Decoding Healthcare's Babel: How to Evaluate Data Aggregation and Analytic Vendors and Solutions

Bob Matthews
PriMed Physicians
MediSync

Change   **Manage**   **Measure**   **Evolve**

PriMed Physicians

- Community based, physician owned and governed

- Greater Dayton, OH (Population~750K)

- Primary care based group:
  - Family Practice, Internal Medicine, Pediatrics
  - Cardiology, Electrophysiology, Neurology, Endocrinology

- 57 physicians; ~110,000 patients

- Management and infrastructure contracted from MediSync since 1997

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MediSync

- Manages (but does not own) multiple medical groups including PriMed Physicians

- Using Six Sigma and Lean, innovates new processes to improve medical group performance

- MediSync processes used by over 125 medical groups

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Disclaimer

✓ There are no conflicts.

✓ We will not mention of any brand names...just characteristics.

✓ Since, submitting the proposal we did start extensive testing of one product.

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Agenda

1. How did we get here?

2. What problems are we solving?

3. What do we need?

4. What types of solutions are available?

5. How to evaluate vendors and solutions

6. Looking forward to using a solution

Change   Manage   Measure   Evolve

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Learning Objectives

1. Participants will be able to define and identify a clear list of requirements and goals for their data aggregation and analytic solution purchases.

2. Participants will be able to identify the types of data analytics that they will require as they plan for and participate in value based care.

3. Participants will be able identify and understand the definitions and inter-relationships between data aggregation and data analytics.

4. Participants will be able to identify the evaluation criteria for reviewing potential data aggregation and analytic solutions including the potential hidden costs, performance limitations and other factors that will determine the usefulness and cost effectiveness of applications purchased and installed.

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Simpler Version of the Goal

- Help you be a better shopper and purchaser of data analytic solutions

- Help you be a better user of data analytic solutions, whatever you use, build or buy
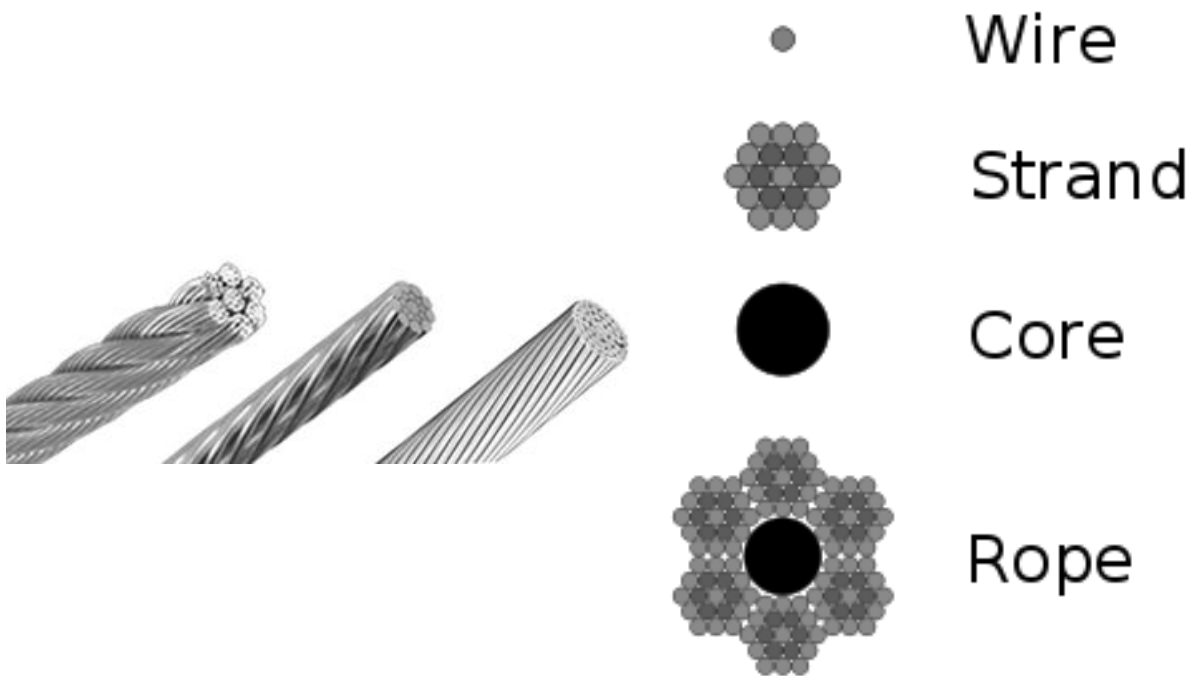
Change **Manage** **Measure** **Evolve**

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Participating In This Talk

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Why Are We Buying Analytics Now?

Volume Based Payments ➡ **Value Based Payments**

Need: *Need:*

- Relatively simple performance data, often "counts": visits, patients, services, collections, etc.

- Match these up to overhead costs.

- Data about population characteristics (i.e. specific patients and sub-populations, disease burden, spends, risks, etc.)

- Predictive data

- Vast performance data (i.e. outcomes, risk mitigation, etc.)

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History of Types of Questions

- Volume questions (How many….?)
- Hedis
- PQRI
- NCQA certs (Diabetes, Heart/Stroke, etc.)
- Local quality scores: CA Employers, Wisconsin, Minnesota, Southwest Ohio, etc.
- NCQA PCMH
- Meaningful Use
- ACO quality – 33 measures
- Chronic Disease Outcomes (HTN, Diabetes, Etc.)
- Detailed population and performance

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History of Value Questions

Number of Questions

Started with a <5

Became 10

Became 20

Became 50

Early stage ACO >100

Full value contracts >500+++

Sample Questions:

- Patients at goal (or not) for a Dx
- Patients not-at-goal by more than a margin of 10% or by number of diseases
- ER visits by Dx / Pt / PCP
- (Re)admission by characteristic
- Use of specific drugs linked to disease parameters

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Options?

- Buy (EHR) analytic solutions

- Go straight to the EHR database and extract

- Build data warehouses

- Buy "bigger" (i.e. multi-source) analytics

- Worry and fret

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First Word of Caution

- Exercise:

  - How many in audience were party to the EHR search and selection in your organization?

