Knowledge-driven Outcomes

IDC HPC Conference
April 30, 2013

Apixio Introduction

HISTORY

Privately held company founded in 2009, based in Silicon Valley

SOLUTIONS

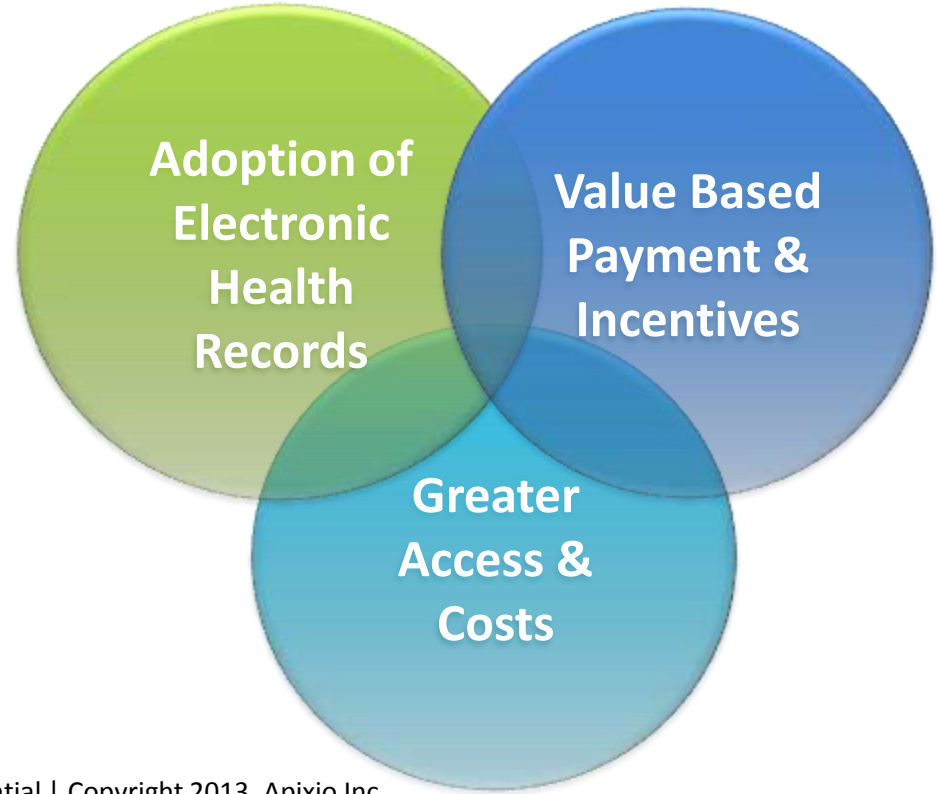
Big data platform and enabled solutions that optimize risk assessment, population health, and revenue for payers, health systems, and provider groups

ALLIANCES

RECOGNITION

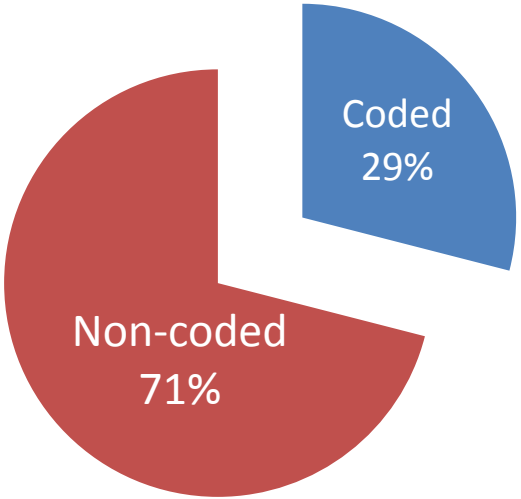
#1 Big Data Platform in Healthcare

Current Healthcare Trends Leading to Greater Reliance Upon Data Analytics



Decision Support ***Fails*** Without Required Clinical Data

How is Splenectomy Documented?




