Secondary Analysis of EHR Data at UNMC Using i2b2, CRANE, and other Relevant Tools

Carol Geary, PhD, MBA, RN
Assistant Professor
Department of Pathology and Microbiology, UNMC

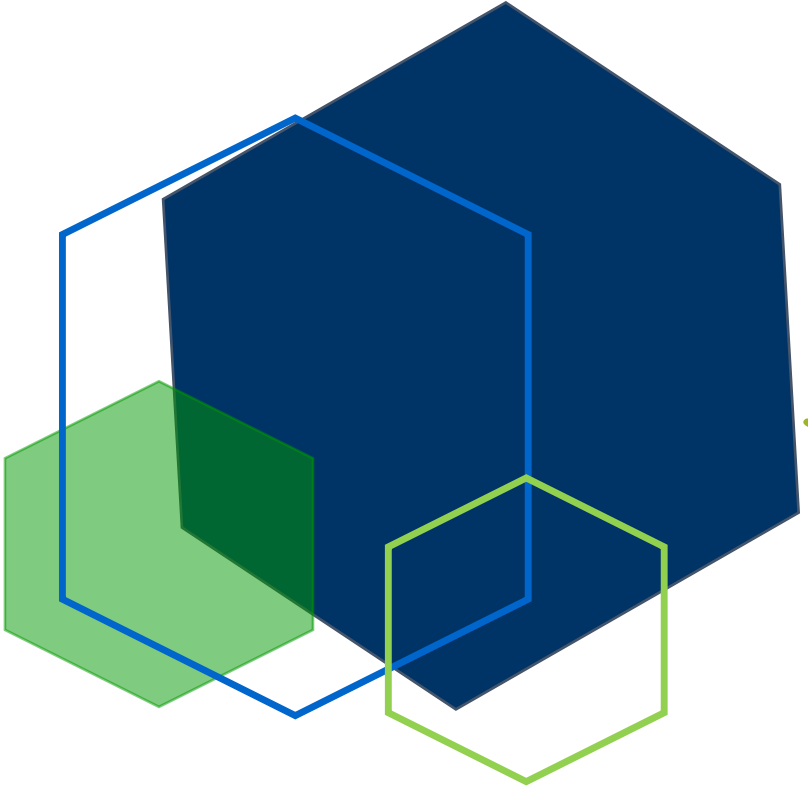
Jerrod Anzalone, MS
Data Access/Program Coordinator
Department of Neurological Sciences, UNMC

October 27, 2020

UNMC

Acknowledgements

Jim McClay, MD, MS
W. Scott Campbell, PhD, MBA
Jim Campbell, MD
Carol Geary, PhD, RN
Jay Pedersen, MA
Jim Svoboda, MS
CRANE Superuser Community



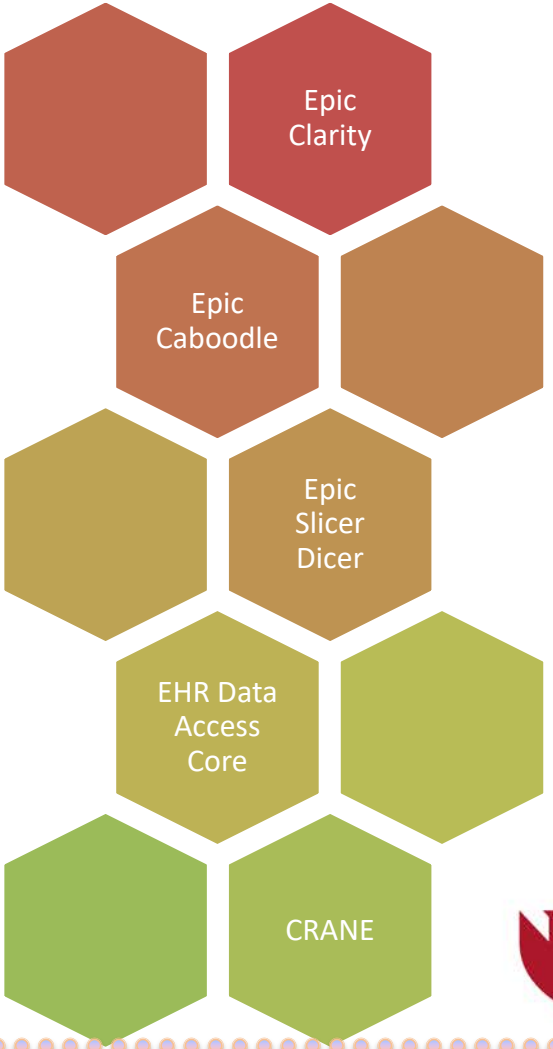
GREAT PLAINS
IDeA | Clinical and
Translational Research

If you aren't already a member, please consider joining. CRANE is one of many resources the Great Plains IDeA-CTR supports:
https://gpctr.unmc.edu/membership/

Agenda

- Overview of CRANE and EHR resources on campus
- Designing studies with EHR data
- Research network participation
- Clinical data standards and interoperability
- The i2b2 clinical data warehouse and analysis software system

EHR Data Management Resources at UNMC



Cogito

A World of Data

Chronicles
Real-time Production Database
Interactive operational workflows

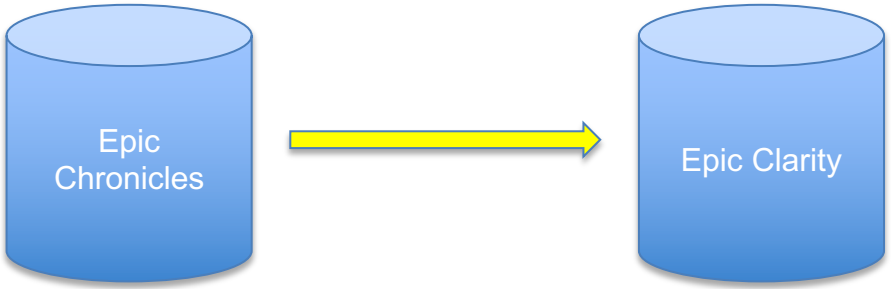
Clarity
Operational Data Store (ODS)
Normalized data for analytics

Caboodle
Enterprise Data Warehouse (EDW)
Analytics on Epic + non-Epic data

Cognitive
Cloud-based Data Store
Data for machine learning experts

Epic Clarity

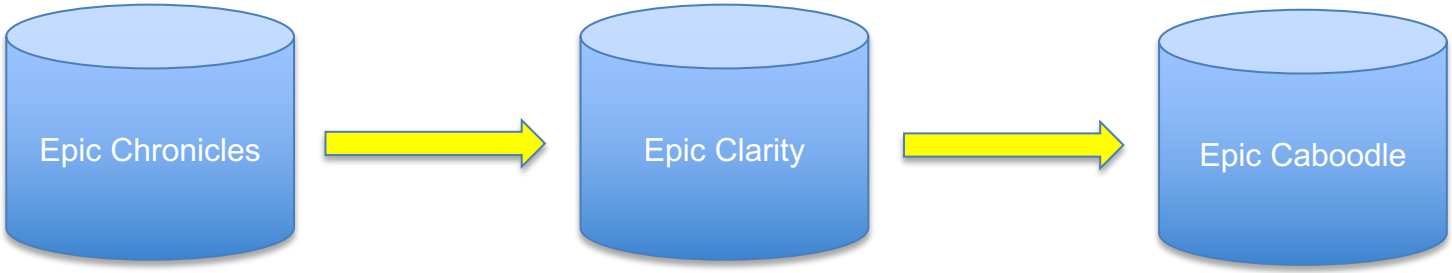
- Epic is a transactional database (hierarchical database)
  - Fast at point of care
  - Slow for data analysis



- Clarity is a relational database
  - Good for data analysis, usually
  - Data dump of all Epic information
  - No classification of information

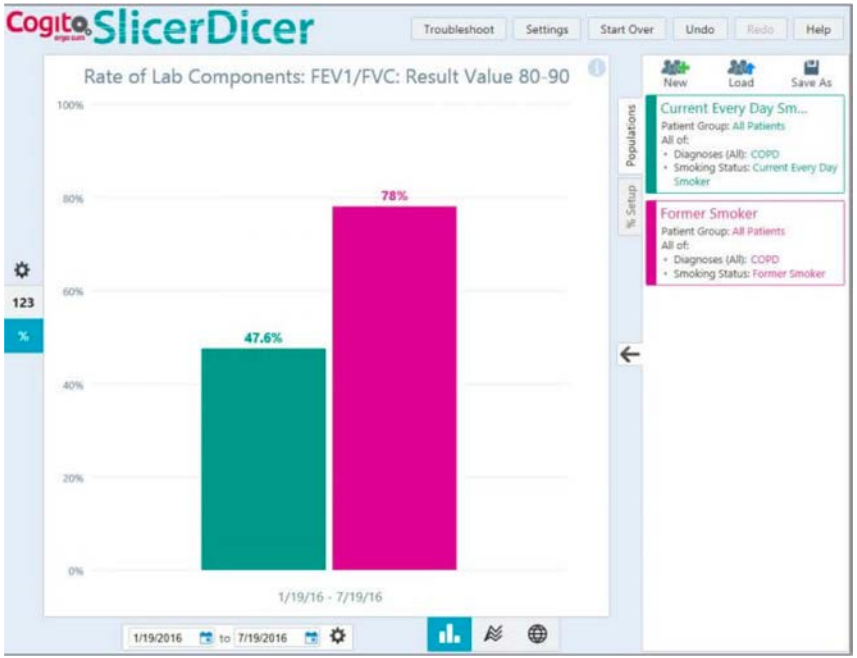
Epic Caboodle

- Clarity extract, relational database
- Categorized Data, not in clinical terms
- External data sources
- Enterprise Data Warehouse (EDW)
- Accessible by EDW team



Slicer Dicer

- Epic ad hoc query tool
  - Aimed at ambulatory physicians who want to investigate their patient populations
  - Requires Epic Access
  - Business orientation
  - Underlying data model not clinically oriented
  - Allows comparison of patient subgroups



https://www.hopkinsmedicine.org/office-of-johns-hopkins-physicians/best-practice-news/slicerdicer-reveals-practice-based-data

EHR Data Access Core

What Does the EHR Data Access Core Provide?

This core facility provides access to Electronic Health Care data for clinical and translational research. This may include:

- feasibility studies
- cross-sectional studies
- health outcomes
- retrospective data analysis
- quality improvement projects
- transfer of datasets to a registry
- case finding for subject recruitment
- public health research

EHR Data Access Core

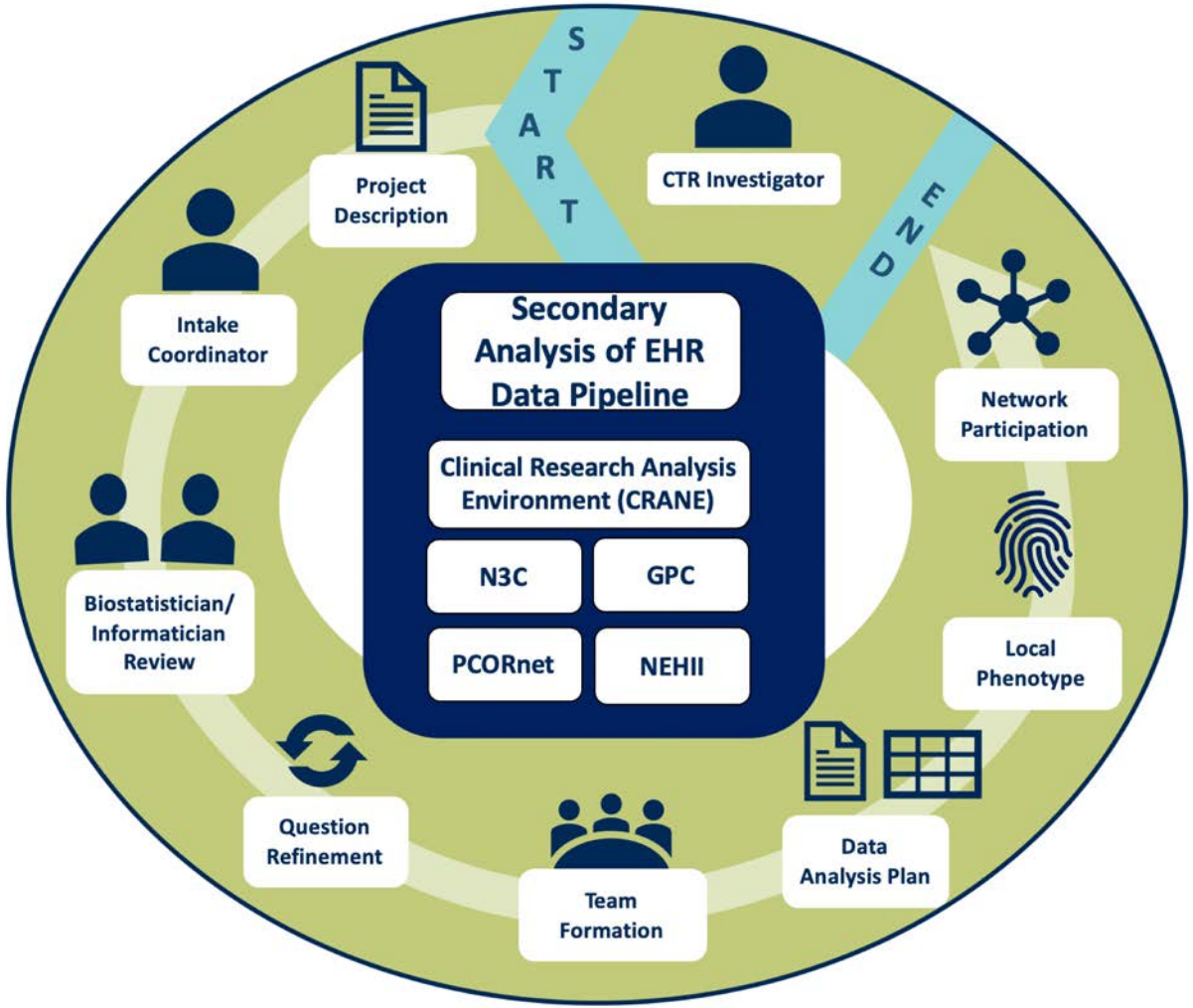
The EHR Data Access Core

- Interacts with Clarity
- Must wrangle data from Clarity
- Requires knowledge of Epic, Epic workflow and clinical context
- More data than CRANE
- No data annotation/characterization (Clarity issue NOT Core's)
- https://www.unmc.edu/cctr/resources/ehr/index.html