  - How many discovered, after purchase and install, that features and functions that were specifically discussed and promised in sales cycle, were not available or were available in some substantially reduced form?

- Lesson 1: You are dealing with sales people!!!

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Sales People *Sell*

- Sample: sales people learn quickly what buyers want...and then they instantly have it!

- Example:

  What do many of us want?

  – Predictive analytics

  Now, suddenly, every vendor is selling predictive analytics!!!

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First Advice

- Learn enough to ask 2nd, 3rd and 4th round questions

- Do NOT ask "Do you do this…?"

  – Ask: "HOW do you do this…"

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Defining the Nature of the Problem

- Increasingly large amounts of data in electronic formats

- History of Health IT was piecemeal and the various technologies do not speak to each other

- Electrons not matching up!

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List of Legacy Systems

- Practice Management[1,2,3]
- EHRs[1,2,3]
  - ER, Cardiology, Orthopedics, Ophthalmology
- Lab Systems
- PACs[1,2,3]
- Incoming CCDs
- Hospital Billing[1,2,3]
- Home Health
- SNF/Nursing Homes
- Case/Care Management
- Registries
- Insurance Claims Payment[1,2,3,4]
- Pharma (SureScripts)
- CCD/CCR
- Other TBD

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Your patients' health stories are in all these systems!

Legacy of Health IT

- Piecemeal functionality (non-integrated)
- Nothing designed to communicate with anything else
  - Brands often made integration more difficult as a marketing ploy
  - Examples: <2005:
        PM←→EHR "required" same brand
- Interface building is a huge business
  - Most interfaces 1 point to 1 point
- Modest recent improvements
        i.e. Lab ←→ EHR

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Implications of Legacy Health IT

- Dis-aggregated data

- Inability to see the "whole patient"

- Even more inability to see the whole population

- Much higher operating costs

- Wasted time for physicians and quality staff

Vendors We Have Vetted

3M Health Information Systems
Adobe
Alcatel Lucent
Anvita Health
APIXIO
Archimedes, Inc.
Atigeo
Caradigm
Cerner
Clinical Architecture
Clinical Solutions
Corepoint Health
Covisint
dbMotion (Allscripts)
Deloitte
DiagnosisOne

Explorys, Inc.
Futrix
GSI Health, Inc.
Harris Corporation
Healthagen
Health Care Dataworks, Inc.
Humedica
Iatric Systems, Inc.
IBM
ICA
Information Builders, Inc.
InteliChart
InterSystems Corporation
Isabel Healthcare
Liaison Technologies, Inc.
McKesson

Medecision
Medisolv
MedVentive
Optum (Axolotl)
Oracle
Philips Healthcare
Rapid Insight, Inc.
Recommind
SAIC
Sandlot Solutions
SAP America
Valence Health
Verisk Health
Xerox
ZeOmega, Inc.

What you will see in sales presentations:

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Sources

- Practice Management[1,2,3]
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Data Aggregation

Data Aggregation

Analytics

Analytics

Data Presentation
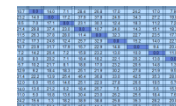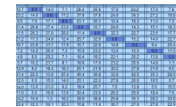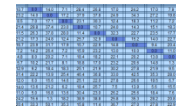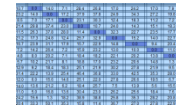
Prepare to Be Amazed!

The Demo

- Data in amazing colors
- Pie charts, graphs, plot lines, graphic lists
- "Revealing facts" piled upon revealing facts
  - Who is going to MI next Wednesday
  - List of all the diabetics who ate too much ice cream last night

The Story Behind The Demo

- Business Intelligence (BI) tools are inexpensive
  - In fact, many BI tools are 'open source' (i.e. free)
- Color and format do not equate to accuracy or truth
- Where did they get these "facts?"

Change | **Manage** | **Measure** | **Evolve**

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Warning!

- The ability to do any analytic function – including 'prediction' – requires that the data be good

- Is the data good?

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Three Keys To Good Aggregation

1. Final version includes **_all_** available data with persistent importance; accuracy assured
    - Good data is incorporated
    - Bad data is excluded