The NEW ENGLAND JOURNAL of MEDICINE

Perspective

Incomplete Care — On the Trail of Flaws in the System

Big Data in Healthcare

Volume	Text, scanned documents, lab results, billing data, images, device data, genomics
Variety	Structured data (e.g., CCD, HL7), Unstructured data from dictations, encounters, transcription, photos, images
Value	Aggregate and analyze data from various databases –mobile; claims, free text, scanned documents, and archived imaged Framework - Machine-learning; NLP; statistical modeling
Velocity	Scalable data storage and retrieval infrastructure with parallel computing capability Real-time analysis across population for decision support

Data Volume for Typical Health System

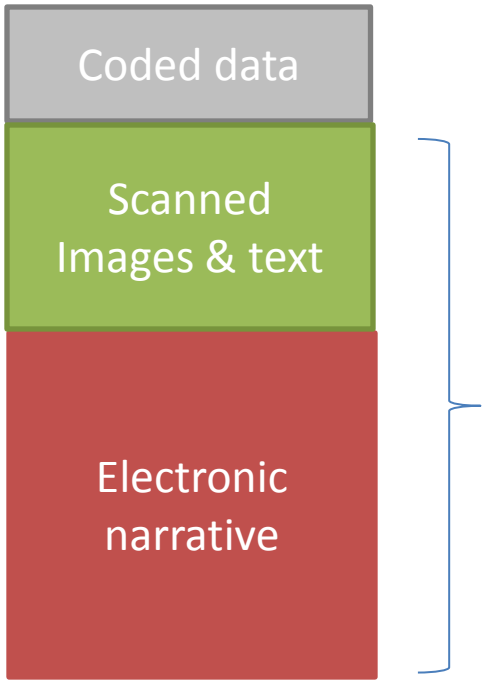
200,000 patients

5 years of data → **10 TB**

Structured data: **13 M** unique concepts

Narrative data: **338 M** unique concepts

Data Variety in Healthcare



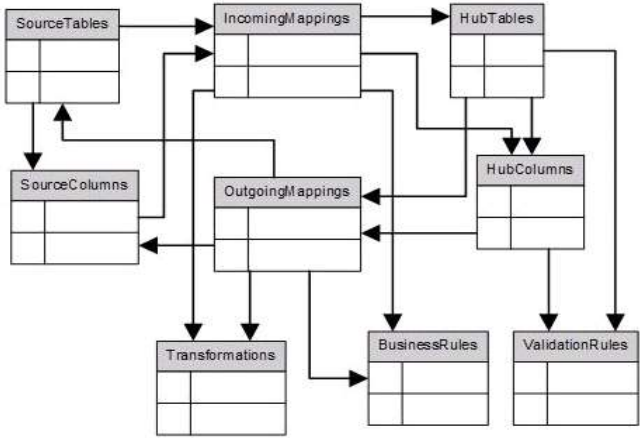
80% of patient information
is represented as textual data

(about 1.5B documents generated per day in US)

Data Variety Can Break a Data Model

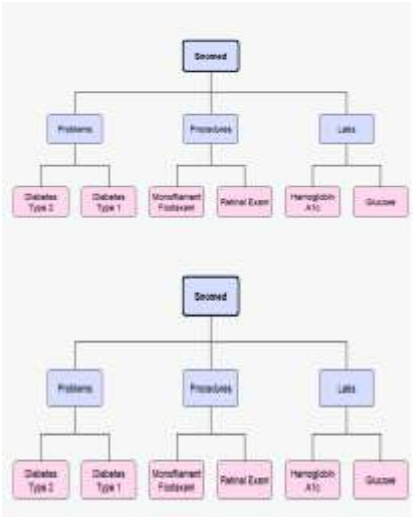
Data handling challenges:

- Varying degree of **resolution**
  - e.g. duration in CCD vs. CCR
- **Duplicate** information
  - e.g. multiple meds prescribe by same physician
- Multiple **coding systems**
  - e.g. same procedure coded differently
- Extracting **meaning** from text
  - e.g. text saying “past history of MI”