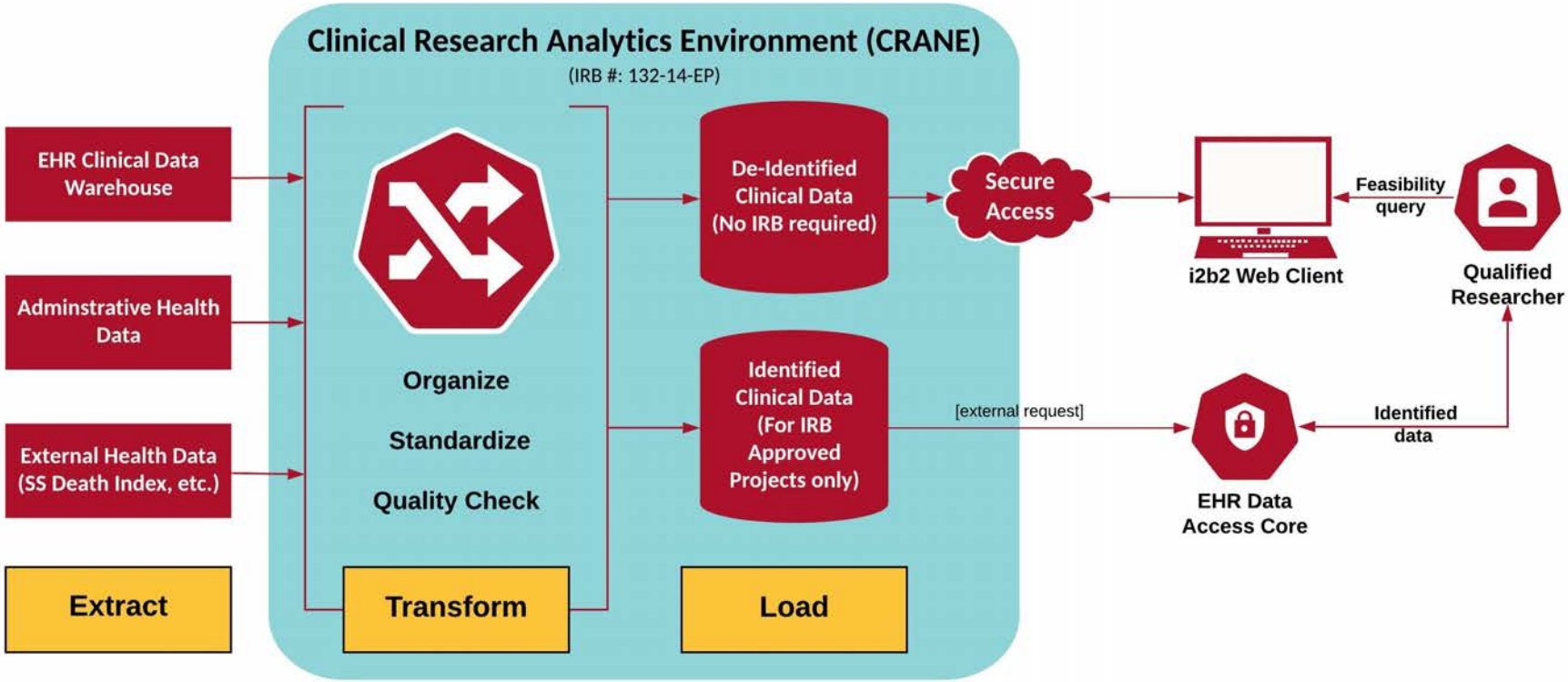
CRANE is NOT the EHR Access Core but can work hand-in-glove

Clinical Research Analytics Environment (CRANE)

- Clarity extract, relational database
- Categorized data using national and international medical data standards
- External data sources (NAACCR; SSDI)
- Identified and de-identified versions
- Many Epic data elements, but not all. Additional information based on user-driven use cases
- Connected to PCORnet Common Data Model and GPC Consortium
- Self-serve and supported service


START
END
Project Description
CTR Investigator
Intake Coordinator
Secondary Analysis of EHR Data Pipeline
Clinical Research Analysis Environment (CRANE)
N3C
GPC
PCORnet
NEHII
Network Participation
Biostatistician/ Informatician Review
Local Phenotype
Question Refinement
Data Analysis Plan
Team Formation

CRANE Overview



CRANE Web Client vs. i2b2

- CRANE is the name we use for the entire environment/registry
- i2b2 – Informatics for Integrating Biology & the Bedside
    - Open-source web client
    - https://www.i2b2.org/

Why use the CRANE web client?

ACCELERATE THE PRE-RESEARCH PROCESS

OBTAIN COUNTS FOR GRANTS AND IRB PROTOCOLS

INTERACT WITH THE DATA IN THE CLINICAL DATA WAREHOUSE IN AN INTERACTIVE AND SELF-SERVICE FASHION

TO MAP ELECTRONIC HEALTH RECORD DATA TO STANDARDS FOR DATA SHARING ACROSS INSTITUTIONS

i2b2

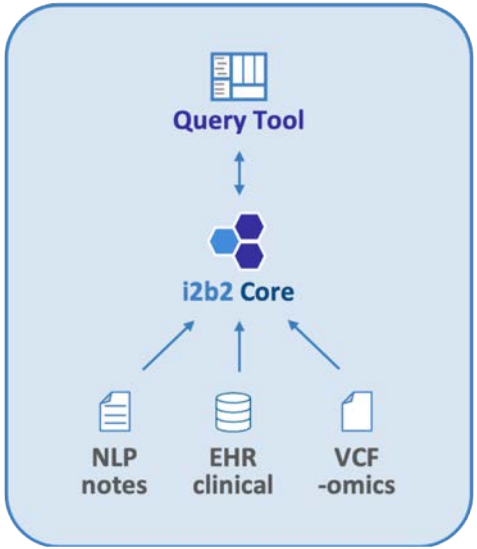
i2b2 = informatics for integrating biology & the bedside

http://i2b2.unmc.edu

i2b2 Research Uses

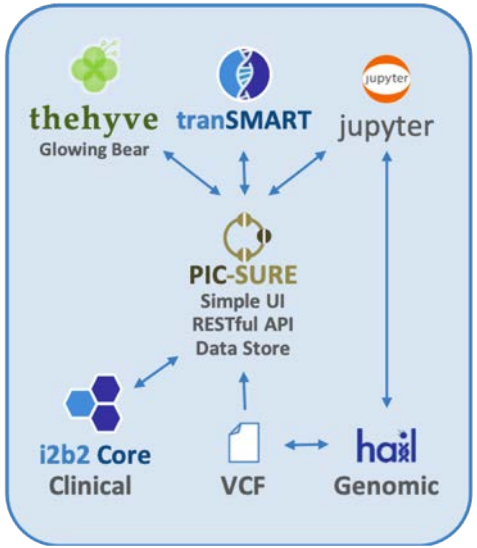
Patient Recruitment

Clinical Investigators



Translational Studies

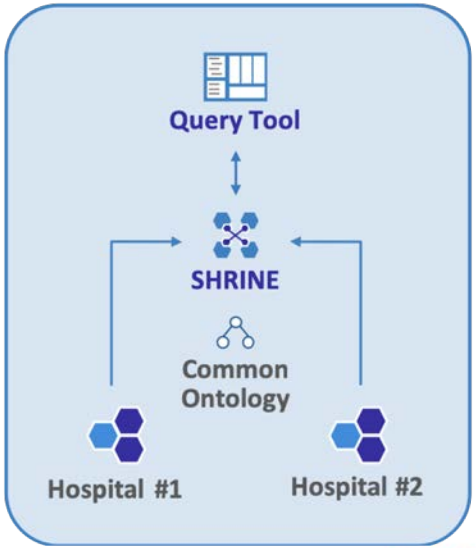
Clinicians and Data Scientists



*Not in use at UNMC

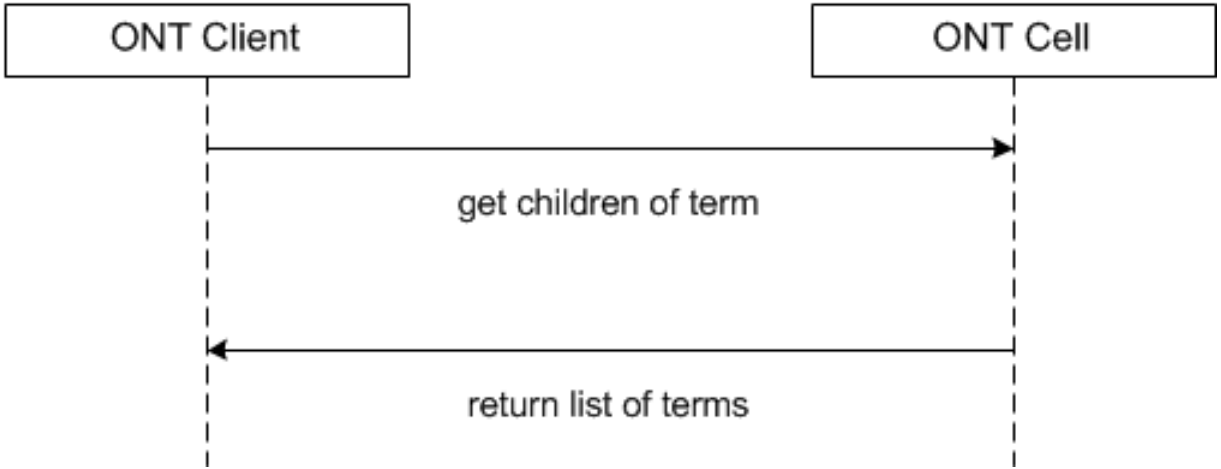
Federated Networks

Epidemiologists



I2b2 Global Usage

i2b2 Parent-Child Relationship



What can I do with it?

Build patient cohorts

Assess study feasibility

Conduct a de-identified study

Obtain pilot data

EHR vs. Claims vs. Registry

- EHR: data from clinic care
  - More robust than claims data
  - Less tailored than registry data
  - Messy and likely incomplete coverage of individuals
- Claims data: entirety of medical claims submitted to insurance
  - Great coverage, limited granularity
  - Encounters, procedures, medications, some demographics
- Registry: data collectively specifically for the purpose of research use
  - More nuanced/specific to study questions
  - Typically cleaner data

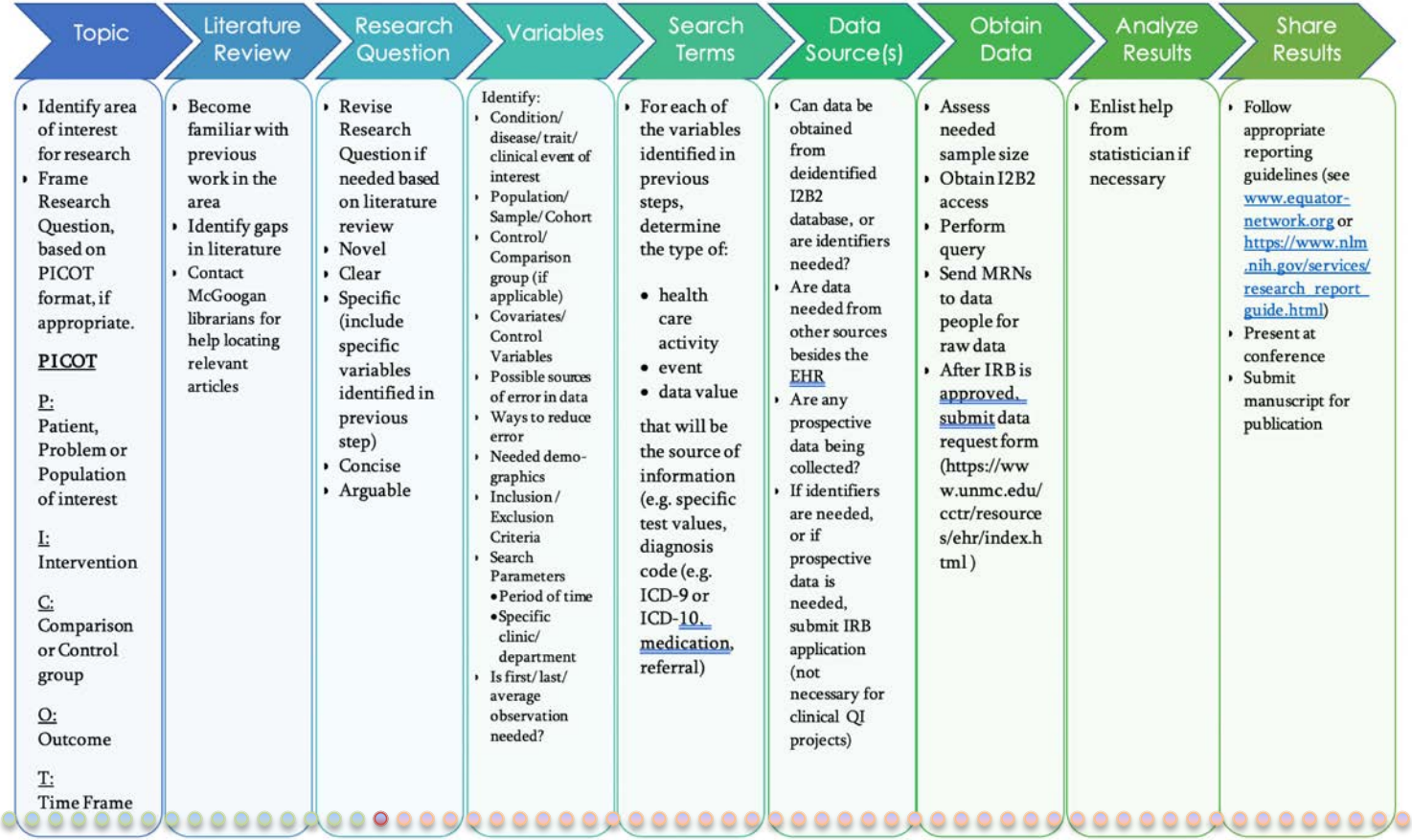
BACKGROUND INFORMATION

EHR in Research

Type	Example	Status
Observational studies	Health utilization Drug utilization Epidemiology (incidence/prevalence) Natural history Risk factors	Widely used and accepted
Safety surveillance	Traditional post-marketing safety surveillance	Widely used and accepted
	Active surveillance (e.g., Sentinel[a])	Emerging
Clinical research	Hypothesis generation	Accepted
	Feasibility assessments	Accepted
	Performance improvement, guideline adherence	Accepted
	Patient recruitment	Emerging
	Comparative effectiveness, health technology assessments	Emerging
	Pragmatic trials (e.g. PROBE design)	Emerging
	Point of care randomization	Emerging
	Registry randomized trials to test new interventions	Emerging
	Source data to populate eCRF (eliminating or minimizing need for data extraction/data entry)	Emerging/potential
	Endpoint or SAE ascertainment	Emerging/potential
Regulatory	Safety surveillance, pharmacovigilance	Accepted
	New indications or marketing authorization	Potential