2. Key aggregation functions occur with extremely high rates of accuracy

3. Final data version is in a format that promotes queries and analysis quickly
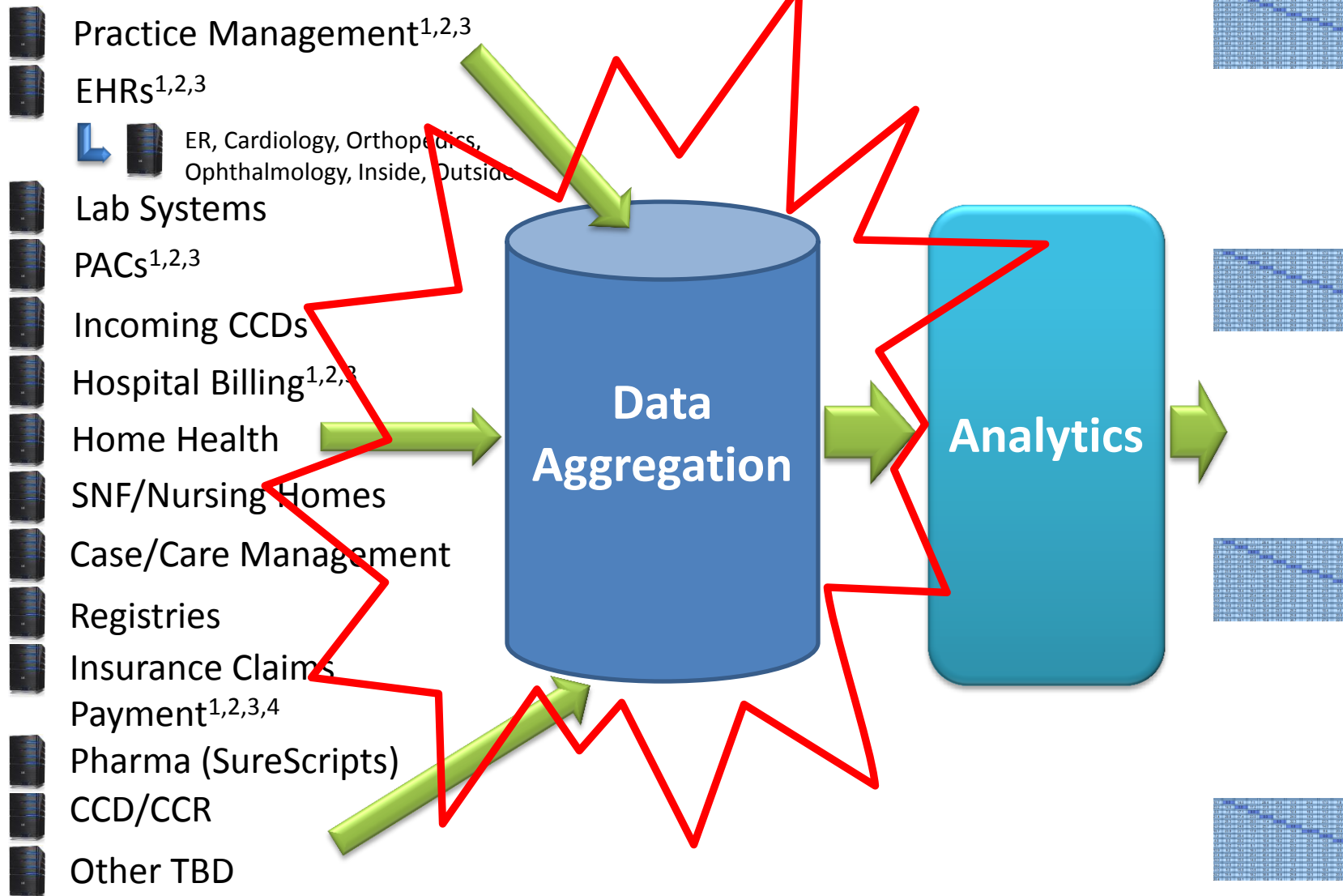
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Data Aggregation

Data Aggregation

Analytics

Analytics

Data Presentation

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Frequently Used 'Languages' and Formats

- ANSI X.12 Standard – A standard for defining Electronic Data Interchange (EDI) of healthcare administrative transactions
- ANSI HL-7 v2 Standard – Standards for the exchange, management and integration of electronic healthcare information
- ANSI HL-7 v3 Standard – Standards for the exchange, management and integration of electronic healthcare information*
- CPT – Current Procedural Terminology
- HCPCS – Healthcare Common Procedure Coding System
- ICD-9-CM – International Classification of Diseases & Procedures
- ICD-10-CM – International Classification of Diseases & Procedures
- ISO – Internal Standards Organization
- LOINC – Logical Observation Identifiers, Names and Codes
- NACIS –North American Industry Classification System
- NCPDP – Script ePrescribing Standard
- NDC – National Drug Codes
- NUBC – National Uniform Billing Code
- RxNorm – Nomenclature for clinical drugs
- SNOMED CT – Systematized Nomenclature of Medicine
- HL7 ADT message
- HL7 ORM (order) message
- HL7 ORU (result) message
- CCD document
- CCR document
- X12 837 Claims data
- PACS image
- UCUM – Units of measure

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Problems With Existing Data 'Languages' and Formats

- Voluntary, not used by software vendors in any consistent manner

- None are 'canonical'
  - Possible to have more than one meaning per term or more than one term per meaning resulting in ambiguity of meanings

- Fail to be able to handle the "many-to-many" possibilities in healthcare
  - i.e. one statement can have multiple meanings and visa versa

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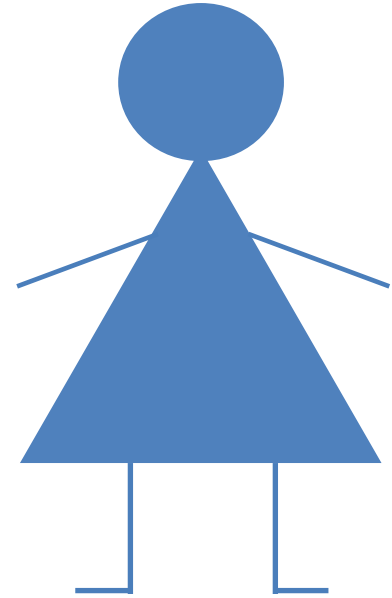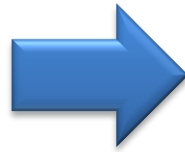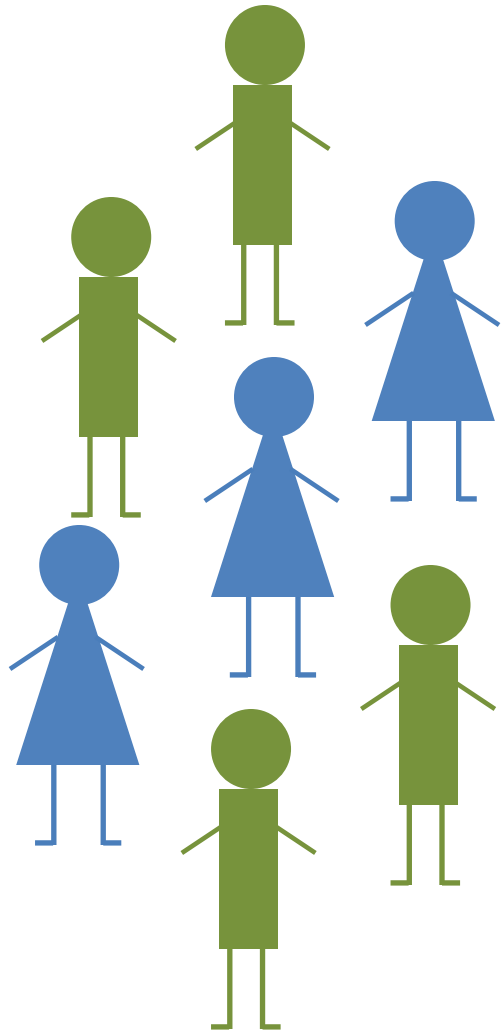
Two Foci for Analytics