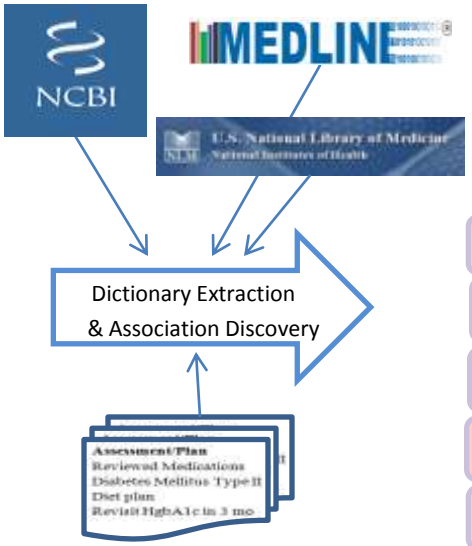


Knowledge Graph: Big Data Approach for Concept Interoperability

Existing Ontologies
(e.g. ICD9, SNOMED)



Medical Literature



Clinical Documents

Knowledge Graph

	Diabetes Type 1	DM 2	Glucose	CPT 83036	Retinal Eye Exam	Echo
Diabetes Type 1	1	0.98	0.9	0.95	0.9	0.2
Diabetes Type 2	0.98	1	0.91	0.96	0.9	0.18
Glucose	0.9	0.91	1	0.98	0.3	0.1
Hemoglobin A1c	0.95	0.96	0.98	1	0.2	0.09
Retinal Eye Exam	0.9	0.9	0.3	0.2	1	0.12
Echocardiogram	0.2	0.18	0.1	0.09	0.12	1