Cowie MR, Blomster JI, Curtis LH, et al. Electronic health records to facilitate clinical research. *Clin Res Cardiol*. 2017;106(1):1-9. doi:10.1007/s00392-016-1025-6

Designing Studies with EHR Data

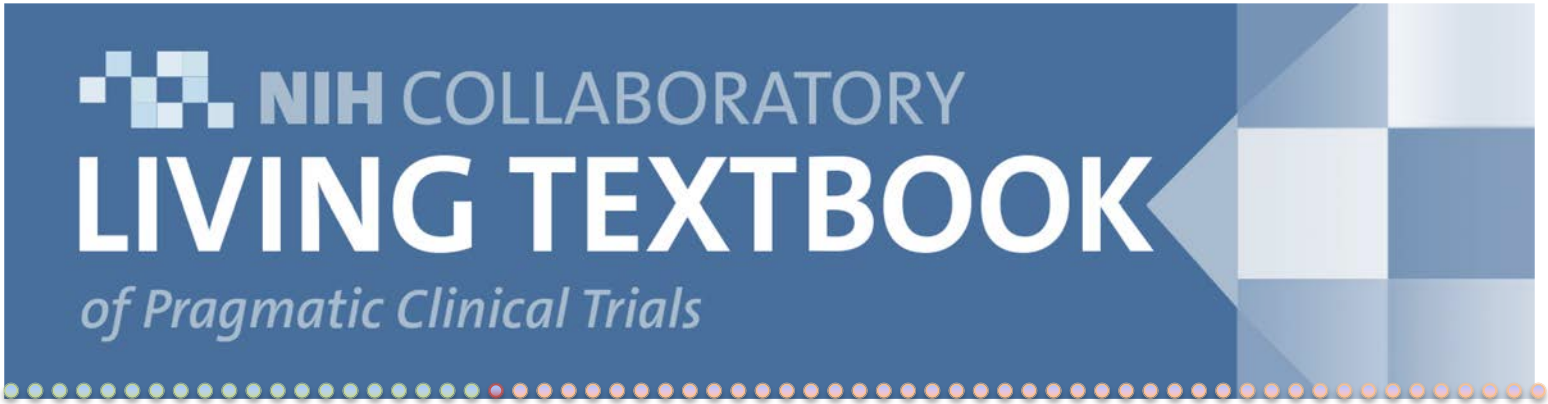


Research Data Analytical Protocol

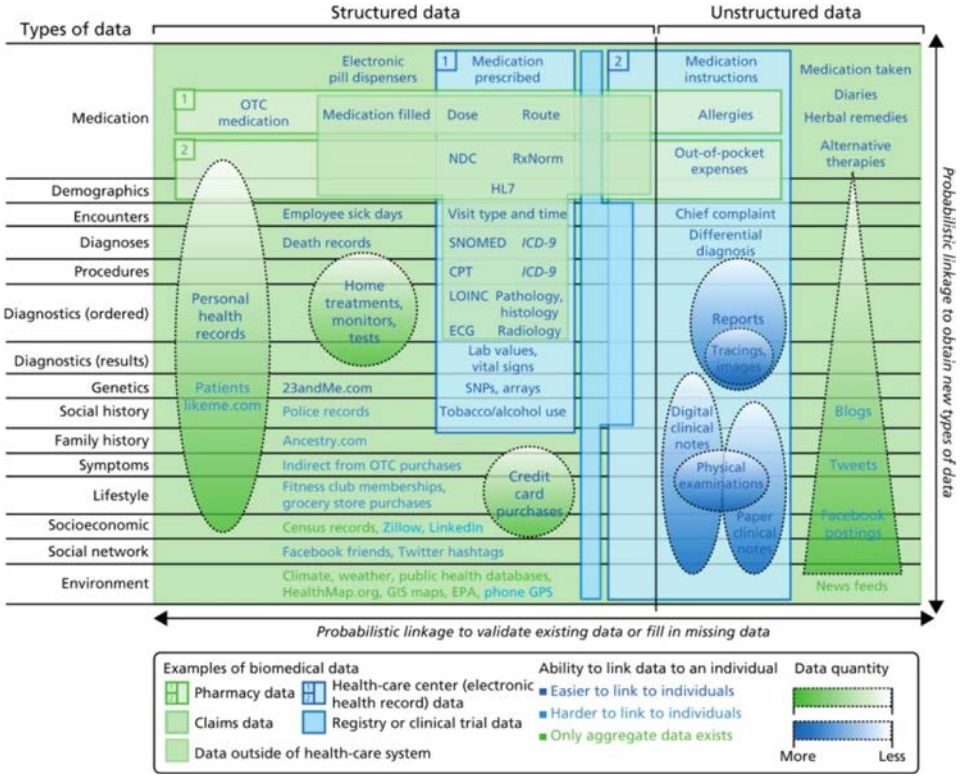
1. State the research question in precise plain language
2. Identify the research plan that would be preferred to address the research question
3. For implementation of the plan, identify a) the specific inclusion and exclusion criteria for the study cohort; b) the independent variables for study, if any; c)the outcomes or dependent variables for analysis
4. For all of the data elements identified in step 3, analyze whether the data is in the scope of CRANE. Survey the TERMINOLOGY MASTER lookup resource to determine whether the data occurs with usable frequency in CRANE data tables.
5. Analyze the variables from step 3 for any value set development or terminological/ontological query requirements; assemble and test the value sets
6. Employing the conceptual features developed in steps 3-5, prepare a computable phenotype(queryable virtual data definition) for each of the data items required by step 3 protocol

Want to learn more?

The NIH Collaboratory put together a *Living Textbook of Pragmatic Clinical Trials* that is a great reference for all things in this domain: https://rethinkingclinicaltrials.org/

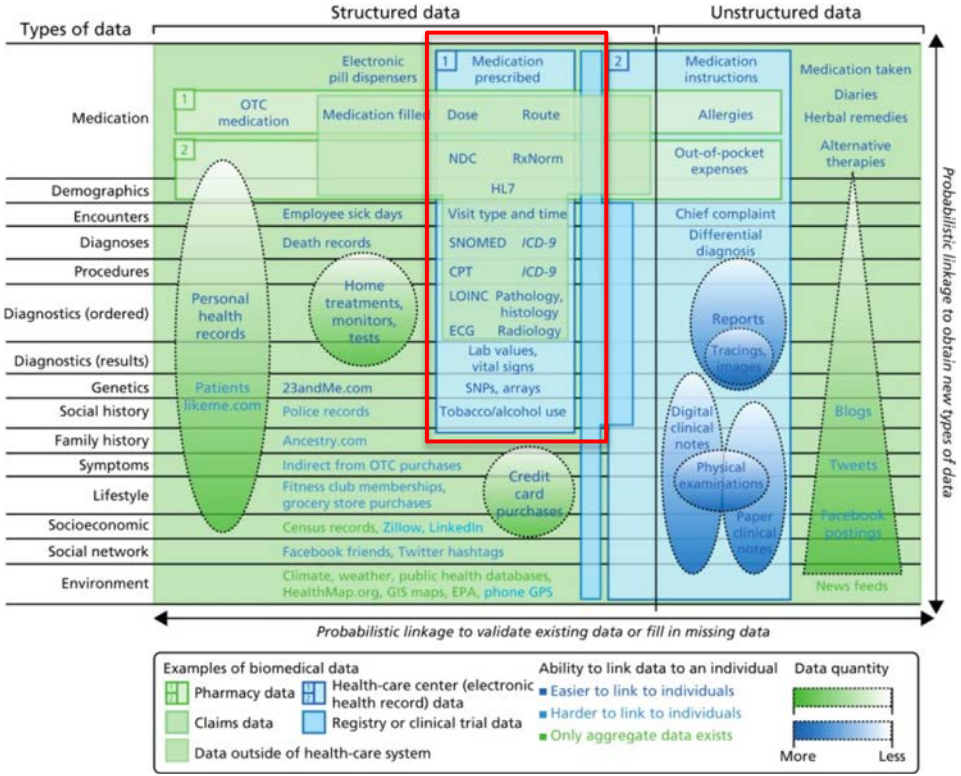


What is the Data?



Weber GM, Mandl KD, Kohane IS. Finding the Missing Link for Big Biomedical Data. JAMA. 2014;311(24):2479–2480. doi:10.1001/jama.2014.4228

What is the Data?



Weber GM, Mandl KD, Kohane IS. Finding the Missing Link for Big Biomedical Data. JAMA. 2014;311(24):2479–2480. doi:10.1001/jama.2014.4228

Internal Data Available

- EHR data at Nebraska Medicine
- Demographics
- Encounters
- Medications
- Diagnoses
- Procedures
- Labs
- Epic flowsheets
- Cancer registry
- **Availability driven by use cases**

External Data Available

- Cancer registry (NAACCR)
- Social security death index
- US Census data
- Surescripts pharmacy dispensing data
- Computed information:
  - Distance from UNMC/Geocoding
  - BIRD Index (education, employment, poverty, public assistance, family structure, and income)
  - Charlson Comorbidity Index coming soon

Clinical Research Data Warehouses

- Differences between a Data Warehouse and a Clinical Data Warehouse
- Differences between a Clinical Data Warehouse and a Clinical Research Data Warehouse
- A Clinical Data Warehouse (CDW) “refers to an enterprise data warehouse in a hospital, which is used for administration, management, clinical practice, and research.”
- A Clinical Research Data Warehouse (CDRW) refers “to a data warehouse in a hospital or other organization that is used only for research.”

Shin SY, Kim WS, Lee JH. Characteristics desired in clinical data warehouse for biomedical research. *Healthc Inform Res*. 2014;20(2):109-116. doi:10.4258/hir.2014.20.2.109

Clinical Research Data Warehouses

- Key Features of a Data Warehouse:
  - Subject oriented
  - Time variant
  - Non-volatile
  - Integrated

Inmon, W. H., & Hackathorn, R. D. (1994). *Using the Data Warehouse*. New York, NY: Wiley.

- Key Features of a Clinical Research Data Warehouse:

Key element	Explanation	Remark
Honest broker	Protecting patient privacy based on hospital policy and HIPAA compliance	De-identification
Query interface	Direct ad-hoc queries Data analysis tools	Cohort discovery Hypothesis design and analysis
Chart review	Reviewing the de-identified EHR charts	
Data extraction	Extracting the necessary (de-identifiable) data	DRM module for access control Virtual desktop environment
IRB interface	Research approvals Waivers	

Shin SY, Kim WS, Lee JH. Characteristics desired in clinical data warehouse for biomedical research. *Healthc Inform Res*. 2014;20(2):109-116. doi:10.4258/hir.2014.20.2.109

Data Model

- Standard for storing clinical data in clinical data warehouse
  - Integration of data from distributed and differently structured databases in order to perform comprehensive analyses.
  - Separation of data used for research from daily operational or transactional data.
  - Standardization of a model across systems.
  - Ease of use by end-users.

- Common Data Model: Allows for interoperability between different medical centers
  - PCORnet
  - i2b2
  - OMOP
  - Etc.

Why Data Models?

- Data modeling: the process of determining how data are to be stored in a database.
- A data model specifies features and relationships, such as:
  - Data types
  - Constraints
  - Relationships between rows of data
  - Metadata definitions, procedures, and assumptions that describe the intended meaning and use of each data element, how data are to be collected, allowed values or ranges, and dependencies between data elements.

BACKGROUND INFORMATION

Kahn, M. G., Batson, D., & Schilling, L. M. (2012). Data model considerations for clinical effectiveness researchers. *Medical care*, *50 Suppl*(0), S60–S67. https://doi.org/10.1097/MLR.0b013e318259bff4

How data is organized

Star Schema:

- One fact table surrounded radially by numerous dimension tables. It relies on dimensional modeling

Relational database:

- A relational database is a collection of data items with pre-defined relationships between them. These items are organized as a set of tables with columns and rows. Tables are used to hold information about the objects to be represented in the database.

BACKGROUND INFORMATION

Dimension Modeling

1. FACTS - the quantitative or factual data being queried.
2. DIMENSIONS – groups of hierarchies and descriptors that define the facts.

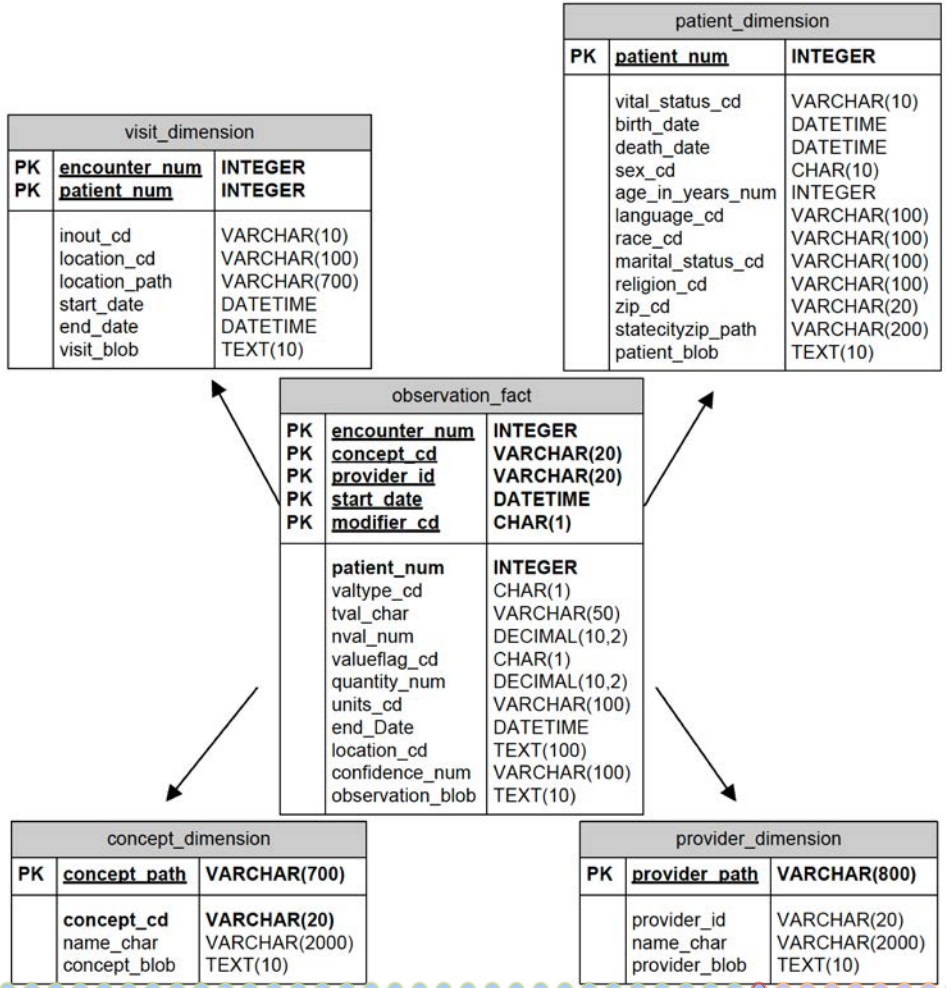
BACKGROUND INFORMATION

HOW DIMENSIONAL DATABASE MODELING SYSTEMS WORK

BACKGROUND INFORMATION

https://praxent.com/blog/dimensional-relational-database-modeling-systems-better-business