1. By Person:

    Pull every available, meaningful piece of data about a specific patient and present it in a useful format

2. By Population:

    Assemble all of the individual patients into a population

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Stages of Aggregation

- Practice Management[1,2,3]
- EHRs[1,2,3]
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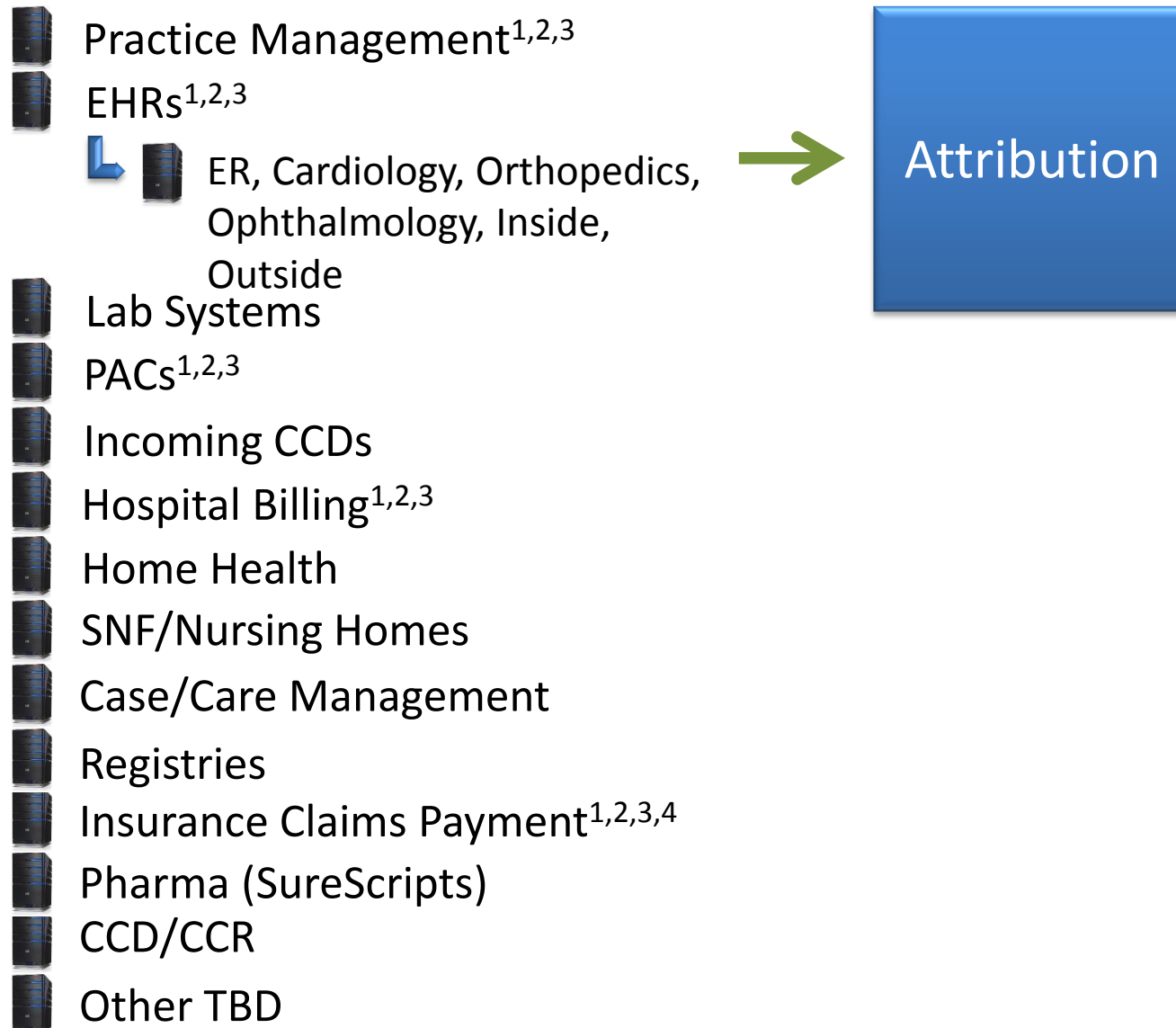
Attribution

Types of Attribution

- How many Master Patient Indices (MPIs)?

- Demographic only?

- Probabilistic?

- Uses clinical data? If so, how?

- Percent correctly attributed without human action

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Factors in Attribution Selection

- Are you more like Kaiser or more like Advocate?
  - Kaiser has one closed system (In- and Outpatient EHR, lab, pharma, etc.)
  - Advocate has thousands of doctors on various EHR platforms plus heterogeneous labs, PACS, etc.

- Number of transactions/day X real error rate
  - Cost of tracking down attribution problems

- Confidence level required by your doctors?

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Stages of Aggregation

Practice Management[1,2,3]

EHRs[1,2,3]

ER, Cardiology, Orthopedics, Ophthalmology, Inside, Outside

Lab Systems

PACs[1,2,3]

Incoming CCDs

Hospital Billing[1,2,3]

Home Health

SNF/Nursing Homes

Case/Care Management

Registries

Insurance Claims Payment[1,2,3,4]

Pharma (SureScripts)

CCD/CCR

Other TBD

Attribution → Event De-Duplication → Data Normalization → Establish Time Segments → Create a New Data Rendering

Three Approaches to Aggregation

1. Consulting approach

2. ETL approach

3. Transformational approach

   – Different types of transformation

Change   Manage   Measure   Evolve

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Consulting Approach

- Many vendors with a long history of performing interfaces
  - See new market opportunities with analytics

- Typically start with "use cases"

- Custom solution created to meet specific needs often using old technologies

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Problems With Consulting and Use Cases

- Typically very, very expensive
  - Takes long time
  - Takes lots of money
  - Maintenance is a big problem (i.e. updates of EHR)

- Pay by the question approach (i.e. use cases)
  - Each new question requires a new engagement

- Data cobbled together in a customized, non-standard format

- Database solutions manually built and maintained

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ETL Approach

- Definition:

  Extract → Transform → Load (ETL)

- Two versions:

  1. "Cut and paste"

  2. "Rack and stack"

