OMOP Common Data Model and Standardized Vocabularies

11-October-2018

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Rimma Belenkaya
Dmitry Dymshyts
Don Torok
Stephen Lyman

After the Tutorials, you will know…

1. History of OMOP, OHDSI
2. How the Standardized Vocabulary works
3. How to find codes and Concepts
4. How to navigate the concept hierarchy
5. The OMOP Common Data Model (CDM)
6. How to use the OMOP CDM

Agenda

Section	Speaker	Time	Item(s)
Registration	-	8:00- 9:00 (1 hour)	
Introduction	Christian	9:00 - 10:00 (1 hour)	Introductions and Ground Rules Foundational • History of OMOP • Why and How • Birth of OHDSI Introduction to OMOP Common Data Model OHDSI Community Example of Remote Study VM Overview
Vocabulary – Part 1	Christian	10:00 – 10:30 (30 min)	Basic Relationships
Break	-	10:30 - 10:45 (15 min)	
Vocabulary – Part 2	Dmitri	10:45- 12:00 (1 hour & 45 min)	Ancestors & Descendants How does it work for Drugs SQL Examples

Agenda (cont.)

Section	Speaker	Time	Item(s)
Lunch	-	12:00 - 1:00 (1 hour)	-
Vocabulary – Part 3	Dmitry	1:00 - 1:30 (30 min)	Continued
Common Data Model	Erica/Clair	1:30 - 3:00 (1 hour & 30 min)	In depth discussion of model Era discussion
Break	-	3:00 - 3:15 (15 min)	-
CDM Examples	Mui	3:15 - 4:40 (1 hour & 25 min)	Leveraging OHDSI Tools (GitHub/Forums/Working Group) Exercises OHDSI Community
Conclusion	Rimma	4:40 – 5:00 (20 minutes)	Conclusion Game Concluding Thoughts

Instructors

Christian Reich, MD, PhD	Mui van Zandt	Erica A. Voss, MPH, PMP
		
Dmitry Dymshyts, MD	**Clair Blacketer, MPH, PMP**	**Rimma Belenkaya, MA, MS**
		

Rovers

Don Torok, MS	Stephen Lyman
	

Ground Rules

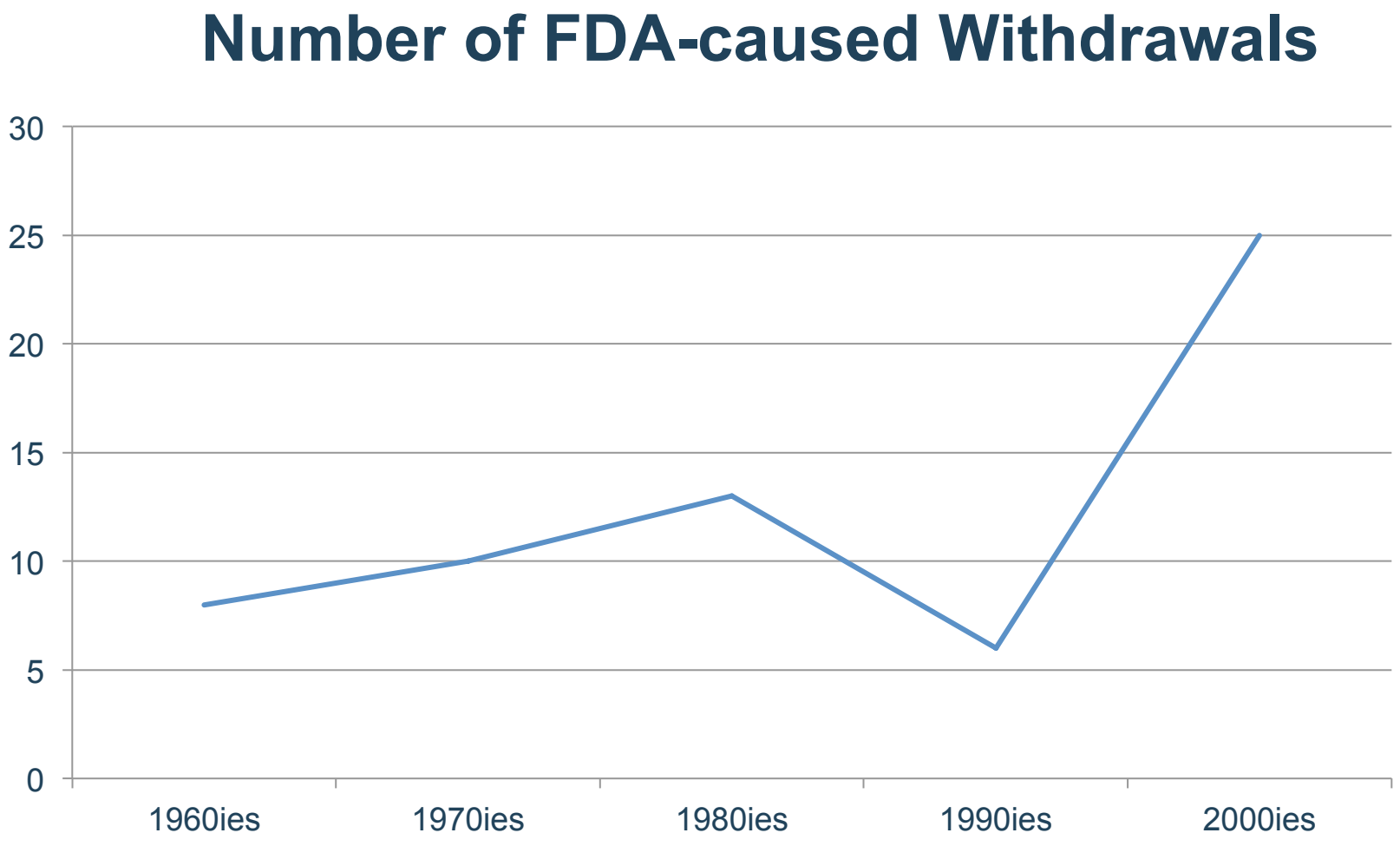
- We are recording
- We may take some questions off-line
- Buddy up if we cannot get the remote desktop working

Foundational

What is OMOP/OHDSI? OMOP Common Data Model (CDM) – Why and How

Observational Medical Outcomes Partnership

FDA Regulatory Action over Time



Observational Medical Outcomes Partnership

FDAAA calls for establishing Risk Identification and Analysis System

SEC. 905. ACTIVE POSTMARKET RISK IDENTIFICATION AND ANALYSIS.

(a) IN GENERAL.—Subsection (k) of section 505 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 355) is amended by adding at the end the following:

"(3) ACTIVE POSTMARKET RISK IDENTIFICATION.—

"(A) DEFINITION.—In this paragraph, the term 'data' refers to information with respect to a drug approved under this section or under section 351 of the Public Health Service Act, including claims data, patient survey data, standardized analytic files that allow for the pooling and analysis of data from disparate data environments, and any other data deemed appropriate by the Secretary.

"(B) DEVELOPMENT OF POSTMARKET RISK IDENTIFICATION AND ANALYSIS METHODS.—The Secretary shall, not later than 2 years after the date of the enactment of the Food and Drug Administration Amendments Act of 2007, in collaboration with public, academic, and private entities—

"(i) develop methods to obtain access to disparate data sources including the data sources specified in subparagraph (C);

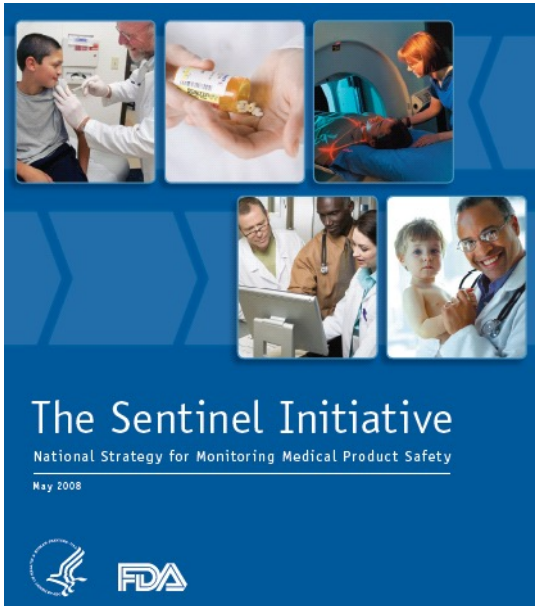
"(ii) develop validated methods for the establishment of a postmarket risk identification and analysis system to link and analyze safety data from multiple sources, with the goals of including, in aggregate—

"(I) at least 25,000,000 patients by July 1, 2010; and

"(II) at least 100,000,000 patients by July 1, 2012; and

"(iii) convene a committee of experts, including individuals who are recognized in the field of protecting data privacy and security, to make recommendations to the Secretary on the development of tools and methods for the ethical and scientific uses for, and communication of, postmarketing data specified under subparagraph (C), including recommendations on the development of effective research methods for the study of drug safety questions.

"(C) ESTABLISHMENT OF THE POSTMARKET RISK IDENTIFICATION AND ANALYSIS SYSTEM.—

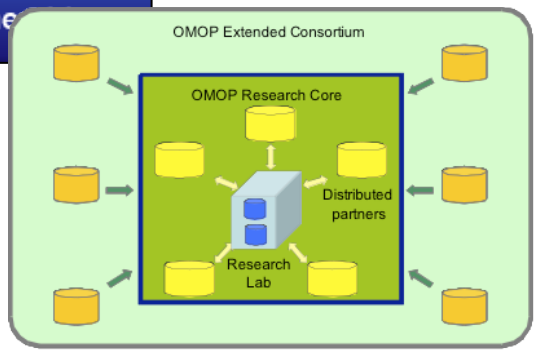


Risk Identification and Analysis System:

a systematic and reproducible process to efficiently generate evidence to support the characterization of the potential effects of medical products from across a network of disparate observational healthcare data sources

OMOP Experiment 1 (2009-2010)

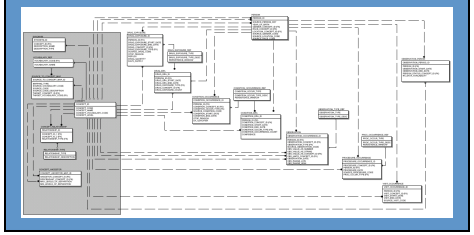
Observational Medical Outcomes Partne



- 10 data sources
- Claims and EHRs
- 200M+ lives

- Open-source
- Standards-based

Common Data Model



OMOP Methods Library

Inception cohort
Case control
Logistic regression

- 14 methods
- Epidemiology designs
- Statistical approaches adapted for longitudinal data