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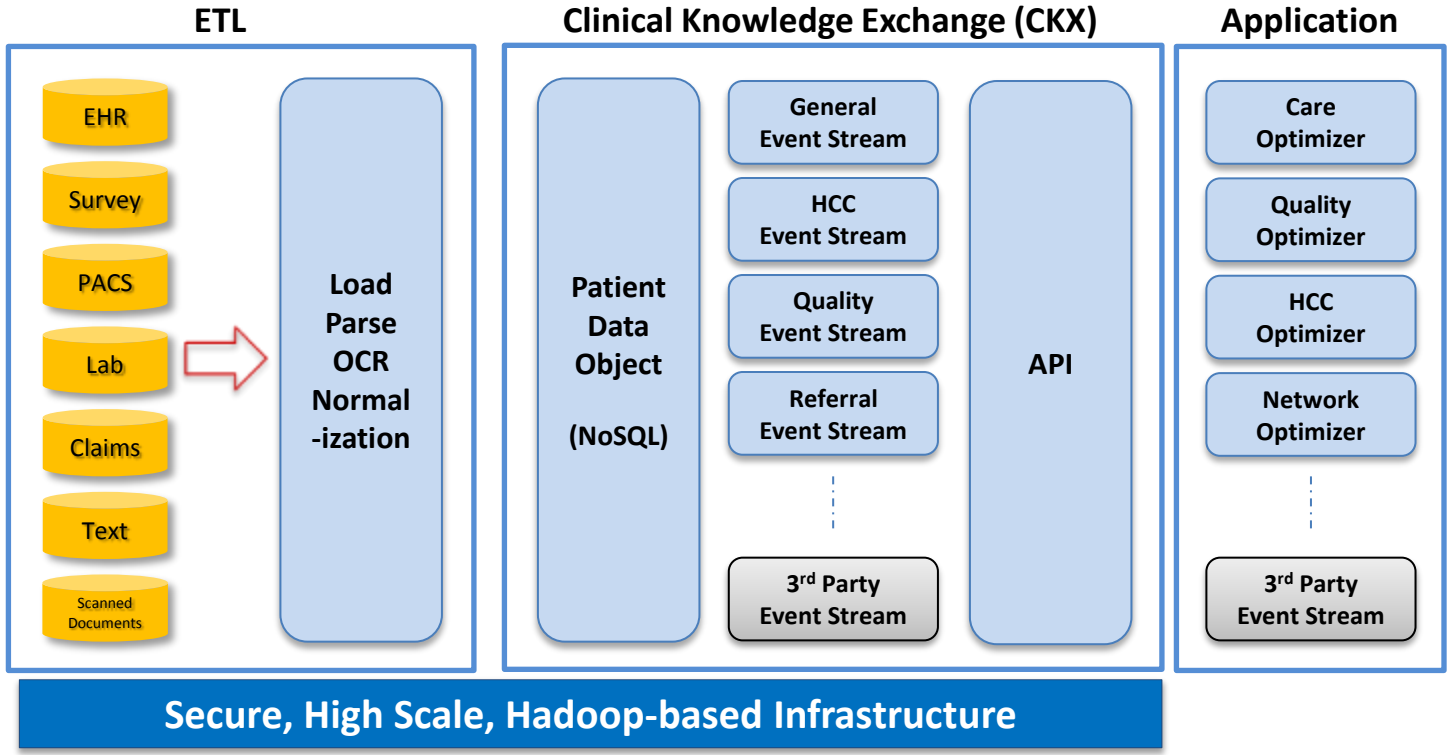
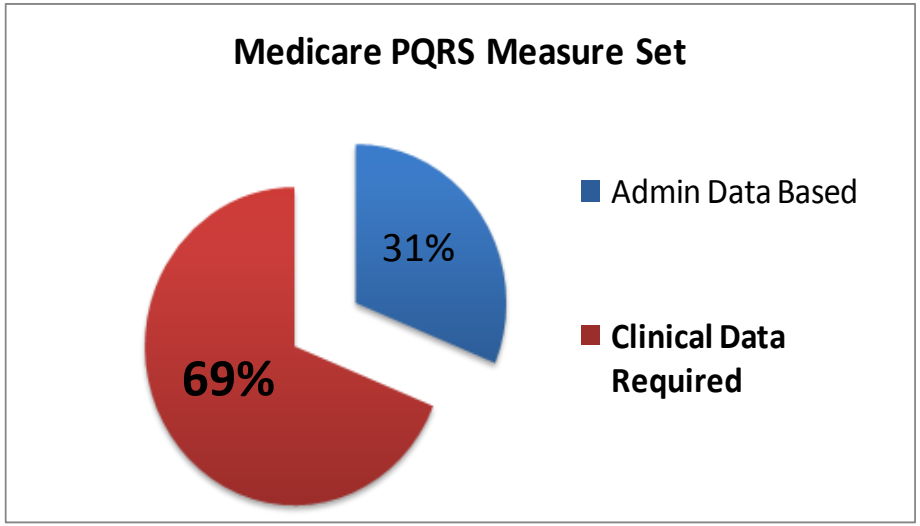
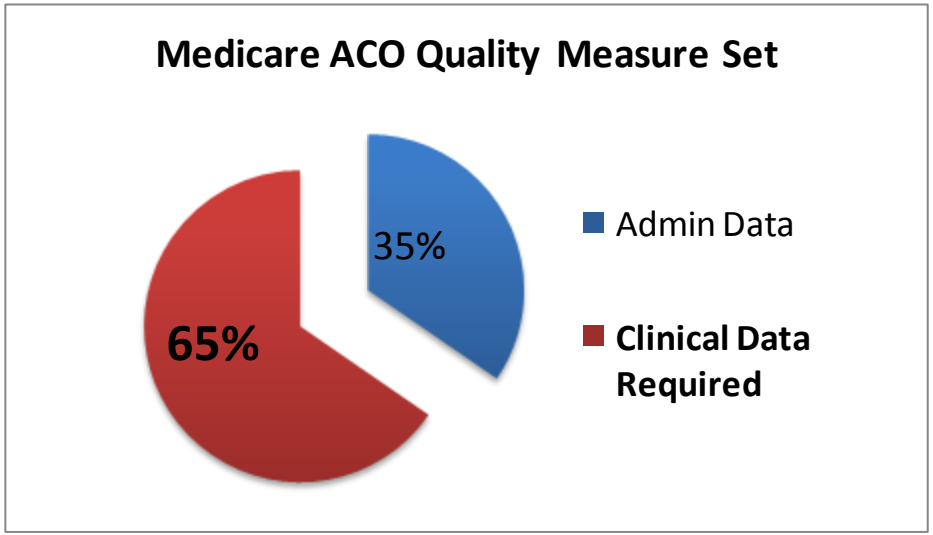
Apixio Platform



