



**2019 HEALTH**  
MEETING

JUNE 24-26 | PHOENIX, AZ



## **Session 100, Beyond Claims: Unlocking the Power of EMR and Real-Time Clinical ADT Data**

[SOA Antitrust Disclaimer](#)

[SOA Presentation Disclaimer](#)

# 2019 Health Meeting

**ANDREW LOEWER, KELVIN WURSTEN, & KATHERINE ZHAO**

**Session 100: Beyond Claims: Unlocking the Power of EMR and Real-Time Clinical ADT Data**

June 25, 2019



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# Speakers



**Andrew Loewer, FSA**  
Evolent Health

Forecasting, analytics, and modeling around risk adjustment to help plan and provider partners succeed under value-based care



**Kelvin Wursten, FSA, CERA, MAAA**  
Collective Medical

Program evaluation / ROI analysis and cost stewardship, pricing, metrics and KPI developing and tracking, to help organizations lower cost and improve care coordination

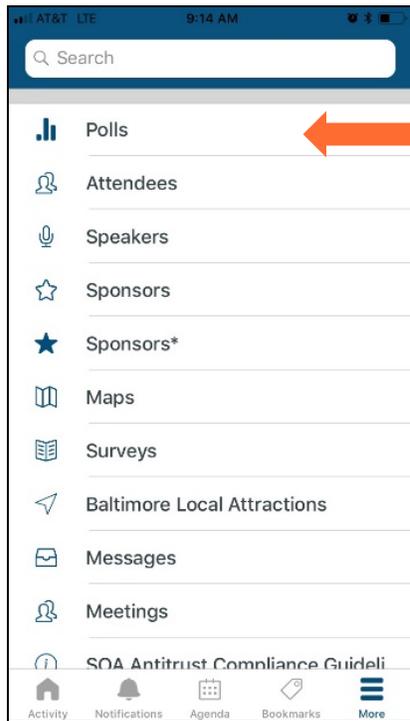


**Katherine Zhao**  
Evolent Health

Analytics in traditional and non-traditional health actuarial roles to solve complex healthcare problems using innovative machine learning approaches

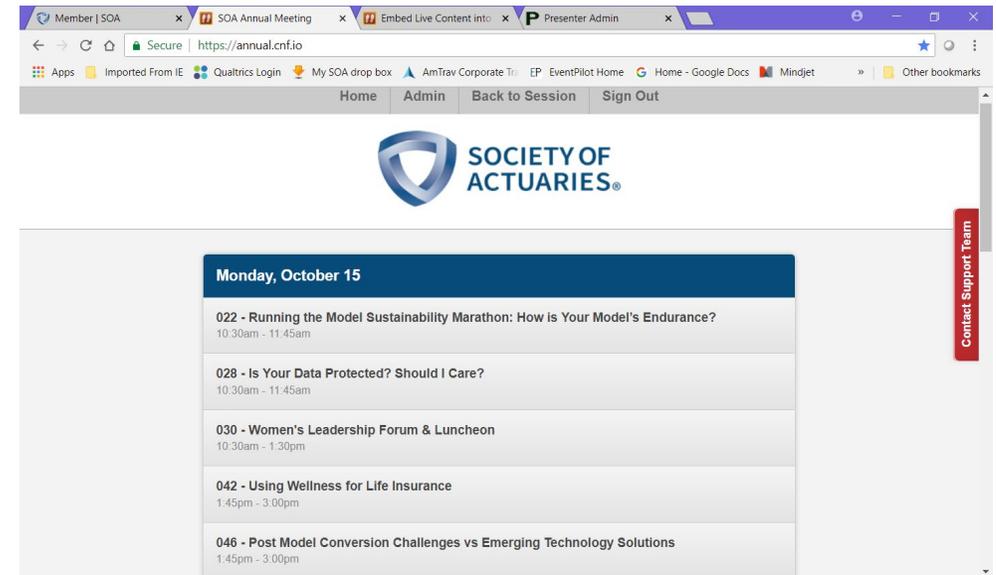
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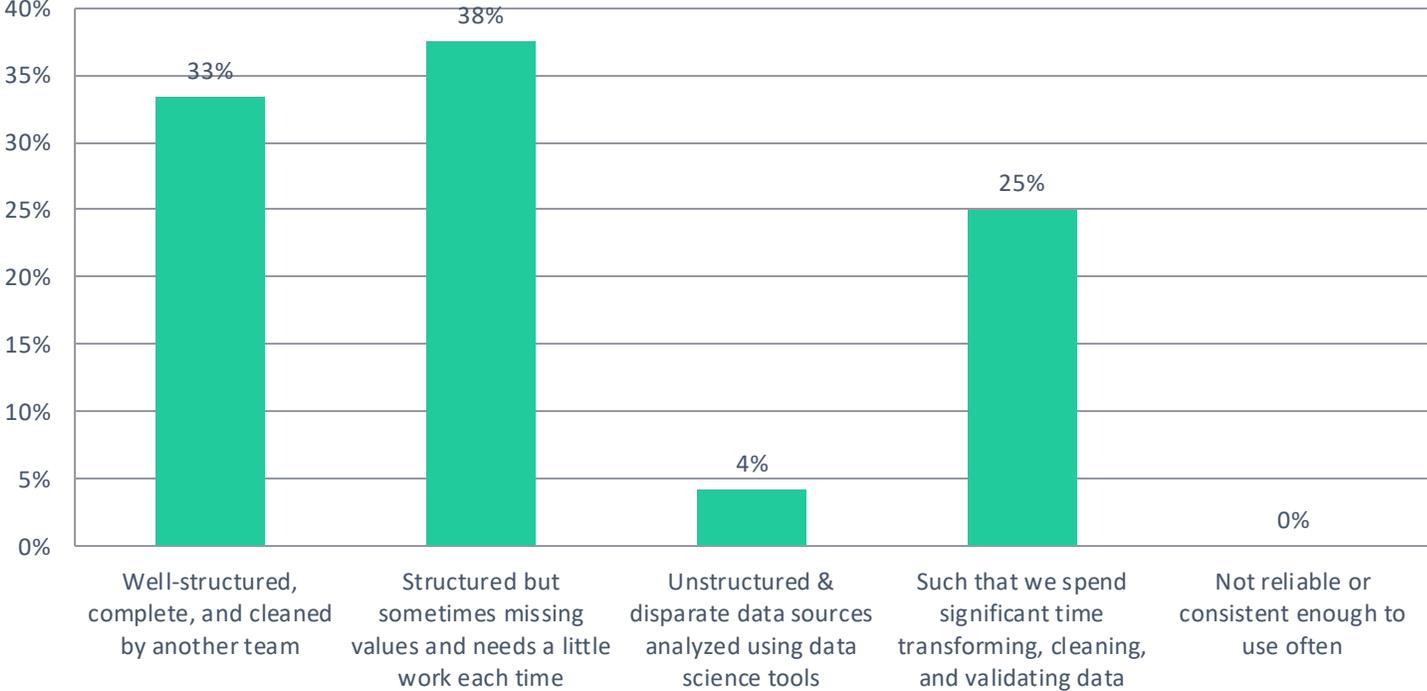
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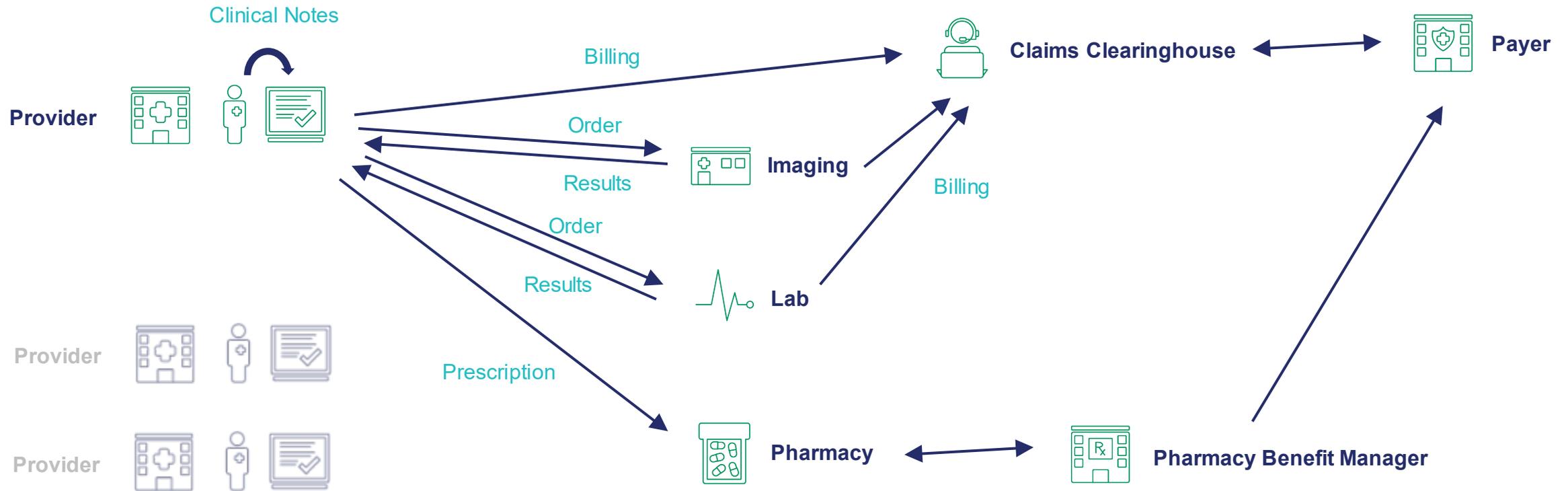
# AGENDA

1. Comparison of Data Sources: Claims, CCD, ADT, and EMR
2. Interoperability & Meaningful Use
3. ADT Messages
4. ADT Use Cases
5. Accessing EMR Data Using CCD
6. Natural Language Processing (NLP) Applied to EMR Data