Drug

Outcome	ACE Inhibitors	Amphotericin B	Antibiotics: erythromycins, sulfonamides, tetracyclines	Antiepileptics: carbamazepine, phenytoin	Benzodiazepines	Beta blockers	Bisphosphonates: alendronate	Tricyclic antidepressants	Typical antipsychotics	Warfarin
Angioedema										
Aplastic Anemia										
Acute Liver Injury										
Bleeding										
Hip Fracture										
Hospitalization										
Myocardial Infarction										
Mortality after MI										
Renal Failure										
GI Ulcer Hospitalization										

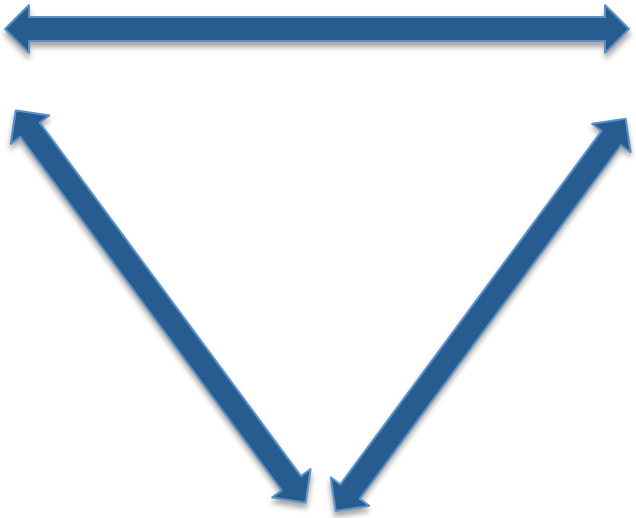
Observational Medical Outcomes Partnership

OMOP Experiment 2 (2011-2012)

Observational Data

4 claims databases

1 ambulatory EMR



Methods

- Case-Control
- New User Cohort
- Disproportionality methods
- ICTPD
- LGPS
- Self-Controlled Cohort
- SCCS

Drug-outcome pairs

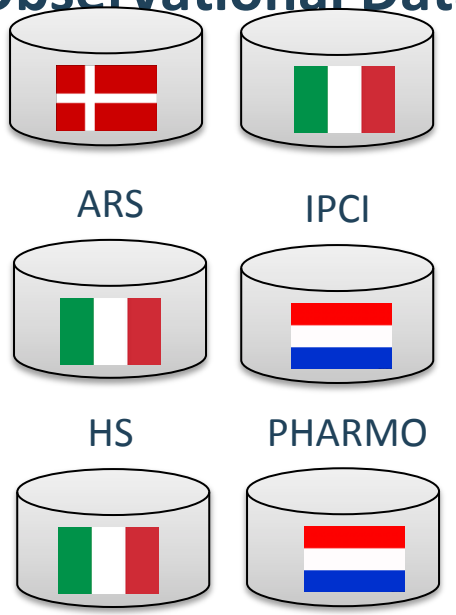
	Positives	Negatives
Total	165	234
Myocardial Infarction	36	66
Upper GI Bleed	24	67
Acute Liver Injury	81	37
Acute Renal Failure	24	64

Observational Medical Outcomes Partnership

European OMOP Experiment

eu-adr

Observational Data



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Observational Medical Outcomes Partnership

Ground Truth for OMOP Experiment

isoniazid

fluticasone

indomethacin

clindamycin

	Positive controls	Negative controls	Total
Acute Liver Injury	81	37	118
Acute Myocardial Infarction	36	66	102
Acute Renal Failure	24	64	88
Upper Gastrointestinal Bleeding	24	67	91
Total	165	234	399

ibuprofen

loratadine

sertraline

pioglitazone

Criteria for positive controls:

- Event listed in Boxed Warning or Warnings/Precautions section of active FDA structured product label
- Drug listed as 'causative agent' in Tisdale et al, 2010: Drug-Induced Diseases
- Literature review identified no powered studies with refuting evidence of effect

Criteria for negative controls:

- Event not listed anywhere in any section of active FDA structured product label
- Drug not listed as 'causative agent' in Tisdale et al, 2010: Drug-Induced Diseases
- Literature review identified no powered studies with evidence of potential positive association

Results

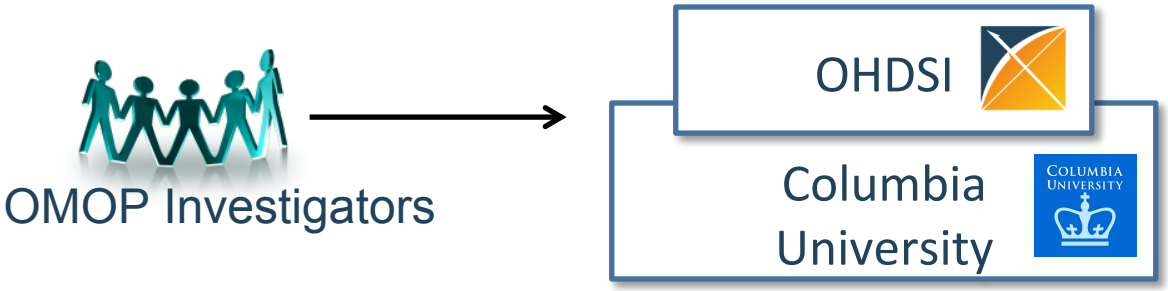
Observational Medical Outcomes Partnership

Main findings in OMOP experiment

- Heterogeneity in estimates due to choice of database
- Heterogeneity in estimates due to analysis choices
- Except little heterogeneity due to outcome definitions
- Good performance (AUC > 0.7) in distinguishing positive from negative controls for optimal methods when stratifying by outcome and restricting to powered test cases
- Self controlled methods perform best for all outcomes

Observational Health Data Sciences and Informatics (OHDSI)
Plans and Ambitions

Fate of OMOP - OHDSI



- The Observational Health Data Sciences and Informatics (OHDSI) program is a **multi-stakeholder, interdisciplinary collaborative** to create **open-source** solutions that bring out the value of observational health data through large-scale analytics

- OHDSI has established **an international network of researchers and observational health databases** with a central coordinating center housed at Columbia University
  - –Public, Open
  - –Not Pharma-funded
  - –International

http://ohdsi.org

OHDSI's Mission & Vision

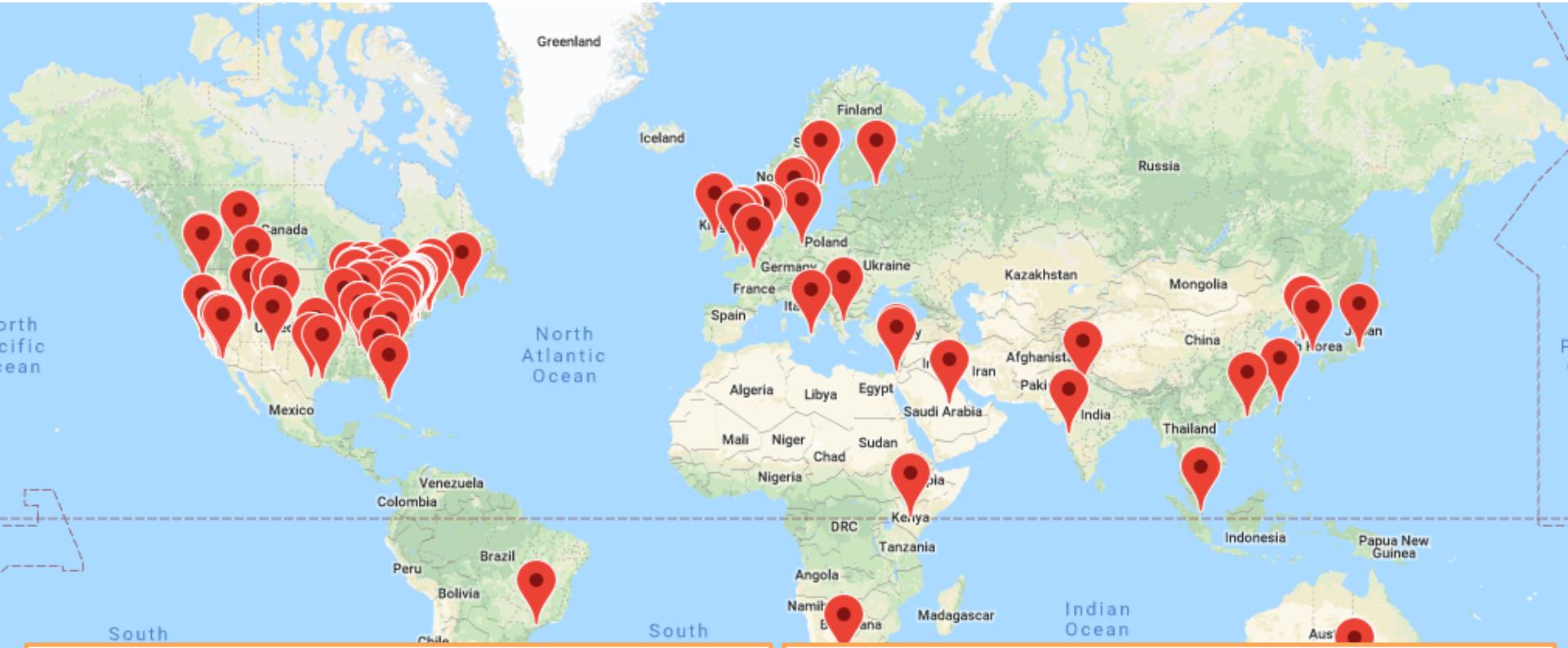
To improve health by empowering a community to collaboratively generate the evidence that promotes better health decisions and better care.

A world in which observational research produces a comprehensive understanding of health and disease.