i2b2 Star Schema

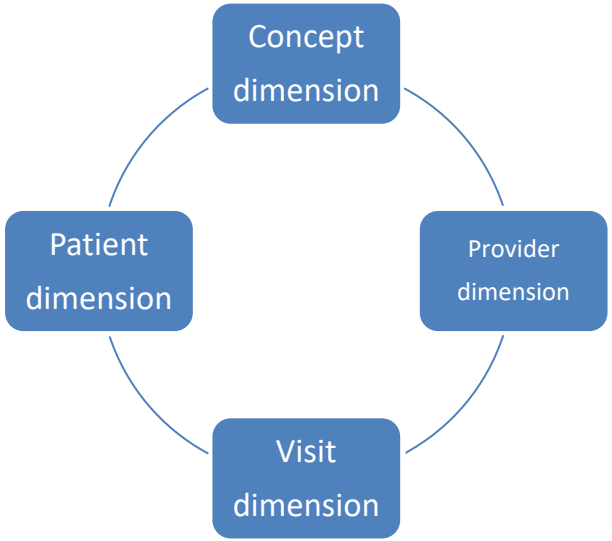


i2b2 Fact Table

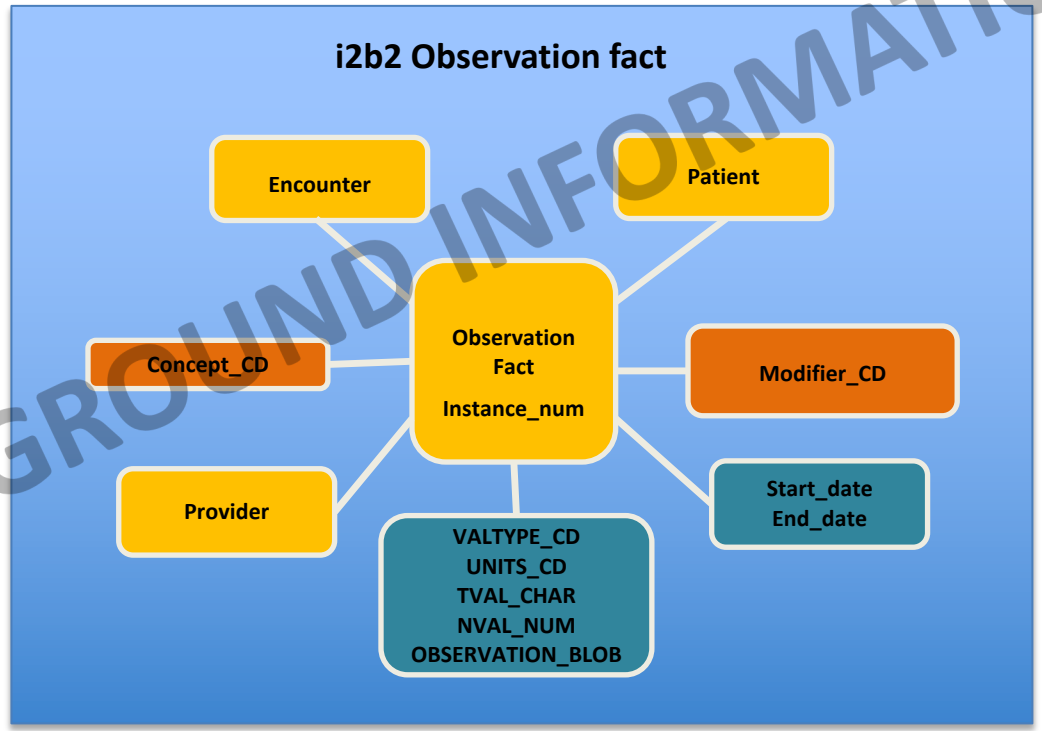
- In i2b2, a fact is an observation on a patient
- Examples of FACTS:
  - Diagnoses
  - Procedures
  - Health History
  - Genetic Data
  - Lab Data
  - Provider Data
  - Demographics Data
- An observation is not necessarily the same thing as an event

i2b2 Dimension Tables

- Dimension tables contain descriptive information about facts.

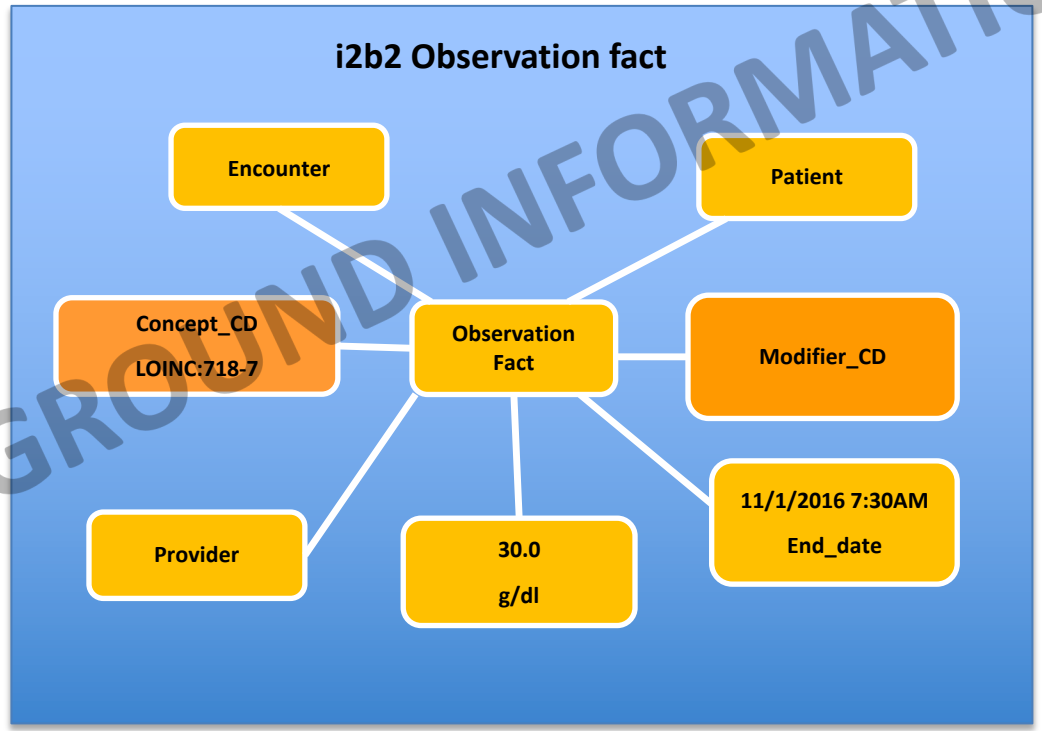


I2b2 Star schema: One fact per record (= One question + answer)



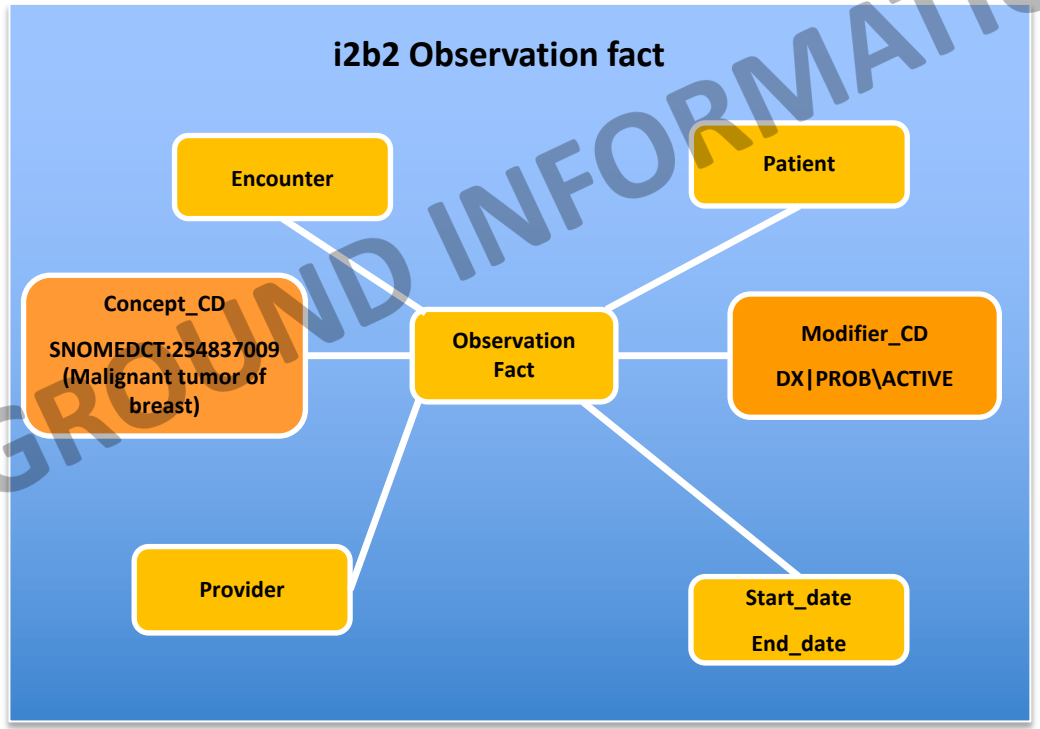
BACKGROUND INFORMATION

What is the patient hemoglobin? “30.0 g/dl”



BACKGROUND INFORMATION

What is the patient problem? "Breast cancer"



BACKGROUND INFORMATION

HOW RELATIONAL DATABASE MODELING SYSTEMS WORK

BACKGROUND INFORMATION

ID	CUSTOMER NAME
458	William Smith
459	John Thompson
460	Candice Lee

ID #459

SALE DATE	AMOUNT	ITEMS
01/14/17	$427.25	11
10/30/16	$35.99	2
09/08/16	$87.65	3

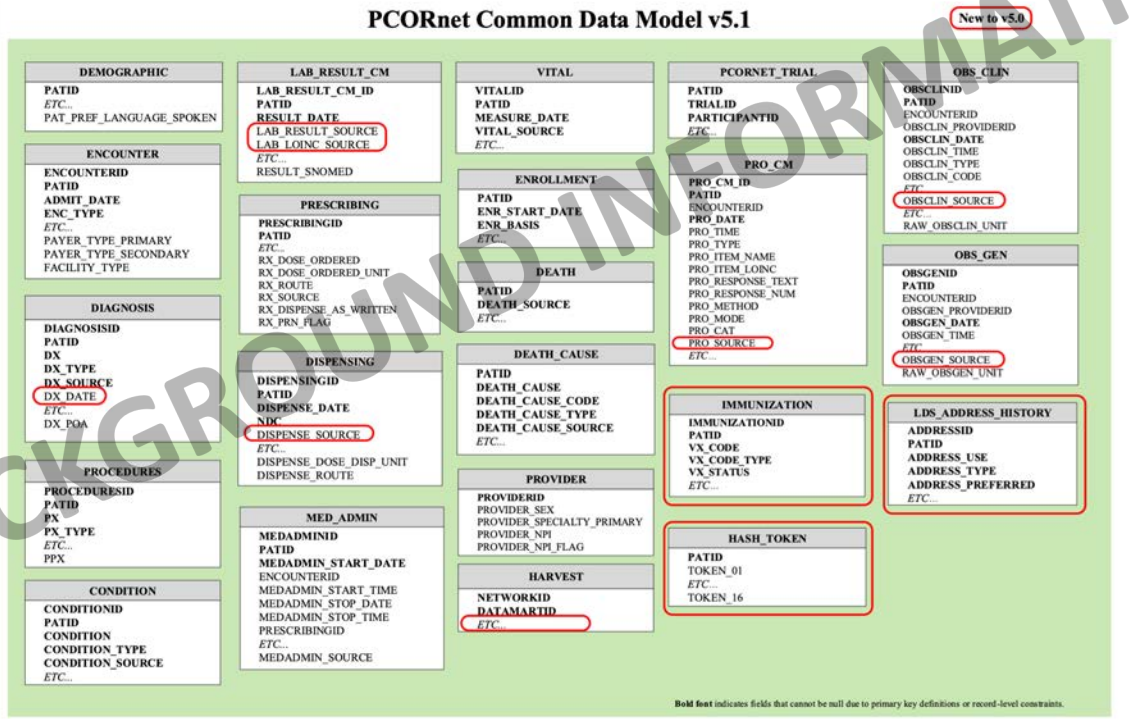
https://praxent.com/blog/dimensional-relational-database-modeling-systems-better-business

Entity-Relationship Diagrams

- An Entity-Relationship Diagram (ERD) is a blueprint of the database. It contains:
  - Entities that represent tables
  - Attributes in each entity, including data types
  - Relationships between entities that are represented by keys
    - Primary Key (PK)
    - Foreign Key (FK)
- PCORnet Common Data Model ERD
- CRANE ERD
- i2b2 Star Schema