### The data I use most frequently for my work is:

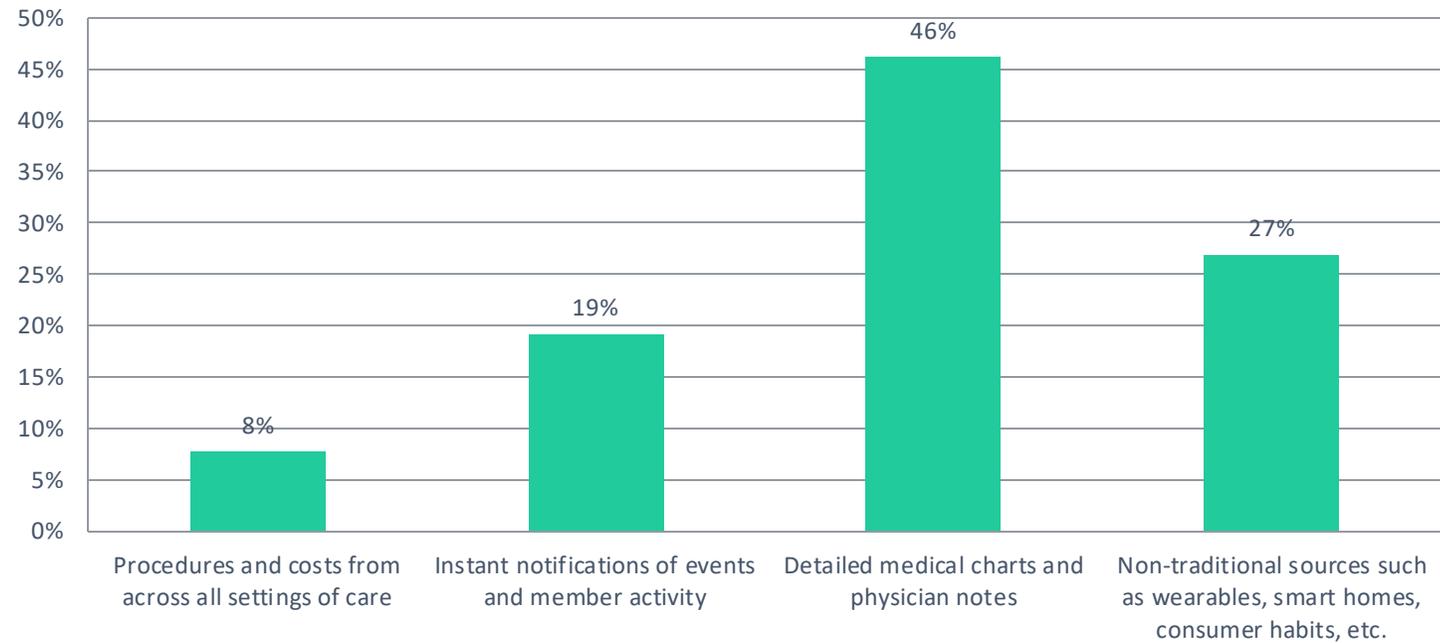


# Data Flow (Practices, Claims, etc.)



Points coverage at either end of the graph, making these the logical places to aggregate data (generally claims and EMR).

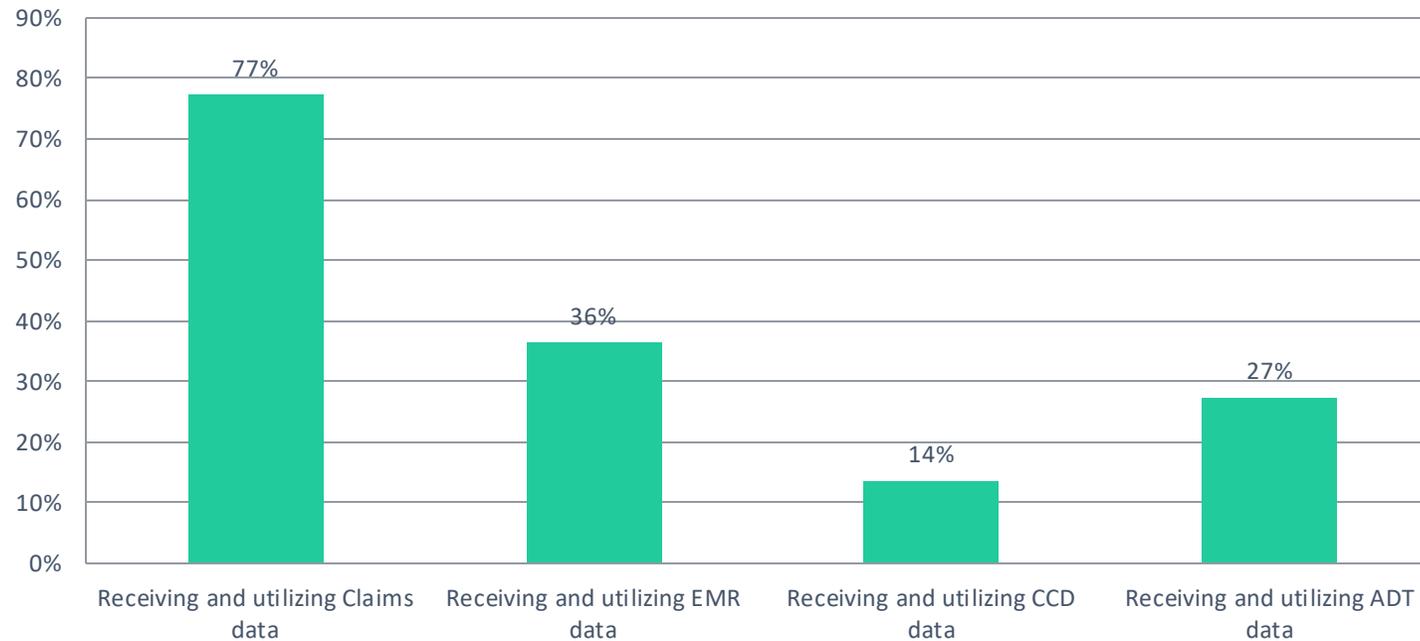
## The most useful data to get access to (that I don't have today) that would improve my work is:



# Comparison of Data Sources

	CLAIMS	CCD	ADT	OTHEREMR
<b>COVERAGE</b>	Members when enrolled in a particular health plan	Patients from a particular practice or provider system	Patient insurance information	Patients from a particular practice or provider system
<b>ELIGIBILITY</b>	Basic demographics	Family history, social history, payers, advance directives		
<b>ENCOUNTERS</b>	Diagnosis & procedure codes, place of service, cost	Problems, procedures	Real time admission and discharge information; diagnoses	
<b>ADDITIONAL</b>		Allergies, medical equipment, vitals, functional stats, plan of care		Notes and custom fields

## Where is your organization at in integrating non-claim data sources?



# Actuaries Can Leverage Standardized Data for Interoperability

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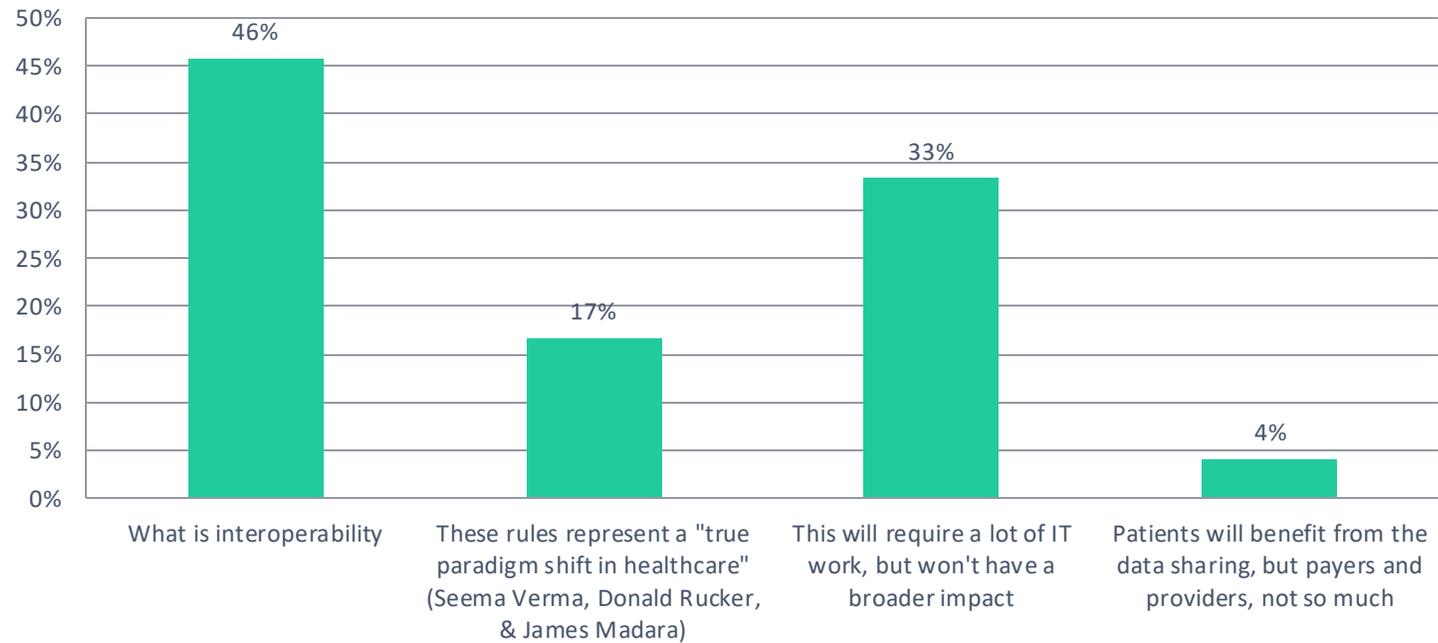
- Health Level-7 (HL7) is a set of international standards for exchanging health data
  - Level 7 refers to concept of computer applications sharing data with each other (e.g. APIs) outside of arrangements involving physical media, direct links, or active sessions
- Messages – real-time flow of information (e.g. patient admitted, test ordered)
- Documents – snapshot of information
- Meaningful Use (Medicare EHR Incentive Program) started in 2010's.
  - Goal: get interoperable EHRs used nationwide
  - Incentives provided to doctors and hospitals who demonstrated efforts to implement systems
    - Progressively meet a larger proportion of standards to continue to receive incentives
  - CMS defines Certified Electronic Health Record Technology (CEHRT)
    - Electronic prescribing of medication
    - Interoperability and exchange of health data
    - Patient access to their health information
    - Data for public health agencies and clinical data registries

Source: <http://healthstandards.com/blog/2008/01/25/comparing-hl7-messages-to-hl7-documents/>



# Cures and the Future of Interoperability

## Cures Proposed Rules from CMS & ONC: How big of a deal with these new proposed regulations be?



# Context: What Just Happened?

U.S. Dept. of Health & Human Services has 2 agencies that both issued major new proposed federal regulations on Monday, February 11, 2019

ONC proposed rule (~750 pages) included:

- Patient Access
- Certain “deregulatory actions”
- New CEHRT Certification Requirements
- Modifications to ONC Health IT Certification Program
- Health IT for the Care Continuum (Pediatric CEHRT requirements, HIT + OUD RFI)
- Information Blocking
- TEFCA RFI
- API Certification Rules
- Conditions and Maintenance of Certification (Implementation, Compliance, Enforcement)
- Registries RFI
- Patient Matching RFI