Join us on the journey

http://ohdsi.org

OHDSI: a global community



OHDSI Collaborators:

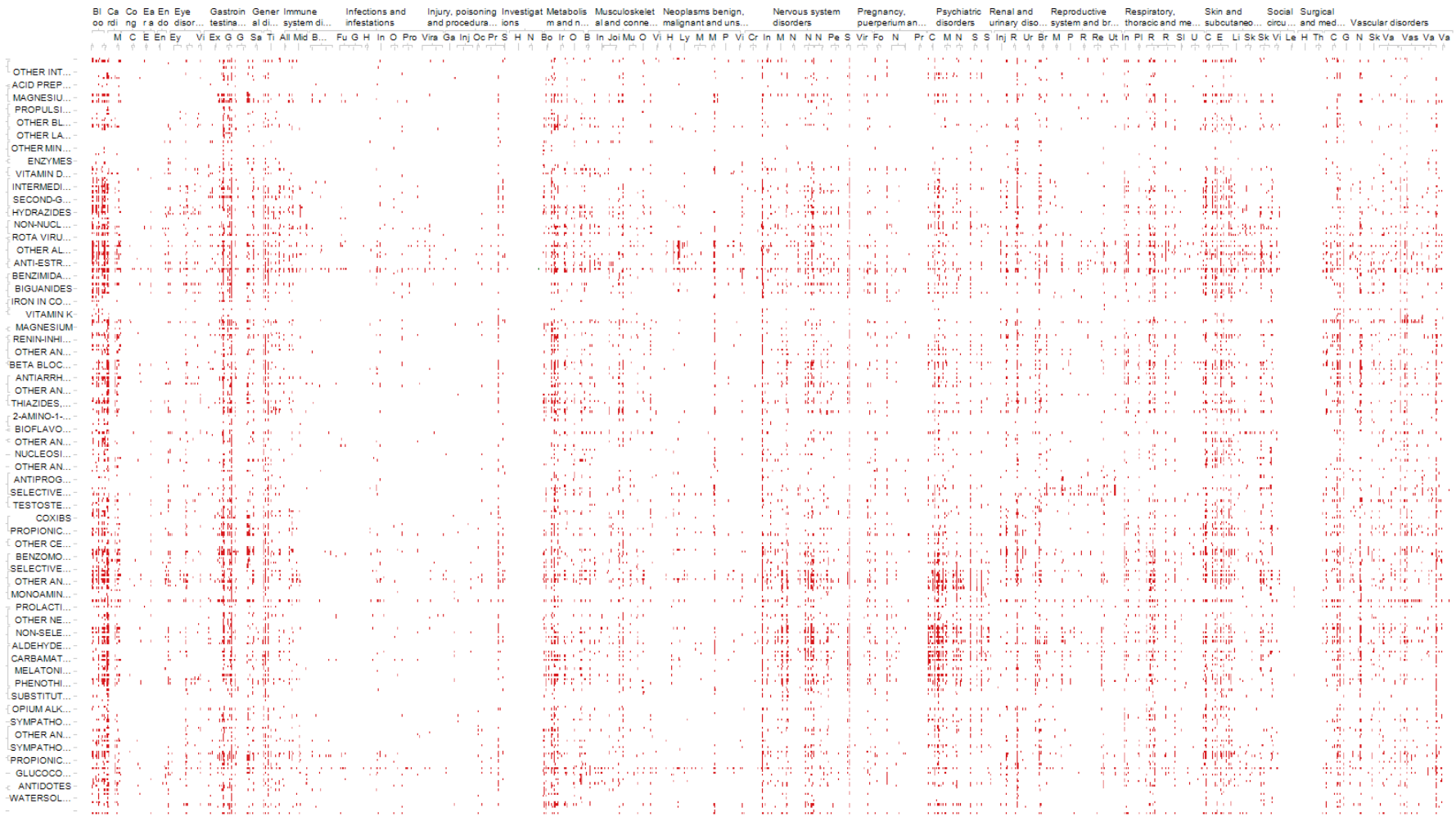
- >220 researchers in academia, industry and government
- >21 countries

OHDSI Data Network:

- >114 databases from 19 countries
- 1.9 billion patients records (duplicates)
- ~222 million non-US patients

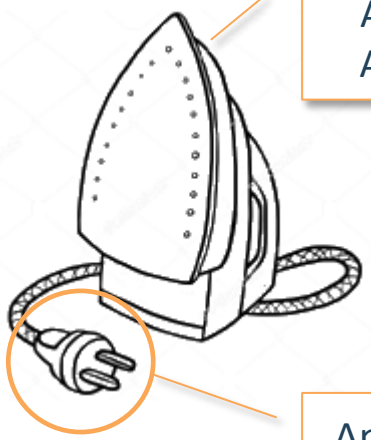
Current pace of evidence generation in healthcare

All health outcomes of interest



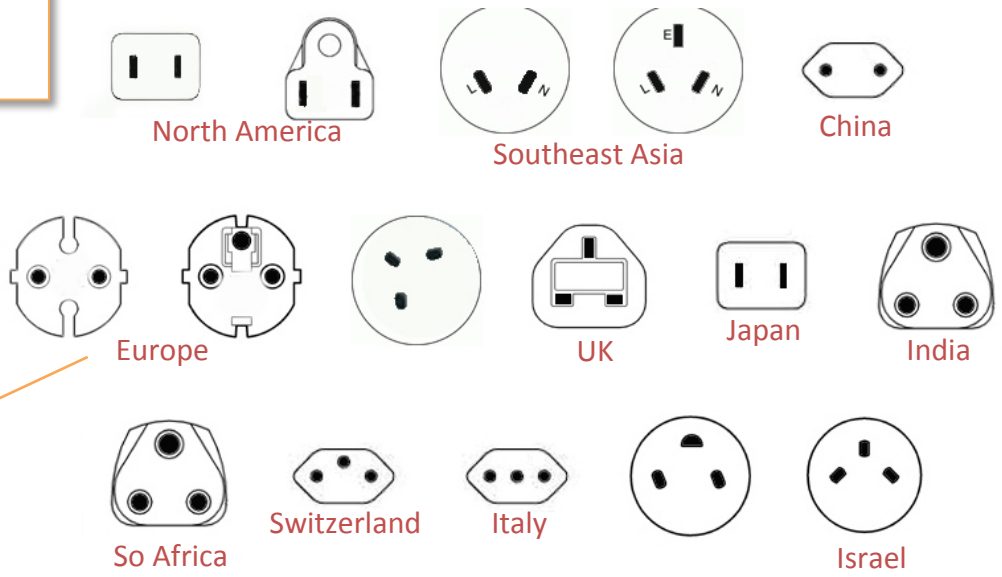
Current Approach: “One Study – One Script“

"What's the adherence to my drug in the data assets I own?"

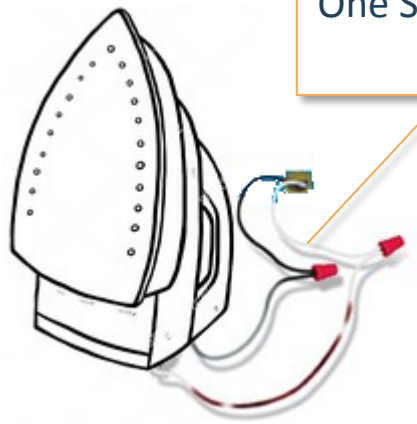


Analytical method: Adherence to Drug

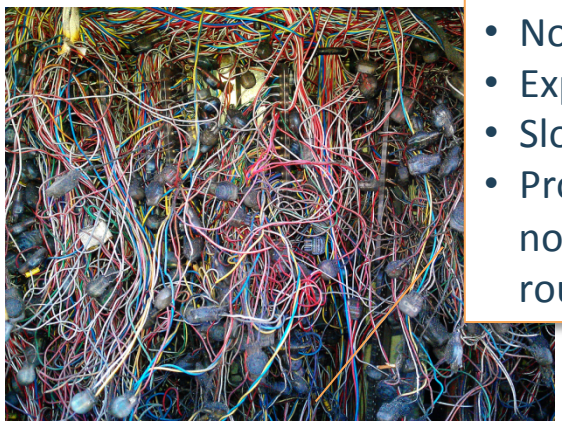
Application to data



Current solution:

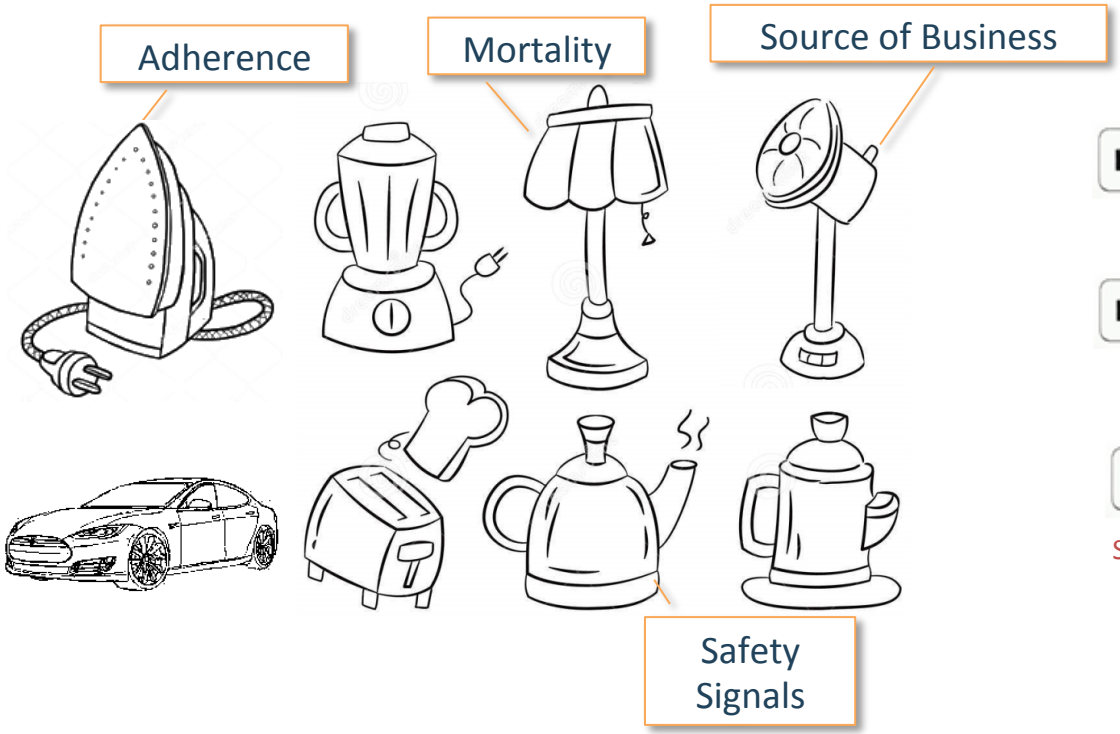


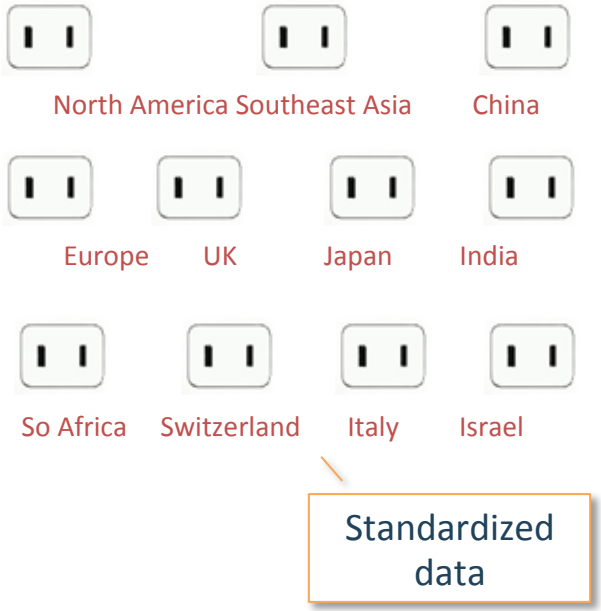
One SAS or R script for each study



- Not scalable
- Not transparent
- Expensive
- Slow
- Prohibitive to non-expert routine use