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How 'Cut and Paste' ETL Works

Practice Management[1,2,3]

EHRs[1,2,3]

ER, Cardiology, Orthopedics, Ophthalmology, Inside, Outside

Lab Systems

PACs[1,2,3]

Incoming CCDs

Hospital Billing[1,2,3]

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Registries

Insurance Claims Payment[1,2,3,4]

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Other TBD

Extract and Paste

1. Problem (Dx) Lists
2. Drug Lists
3. Allergies Lists
4. Past Medical and Surgical History Lists
5. Others

add condition	check interactions
Health Record summary	how to

Current Health Conditions	Date First Diagnosed ▼
Click on an item to edit, delete or view related information.	
Acute Allergic Pinkeye	11/19/2008
Left Lower Quadrant Abdominal Pain	11/19/2008
Anal fissure	11/19/2008
Dizziness and giddiness symptoms (2 entries)	11/11/2008
Fever (3 entries)	07/16/2008
Breast Lump (2 entries)	05/12/2008
Abnormal Breast Xray	05/12/2008
Diverticulosis (2 entries)	04/22/2008
Internal Hemorrhoids	04/22/2008
Nausea (2 entries)	03/20/2008
Acid Reflux (GERD) (3 entries)	03/10/2008
Acute pharyngitis (2 entries)	10/30/2007
Left Upper Quadrant Abdominal Pain	09/06/2007
Abdominal or Pelvic Mass or Swelling	09/06/2007
Hernia (3 entries)	08/16/2007
Gallstones and Gallbladder Inflammation (2 entries)	08/16/2007
Gallstones (3 entries)	08/16/2007
Abdominal Pain (8 entries)	08/15/2007
Diaphragmatic hernia without mention of obstruction or gangrene (2 entries)	08/15/2007
Umbilical Hernia	08/15/2007
Generalized abdominal pain (4 entries)	08/13/2007
Pain above Stomach (9 entries)	08/13/2007
Arm or Leg Pain (5 entries)	06/19/2007
Broken Toe, One or More, without Skin Tear (6 entries)	06/19/2007
Fluid in the Middle Ear	04/16/2007
Hair Loss	04/03/2007
Poor Nutrient Absorption After Surgery (2 entries)	04/03/2007
Obesity	04/03/2007
Ear discharge	03/14/2007
Acute Middle Ear Infection with Mucus	03/14/2007
Asthma	08/04/2006
Tear of Medial Knee Cartilage or Meniscus	08/04/2006

How 'Rack and Stack' ETL Works

Practice Management[1,2,3]

EHRs[1,2,3]

⌐ ER, Cardiology, Orthopedics, Ophthalmology, Inside, Outside

Lab Systems

PACs[1,2,3]

Incoming CCDs

Hospital Billing[1,2,3]

Home Health

SNF/Nursing Homes

Case/Care Management

Registries

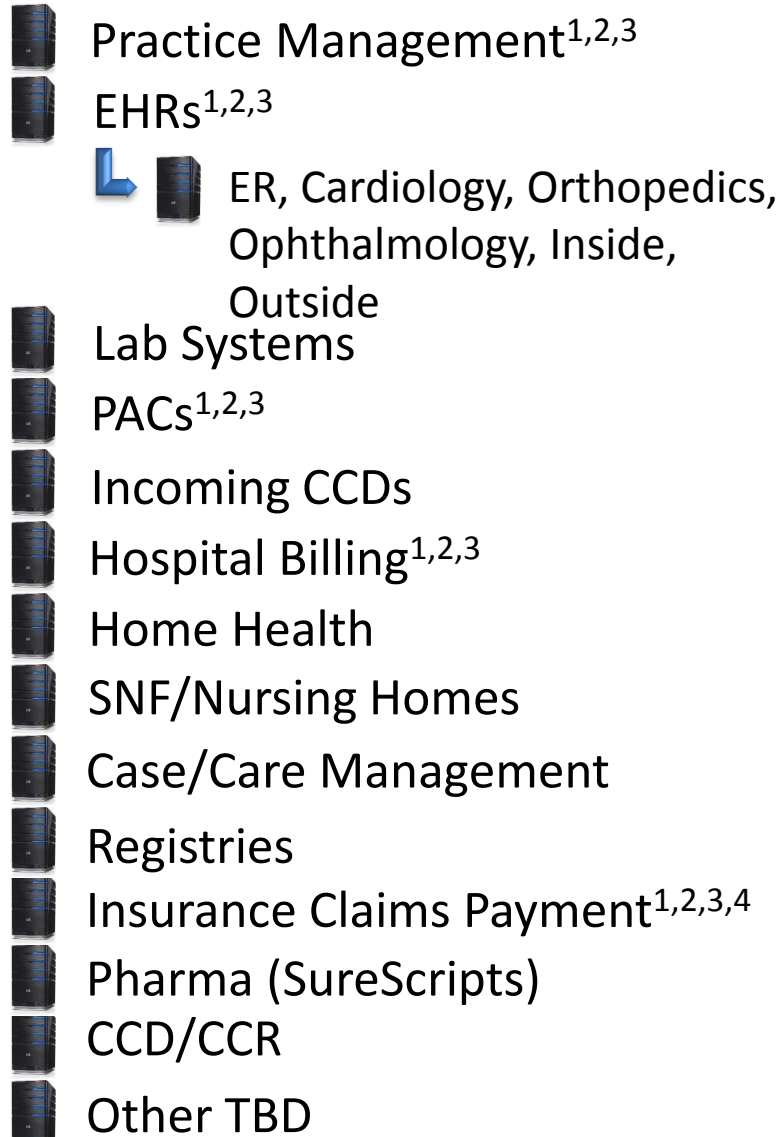Insurance Claims Payment[1,2,3,4]

Pharma (SureScripts)

CCD/CCR

Other TBD

Episode Records

- 8/21/13 Lab Results
- 7/20/13 Imaging Study
- 6/14/13 ER Episode
- 5/21/13 Outpatient Office Visit
- 4/08/13 Outpatient Office Visit

DOCS4DOCS®

#2 Gross, Betsy
Dr. Cushing

Document INBOX

General
Inbox
Inbox History
Report Search
System Messages
Help
Logout

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2001-2005. All Rights
Reserved.