CMS proposed rule (~250 pages) included:

- Patient Access
- ADT Notifications
- Information Blocking
- Payer Interoperability
- CEHRT Certification Requirements
- RFI: PAC transitions in care
- RFI: patient matching

# Detail: Cures Proposed Rules (CuresNPRM) from CMS & ONC [1/4]

## Key Process Points

- These are “proposed” rules, which means (i) they are not yet effective, and (ii) they will change (potentially in many material ways)
- HHS 90 day comment period ended on June 3rd
- Roughly 90-180 after close of comment period (could be longer), ONC & CMS will likely issue final regulations plus commentary which will be important regulatory guidance
- Likely 1-2 years after issuance of final regulations, the various provisions of the final rules will become effective

## 1 Hospitals must Share ADT Notifications: New Medicare CoP Requirement

A. All hospitals must send inpatient ADT for all patients regardless of payer type **at admission and at discharge; to other providers; for treatment, care coordination, or quality improvement**

- i. ED not required to be included; regulations may expand to ED visits in the final rule after public comments
- ii. Payers not required to be permitted access; data use rights do not necessarily (but could) include “Payment” and most “Healthcare Operations” activities for payers
- iii. Only send ADT notifications to other providers that have an established “care relationship” and have a “reasonable certainty” of receipt by these other providers
- iv. ADT minimum data element requirements very limited
- v. Use of an “intermediary” is permitted, but not required

# Detail: Cures Proposed Rules (CuresNPRM) from CMS & ONC [2/4]

## Information Blocking

- A. "Cures Act" general rules apply to **certified HIT developers** (EMRs), **HIE and "health information networks"**, and **providers**
- i. Electronic Health Information (EHI) must be accessible, exchangeable and usable without "special effort" unless a specific, permitted exception applies. "Info blocking" = a practice that is "likely to interfere with, prevent, or materially discourage access, exchange or use of EHI."
  - ii. Exceptions: Preventing harm (patient safety), promoting privacy, promoting security, recovering costs reasonably incurred, requests that are infeasible, licensing of interoperability elements on reasonable and non-discriminatory terms, maintaining and improving health IT performance
  - iii. Examples of practices that CMS says are clear info blocking = HIE agreements that prohibit entities that receive EHI from the HIE from sharing the EHI with entities who are not participants of the HIE
  - iv. Enforcement: HHS OIG can impose up to \$1M civil monetary penalty on HIT developer or HIE/HIN if engage in info blocking and do not meet exception; and impose "disincentive" for a provider, if info blocking practices don't meet exception
- B. API Certification rules apply only to certified **HIT developers** (i.e., EMRs, many HIEs and other HIT companies that voluntarily become certified). Requirements include:
- i. **Standardized** – Open APIs per required technical specifications (FHIR v2, USCDI data model, persistent user authentication / app authorization, etc.)
  - ii. **Transparent** – Publicly Accessible Documentation (e.g., terms & conditions, fees and structure, app developer verification process)
  - iii. **Pro-Competitive** – Must adopt practices that promote efficient access/exchange of EHI via competitive marketplace (very limited ability to charge fees for API access, providers (not HIT developer) have sole authority to decide to can use APIs, etc.)

# Detail: Cures Proposed Rules (CuresNPRM) from CMS & ONC [3/4]

## New Payer Open API Requirements

A. HHS will require that all payers under its jurisdiction (MA plans, Medicaid MCOs, Medicaid FFS Programs, Commercial plans on Exchanges, Medicare ACOs, FEP plans) do the following:

- i. Implement API to enable patient access their data (adjudicated claims data [including costs], encounters w/ capitated providers, enrollee cost-sharing, clinical data where available)
- ii. Implement API to share up to 5 years of past claims data from “old” payer to “new” payer upon patient request to assist in transition to new health plan
- iii. Implement Provider Directory API to enable current or prospective enrollee to identify whether provider is in network for a particular health plan
- iv. Payers must join “trusted exchange network” (TEN). To qualify, a TEN must: (a) be capable of exchanging EHI per state/federal privacy laws, (b) capable of connecting both inpatient and ambulatory EHRs, (c) support secure messaging or electronic querying by and between patients, providers, and payers.
- v. State Medicaid program must share dual eligible enrollment data on a daily basis

# Detail: Cures Proposed Rules (CuresNPRM) from CMS & ONC [4/4]

## CEHRT/HIT Certification & Technical Standards

A. CMS Propose Rule updates CEHRT 2017 Edition Certification Criteria to incorporate new standards:

- i. USCDI Version 1 establishes (a) standard data elements which CEHRT must be able to share at data element level (not document level) to support Open APIs;
- ii. Data Segmentation for Privacy & Consent Management = supports more granular privacy tagging (vs. document level tagging, which has been useless)
- iii. CMS now prohibits EMR vendor contractual restrictions (“gag clauses”) on hospitals from sharing documentation, screen shots, user experience info, etc.

# Summary: Cures Proposed Rules (CuresNPRM) from CMS & ONC

## Summary of Proposed Rules

1. Hospitals must share ADT notifications for all inpatient related stays to other providers
2. Any information blocking is prohibited, applicable to all providers, certified EMRs, HIEs and HINs and standardized APIs must be established by certified EMRs
3. All payers under HHS must have APIs to enable patients to access claims; likely will broaden to all payers
4. Improved certified HCIT requirements include broader data sets to be shared, and consent management to be included

## Health Plans Sharing Claims

Required	Optional
patients	providers, *other health plans

\*required on patient request

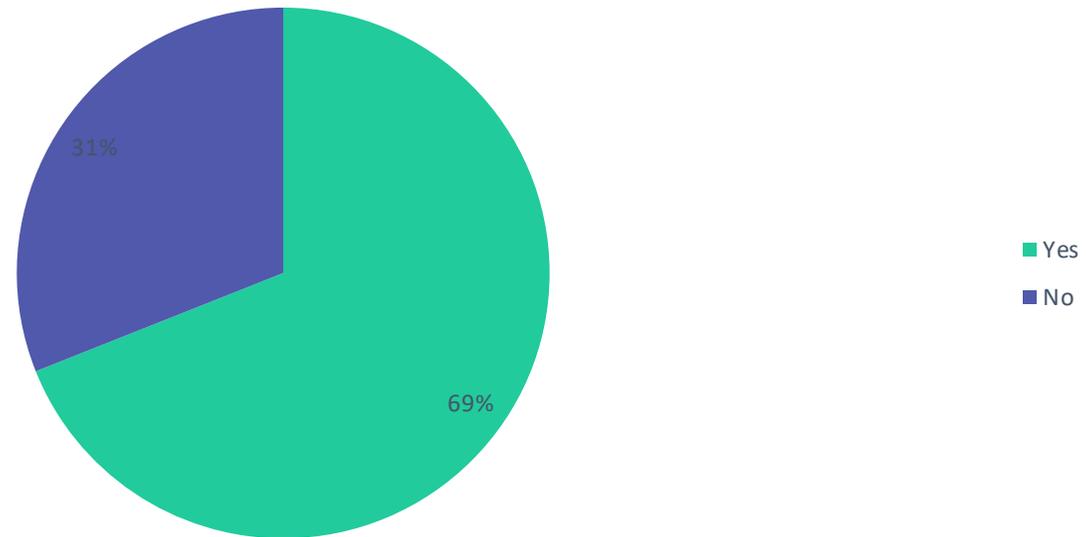
## Providers Sharing ADT

Required	Optional
patients, other providers	Health Plans

How can I learn more?

<https://www.healthit.gov/topic/laws-regulation-and-policy/notice-proposed-rulemaking-improve-interoperability-health>

Are health plans willing to give claims to providers in exchange for providers giving data to health plans?





## ADT & HL7

# HL7, ADT, FHIR, and other Acronyms [1/2]

## Who is HL7

- International not-for-profit standards organization founded in 1987
  - “Founded in 1987, Health Level Seven International (HL7) is a not-for-profit, ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of **electronic health information** that supports clinical practice and the management, delivery and evaluation of health services. HL7 is supported by more than 1,600 members from over 50 countries, including 500+ corporate members representing healthcare providers, government stakeholders, payers, pharmaceutical companies, vendors/suppliers, and consulting firms.” -HL7.org

## What do they do? Define standards and formats for messaging and data exchange, offer trainings, etc.

- HL7 versions:
  - V2 – Current most commonly used standard, pipe delimited format; uses ^,~, & for arrays (3 levels only)
  - V3 – xml format, generally not adopted given larger file sizes
  - FHIR (Fast Health Interoperability Resources) – HL7’s branded version of JSON, more efficient than v3, can embed arrays with [], comma delimited
    - Defined common JSON format
    - Introduced authentication
    - FHIR is conversational

# HL7, ADT, FHIR, and other Acronyms [2/2]

## What is an ADT message?

- Hospital messages focus on patient Admit, Discharge, & Transfers (ADT) for ED visits & inpatient stays based on HL7 standard
- Primarily relies on specific header codes. Examples:
  - **A03** – patient discharge message
  - **PV1-10|02** – inpatient visit
  - **DG1|001|I9|1550** – ICD-9 code for diagnosis of malignant neoplasm of liver
- HL7 V2 examples:

FICTIONAL  
SAMPLES

```
MSH|^&|ADT1|MCM|LABADT|XYZ|200102151112|SECURITY|ADT^A03^ADT_A03|
MSG00001|P|2.5|12345678||AL|NE
EVN|A03|20010215120759
PID|1||PATID1234^5^M11^ADT1^MR^MCM123456789^U^SS^A^SS||
WILSON^RACHEL^A||19610615|F||C|1200 N ELM STREET^^GREENSBORO^NC^27401
-1020|GL|(919)379-1212|(919)271-3434||S||
PATID12345001^2^M10^ADT1^AN^A|123456789|987654^NC|
NK1|1|WILSON^ROGER^K|HU^HUSBAND||||NK^NEXT OF KIN
PVI|1|I|4000^2012^01||||004777^BLOOMFIELD^KARYN^J.||||SUR||||ADM|A0|N|
1026^BLOOMFIELD^KARYN^J. |OB|H0100240||||||ALV|||||||
20010823095130|20010823102455
```

```
MSH|^~\&|ADT1|MCM|LABADT|MCM|198808181126|SECURITY|ADT^A01|MSG00001-|P|2.4
EVN|A01|198808181123
PID|||PATID1234^5^M11||JONES^WILLIAM^A^III||19610615|M-||C
PV1|1|I|2000^2012^01|||004777^LEBAUER^SIDNEY^J. |||SUR||-||ADM|A0
AL1|1||^PENICILLIN||PRODUCES HIVES~RASH~LOSS OF APPETITE
DG1|001|I9|1550|MAL NEO LIVER, PRIMARY|19880501103005|F
PR1|2234|M11|111^CODE151|COMMON PROCEDURES|198809081123
```

- Constant stream of data (messages) flowing from the EHR
  - ADT data aggregators process an average of 3,000 – 5,000 ADT messages per hospital, per day (heavily dependent on size)
  - Each hospital visit typically results in several ADT messages (admission, update, discharge) with different discrete pieces of information
- Examples of data typically included in ADT
  - Normalized codes: Diagnosis code, Encounter Type, Encounter Date/Time
  - Free Text: chief complaint
  - Patient information: first name, last name, address, DOB, Medical Record Number (MRN)
  - Other: Treating Provider, Assigned Patient Location, Hospital Service, Diagnosis Code, Diagnosis Description



## Sources of ADT Data

# Sources of ADT Data Today

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## Sources of ADT data

- HIEs (state or regional)
- Data aggregators and Encounter Notification Service Providers
- Da Vinci project

## Challenges—MPI, aggregation, data quality

- Decision on how to receive – daily report / real time differences?