Solution: Data Standardization Enables Systematic Research

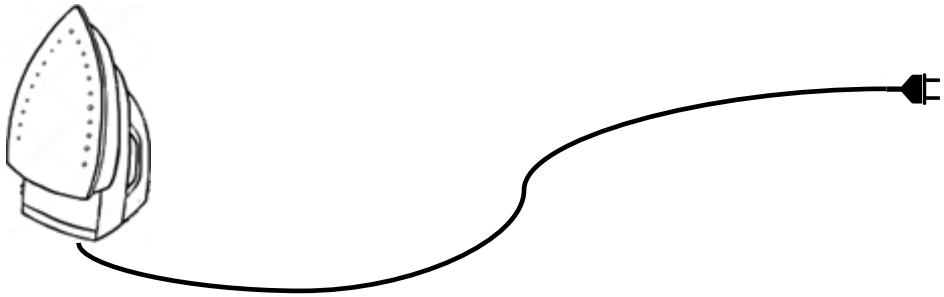


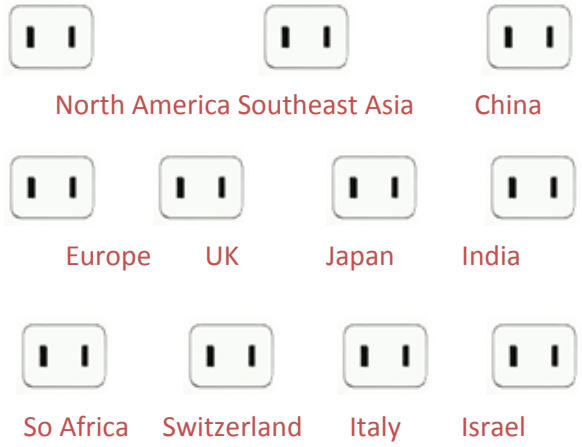


OHDSI Tools

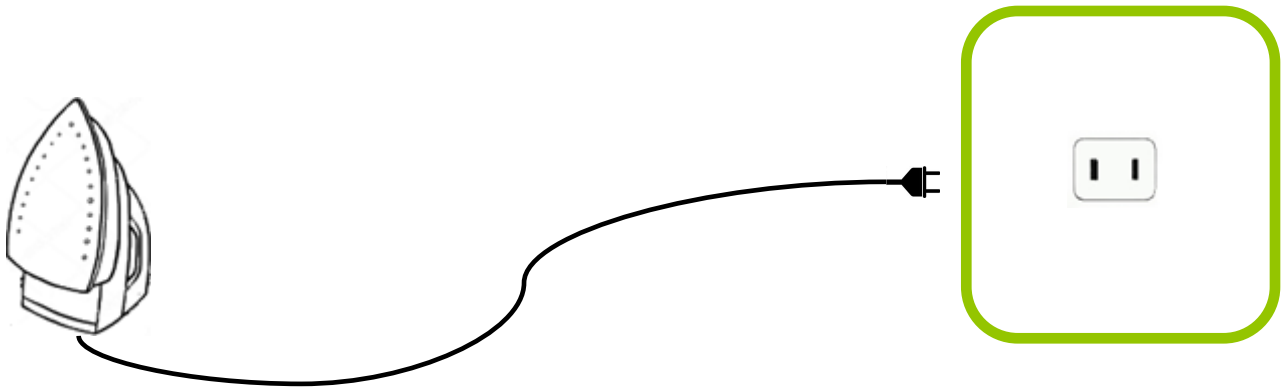
OMOP CDM

Analytics can be remote

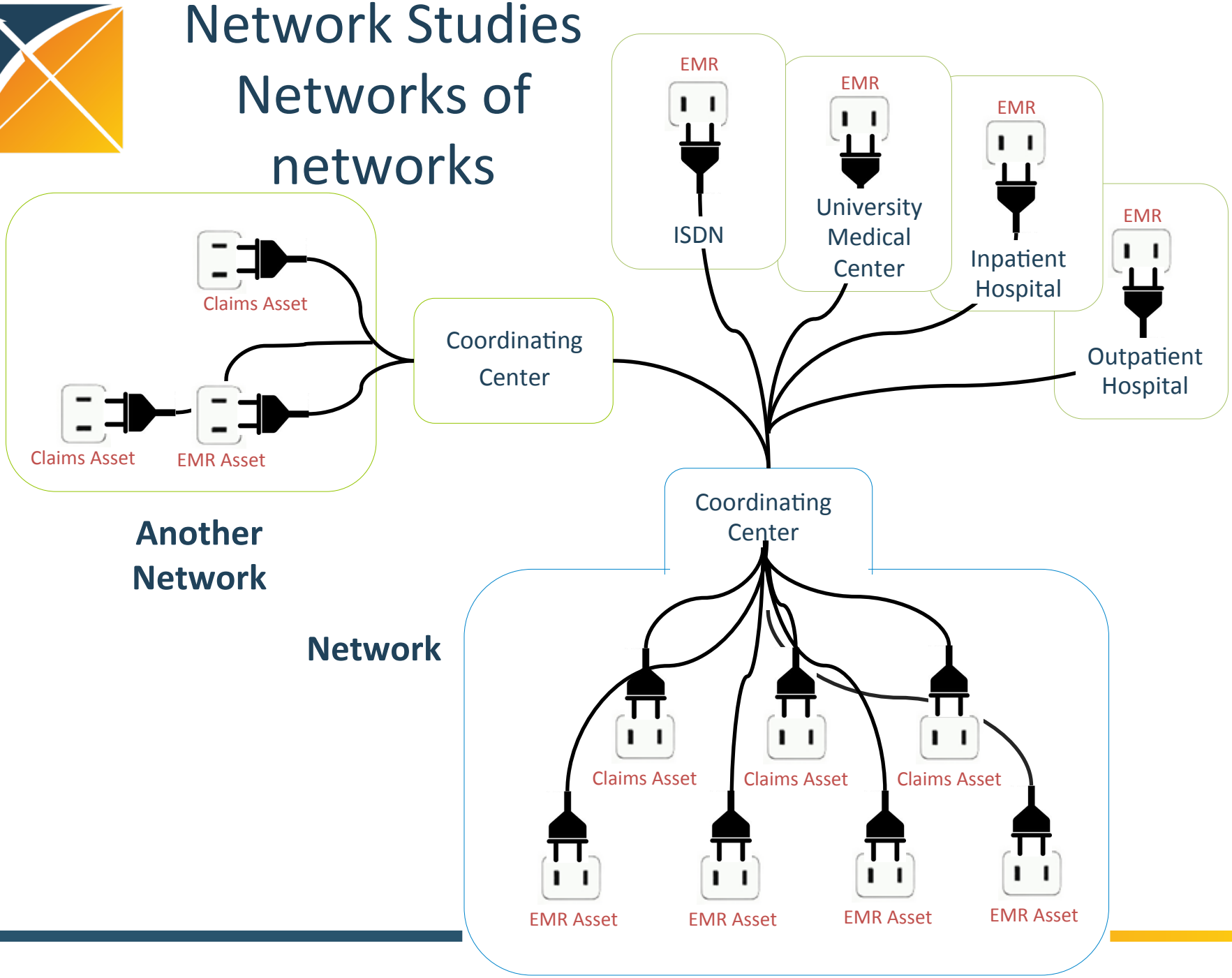




Analytics can be behind firewall



Network Studies Networks of networks



Virtual Machine

OHDSI in a Box

amazon web services™ EC2

Microsoft SQL Server

cdm

webapi

Microsoft SQL Server Management Studio

Atlas

WebAPI

Tomcat

Methods Library

OHDSI R packages

Studio

synpuf_100k

synpuf_2.3m

WhiteRabbit

RabbitInAHat

How to Sign into the Remote Desktop

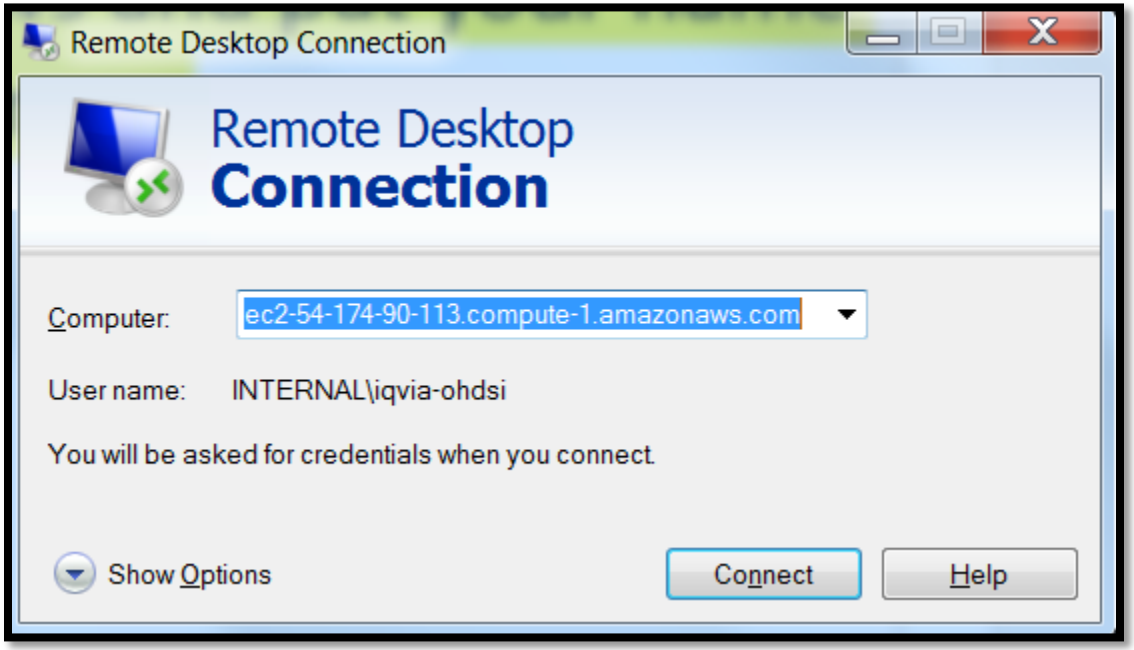
- Use the shortcut on the desktop named “Remote Desktop”