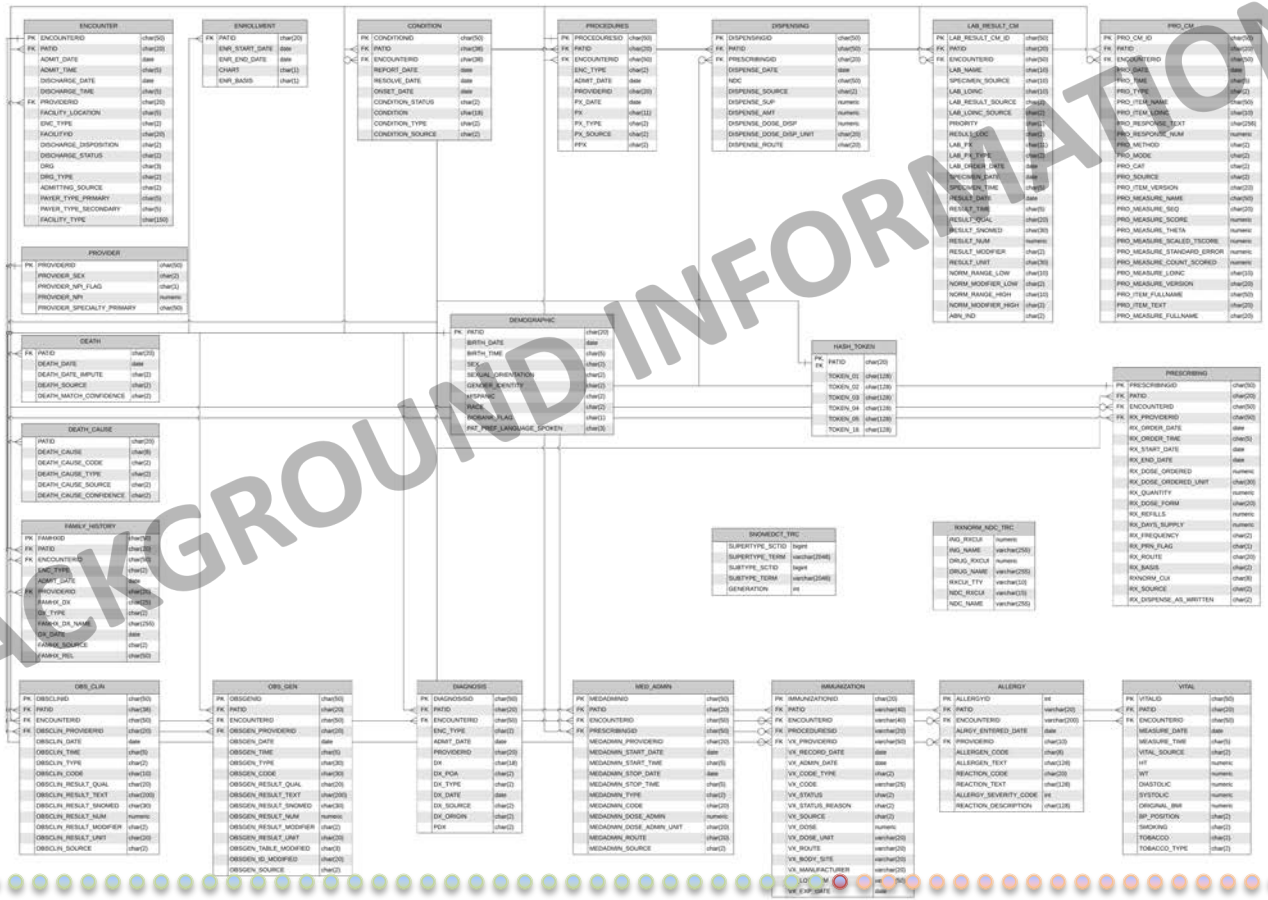
BACKGROUND INFORMATION

PCORnet CDM E-R Diagram

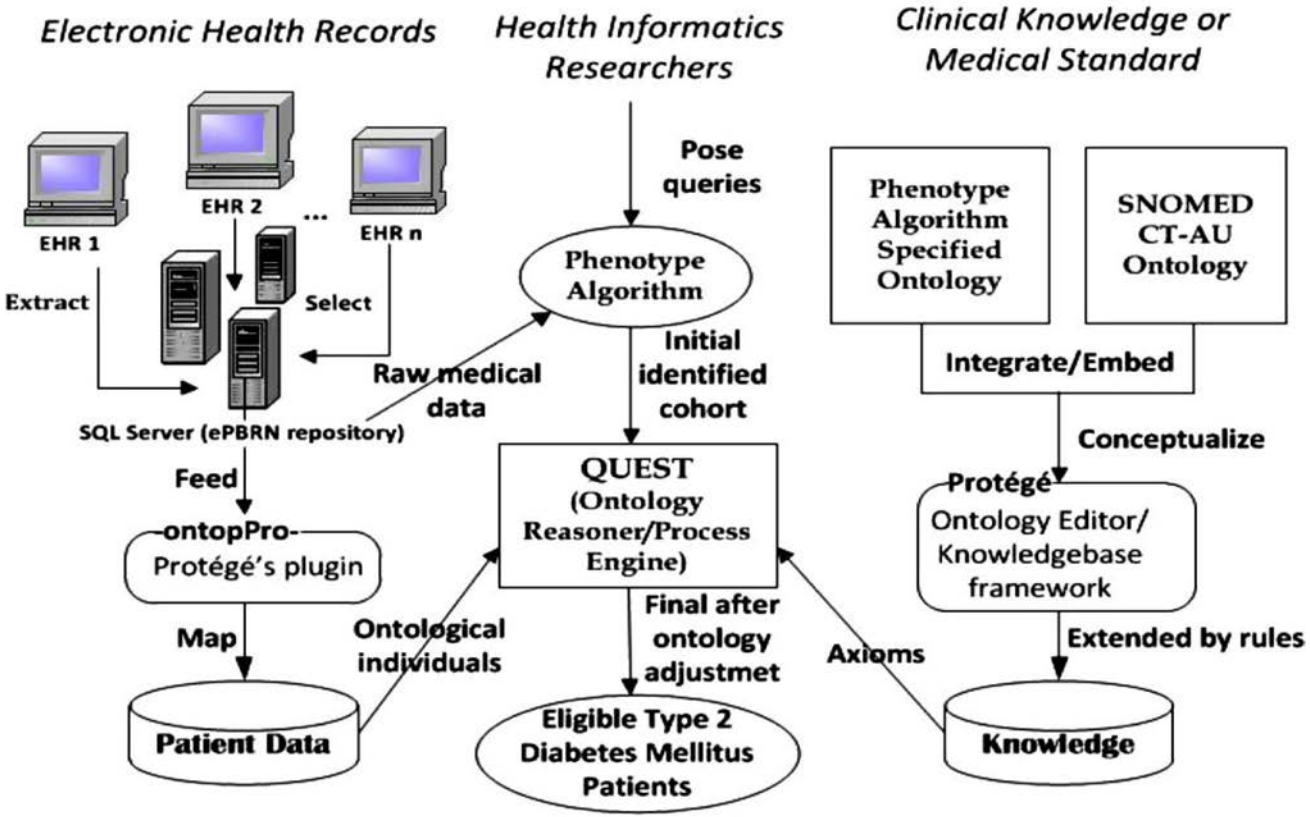


BACKGROUND INFORMATION

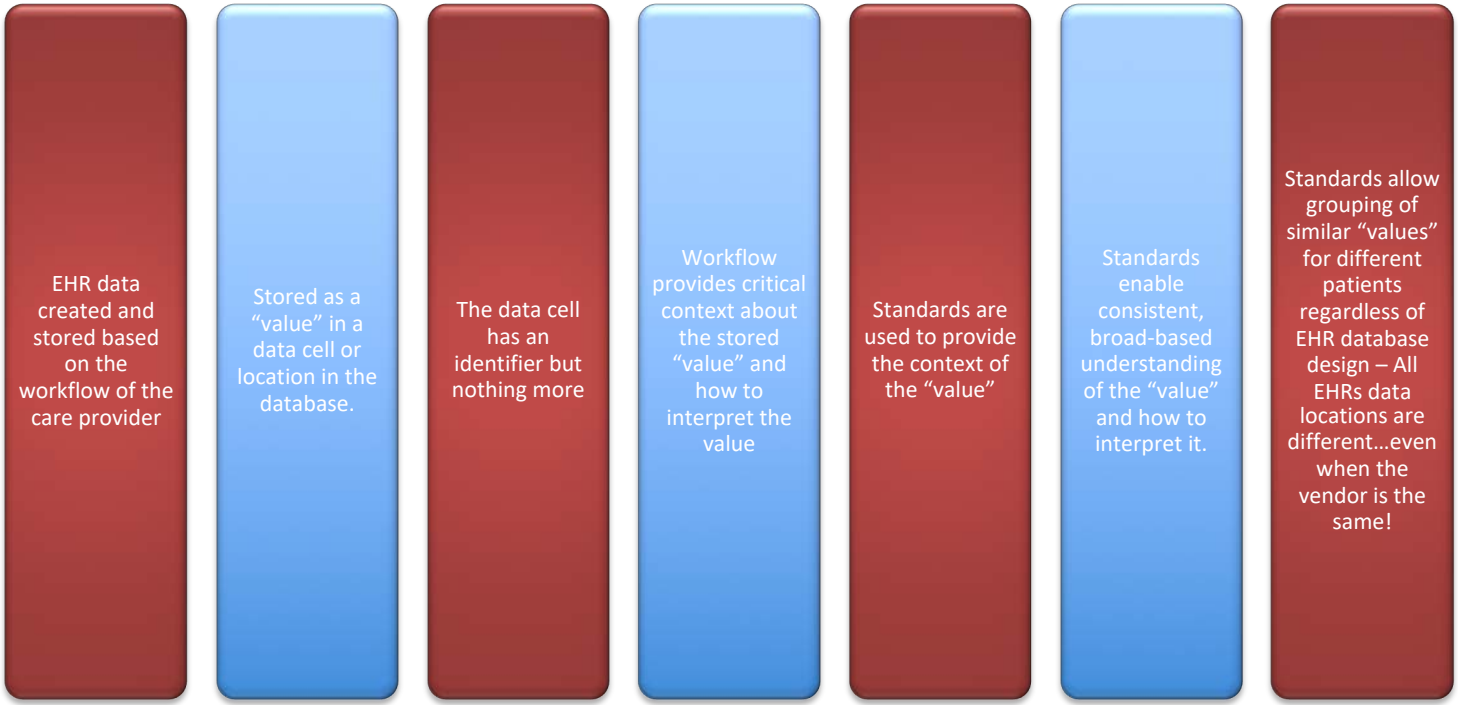
CRANE E-R Diagram



Integrating EHRs to support integrated care: an ontological approach



The Focus on Standards



CRANE Standards Deployed

I2B2 IDENTIFIER	DATATYPE	ORGANIZATION/ CODE TERMINOLOGY NAME	REFERENCE RESOURCE
CPT4	Professional services procedure codes	AMA/Common Procedural Terminology version 4	AMA copyright a problem; use i2b2 to browse
ICD-9-CM (ICD9CM)	Vol 1 Encounter billing diagnoses before 20151001 Vol 3 Hospital billing Procedures before 20151001	NCVHS/International Classification of Diseases version 9 Clinical Modification	http://www.icd9data.com http://icd9cm.chrisendres.com
ICD-10-CM (ICD10CM)	Encounter billing diagnoses after 20151001	NCVHS/International Classification of Diseases version 10 Clinical Modification	https://www.icd10data.com/
ICD-10-PCS (ICD10PCS)	Hospital billing procedure codes after 20151001	NCVHS/International Classification version 10 Procedure Coding Scheme	https://www.icd10data.com/
LOINC	Laboratory, pathology and clinical finding results	Regenstrief Institute/ Logical Objects Identifiers and Numeric Codes	http://search.loinc.org http://www.loinc.org for additional datasets
NDC	Manufactured drug products	FDA/National Drug Codes	https://mor.nlm.nih.gov/RxNav/ (incomplete, active codes only)
RXNORM	Clinically orderable drugs for US pharmacopoeia	NLM/RXNORM	https://mor.nlm.nih.gov/RxNav/ (incomplete, active codes only)
SNOMEDCT	Problem list, past medical history, family history, surgical and procedure history, microorganisms	Systematized Nomenclature of Medicine - Clinical Terminology	https://browser.ihtsdotools.org/

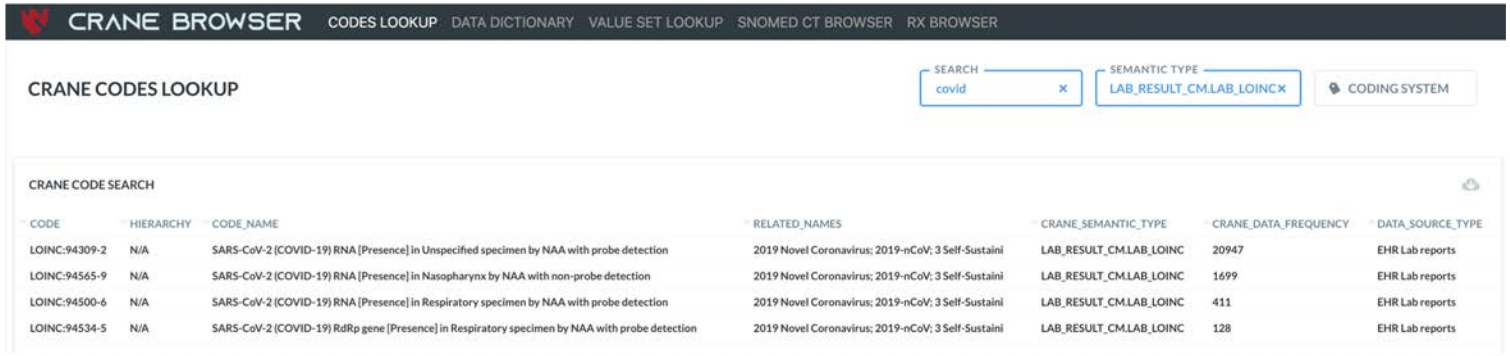
Terminology Master and Data Dictionary

https://gpctr.unmc.edu/cores/biomedical-informatics-cyberinfrastructure/crane/crane-terminology-lookup-tool/

Terminology Master Use Case

COVID-19 Lab Tests: https://loinc.org/sars-cov-2-and-covid-19/

Which code(s) is/are in use at Nebraska Medicine?