## Considerations

- For the data source they are looking at, do their data use agreements enable your use cases?
- Is the source a raw ADT pass through, is it normalized across multiple facilities, how good is the normalization?
- What is the MPI methodology? How accurate/complete is it? Privacy protections?
- What % of your members does the ADT source have data for?
- What data is filtered out? If there is no filtering, is that okay?

**Example** – Massachusetts Rule: “a provider shall not ... (2) disclose the results of [an HIV diagnostic test] to any person other than the subject without first obtaining the subject’s written informed consent” [M.G.L. ch 111 § 70F]



# ADT Use Cases & Case Study

# ADT Use Cases

Use Cases	Benefits	Challenges
Overutilization of Acute Care Services – inpatient readmissions	<ul style="list-style-type: none"> <li>Avoiding a few readmissions care result in significant cost savings</li> <li>Readmission reductions improves HEDIS scores (PCR)</li> <li>Quick measurement – only need to follow outcomes 30 days post discharge</li> </ul>	<ul style="list-style-type: none"> <li>With average readmission rates in the 10-15% range, need a large intervention population to have an impact (with 100% CM effectiveness, need to engage 10 members to avoid 1 readmit)</li> </ul>
Overutilization of Acute Care Services – ED encounters	<ul style="list-style-type: none"> <li>Reducing ED visits can also potentially avoid costlier Inpatient stays</li> <li>Focus on ED frequent utilizers can lead to avoiding multiple ED visits by engaging a single member</li> <li>ED reductions improve HEDIS scores (EDU)</li> </ul>	<ul style="list-style-type: none"> <li>Lower cost per visit means more ED visits need to be avoided to achieve significant dollar savings</li> <li>Slower measurement – typical need at least 90 days post tracking to see impact</li> </ul>
Process Efficiency – streamline inpatient notification / authorization process	<ul style="list-style-type: none"> <li>Operational expense savings are easy to measure</li> <li>Streamlined processes eliminate need for hospitals to send notifications on admission</li> </ul>	<ul style="list-style-type: none"> <li>Workflow changes need to occur to gain efficiencies which can be delayed based on health plan IT resourcing</li> <li>Workflow can be split between old and new processes as additional hospitals go live</li> </ul>
Case Management – accurate member contact info	<ul style="list-style-type: none"> <li>Accurate contact info can improve care management engagement rates increasing effective of each care manager</li> </ul>	
Predictive Models	<ul style="list-style-type: none"> <li>Adding real time data to supplement claims data for predictive models can help improve accuracy of predictions by taking into account the current visit information in the predictive model</li> </ul>	<ul style="list-style-type: none"> <li>Real time data often not as complete as lagged claims data; Example: Primary diagnosis may not be known in real time, and may be added after the patient is discharged as part of the claim</li> </ul>

# High Emergency Department Utilization (by patient address)

roughly\*

**3,839**

patients with persistent patterns of emergency department utilization (10+ ED encounters within 12 months)