goo.gl/aXKY9e

- Pick one of the rows and put your name on the second column

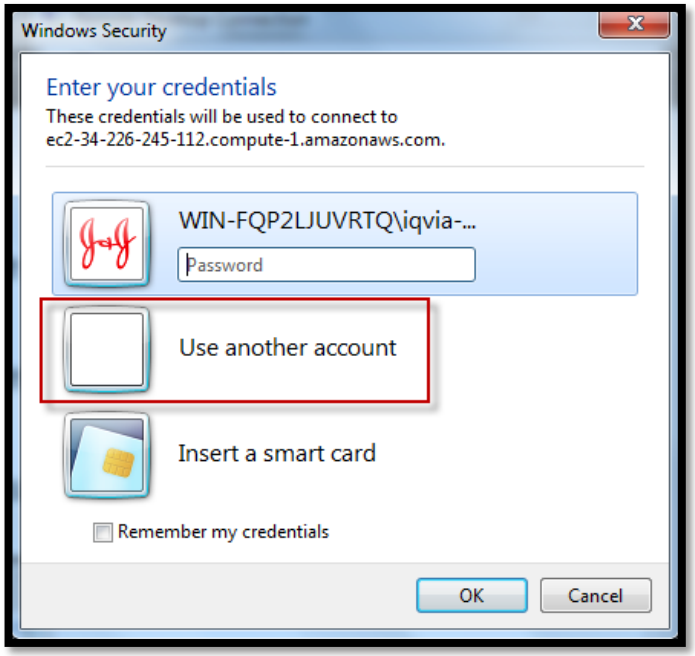
How to Sign into the Remote Desktop

- Take Column A from spreadsheet and copy into the “Computer” field



How to Sign into the Remote Desktop

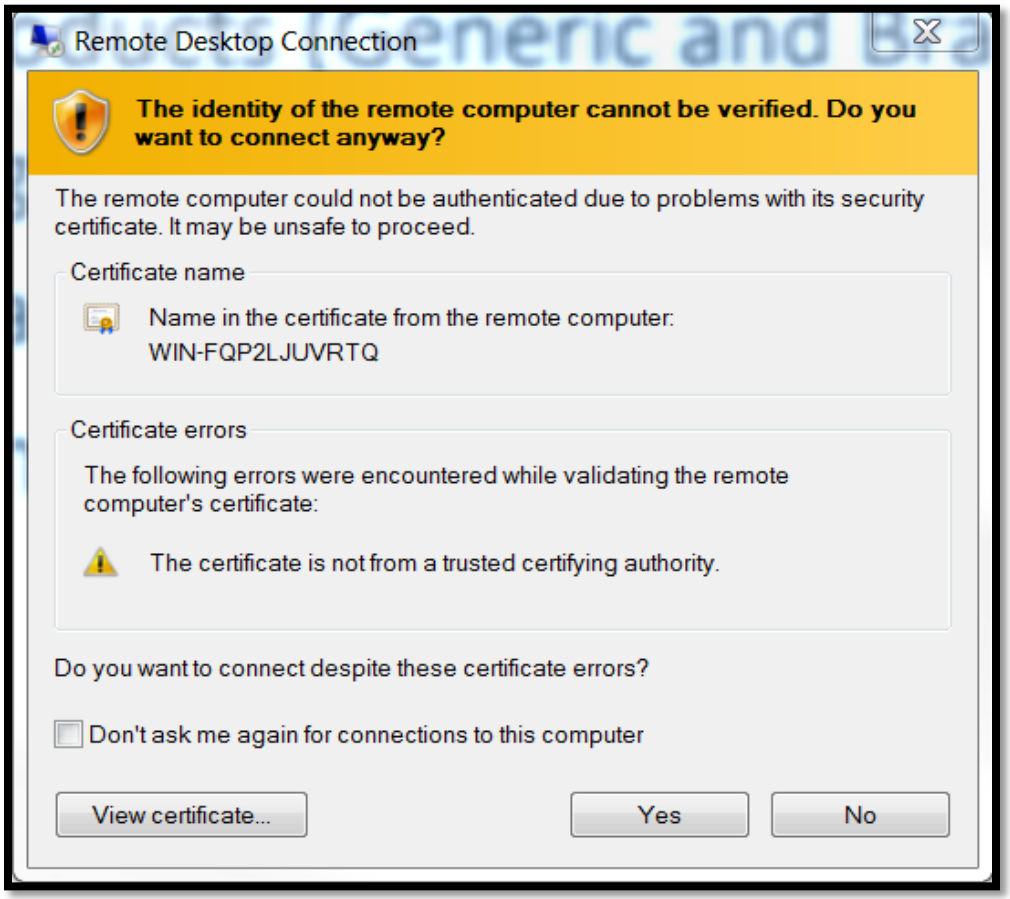
- Pick ‘Use Another Account’
- Copy username from Column C
- Copy password from Column D



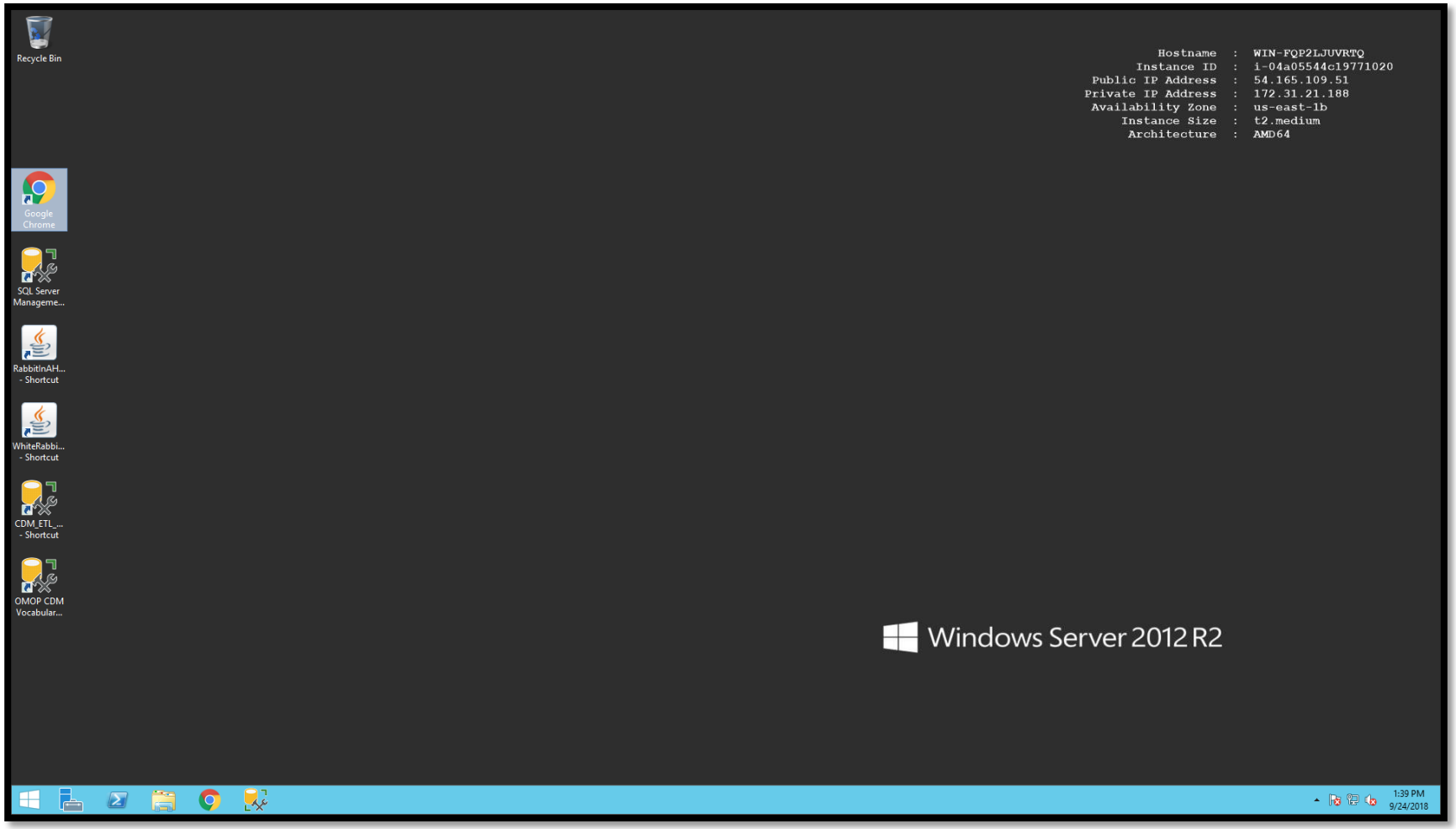
A	B	C	D
RDP URL	**Name**	**Username**	**Password**
ec2-34-226-245-112.compute-1.amazonaws.com	Erica Voss	iqvia-ohdsi	I!QViAOH@DSI18
ec2-52-87-207-197.compute-1.amazonaws.com	Mui Van Zandt	iqvia-ohdsi	I!QViAOH@DSI18

How to Sign into the Remote Desktop

- If you get this page, select “Yes”