Required Clinical Facts for Quality Measures are not Readily Accessible in Widely Available Billing Data

Quality Measures Used to Determine Physician and Health System Performance





Quality Reporting Not Addressed Effectively

- Physicians required to enter these required data into electronic record templates
- Nurses or administrators audit chart and abstract required data from the physician documentation
- Organizations accept under-performing measures

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Infer Facts Using Algorithmic Text Mining

Evidence of systolic heart failure (LVEF < 40%)

PHYSICAL EXAMINATION: Today her weight was 179 pounds. Blood pressure was 138/79 with a heart rate of 109. Her apex was unremarkable. S1 was normal. S2 was normally split. I did not heard any murmur, nor did I heard any S3. Chest exam showed a prolonged expiratory phase with few rhonchi in both lung fields. Abdomen was slightly obese. There was no area of tenderness. I did not felt any organomegaly.

EKG: Electrocardiogram shows sinus tachycardia without evidence of atrial or ventricular enlargement, possibility of P-pulmonale, otherwise normal.

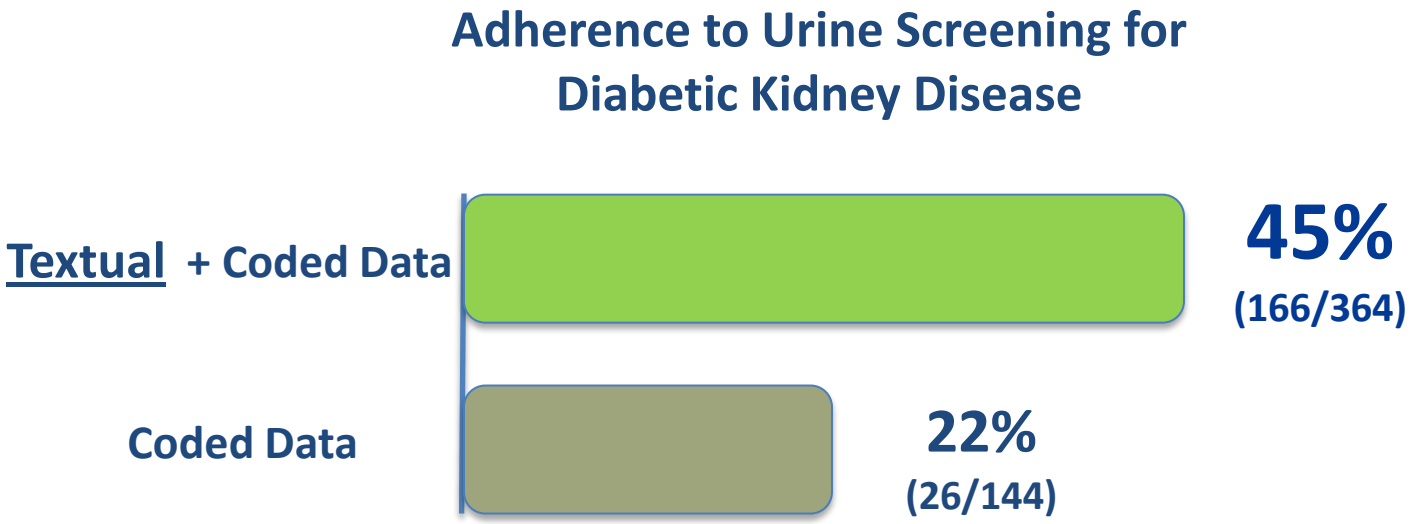
ASSESSMENT/PLAN: What I did was that I reduced the furosemide to 40 mg once a day, continue the atorvastatin, Ranexa, aspirin and metoprolol 25 mg b.i.d. I discontinued the lisinopril.