**72,851**

encounters  
April 2018 – March 2019

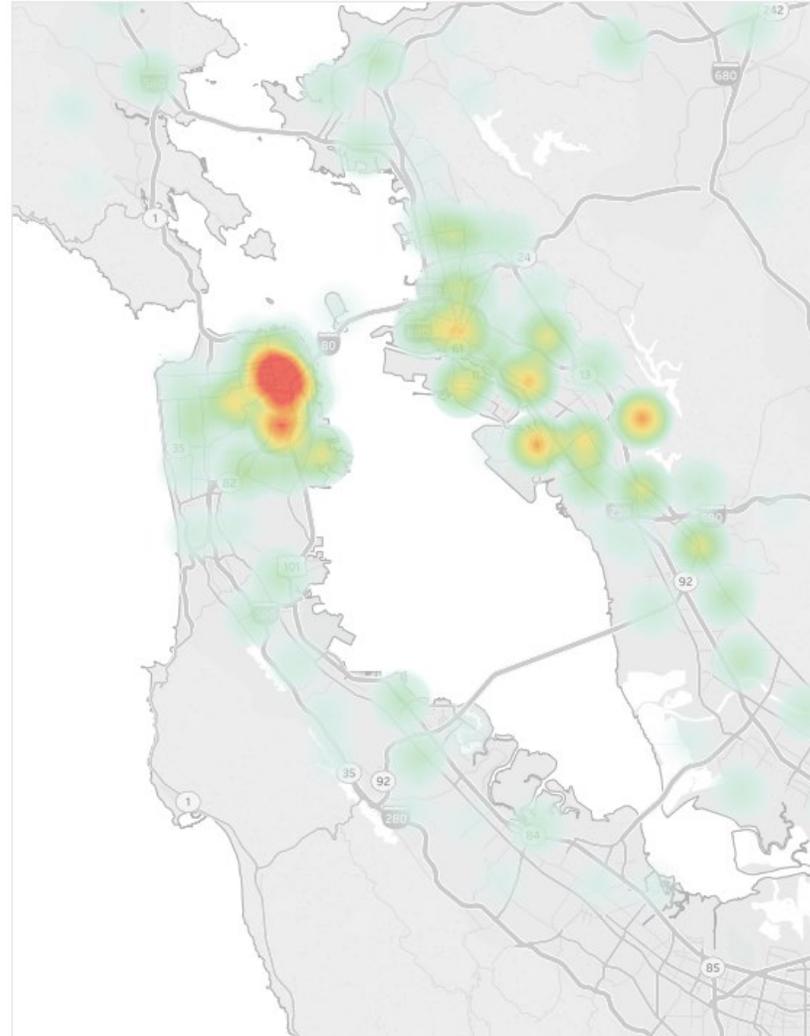
**76%**

have a behavioral health diagnosis

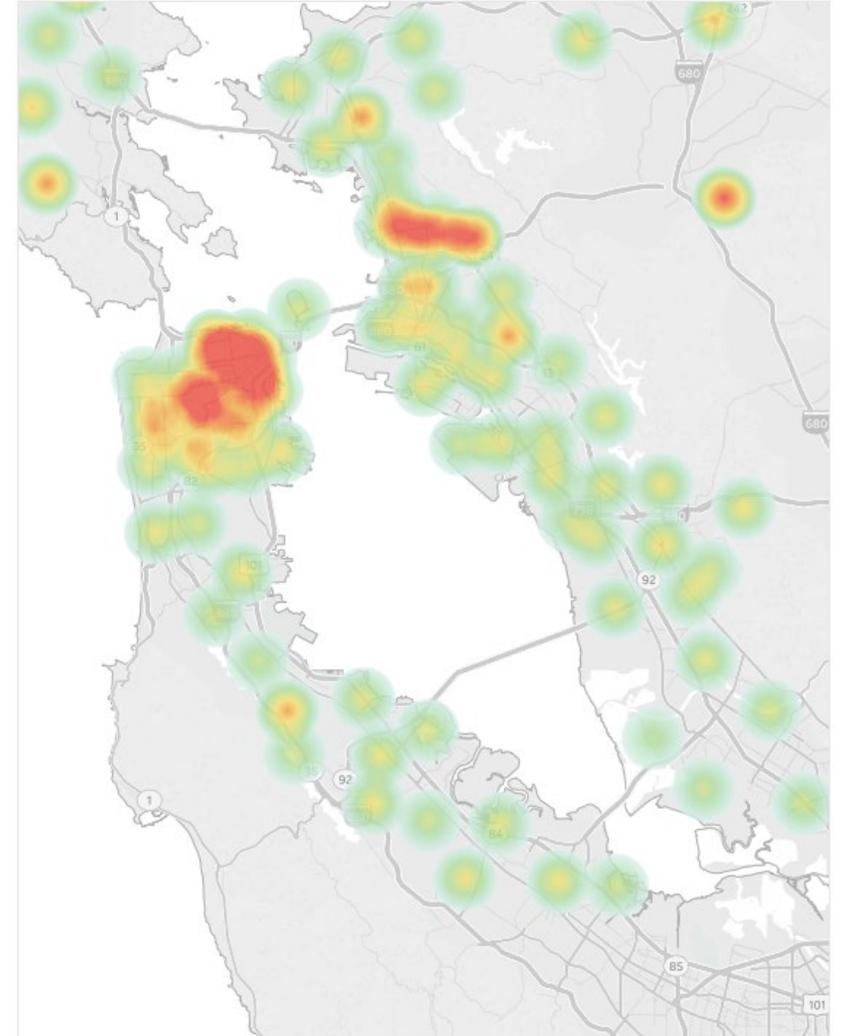
**5%**

are suspected homeless

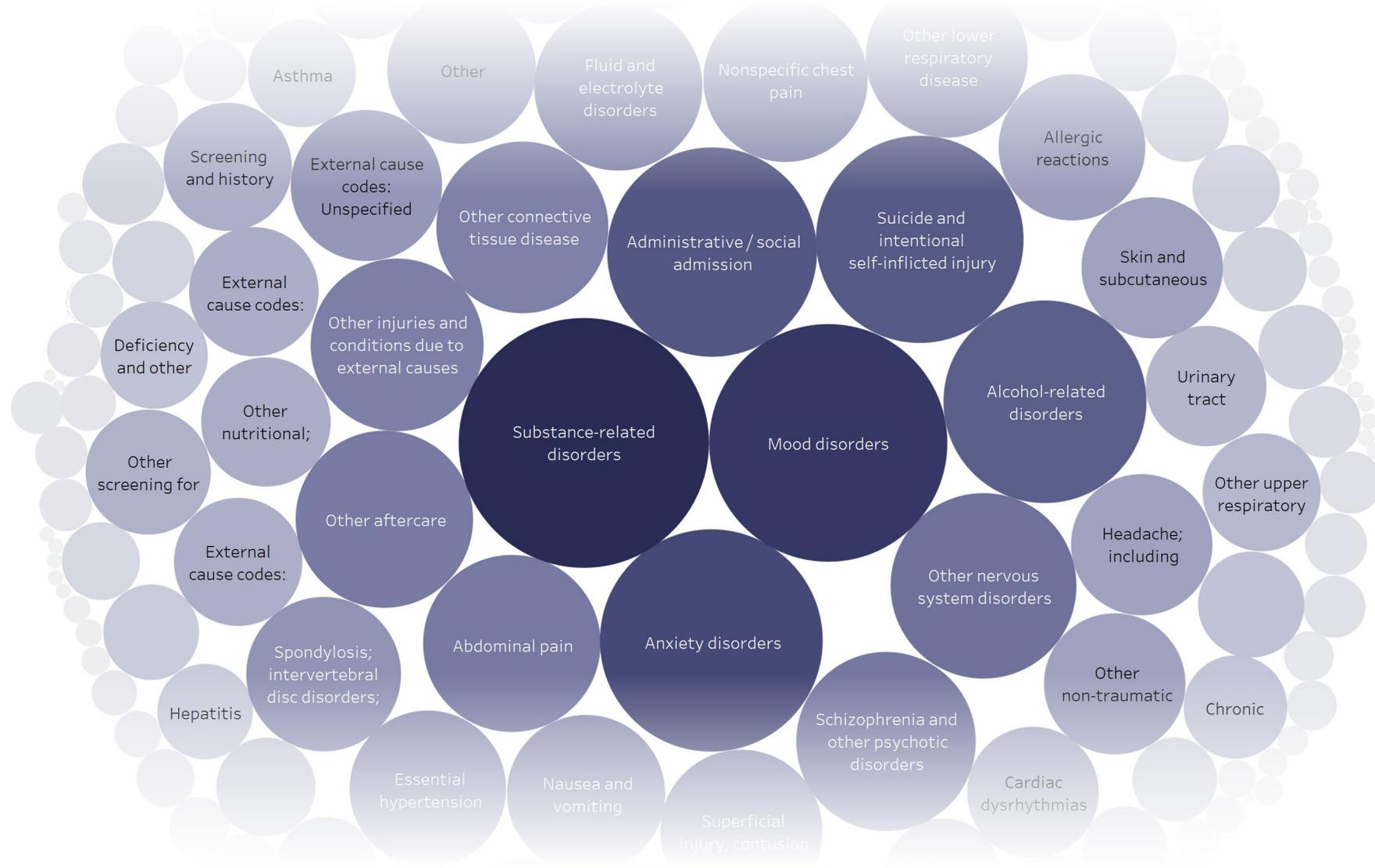
Count of Patients



Average Encounters Per Patient



# Diagnosis for Patients with Mental Illness and 10+ ED visits in the Prior 12 Months





# **Structured EMR Data Using Continuity of Care Document**

# What is CCD?

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- CCD or **Continuity of Care Document** is an electronic document exchange standard for sharing patient health information. Summaries include pertinent information about current and past health status in a form that can be shared by all EHR systems including:
  - Allergies
  - Problems
  - Procedures
  - Family History
  - Social History
  - Payers
  - Advance Directives
  - Medications
  - Immunizations
  - Medical Equipment
  - Vital Signs
  - Functional Stats
  - Results
  - Encounters
- HHS has established regulations and official notices on adopting national standards on meaningful use of EHR systems. The FCC also has a role in electronic health records technology under the National Broadband Plan

# Using CCD vs Claims Data

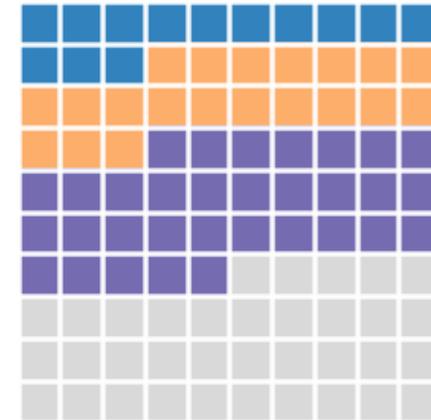
## Claims

- Cover most settings of care (medical, Rx, home health, specialists, devices, etc.)
- Only cover while member is enrolled in the plan
- Sometimes only contain information needed to get paid (exacerbated by the move from FFS)
- **Breadth** not **depth**

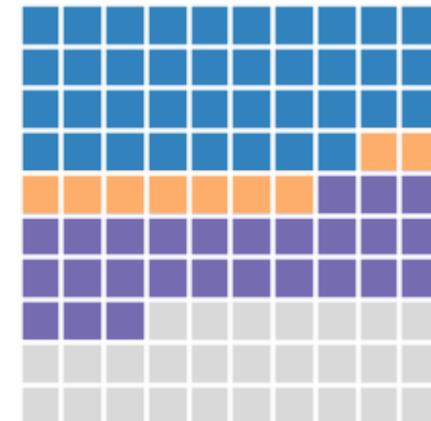
## CCD

- Member history (not necessarily specific but major conditions & dates)
- More detailed data or results than needed for payment
- Suppressed information (e.g. mental health, substance abuse)
- **Depth** not **breadth**

Client 1



Client 2



# Patient Example CCD vs Claims in 2018

51 year old male living in urban area of northeast US enrolled in Medicaid with extensive utilization

## Claims

Includes office & outpatient visits including significant home health and personal care services

Several medications for diabetes, gabapentin for nerve pain, and several prescriptions for anti-depressants

Type 2 diabetes, hypertension, peripheral vascular disease, chronic kidney disease, astigmatism

### ENCOUNTERS

### MEDICATIONS

### PROBLEMS

### DETAILS

Shows some of the same visits, including office visit, immunization, eye exam, and blood testing but none of the home health utilization

Shows diabetes medications but does not include others

Hypertension and peripheral vascular disease are not listed. Both of these conditions are relevant for risk scoring / predicted utilization. Cataracts, leg swelling are coded, though not in claims.

Details on telephone communication, care management, dental encounters. Weight, BMI, blood pressure, smoking status, and other vitals. Flu, PCV, and TDAP vaccinations were administered.

## CCD

# Coding

## CLAIMS + EMR

### ICD-10

- Diagnoses (tens of thousands)
- Examples: E11 - Diabetes, W61.61 - Bitten by duck

### CPT/HCPCS

- Procedures (10-20k codes)
- Examples: 99213 - Office Visit, S0390 - Routine foot care

## EMR

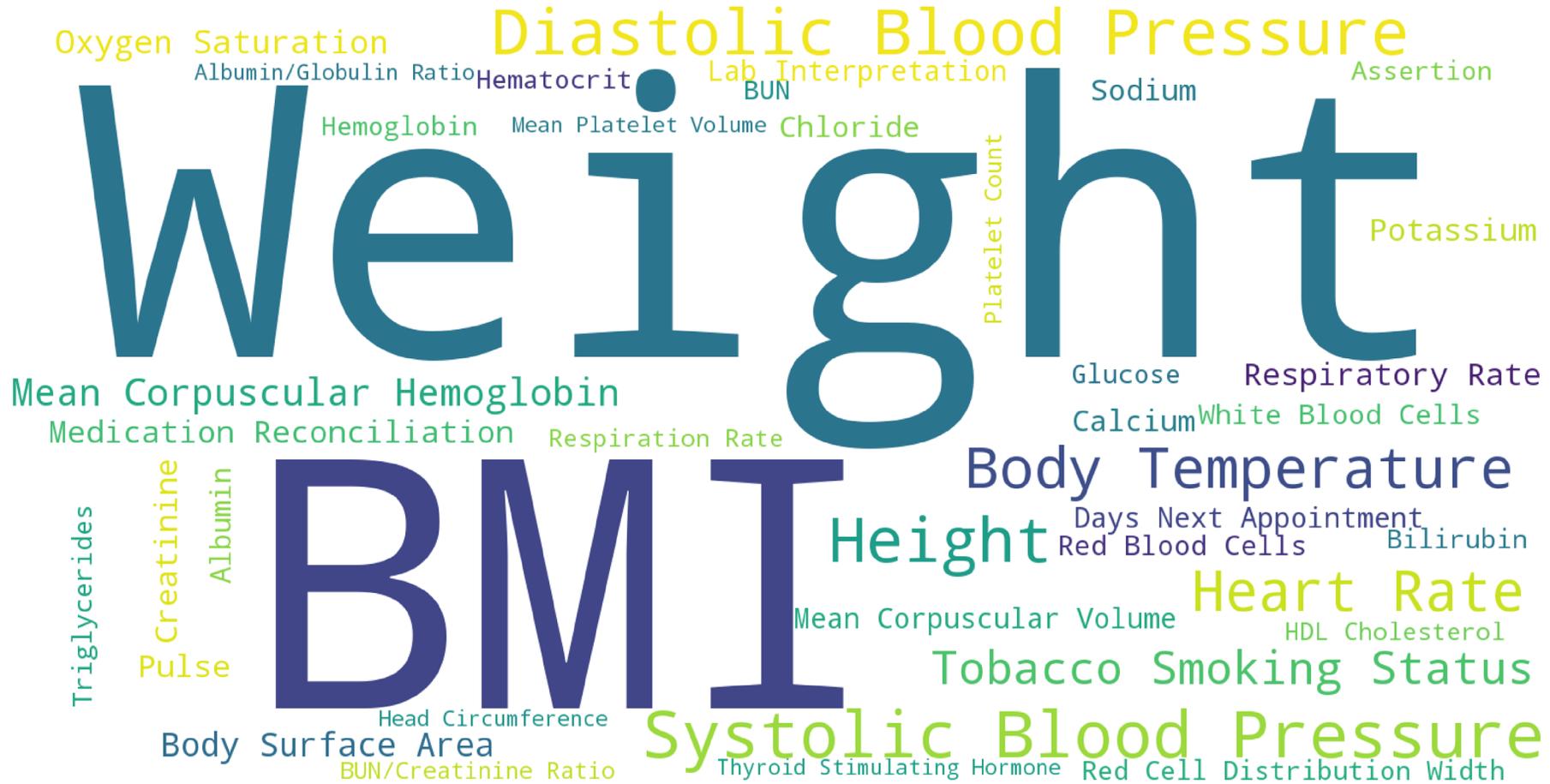
### SNOMED

- **SNOMED (Systematized Nomenclature of Medicine):** More clinically focused set of coding for diagnoses, procedures, and other parts of medical chart
- ~130k SNOMED diagnosis terminologies available
- 86% can be converted to ICD-10, though often need to look at other data to do so (e.g. other diagnoses, patient sex, etc.)
- Often one SNOMED could map to multiple ICD-10 codes
- Examples: 65194006 - Night blindness, 722193000 - Husband deceased