Holds all new documents.

Filters: | Select All | Unselect All | Selected Providers | Selected Patients | Checkmark first-last |

Actions: | Review Selected | Print/Keep | Print/Remove | Remove Selected | Forward Selected |

	Provider	MRN	Patient Name	Arrival	!	Doc Type	Doc Details
☐	Cushing, Herbert E.			2006 01/27 01:00 PM ❗✉		Lab	**STAT** AMYLASE SERUM [Forwarded]
☐	Cushing, Herbert E.			2006 01/26 03:20 PM		Transcription (Clarian)	New Patient Evaluation
☐	Cushing, Herbert E.			2006 01/26 05:50 PM		Lab (Clarian Indiana University)	ALT SerPl QN
☐	Cushing, Herbert E.			2006 01/26 05:50 PM		Lab (Clarian Indiana University)	AST SerPl QN
☐	Cushing, Herbert E.			2006 01/19 10:50 AM		Lab (Clarian Indiana University)	Creatinine SerPl QN
☐	Cushing, Herbert E.			2006 01/19 10:50 AM	⚠	Lab (Clarian Indiana University)	Lipid Panel SerPl QN
☐	Cushing, Herbert E.			2006 01/19 04:50 PM	⚠	Lab (Clarian Indiana University)	CD4 Followup
☐	Cushing, Herbert E.			2006 01/20 06:20 AM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/19 02:10 PM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/26 10:40 AM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/25 11:21 AM	⚠	Lab (Clarian MW)	CBC
☐	Cushing, Herbert E.			2006 01/25 11:21 AM	⚠	Lab (Clarian MW)	Auto Diff
☐	Cushing, Herbert E.			2006 01/25 12:20 PM		Lab (Clarian MW)	Creatinine SerPl QN
☐	Cushing, Herbert E.			2006 01/25 02:30 PM	⚠	Lab (Clarian MW)	Vancomycin Pre SerPl QN
☐	Cushing, Herbert E.			2006 01/19 02:10 PM		Transcription (Clarian)	New Patient Evaluation
☐	Cushing, Herbert E.			2006 01/20 01:30 PM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/19 04:00 PM		Transcription (Clarian)	Discharge Summary
☐	Cushing, Herbert E.			2006 01/20 09:50 AM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/25 09:20 AM		Radiology (Clarian)	CT Lower Extremity With Contrast
☐	Cushing, Herbert E.			2006 01/26 10:30 AM		Transcription (Clarian)	New Patient Evaluation
☐	Cushing, Herbert E.			2006 01/19 02:10 PM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/26 02:20 PM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/19 02:10 PM		Transcription (Clarian)	Return Clinic Visit
☐	Cushing, Herbert E.			2006 01/20 10:10 AM		Transcription (Clarian)	Return Clinic Visit

Problems With ETL

Cut and Paste ETL

- What about all the bad data?
- Problems repeated
- Typically rely upon demographics for patient attribution…lots of errors
- The application is not smart, just moves lists of codes around
- Requires great expertise

Rack and Stack ETL

- Are your doctors going to click all those episode records open and then read them?
- Basically an archive that is poorly labeled
- Very low frequency of use

Transformational Approach

- Assumes all data that comes in is defective
  - A good assumption
- Pulls incoming data apart and transforms it - designed to improve accuracy and format:
    1. Faulty data is discarded or marked
    2. New data is organized and has more meaning (i.e. not just lists)
    3. For some, new version is written in a new format for easier analysis and additional value added steps

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Illustration of 'Cleansed' vs. Dirty Data

- One vendor set out to manually "dry clean" the data from multiple sources

- Entire data cleansing was organized by disease state

- Spent ~$30M+ doing 5 diseases

- 23 ways to represent aspirin

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The Challenge of 'Meaning'

- Applications that only have lists of codes do not have "knowledge" built in
  - It just moves codes from one place to another

- When the application does not have knowledge, your team has to create all meaning manually
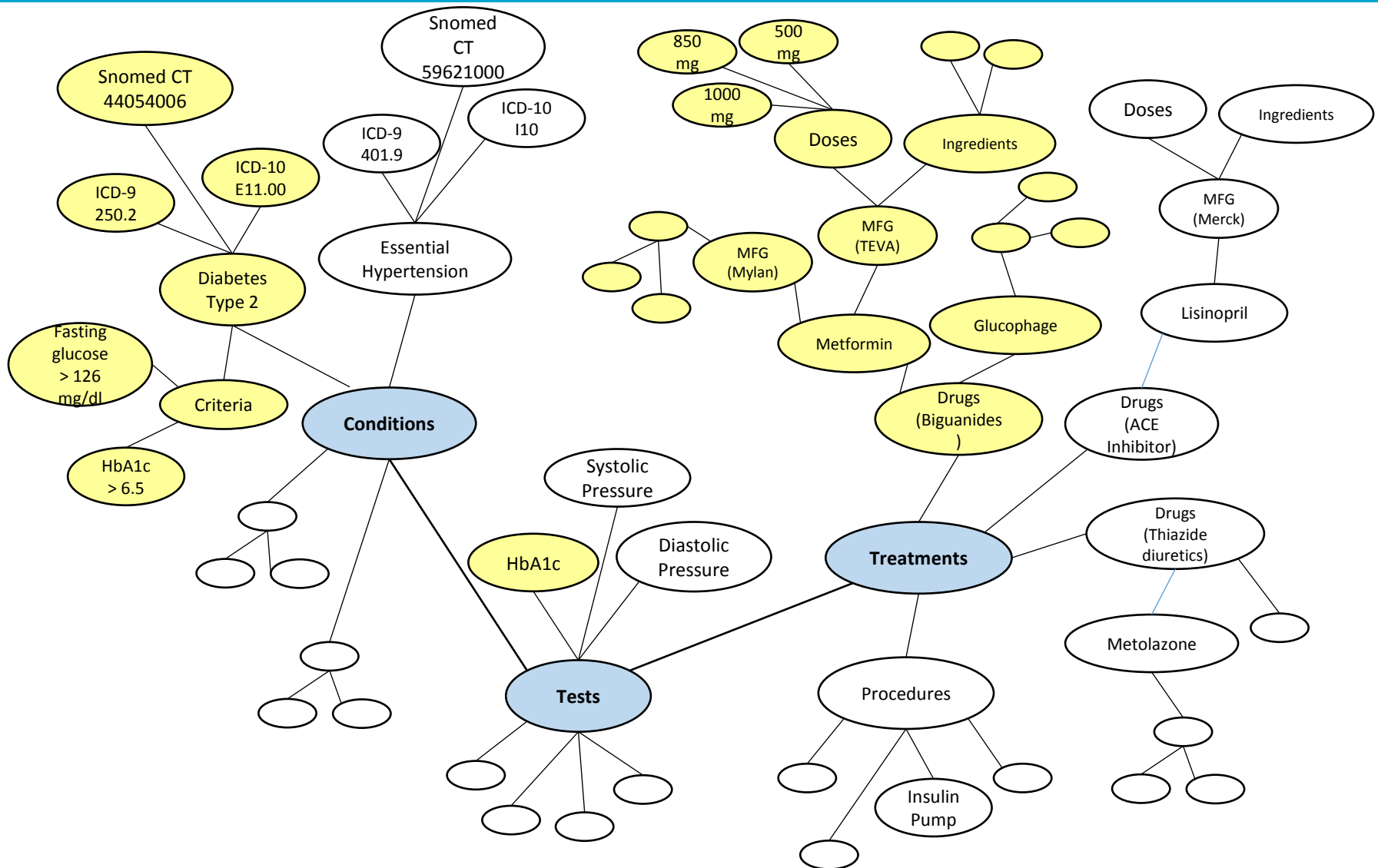
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Concept of an Ontology

