security and privacy, and regulatory compliance.

In terms of technical challenges, it can be hard to integrate disparate EHR systems while also ensuring compatibility with the different standards (HL7 FHIR, SNOMED CT, etc.) because in many cases, EHR systems are often developed by different vendors, each with its own architecture, data models, and terminology mappings. Integrating these diverse systems while also ensuring compatibility with the various standards requires careful mapping and transformation of data to ensure interoperability. To manage this, thorough testing and the usage interoperability tools to ensure seamless data exchange will be important.

Data security and privacy is a problem because ensuring compliance with regulations (e.g., HIPAA) and protecting patient data during exchange is extremely important. Transferring systems can open many loopholes which could leave patient data open to unwarranted attacks and theft of information. To address this, robust encryption, access controls, and regular audits will help manage this risk.

In terms of regulatory compliance, keeping up with changing regulations and standards (e.g., ICD-10 updates) can be challenging because of how frequent there are updates in regulations and standards in healthcare. Especially since coding systems like ICD-10, are updated regularly to reflect changes in medical practices and technologies, keeping track of these updates and ensuring compliance can be time-consuming. To address this, regulatory changes would need to be closely monitored and updated to the system accordingly.

References

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