### LOINC

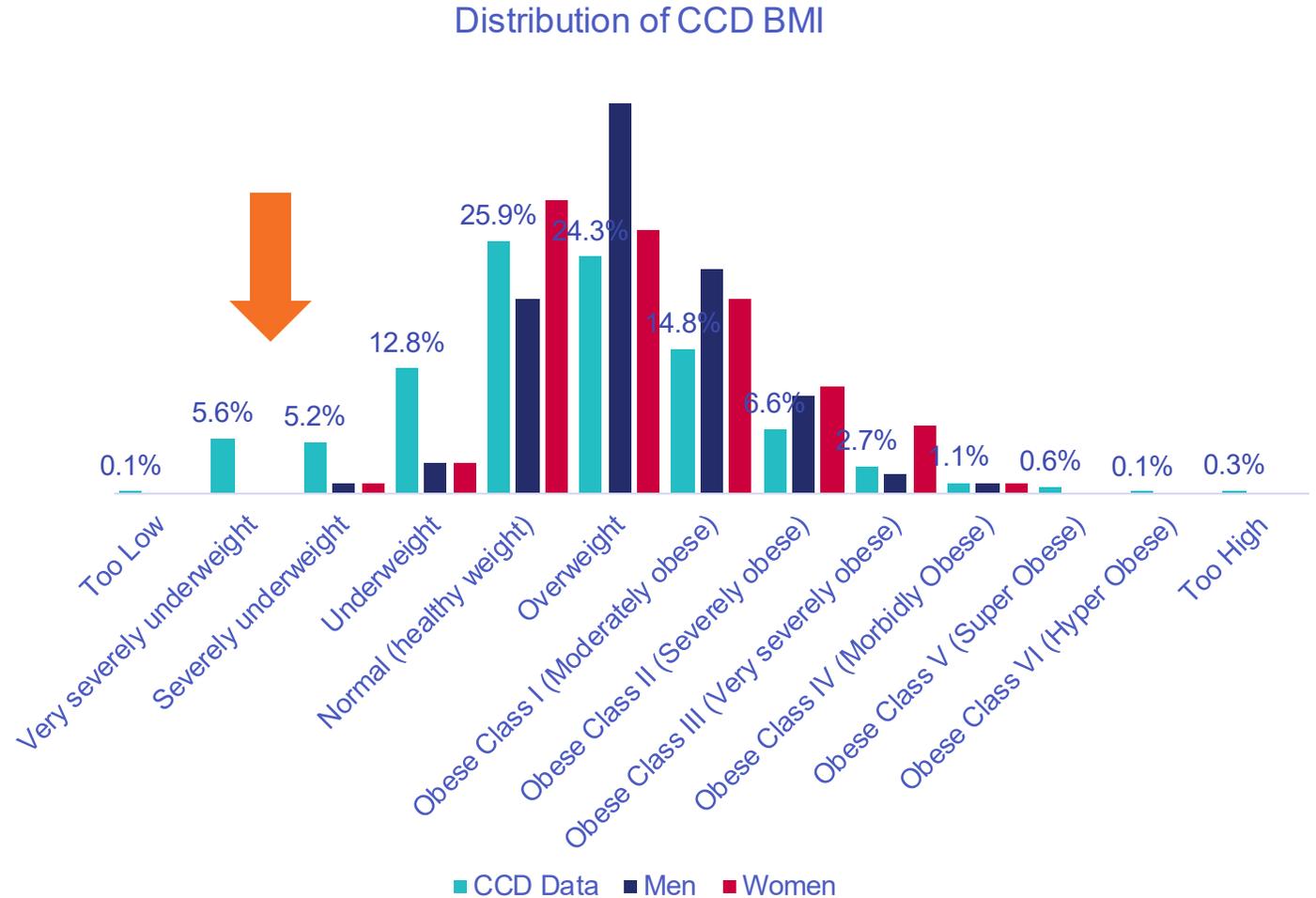
- Logical Observation Identifiers Names and Codes: coding system for medical lab observations (tens of thousands)
- Examples: 8867-4 - Heart rate, 6719-9 - Allergy, cherry

# Top Available Fields in CCD



# BMI From CCD Data

- A few observations lack units or contain blanks or “n/a”
- Varying precision (some to many decimals places, others appear to be rounded)
- Our distribution comes out much lower than America – could be population or data issue?
- Very Severely Underweight looks suspect (unlikely that >5% of population has this low of BMI – 82 lbs for 5’ 8” person)

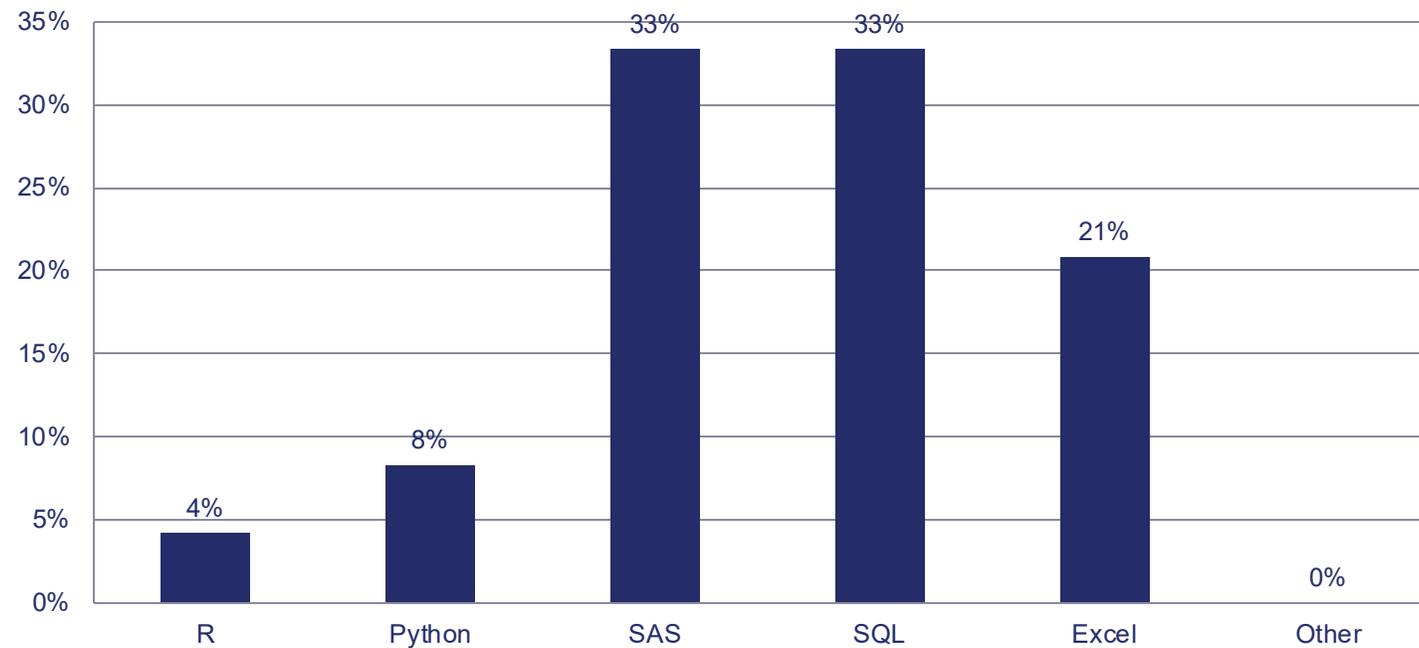




# **Unstructured EMR Data Using Natural Language Processing**

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The tool I use most frequently for data analysis/predictive modeling/machine learning is:

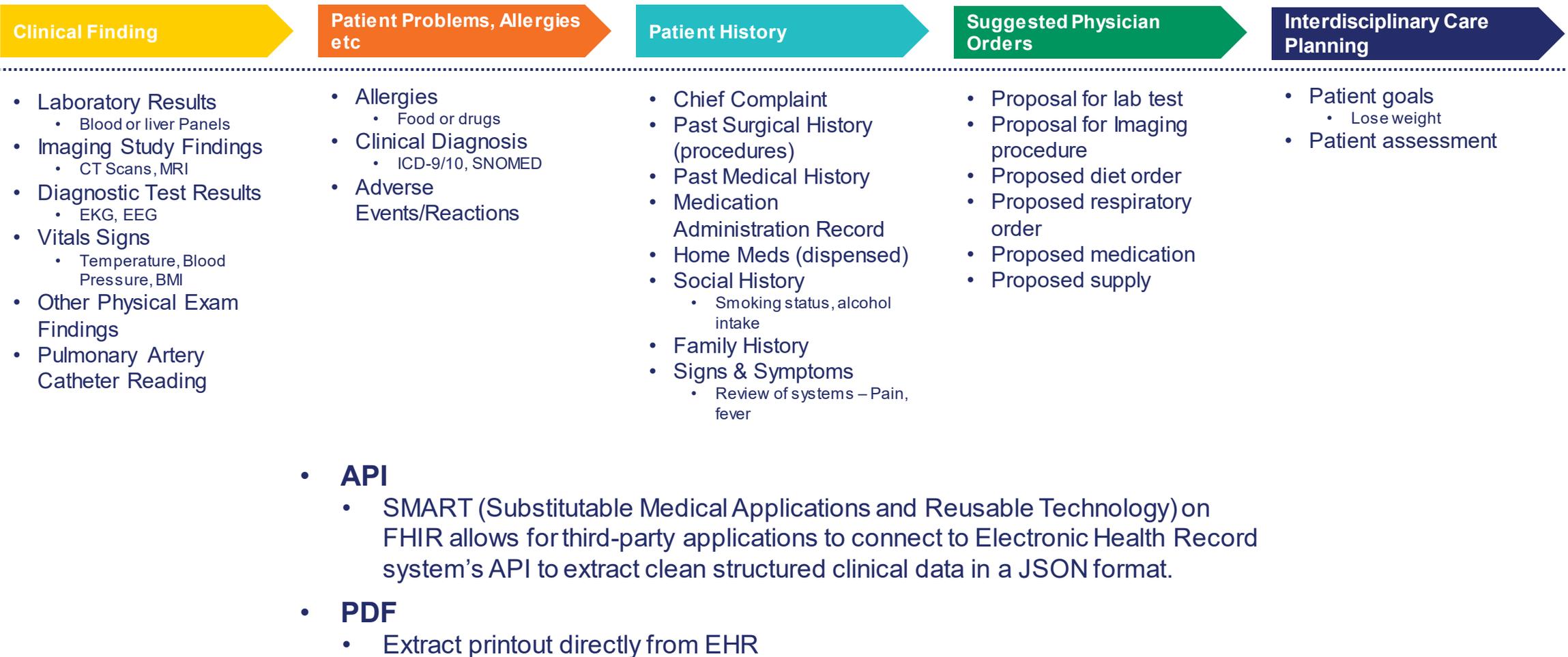


# Natural Language Processing Overview

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- NLP is the branch of AI that enables computers to understand and process human language. Some major NLP tasks are:
  - Stemming: reducing words into their root form, i.e. “diabet” would be root for “diabetes”, “diabetic”.
  - named entity recognition: Person, place, time recognition
  - terminology extraction: involves building a corpus from which specific terminologies can be extracted
  - part of speech tagging: marking up a word in a text (corpus) as corresponding to a particular part of speech such as verb, nouns, adjectives, etc.
- Open sourced tools that can be leveraged to do basic NLP tasks/processes:
  - NLTK: Python based toolkit supporting many NLP tasks, but not industrial strength.
  - Stanford CoreNLP: Java based toolkit from Stanford University capable of common NLP tasks.
  - Gensim: efficient and scalable NLP built in Python.
  - **Pros:** cost effective, large community of contributors and users and transparent algorithm
  - **Cons:** not targeted towards healthcare data, more difficult to use, often not scalable or efficient, could be difficult to maintain; no technical support
- Paid NLP service include IBM Watson and recently Amazon Medical Comprehend
  - **Pros:** easier to create one stream process; technical support; healthcare specific
  - **Cons:** black box, expensive, difficult to make customization.

# EHR Structure



# Example of Medical Record (API)

- [http://wiki.hl7.org/index.php?title=Publicly Available FHIR Servers for testing](http://wiki.hl7.org/index.php?title=Publicly_Available_FHIR_Servers_for_testing)
- Cerner Example:

```
{
  "resourceType": "Conformance",
  "text": {
    "status": "generated",
    "div": "<div>Generated Conformance Statement</div>"
  },
  "url": "https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6",
  "name": "Cerner Conformance Statement",
  "status": "draft",
  "publisher": "Cerner",
  "date": "2015-12-03T00:00:00+00:00",
  "description": "Describes capabilities of this server",
  "kind": "instance",
  "fhirVersion": "1.0.2",
  "acceptUnknown": "no",
  "format": [
    "json"
  ],
  "rest": [
    {
      "mode": "server",
      "documentation": "All the functionality defined in FHIR",
      "security": {
        "cors": true
      },
      "resource": [
        {
          "type": "AllergyIntolerance",
          "interaction": [
            {
              "code": "read"
            },
            {
              "code": "search-type"
            }
          ]
        }
      ]
    }
  ]
}
```

```
  "searchParam": [
    {
      "name": "_id",
      "type": "token",
      "documentation": "A single or comma separated list of AllergyIntolerance instances"
    },
    {
      "name": "patient",
      "type": "reference",
      "documentation": "Who the sensitivity is for. It is a reference to a Patient"
    },
    {
      "name": "status",
      "type": "token",
      "documentation": "Certainty of the allergy or intolerance"
    }
  ],
  "type": "Condition",
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "search-type"
    }
  ],
  "searchParam": [
    {
      "name": "_id",
      "type": "token",
      "documentation": "A single or comma separated list of Conditions"
    },
    {
      "name": "patient",
      "type": "reference",
      "documentation": "The patient who has the condition. It is a reference to a Patient"
    }
  ]
}
```

```
  "name": "clinicalstatus",
  "type": "token",
  "documentation": "A list of desired clinical statuses of the patient"
},
{
  "name": "category",
  "type": "token",
  "documentation": "The category of the condition"
}
],
{
  "type": "Device",
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "search-type"
    }
  ]
},
  "searchParam": [
    {
      "name": "patient",
      "type": "reference",
      "documentation": "The patient who has the device affixed. It is a reference to a Patient"
    },
    {
      "name": "_id",
      "type": "token",
      "documentation": "A single or comma separated list of Device instances"
    }
  ]
},
{
  "type": "DocumentReference",
  "interaction": [
    {
      "code": "read"
    },
    {
      "code": "search-type"
    }
  ]
}
]
```



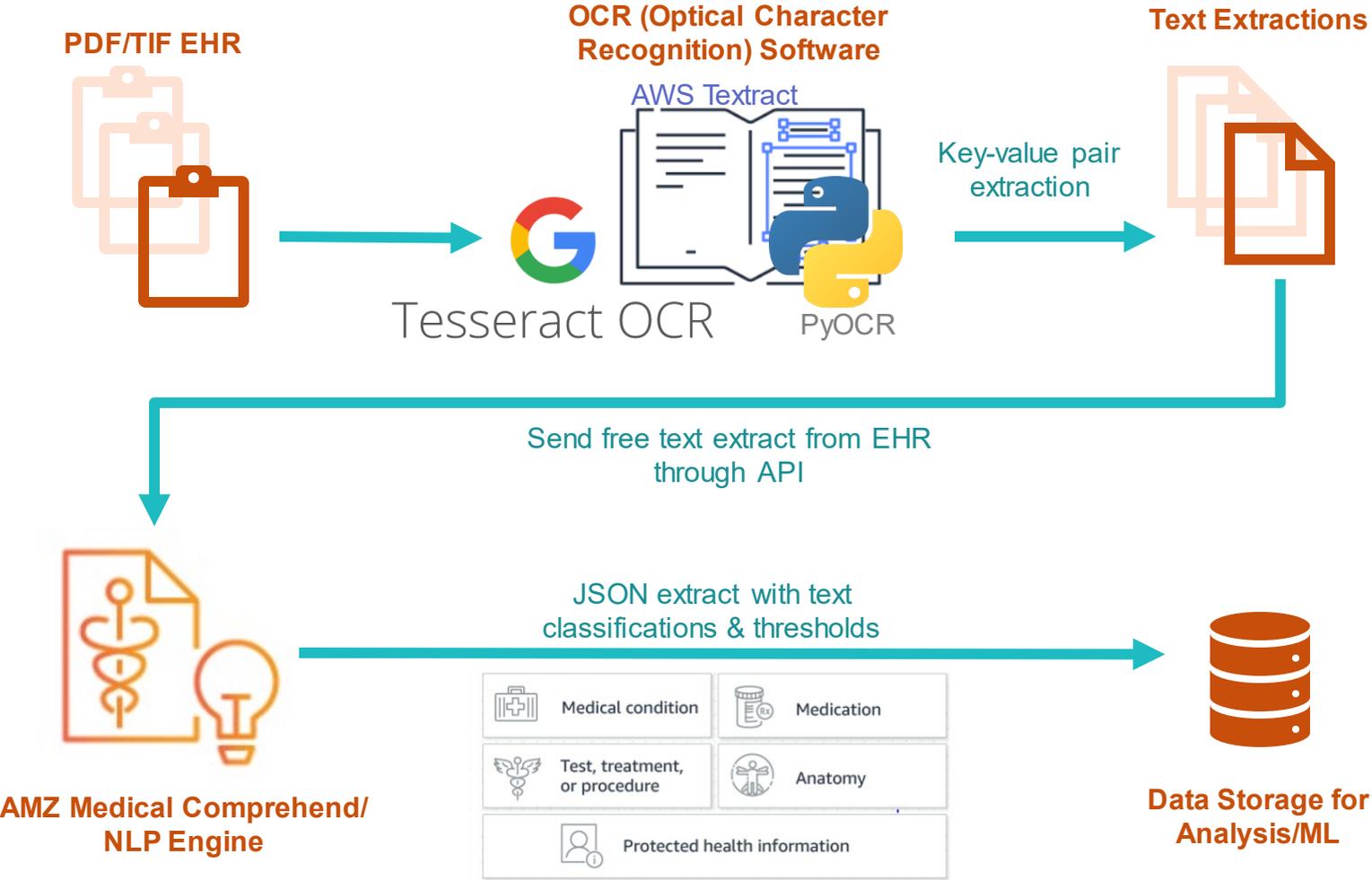


# Natural Language Processing in Healthcare

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- When working with healthcare data, most open sourced tools are not sufficient as they are: healthcare data has very specific vocabulary and the NLP solution will have to recognize medical terms, drug names, procedure names and their respective abbreviations.
- Other challenges facing free text healthcare data:
  - Use of acronyms: “ASCVD” = Atherosclerotic cardiovascular disease, which is not just the first letter of each word; and treating “CA” as “cancer” rather than “calcium” or “California”.
  - Misspelling: recognizing “daibetes” = “diabetes”
  - Negation: “patient shows no sign of depression” will not lead to a false positive for depression
  - Scaling the solution
    - Individually addressing each challenge can lead to a highly inefficient process. Some of the newest algorithms such as word2vec can model word meaning from its context, which is a potential solution to acronyms and abbreviations, but is computationally expensive.
    - Choosing the right algorithm may be a challenge as you will have to weigh precision and accuracy against time and computing power constraints of an expensive algorithm. Sometimes using regular expressions (text patterns) or text mining your corpus (body of words that is used for a specific purpose) should be used instead of NLP.
      - Example of using regular expressions would be to extract date values in EHR
      - Example of using text matching would be on “Active Problem” section of the EHR, which will contain either SNOMED descriptions or ICD-10 descriptions/code.