CODE	HIERARCHY	CODE_NAME	RELATED_NAMES	CRANE_SEMANTIC_TYPE	CRANE_DATA_FREQUENCY	DATA_SOURCE_TYPE
LOINC:94309-2	N/A	SARS-CoV-2 (COVID-19) RNA [Presence] in Unspecified specimen by NAA with probe detection	2019 Novel Coronavirus; 2019-nCoV; 3 Self-Sustaini	LAB_RESULT_CM.LAB_LOINC	20947	EHR Lab reports
LOINC:94565-9	N/A	SARS-CoV-2 (COVID-19) RNA [Presence] in Nasopharynx by NAA with non-probe detection	2019 Novel Coronavirus; 2019-nCoV; 3 Self-Sustaini	LAB_RESULT_CM.LAB_LOINC	1699	EHR Lab reports
LOINC:94500-6	N/A	SARS-CoV-2 (COVID-19) RNA [Presence] in Respiratory specimen by NAA with probe detection	2019 Novel Coronavirus; 2019-nCoV; 3 Self-Sustaini	LAB_RESULT_CM.LAB_LOINC	411	EHR Lab reports
LOINC:94534-5	N/A	SARS-CoV-2 (COVID-19) RdRp gene [Presence] in Respiratory specimen by NAA with probe detection	2019 Novel Coronavirus; 2019-nCoV; 3 Self-Sustaini	LAB_RESULT_CM.LAB_LOINC	128	EHR Lab reports

Data Refresh Timeline

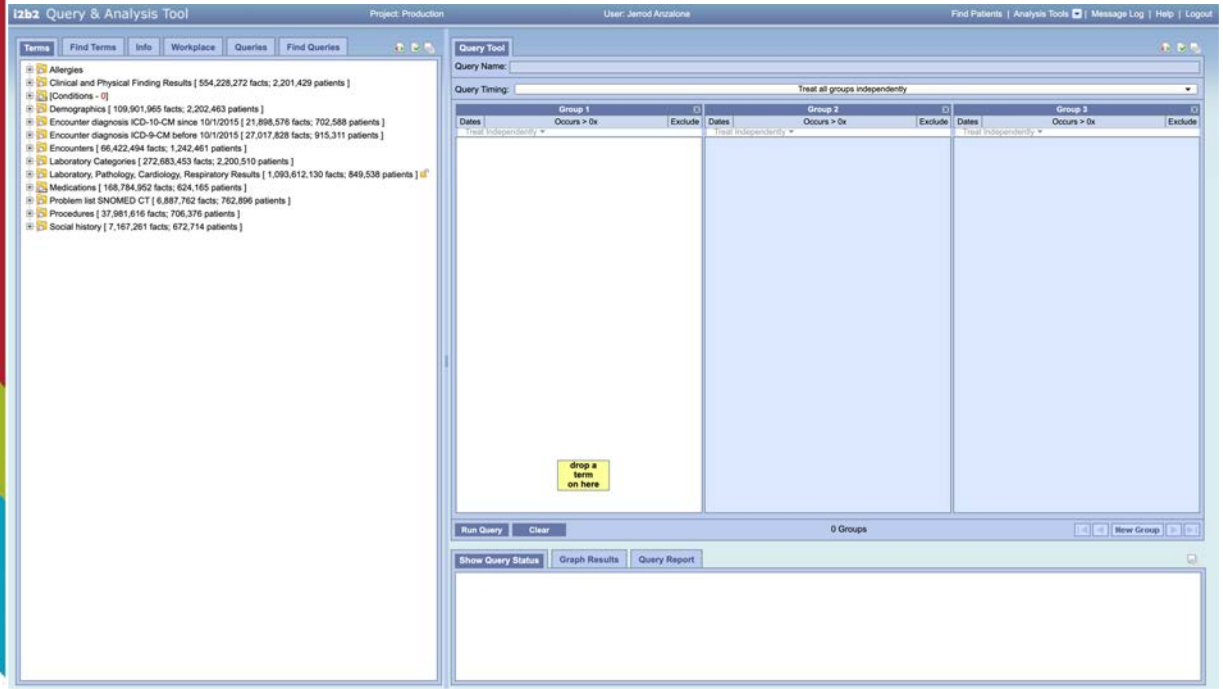
- Weekly for CRANE Data Model
- Quarterly for i2b2 (likely moving to weekly in the coming months)
- Geocoding data refreshed ~annually
- SDH data refresh ongoing – building into ETL process

De-identification Process

- Removes 18 HIPAA patient identifiers
- Involves a date offset of 1-30 days in the past

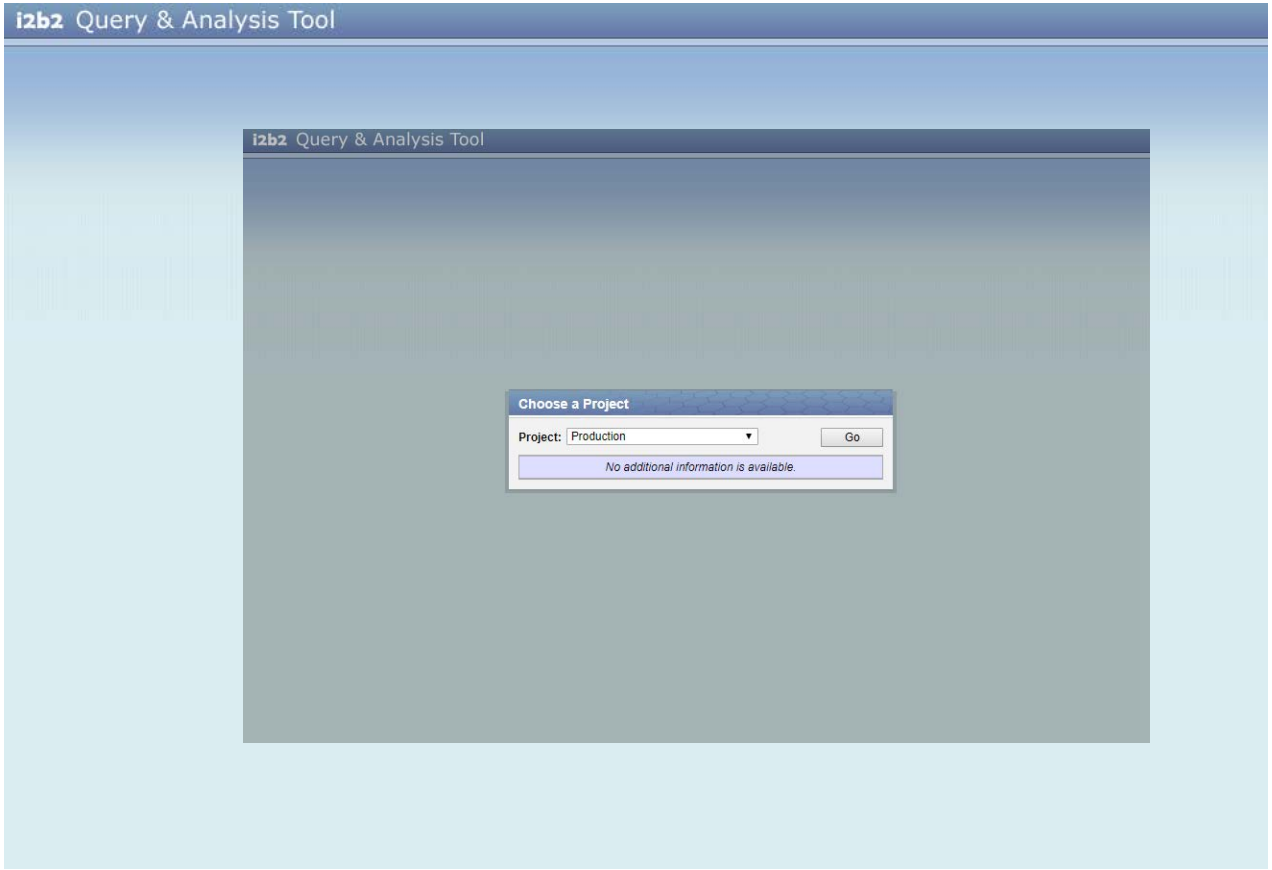
Patient	Variable	Original Date	Date Offset	CRANE Date
Patient #1	Date of Admission	12/10/2010	-7 days	12/3/2010
Patient #1	Type II Diabetes Diagnosis	01/20/2012	-7 days	01/13/2012
Patient #2	Date of Admission	05/15/2014	-13 days	05/02/2014
Patient #2	Type II Diabetes Diagnosis	11/19/2015	-13 days	11/06/2015

PHI (Patient Healthcare Identifiers) HIPAA Common Rule
Name
Dates (birthday etc)
Telephone number
Address and ZIP code
FAX number
Social Security number
Email address
Medical record identifier
Account numbers
Health plan beneficiary numbers
Certificate and license numbers
Vehicle identifiers
Web URLs
Device identifiers
Internet protocol addresses
Full face photograph
Biometric identifiers
Unique identifying number or code

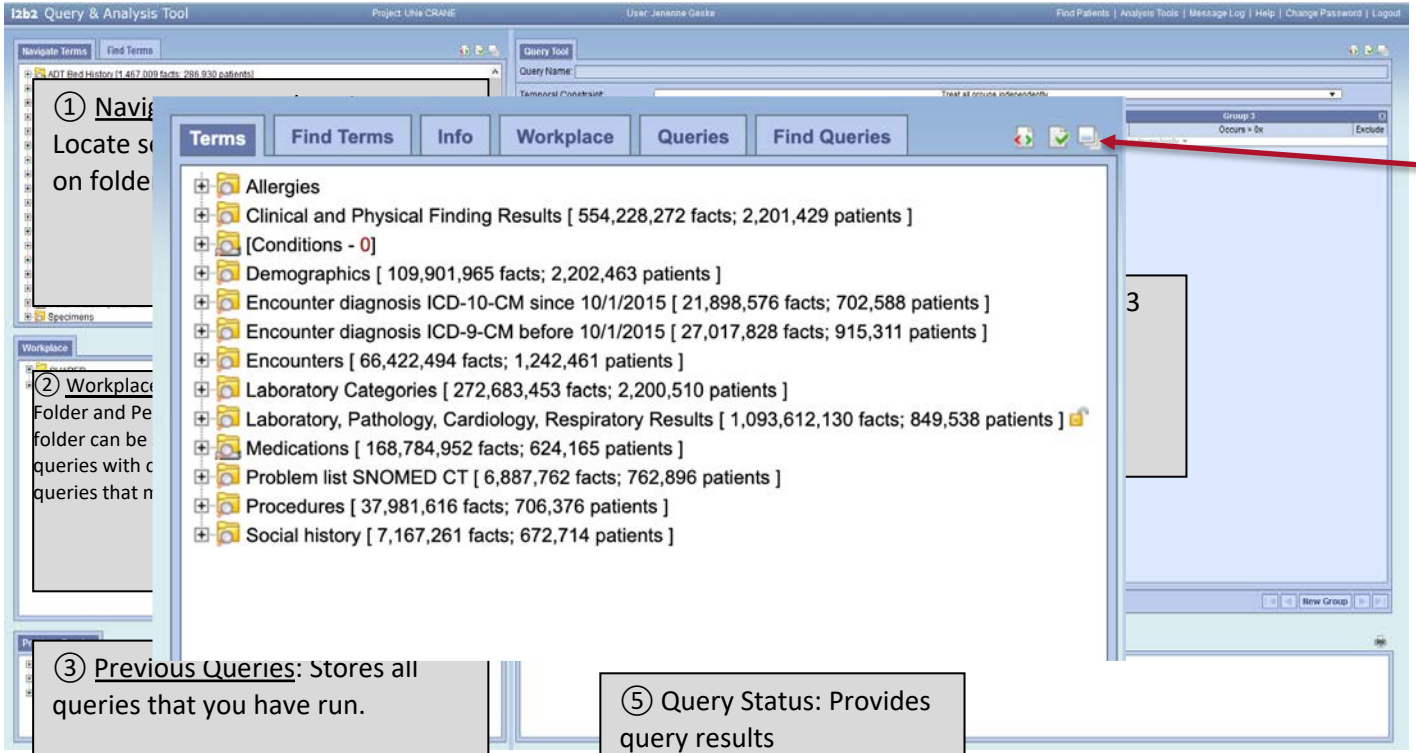


I2B2 Query & Analysis Tool

http://i2b2.unmc.edu


i2b2 Query & Analysis Tool
i2b2 Query & Analysis Tool
Choose a Project
Project: Production
Go
No additional information is available.

Home Screen



① Navig
Locate s
on folde

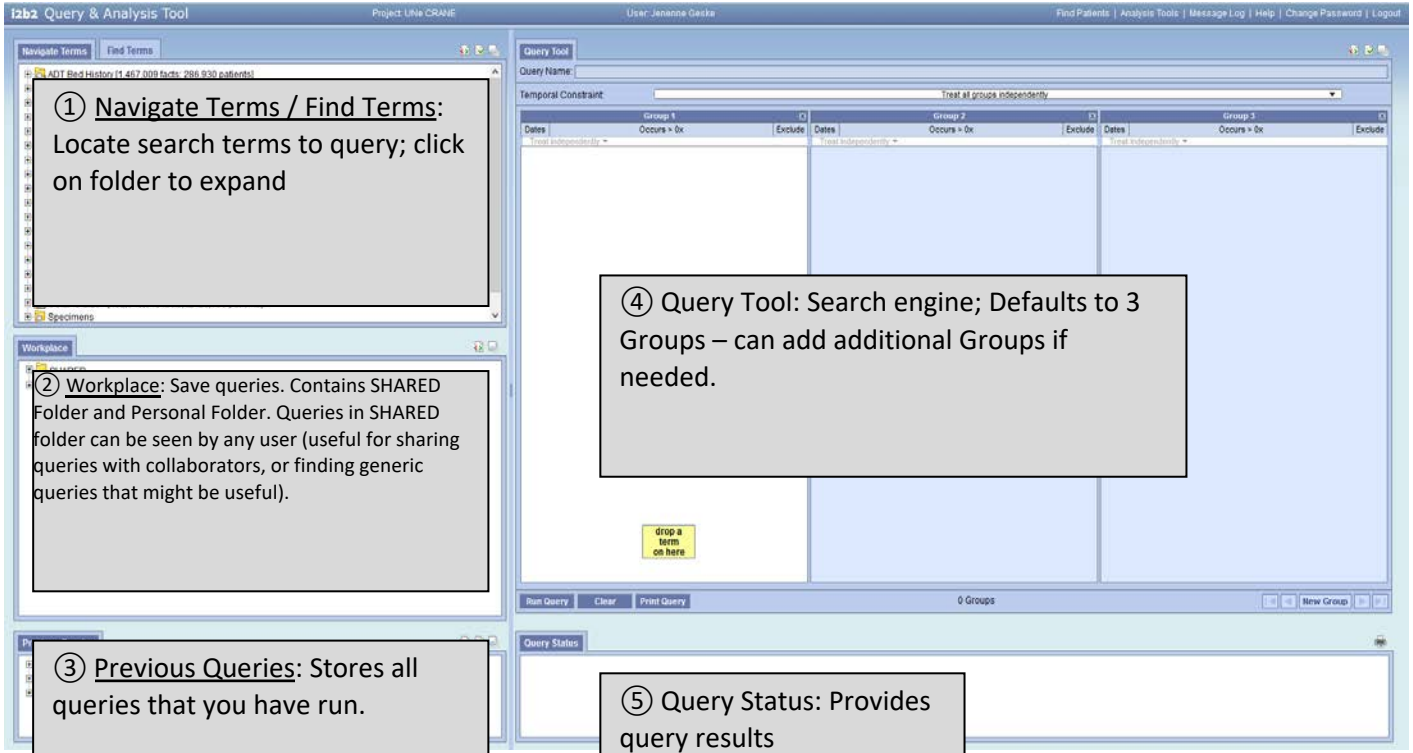
② Workplac
Folder and Pe
folder can be
queries with c
queries that n

3

③ Previous Queries: Stores all queries that you have run.