- Definition: The meanings of data elements are established by mapping all elements and sub-elements to each other

- Result: There is a place to store each piece of data and each type of data (or data element)
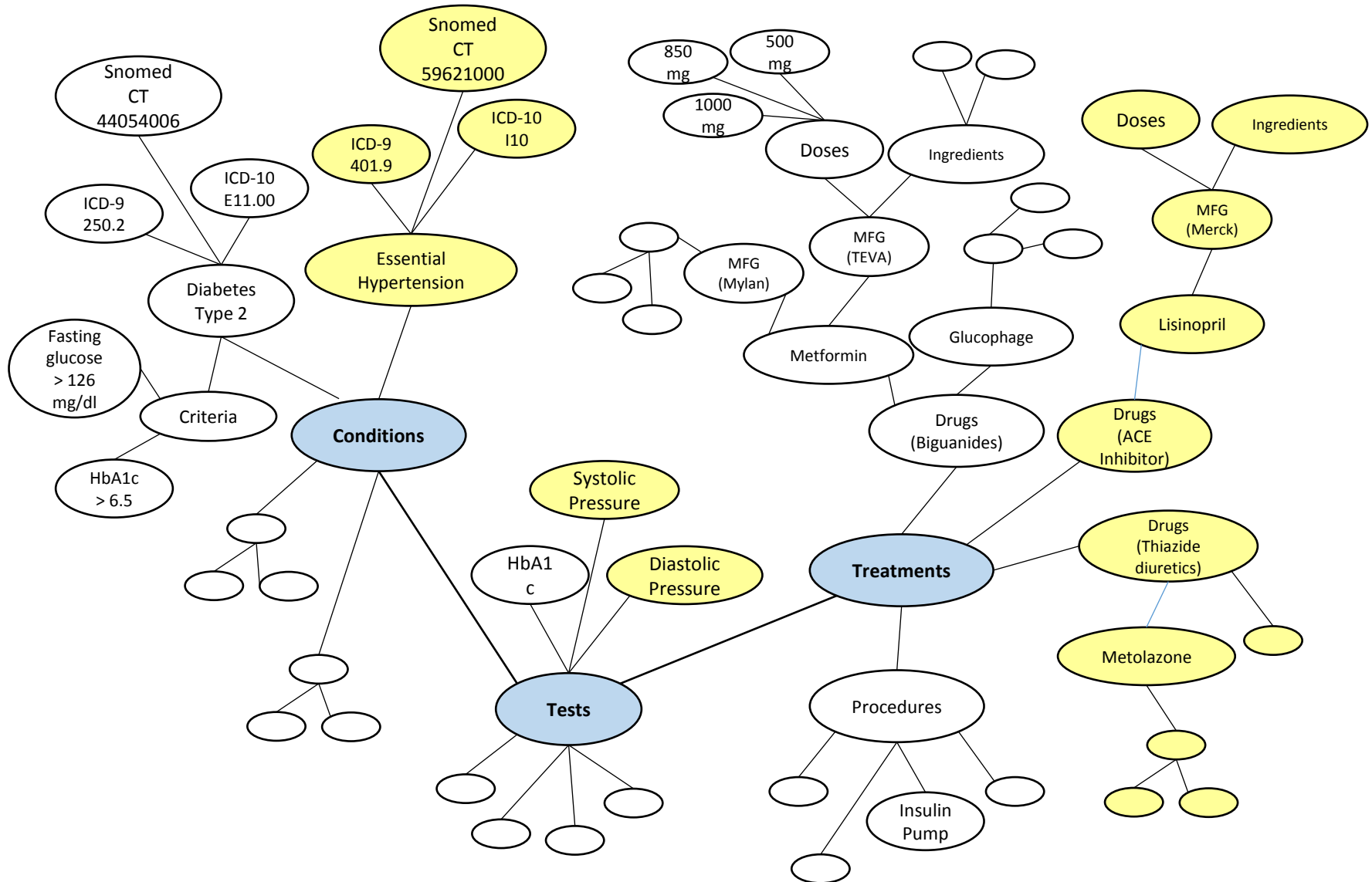
MEDISYNC
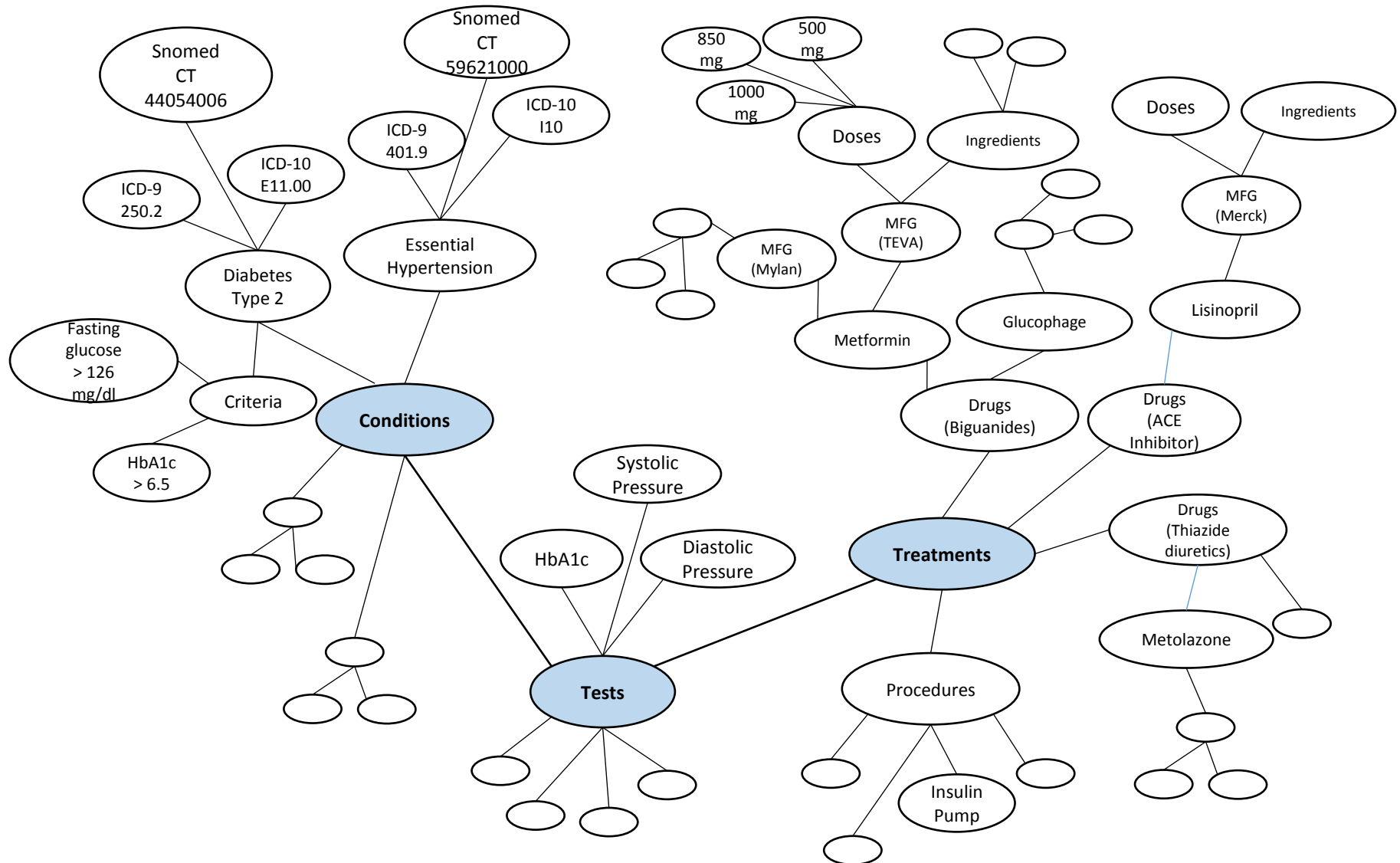
Ontology Example