# EHR Data Extraction Workflow



# AWS Medical Comprehend Example - Retrospective Risk Adjustment

Example of a single encounter for a Medicare patient

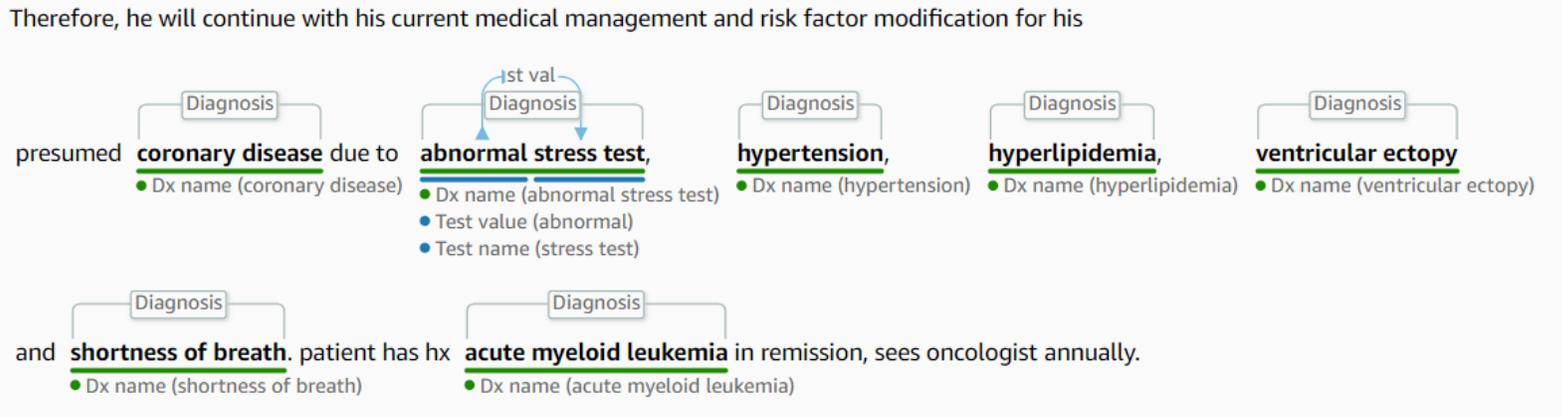
## Claims Dx

- I25.118: Coronary artery disease involving native coronary artery with other forms of angina pectoris
- I10: Essential hypertension
- R94.39 : Abnormal stress test
- E78.2: Mixed hyperlipidemia
- I49.3: ventricular premature complex
- R06.09: dyspnea on exertion

## Doctor's Notes

- + 1 diagnosis, leading to 0.48 HCC point lift and \$5K increase in payment after supplemental submission.
- AWS comprehend flagged “acute myeloid leukemia” (C92.00) but it has its drawback -- it missed “remission” which should be coded as (C92.01). It’s important for coder review to catch these issues but not miss opportunity.

	date	diagnosis_codes_list
1	2017-02-22	I25.118,I10,R94.39,E78.2,I49.3,R06.09



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# Social Q&A



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# Beyond Claims

Unlocking the power of EMR and real-time clinical ADT data

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June 25, 2019

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Director, Data Science



# Agenda

What are HL7 ADT messages

CMS Interoperability

Sources of ADT data

ADT Use Case

Case Studies



What is HL7?

# HL7, ADT, FHIR, and other Acronyms

- Who is HL7
  - International not-for-profit standards organization founded in 1987
    - “Founded in 1987, Health Level Seven International (HL7) is a not-for-profit, ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of **electronic health information** that supports clinical practice and the management, delivery and evaluation of health services. HL7 is supported by more than 1,600 members from over 50 countries, including 500+ corporate members representing healthcare providers, government stakeholders, payers, pharmaceutical companies, vendors/suppliers, and consulting firms.” -HL7.org
- What do they do? define standards and formats for messaging and data exchange, offer trainings, etc.
  - HL7 versions:
    - V2 – Current most commonly used standard, pipe delimited format; uses ^,~,& for arrays (3 levels only)
    - V3 – xml format, generally not adopted given larger file sizes
    - FHIR (Fast Health Interoperability Resources) – HL7’s branded version of JSON, more efficient than v3, can embed arrays with [], comma delimited

## Benefits of FHIR

- FHIR – HL7's branded version of JSON, more efficient than v3, can embed arrays with [], comma delimited
- JSON
- Rest
- Defined common JSON format
- Introduced authentication
- FHIR is conversational
  - Everyone wants everything, and don't want to have to ask for everything in the conversation every time
  - The conversation can be circumvented
- Unclear if FHIR will be adopted broadly across the industry
  - Explicitly named in proposed interoperability regulations



What is ADT?

# ADT Message Feed: What it is & How it works

## What is an ADT message?

- Hospital messages focus on patient Admit, Discharge, & Transfers (ADT) for ED visits & inpatient stays based on HL7 standard
- Primarily relies on specific header codes. Examples:
  - A03 = patient discharge message
  - PV1-10 I 02 = inpatient visit
  - DG1 I 001 I 9 I 1550 = ICD-9 code for diagnosis of malignant neoplasm of liver
- HL7 V2 examples:

```
MSH|^~\&|ADT1|MCM|LABADT|XYZ|200102151112|SECURITY|ADT^A03^ADT_A03|
MSG00001|P|2.5|12345678||AL|NE
EVN|A03|20010215120759
PID|1||PATID1234^5^M11^ADT1^MR^MCM123456789^A^U^SSA^SS||
WILSON^RACHEL^A||19610615|F||C|1200 N ELM STREET^AGREENSBORO^NC^27401
-1020|GL|(919)379-1212|(919)271-3434||S||
PATID12345001^2^M10^ADT1^AN^A|123456789|987654^NC|
NK1|1|WILSON^ROGER^K|HU^HUSBAND|||NK^NEXT OF KIN
PV1|1|I|4000^2012^A01|||004777^BLOOMFIELD^KARYN^J.||||SUR||||ADM|A0|N|
1026^BLOOMFIELD^KARYN^J. |OB|H0100240|ALV|
20010823095130|20010823102455
```

**FICTIONAL SAMPLE**

```
MSH|^~\&|ADT1|MCM|LABADT|MCM|198808181126|SECURITY|ADT^A01|MSG00001-|P|2.4
EVN|A01|198808181123
PID|||PATID1234^5^M11||JONES^WILLIAM^A^III||19610615|M-||C
PV1|1|I|2000^2012^01|||004777^LEBAUER^SIDNEY^J.||||SUR||-||ADM|A0
AL1|1|||^PENICILLIN||PRODUCES HIVES~RASH~LOSS OF APPETITE
DG1|001|I9|1550|MAL MEO LIVER, PRIMARY|19880501103005|F
PR1|2234|M11|111^CODE151|COMMON PROCEDURES|198809081123
```

**FICTIONAL SAMPLE**

- Constant stream of data (messages) flowing from the EHR
  - ADT data aggregators process an average of 3,000 – 5,000 ADT messages per hospital, per day (heavily dependent on size)
  - Each hospital visit typically results in several ADT messages (admission, update, discharge) with different discrete pieces of information
- Examples of data typically included in ADT
  - Normalized codes: Diagnosis code, Encounter Type, Encounter Date/Time
  - Free Text: Chief complaint
  - Patient information: first name, last name, address, DOB, Medical Record Number (MRN),
  - Other: Treating Provider, Assigned Patient Location, Hospital Service, Diagnosis Code, Diagnosis Description



## Sources of ADT data

# Sources of ADT Data Today

## Sources of ADT data

- HIEs (state or regional)
- Data aggregators and Encounter Notification Service Providers
- Commonwell, Carequality
- Da Vinci project

## Challenges – MPI, aggregation, data quality

- Decision on how to receive – daily report / real time differences?

## Considerations:

- For the data source they are looking at, do their data use agreements enable the use cases you want to use at a health plan?
- Is the source a raw ADT pass through, is it normalized across multiple facilities, how good is the normalization?
- What is the MPI methodology? How accurate/complete is it? Privacy protections?
- Match rate / What % of your members does the ADT source have data for?
- What data is filtered out? If there is no filtering, is that okay?
  - Example: Massachusetts Rule: “a provider shall not ... (2) disclose the results of [an HIV diagnostic test] to any person other than the subject without first obtaining the subject’s written informed consent” [M.G.L. ch 111 § 70F]



# Cures and the Future of Interoperability

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**Poll: Cures Proposed Rules from CMS &  
ONC: How big of a deal with these new  
rules be?**

# Context: What Just Happened?

- U.S. Dept. of Health & Human Services has 2 agencies that both issued major new proposed federal regulations on Monday, February 11, 2019
  - CMS proposed rule (~250 pages) included:
    - Patient Access
    - ADT Notifications
    - Information Blocking
    - Payer Interoperability
    - CEHRT Certification Requirements
    - RFI: PAC transitions in care
    - RFI: patient matching
  - ONC proposed rule (~750 pages) included:
    - Patient Access
    - Certain “deregulatory actions”
    - New CEHRT Certification Requirements
    - Modifications to ONC Health IT Certification Program
    - Health IT for the Care Continuum (Pediatric CEHRT requirements, HIT + OUD RFI)
    - Information Blocking
    - TEFCA RFI
    - API Certification Rules
    - Conditions and Maintenance of Certification (Implementation, Compliance, Enforcement)
    - Registries RFI
    - Patient Matching RFI



# ADT Use Cases & Case Study

# ADT ROI Use Cases

Health Plan ROI Use Cases	Benefits	Challenges
Overutilization of Acute Care Services – Inpatient readmission	<ul style="list-style-type: none"> <li>• Avoiding a few readmissions care result in significant cost savings</li> <li>• Readmission reductions improves HEDIS scores (PCR)</li> <li>• Quick measurement – only need to follow outcomes 30 days post discharge</li> </ul>	<ul style="list-style-type: none"> <li>• With average readmission rates in the 10-15% range, need a large intervention population to have an impact (with 100% CM effectiveness, need to engage 10 members to avoid 1 readmit)</li> </ul>
Overutilization of Acute Care Services – ED visits	<ul style="list-style-type: none"> <li>• Reducing ED visits can also potentially avoid costlier Inpatient stays</li> <li>• Focus on ED frequent utilizers can lead to avoiding multiple ED visits by engaging a single member</li> <li>• ED reductions improve HEDIS scores (EDU)</li> </ul>	<ul style="list-style-type: none"> <li>• Lower cost per visit means more ED visits need to be avoided to achieve significant dollar savings</li> <li>• Slower measurement – typical need at least 90 days post tracking to see impact</li> </ul>
Process Efficiency – Streamline inpatient notification / authorization process	<ul style="list-style-type: none"> <li>• Operational expense savings are easy to measure</li> <li>• Streamlined processes eliminate need for hospitals to send notifications on admission</li> </ul>	<ul style="list-style-type: none"> <li>• Workflow changes need to occur to gain efficiencies which can be delayed based on health plan IT resourcing</li> <li>• Workflow can be split between old and new processes as additional hospitals go live</li> </ul>
Case Management – Accurate Member Contact Info	<ul style="list-style-type: none"> <li>• Accurate contact info can improve care management engagement rates increasing effective of each care manager</li> </ul>	

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# Social Q&A

THANK YOU



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**Poll: Where is your organization at in integrating non-claim data sources?**

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**Poll: The data I use most frequently for my work is:**

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**Poll: The most useful data to get access to  
(that I don't have today) that would  
improve my work is:**