⑤ Query Status: Provides query results

Home Screen



① Navigate Terms / Find Terms: Locate search terms to query; click on folder to expand

② Workplace: Save queries. Contains SHARED Folder and Personal Folder. Queries in SHARED folder can be seen by any user (useful for sharing queries with collaborators, or finding generic queries that might be useful).

③ Previous Queries: Stores all queries that you have run.

④ Query Tool: Search engine; Defaults to 3 Groups – can add additional Groups if needed.

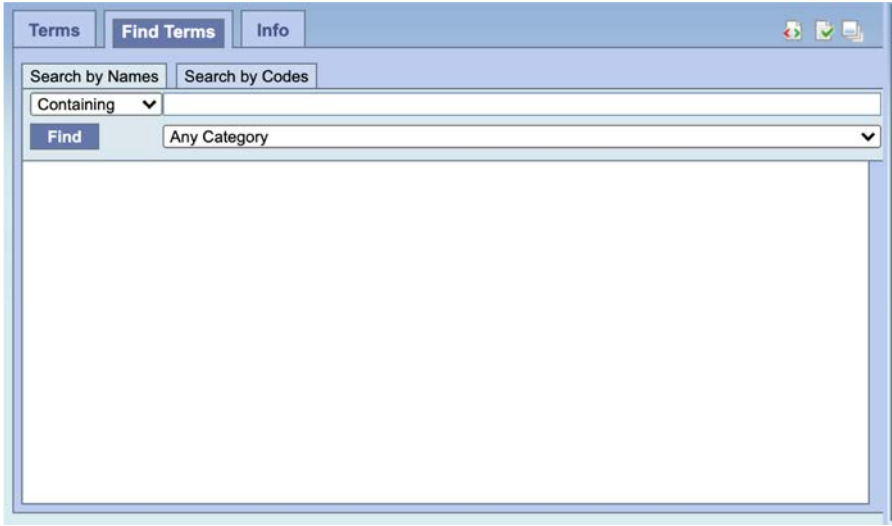
⑤ Query Status: Provides query results

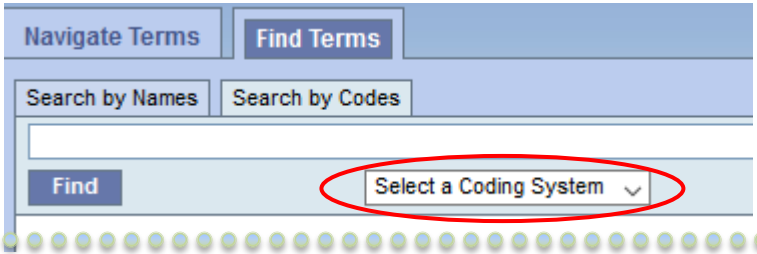
Web Client Contents

- Allergies
- Clinical and Physical Finding Results [554,228,272 facts; 2,201,429 patients]
- [Conditions - 0]
- Demographics [109,901,965 facts; 2,202,463 patients]
- Encounter diagnosis ICD-10-CM since 10/1/2015 [21,898,576 facts; 702,588 patients]
- Encounter diagnosis ICD-9-CM before 10/1/2015 [27,017,828 facts; 915,311 patients]
- Encounters [66,422,494 facts; 1,242,461 patients]
- Laboratory Categories [272,683,453 facts; 2,200,510 patients]
- Laboratory, Pathology, Cardiology, Respiratory Results [1,093,612,130 facts; 849,538 patients]
- Medications [168,784,952 facts; 624,165 patients]
- Problem list SNOMED CT [6,887,762 facts; 762,896 patients]
- Procedures [37,981,616 facts; 706,376 patients]
- Social history [7,167,261 facts; 672,714 patients]

Main Categories – Organized by standards-based metadata

Searching in i2b2





Use Case – Cohort Identification

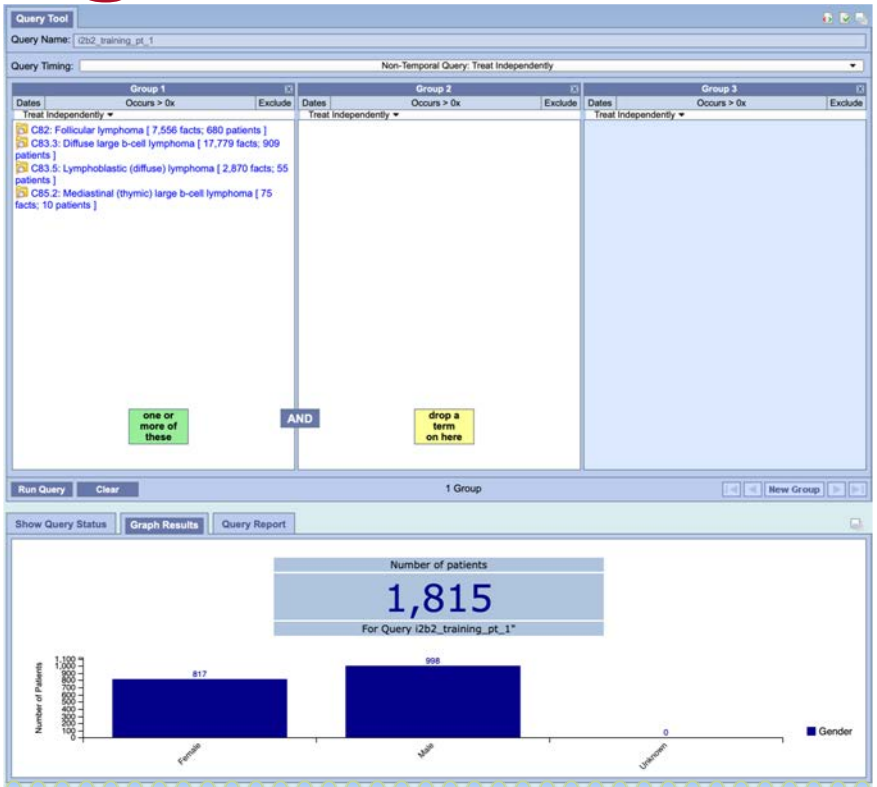
Distinct LBCL/DLBCL cancer patients, 18 years of age and over, will be identified using the following ICD-10 Codes:

- LBCL/DLBCL ICD 10 Codes:
  - C82.00-C82.69
  - C82.80-C82.99
  - C83.30-C83.39
  - C83.50-C83.59
  - C85.20-C85.29

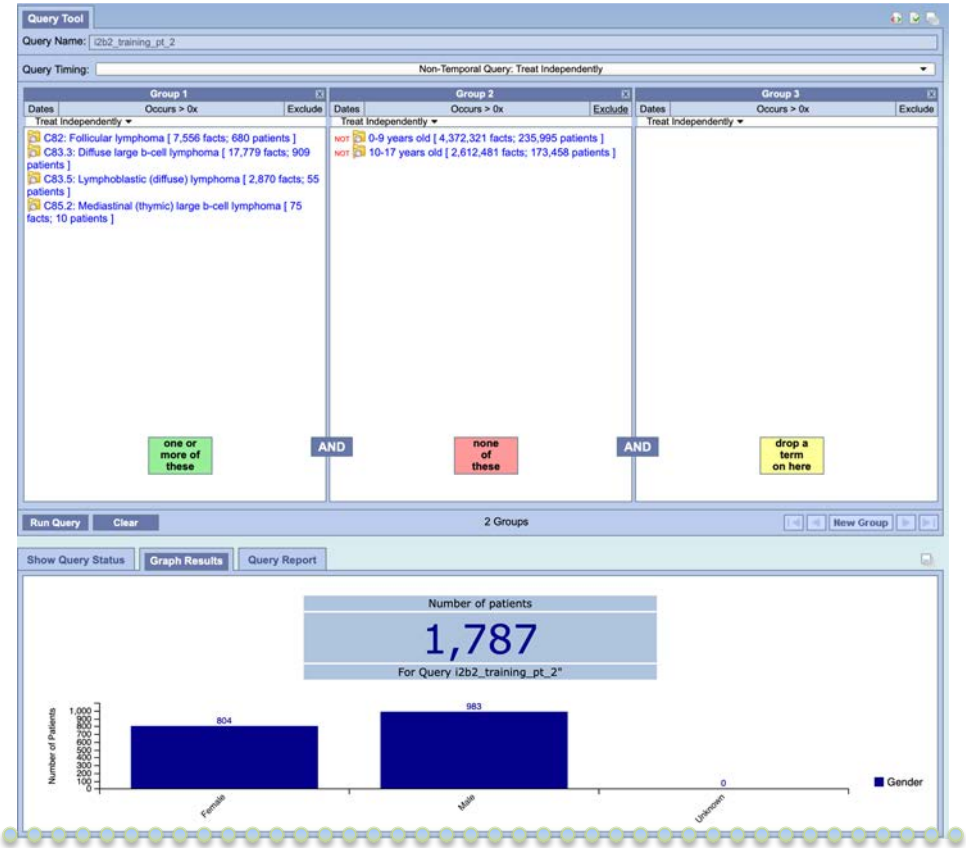
- Patients diagnosed with LBCL/DLBCL that have received Lenalidomide (Revlimid) treatment in three lines of therapy or less will be broken out by year.

- Where possible, at least 1 of the 3 treatment lines should be an anti-CD20 containing therapy (i.e. Rituximab, Rituxan).

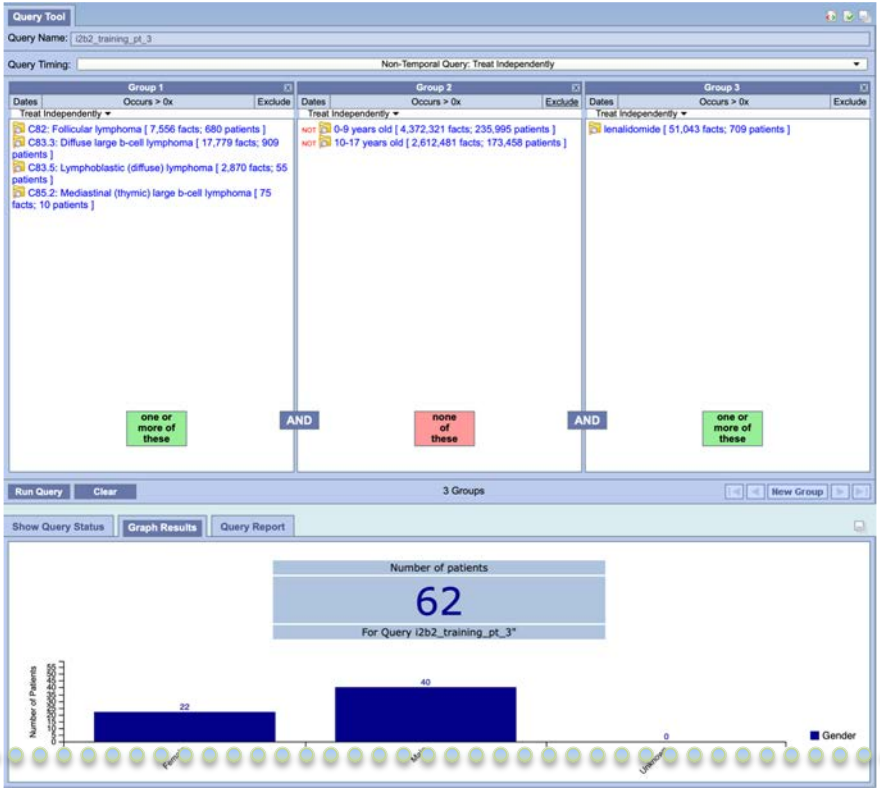
Patient Count with Diagnosis



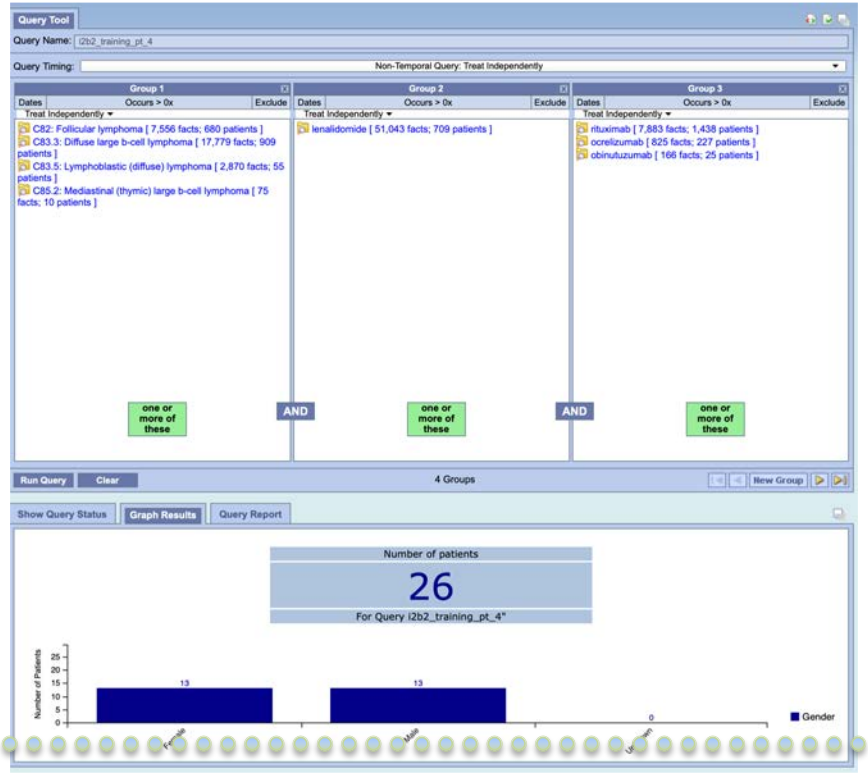
Adult Patients with Dx



First Treatment Criteria



Second Treatment Criteria



Practice Case

Build a query identifying patients with Multiple Sclerosis with a COVID-19 lab test.

After you've done this, narrow down your search to females over age 65 who live within 50 miles of UNMC (i.e. 68105).