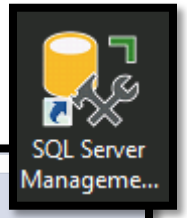


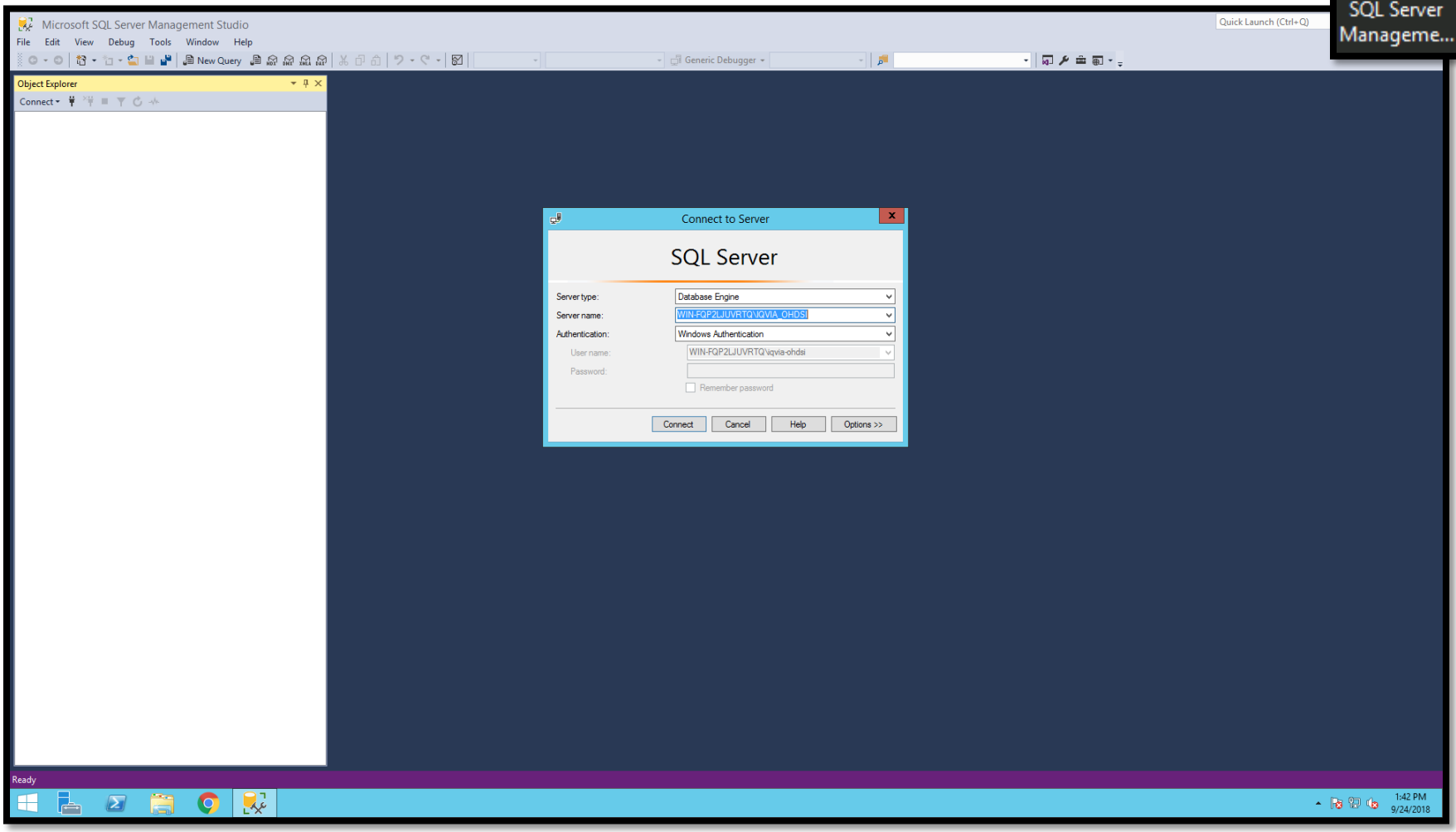
OHDSI in a Box



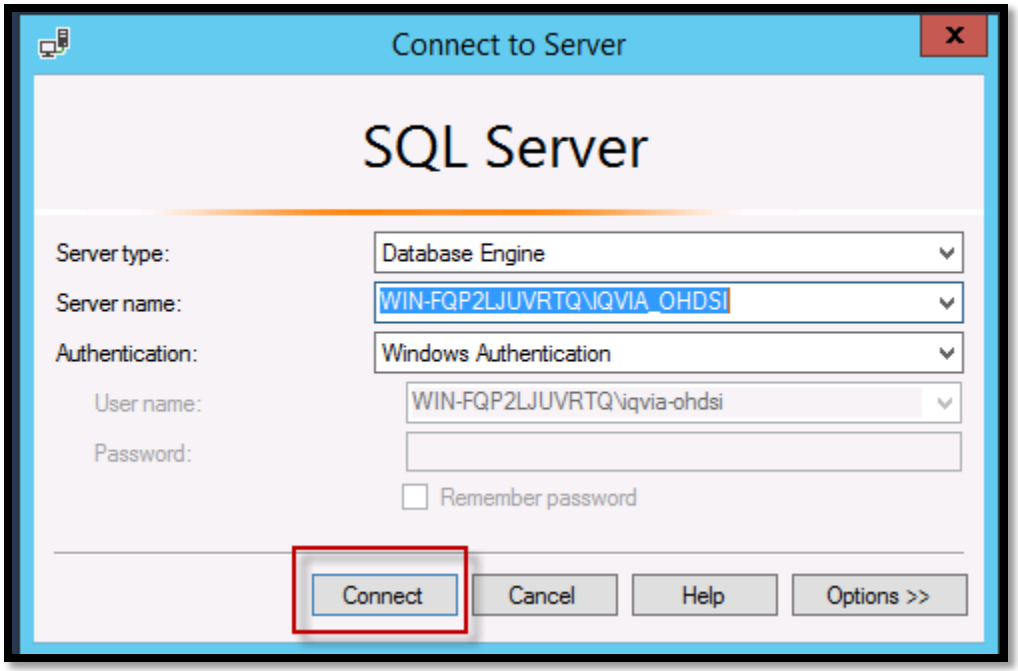
CDM Database: Open Query Tool

- Click on “SQL Server management Studio”