I had a chance to look at the echocardiogram that was done across the street. It shows normal LV with an ejection fraction of 64% and there is abnormal diastolic filling pattern. Therefore, the possible heart failure is mainly because of diastolic dysfunction. My own impression is that majority of her symptoms are related to lungs and I urged her to see even Dr. Jain or Dr. Delaney in the Pulmonary Division. She is making an appointment to see them. I am planning to see her in about three months' time.

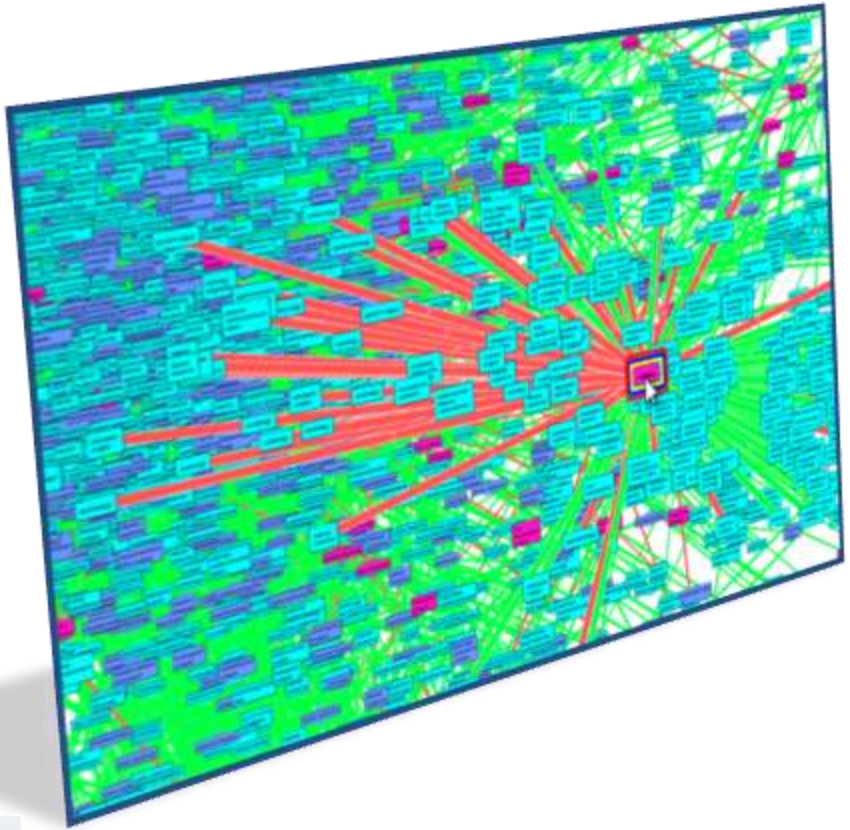
Automated Text Mining Using Machine Learning Algorithms

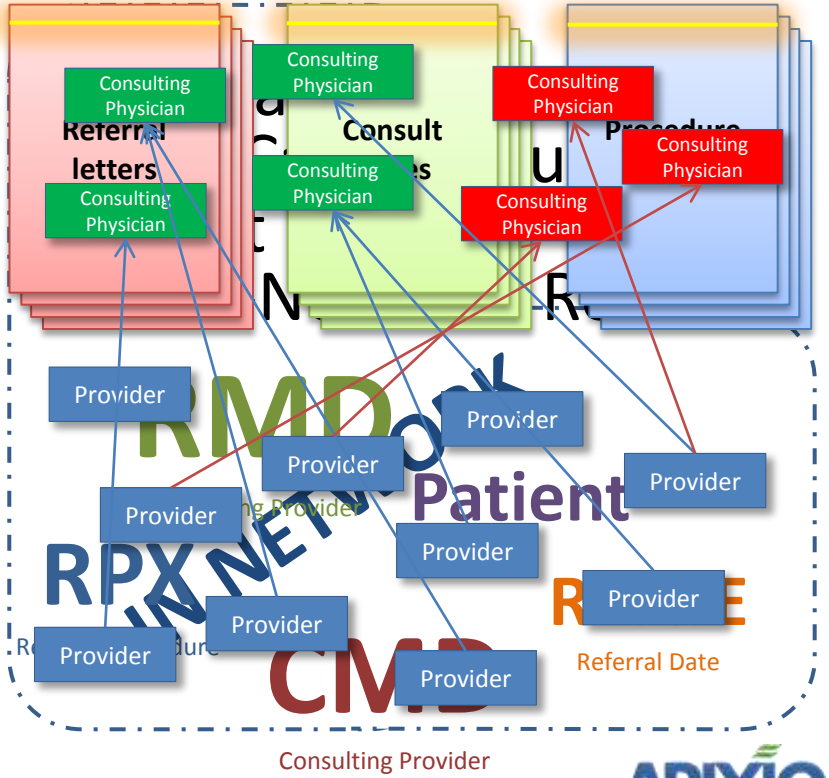
Quality Measure	Numerator fact	Precision	Accuracy
Diabetes mellitus: Need dilated eye exam to detect retinal disease	Evidence of dilated eye exam performed	100%	93%
Diabetes mellitus: Need foot exam to detect peripheral neuropathy	Evidence of diabetic foot exam performed	94%	93%
Pneumococcal vaccine required in patients 65 years and older	Evidence of pneumococcal vaccine performed	96%	96%