NOTE: Do not run these queries or they'll go into a long queue with all of you executing at the same time.

Data Beyond Patient Counts

- Patient count associated with patient list
- Patient list uses obfuscated patient identifier
- Data elements (facts) extracted for patients in list
- Series of .csv files for import into analytics software:
    - R, Tableu, SAS

PATIENT_NUM	CONCEPT_CD	PARAMETER	RESULT	UNITS	START_DATE	END_DATE
2054	LOINC:1975-2	Serum Bilirubin	0.6	mg/dL	[2019/03/11:03:51:00 AM]	[2019/03/11:06:47:00 AM]
2054	LOINC:1975-2	Serum Bilirubin	1.2	mg/dL	[2019/03/12:09:40:00 AM]	[2019/03/12:10:21:00 AM]
2054	LOINC:2160-0	Serum Creatinine	0.83	mg/dL	[2019/03/08:03:41:00 AM]	[2019/03/08:05:08:00 AM]
2054	LOINC:2160-0	Serum Creatinine	1.07	mg/dL	[2019/03/09:06:31:00 AM]	[2019/03/09:07:13:00 AM]
2054	LOINC:2160-0	Serum Creatinine	1.09	mg/dL	[2019/03/09:09:53:00 AM]	[2019/03/09:10:18:00 AM]
2054	LOINC:2160-0	Serum Creatinine	1.08	mg/dL	[2019/03/09:02:02:00 PM]	[2019/03/09:02:34:00 PM]
2054	LOINC:2160-0	Serum Creatinine	1.22	mg/dL	[2019/03/10:04:36:00 AM]	[2019/03/10:05:10:00 AM]
2054	LOINC:2160-0	Serum Creatinine	1.3	mg/dL	[2019/03/10:09:48:00 PM]	[2019/03/10:10:17:00 PM]
2054	LOINC:2160-0	Serum Creatinine	1.18	mg/dL	[2019/03/11:03:51:00 AM]	[2019/03/11:04:32:00 AM]
2054	LOINC:2160-0	Serum Creatinine	0.95	mg/dL	[2019/03/11:10:27:00 AM]	[2019/03/11:11:19:00 AM]
2054	LOINC:2160-0	Serum Creatinine	0.77	mg/dL	[2019/03/11:03:11:00 PM]	[2019/03/11:04:45:00 PM]
2054	LOINC:2160-0	Serum Creatinine	0.71	mg/dL	[2019/03/11:06:36:00 PM]	[2019/03/11:07:23:00 PM]
2054	LOINC:2160-0	Serum Creatinine	0.67	mg/dL	[2019/03/12:12:11:00 AM]	[2019/03/12:12:46:00 AM]
2054	LOINC:2160-0	Serum Creatinine	0.58	mg/dL	[2019/03/12:05:51:00 AM]	[2019/03/12:06:35:00 AM]
2054	LOINC:2160-0	Serum Creatinine	0.57	mg/dL	[2019/03/12:09:40:00 AM]	[2019/03/12:10:21:00 AM]

Crane/I2B2 Test Runs

Let's try to build a patient cohort and explore I2B2

Step 1: Find patients

Start by testing/building cohort

Once you have your cohort, check patient set and execute the query

Step 2: Explore patients

Select CARE (Cohort Analysis and Refinement Expeditor)

Drag prior query with patient set into patient set field

Query Tips

- Refining a query
  - Temporal constraint
  - Date constraints
  - Number of occurrences
  - Exclusions
  - Lab values
- For more efficient queries, search for the most restrictive element first
  - To identify males injured falling out of space craft
  - **Item 1**: ICD for falling out of spacecraft
  - **Item 2**: Males

Next Steps?

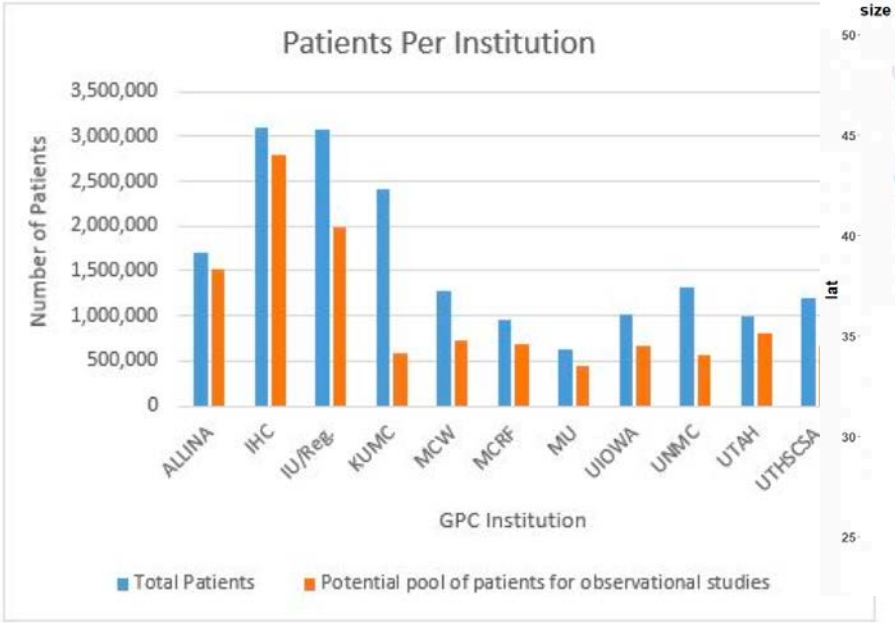
In our hypothetical use case, we obtained a cohort of 23 patients, which may be sufficient for a pilot study. How can we obtain a larger cohort?

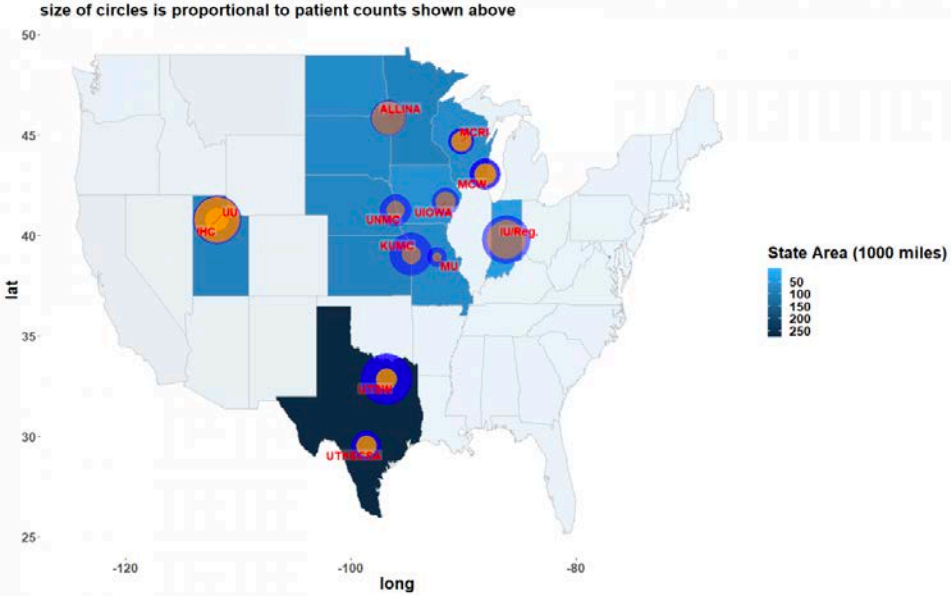
Enter: Greater Plains Collaborative

Still want more?

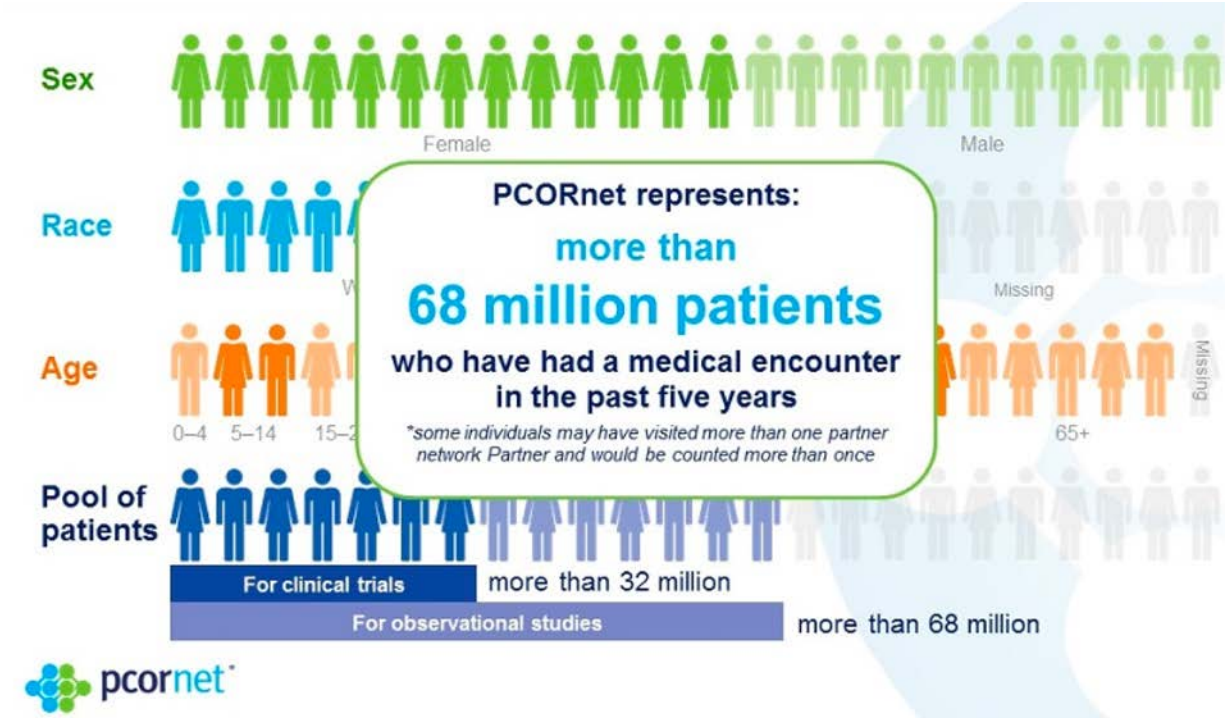
Enter: PCORnet

Greater Plains Collaborative (GPC)





PCORnet


Sex
Female
Male
Race
Missing
Age
0–4
5–14
65+
Missing
Pool of patients
For clinical trials
more than 32 million
For observational studies
more than 68 million
PCORnet represents:
more than
68 million patients
who have had a medical encounter in the past five years
*some individuals may have visited more than one partner network Partner and would be counted more than once
pcornet

National COVID Cohort Collaborative (N3C)

Image courtesy of NCATS

National COVID Cohort Collaborative (N3C)

Building a COVID-19 Analytics Platform to Turn Clinical Data into Knowledge: Introducing the National COVID Cohort Collaborative (N3C)

Wednesday, October 28, 2020 | Noon - 1:00 PM CST

Melissa Haendel, PhD
Professor of Medical Informatics and Clinical Epidemiology, School of Medicine
Director of the Center for Data to Health,
Oregon Clinical and Translational Research Institute
Biomedical Informatics Graduate Program,
School of Medicine
Portland, OR

Learn more here:
https://gpctr.unmc.edu/cores/biomedical-informatics-cyberinfrastructure/national-covid-cohort-collaborative-n3c/

Introductory Webinar tomorrow:
https://unmc.zoom.us/j/94169168256?pwd=V0pROVpJM21sR0V5V0FpZ3JmSlhXQT09

To Learn More

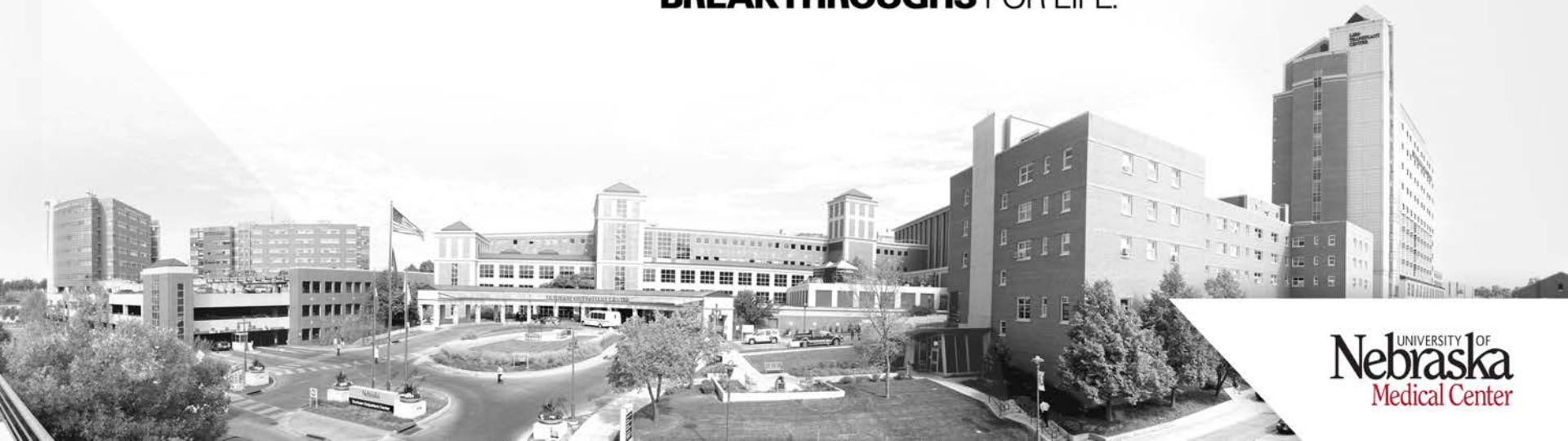
- Play around in I2B2 building test cases
- A lot of I2B2 user guides available online from different academic medical centers
- CRANE Superuser Forum: Wednesday 3-4PM
- Reach out to Data Access/Program Coordinator:
  - Jerrod Anzalone (alfred.anzalone@unmc.ed)
- Reach out to BERD support:
  - Kaeli Samson, Ran Dai, Lorena Baccaglini
- Reach out to Superusers:
  - We have a group of over 20 spread throughout campus, including Leeza Struwe
- Reach out to the experts:
  - Jim McClay, Jim Campbell, Scott Campbell

Citing CRANE in publications

The project described utilized the University of Nebraska Medical Center Clinical Research Analytics Network supported in part by the National Institute Of General Medical Sciences, 1U54GM115458-01. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

UNMC[SM]

BREAKTHROUGHS FOR LIFE.®



University of Nebraska Medical Center