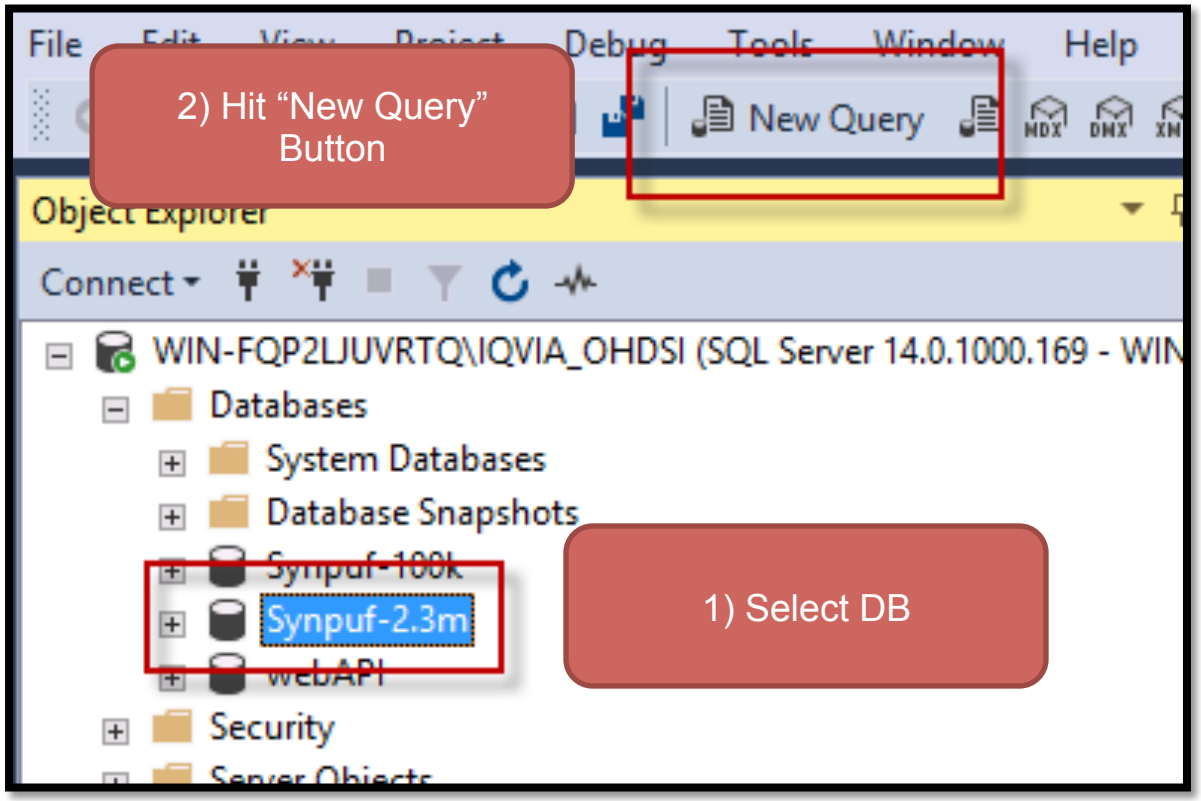


CDM Database: Connect to DB

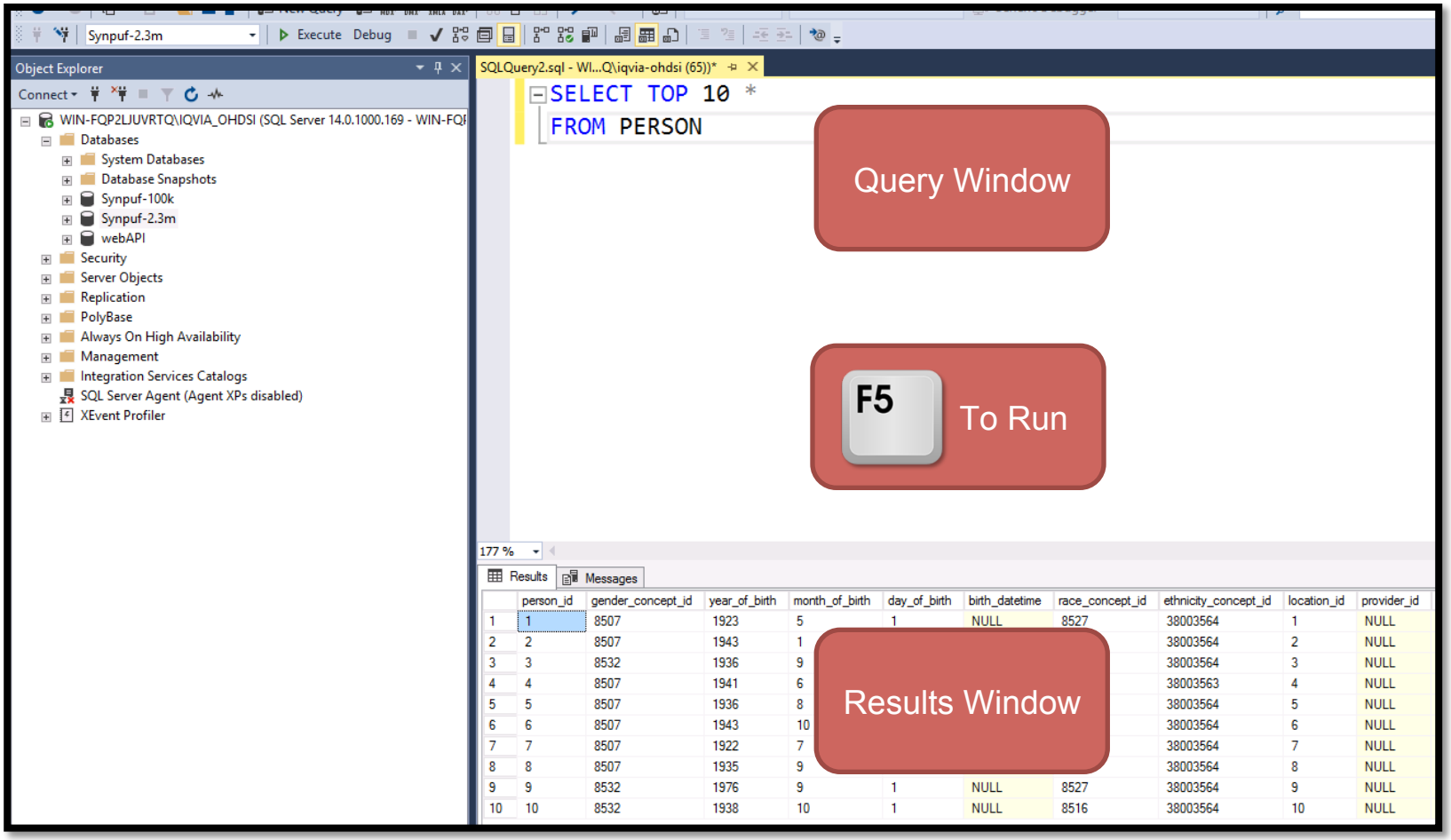


Connect the DB

CDM Database: Open Query Window



OHDSI in a Box



	person_id	gender_concept_id	year_of_birth	month_of_birth	day_of_birth	birth_datetime	race_concept_id	ethnicity_concept_id	location_id	provider_id
1	1	8507	1923	5	1	NULL	8527	38003564	1	NULL
2	2	8507	1943	1				38003564	2	NULL
3	3	8532	1936	9				38003564	3	NULL
4	4	8507	1941	6				38003563	4	NULL
5	5	8507	1936	8				38003564	5	NULL
6	6	8507	1943	10				38003564	6	NULL
7	7	8507	1922	7				38003564	7	NULL
8	8	8507	1935	9				38003564	8	NULL
9	9	8532	1976	9	1	NULL	8527	38003564	9	NULL
10	10	8532	1938	10	1	NULL	8516	38003564	10	NULL

Vocabulary

Basic Relationship, Ancestors, & Descendants

How does it work for Drugs

SQL Examples

OMOP Common Vocabulary Model

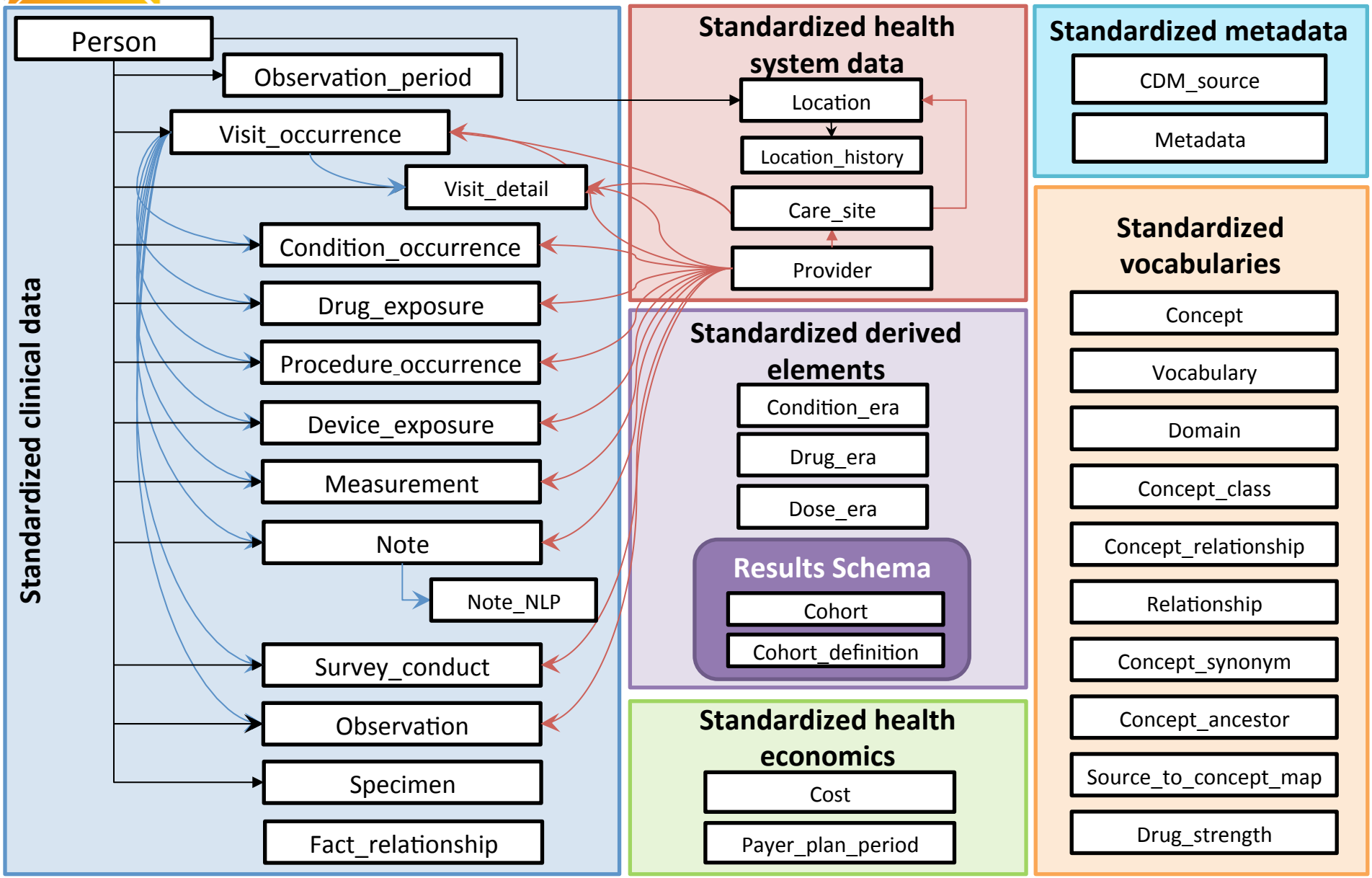
What it is

- **Standardized structure** to house existing vocabularies used in the public domain
- **Compiled standards** from disparate public and private sources and some OMOP-grown concepts

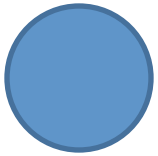
What it's not

- **Static dataset** – the vocabulary updates regularly to keep up with the continual evolution of the sources
- **Finished product** – vocabulary maintenance and improvement is ongoing activity that requires community participation and support

CDM Version 6 Key Domains

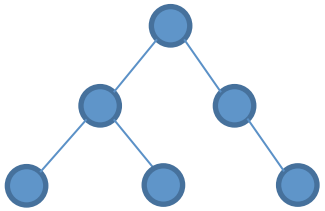


Structure of OMOP Vocabulary



All content: concepts in **`concept`**

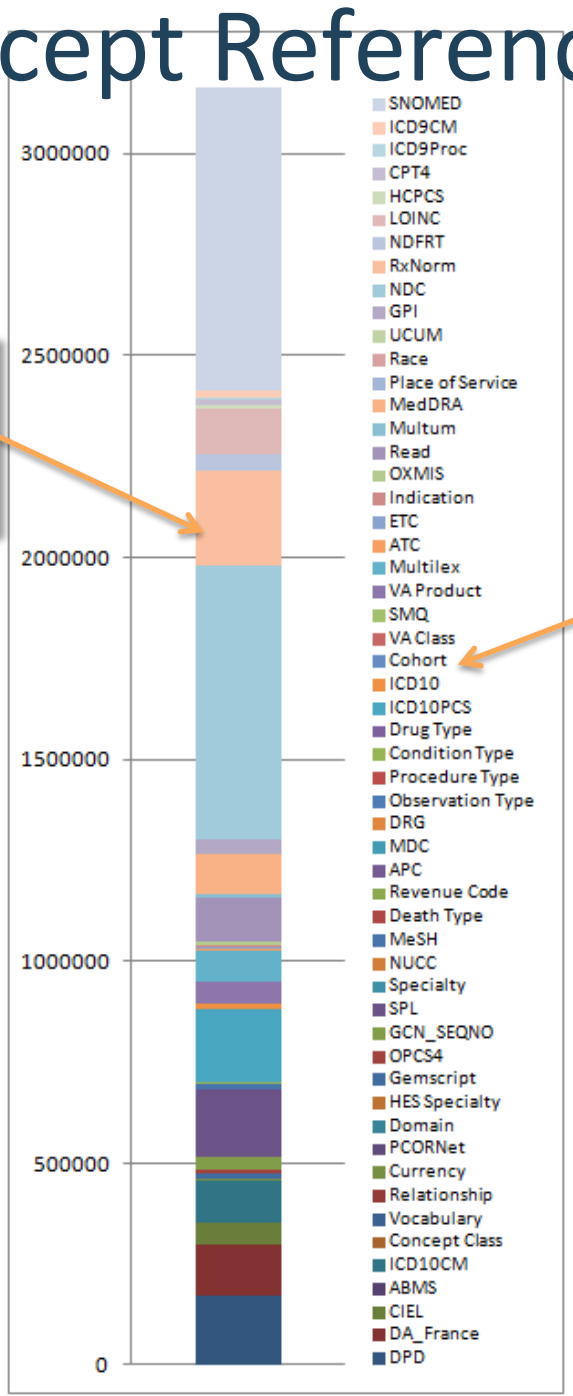
Direct relationships between concepts in **`concept_relationship`**



Multi-step hierarchical relationships pre-processed into **`concept_ancestor`**

Single Concept Reference Table

All vocabularies stacked up in one table



Vocabulary ID

Dozens of schemes, formats, rules

LOINC_248_MULTI-AXIAL_HIERARCHY.CSV

PATH_TO_ROOT	SEQUENCE	IMMEDIATE_PARENT	CODE	CODE_TEXT
	1		LP31755-9	Microbiology
LP31755-9	1	LP31755-9	LP14559-6	Microorganism
LP31755-9.L	1	LP14559-6	LP98185-9	Bacteria
LP31755-9.L	1	LP98185-9	LP14082-9	Bacteria
LP31755-9.				
LP31755-9.				
LP31755-9.				
LP31755-9.				
LP31755-9.				
LP31755-9.				
LP31755-9.				
LP31755-9.				