Text Mining for Quality Reporting Accuracy

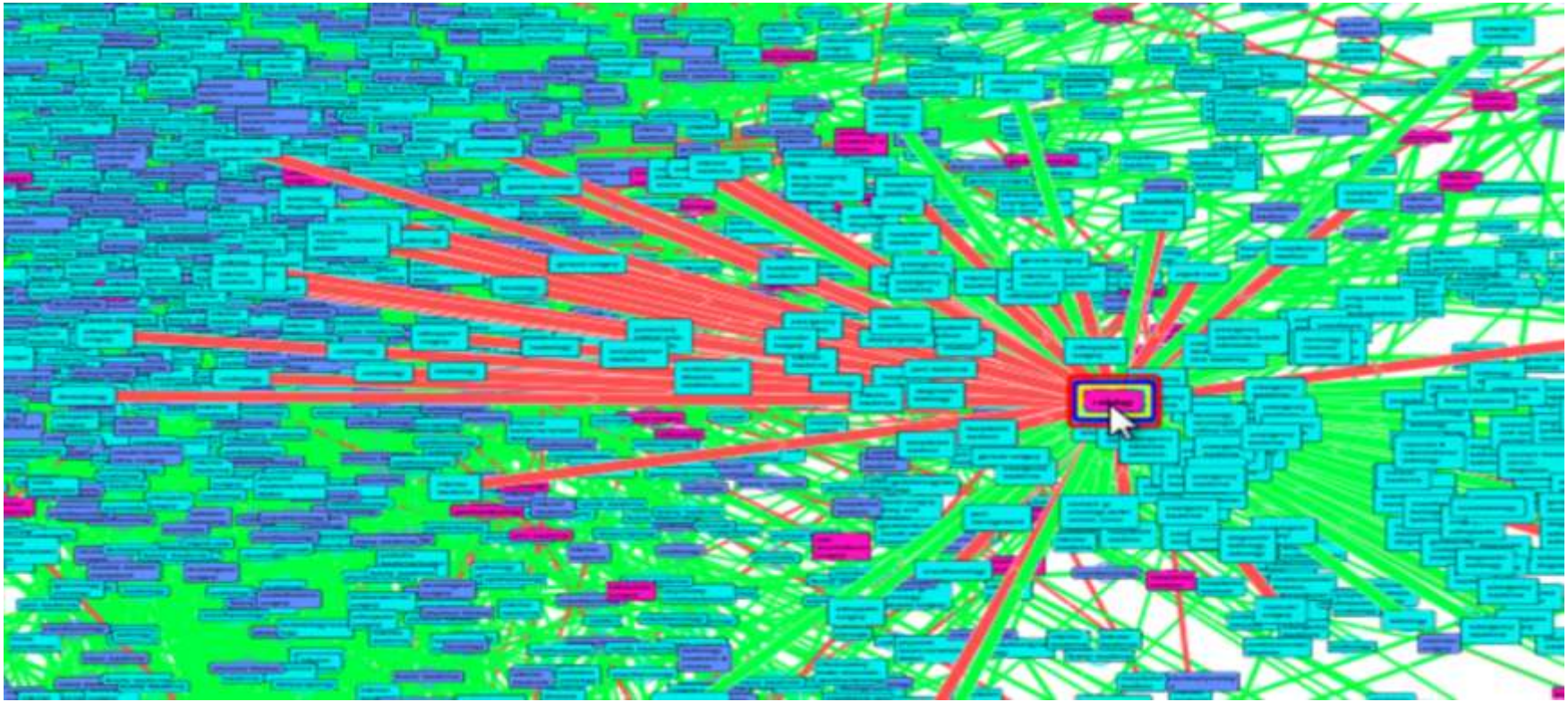


Understanding a Care Network

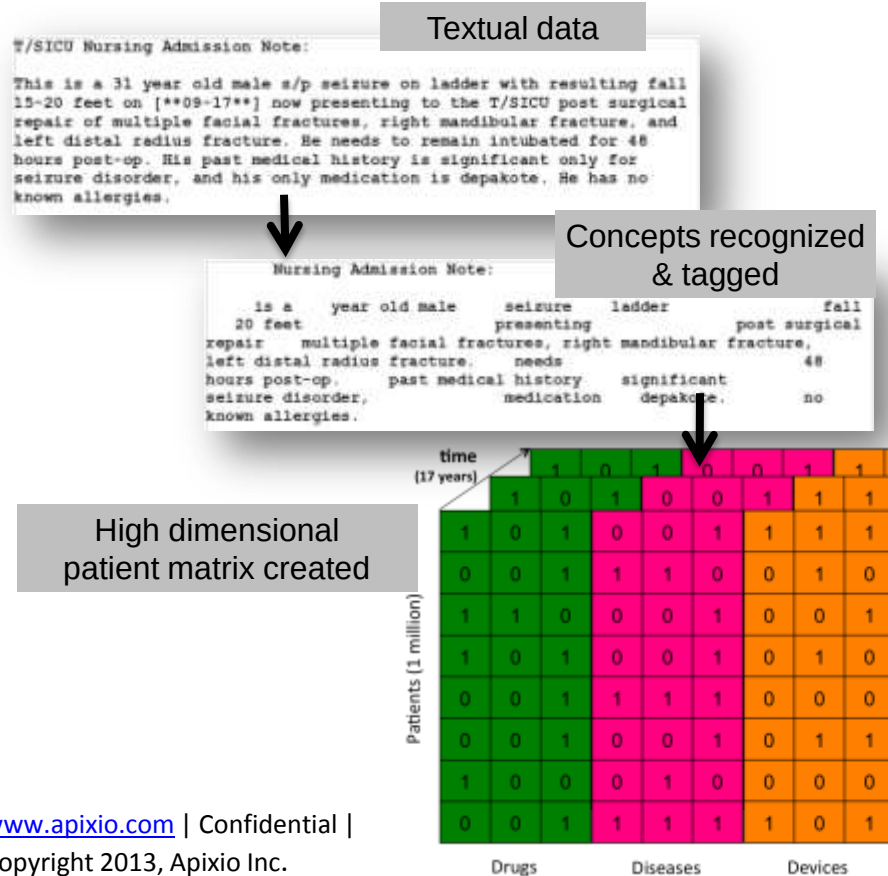




Referral Patterns to a Network Radiologist



Data Driven Insights using a Mathematical Representation of the Patient



Identify patient attributes strongly associated with outcomes of interest for

- Predictive risk models
- Risk adjustment models
- Virtual clinical trials

Summary of Big Data in Healthcare

- The shift towards performance-based payment places a great premium on data analytics

- Challenges in using data in health care include the ability to aggregate, mine, and analyze (real-time/ batch) large volumes of multi-modal data for many different use cases

- Improvements in care delivery and population management will be realized by deriving insights from analysis of unstructured data

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Thank You