Ontology Example - Diabetes Mellitus Type 2

Ontology Example - Essential Hypertension

After Cleaning Data Up, How Do They Store the New Version?

- Does the data return to original languages and formats?
  - i.e. LOINC, Snomed CT, ICD-9?

- What kind of a database?
  - Relational database?
  - Other?

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Relational vs. NoSQL Databases

- For a long time, relational databases were the highest standard

- Problems:
  - Consists of rows and columns (i.e. tables)
  - You must map all the of data elements to rows and columns and plan the "Joins"
  - Very slow if using very large data configurations
    - Healthcare is a VERY LARGE data configuration
  - Planning all the joins for healthcare is a problem

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NoSQL "Big Data"

- Does not use rows and columns

- Think of a web

- "N dimensional" – can go into infinity

- Control content by setting up multiple "axes" or nodal points

- Much, much faster

- Used by Google, Amazon, Facebook, etc.

- Good for the size of healthcare data

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What Else Does It Do?

Sources

- Practice Management[1,2,3]
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- Payment[1,2,3,4]
- Pharma (SureScripts)
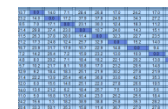- CCD/CCR
- Other TBD

Data Aggregation

Data Aggregation

Analytics

Analytics

Data Presentation

PCP Presentation

Patient Presentation

Specialist Presentations

Other Analytics

Tools

?

What Else Does It Do?

- Ability to configure custom presentation views:
  - For PCPs versus cardiology, versus ER doctor
  - For the patient, patient's family, etc.

- Ability to build tools to improve care
  - Care management workflows
  - Custom workflows

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How to Shop

- Learn enough to ask detailed follow-up questions (i.e. three hours on aggregation)
- Don't ask vendors, "Do you do this…?"
  - Ask "How do you do this?"
- How good is the aggregation?
  - How is attribution done (demographics with or without clinical?)
- Is this vendor's approach:
  - Consulting
  - ETL
  - Transformational
- Which approach do you want?

How to Shop - 2

- What is the final version of the data written into?
  - Relational database vs. "NoSQL" database
- Is the data designed to answer certain questions or is it designed to answer all questions? (i.e. do you pay by the question?)
- What kinds of rules can be included?
- Is there a tools capability?
  - If so, how powerful?
  - Can complex processes be built and operated within the application?

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How to Shop - 3

- Can the presentation views be configured?

- Can a non-programmer create tools and workflows?

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Questions?

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Change **Manage** **Measure** **Evolve**

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