loinc.csv

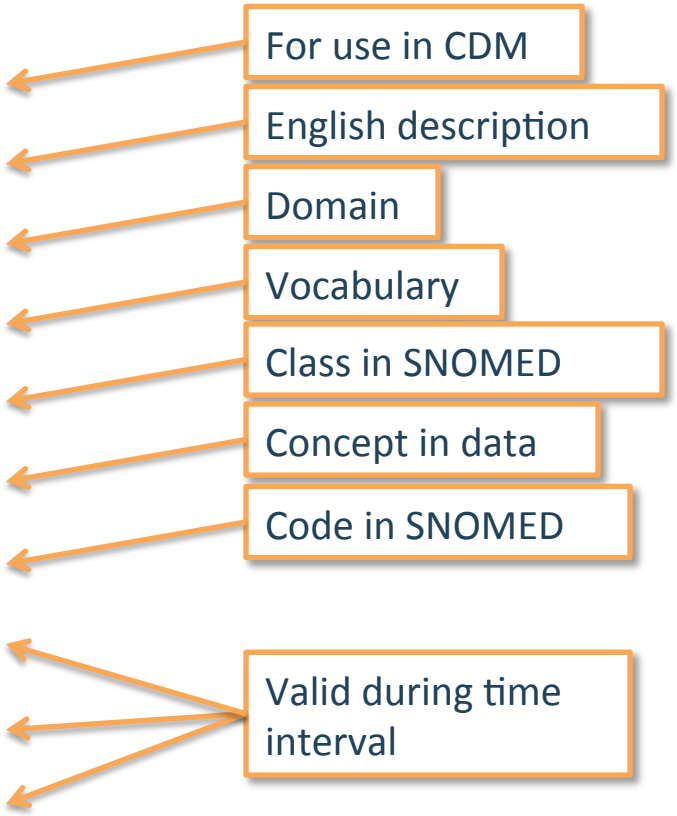
LOINC_NU	COMPONENT	PROPERTY	TIME_ASPCT	SYSTEM	SCALE_TYP	METHOD_TYP	CLASS	SOURCE	DATE_LAST_CH	CHNG_TYP	COMM
10454-7	Xylose^2H post 25 g xylose PO	MCnc	Pt	Ser/Plas	Qn		CHAL	SH	19961220	ADD	
10455-4	Xylose^30M post 25 g xylose PO	MCnc	Pt	Ser/Plas	Qn		CHAL	SH	19961220	ADD	
10456-2	Xylose^post 6H CFst	MCnc	Pt	Ser/Plas	Qn		CHAL	SH	19961220	ADD	
10457-0	Actin Ag						PATH	SH;DL-M	20060706	MIN	
10458-8	Alkaline phosphatase.placer						PATH	DL-M	20060706	MIN	
10459-6	Alpha-1-Fetoprotein Ag										
10460-4	Lactalbumin alpha Ag										
10461-2	Alpha-1-Antichymotrypsin										
1046-2	H NOS Ab										
10462-0	Alpha 1 antitrypsin Ag										
10463-8	Amyloid A component Ag										
10464-6	Amyloid P component Ag										
10465-3	Amyloid.prealbumin Ag										
10466-1	Anion gap 3										

CMS32_DESC_LONG_SHORT_DX.xlsx

DIAGNOSIS CODE	LONG DESCRIPTION	SHORT DESCRIPTION
0010	Cholera due to vibrio cholerae	Cholera d/t vib cholerae
0011	Cholera due to vibrio cholerae el tor	Cholera d/t vib el tor
0019	Cholera, unspecified	Cholera NOS
0020	Typhoid fever	Typhoid fever
0021	Paratyphoid fever A	Paratyphoid fever a
0022	Paratyphoid fever B	Paratyphoid fever b
0023	Paratyphoid fever C	Paratyphoid fever c
0029	Paratyphoid fever, unspecified	Paratyphoid fever NOS
0030	Salmonella gastroenteritis	Salmonella enteritis
0031	Salmonella septicemia	Salmonella septicemia
00320	Localized salmonella infection, unspecified	Local salmonella inf NOS
00321	Salmonella meningitis	Salmonella meningitis
00322	Salmonella pneumonia	Salmonella pneumonia
00323	Salmonella arthritis	Salmonella arthritis
00324	Salmonella osteomyelitis	Salmonella osteomyelitis
00329	Other localized salmonella infections	Local salmonella inf NEC

What's in a Concept

CONCEPT_ID	313217
CONCEPT_NAME	Atrial fibrillation
DOMAIN_ID	Condition
VOCABULARY_ID	SNOMED
CONCEPT_CLASS_ID	Clinical Finding
STANDARD_CONCEPT	S
CONCEPT_CODE	49436004
VALID_START_DATE	01-Jan-1970
VALID_END_DATE	31-Dec-2099
INVALID_REASON	



MiniSentinel in use: Dabigatran and bleeding

Dabigatran and Postmarketing Reports of Bleeding

Mary Ross Southworth, Pharm.D., Marsha E. Reichman, Ph.D., and Ellis F. Unger, M.D.

N Engl J Med 2013; 368:1272-1274

Intracranial and Gastrointestinal Bleeding Events in New Users of Dabigatran and Warfarin from the Mini-Sentinel Distributed Database, October 2010 through December 2011.*

Analysis	Dabigatran			Warfarin		
	No. of Patients	No. of Events	Incidence (no. of events/ 100,000 days at risk)	No. of Patients	No. of Events	Incidence (no. of events/ 100,000 days at risk)
Gastrointestinal hemorrhage						
Analysis with required diagnosis of atrial fibrillation	10,599	16	1.6	43,541	160	3.5
Sensitivity analysis without required diagnosis of atrial fibrillation	12,195	19	1.6	119,940	338	3.1
Intracranial hemorrhage						
Analysis with required diagnosis of atrial fibrillation	10,587	8	0.8	43,594	109	2.4
Sensitivity analysis without required diagnosis of atrial fibrillation	12,182	10	0.9	120,020	204	1.9

All Content in CDM is Coded as Concepts

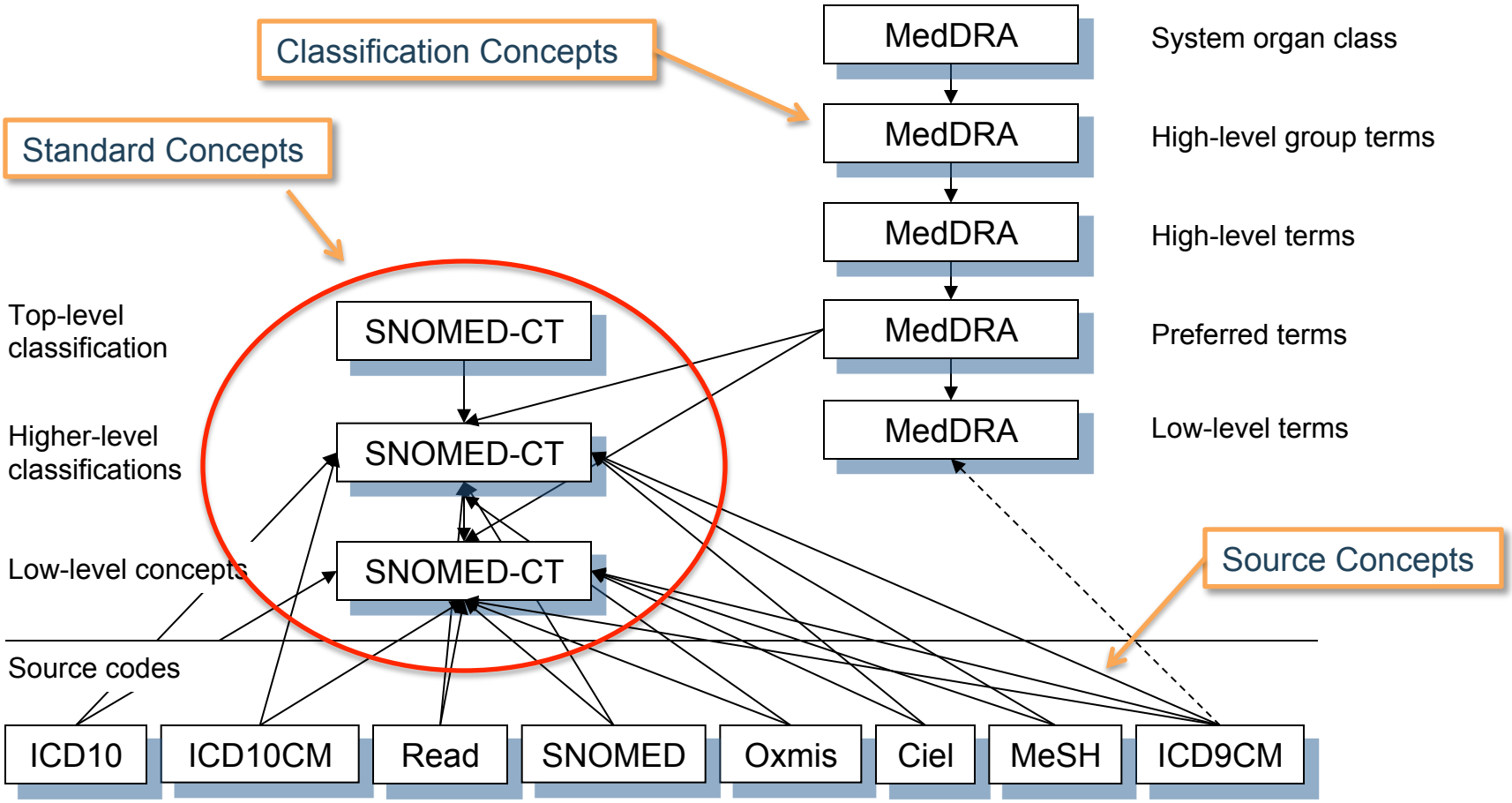
- Concepts are referred to by concept_id

- All details are in the **CONCEPT** table:

```
SELECT *
FROM concept
WHERE concept_id = 313217
```

concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code	valid_start_date	valid_end_date	invalid_reason
313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004	1970-01-01	2099-12-31	NULL

Condition Concepts



Finding the Right Concept #1

1. ..if I know the **ID**

```
SELECT * FROM concept WHERE concept_id = 313217
```

CONCEPT_ID	CONCEPT_ NAME	DOMAIN_ID	VOCABULARY _ID	CONCEPT_ CLASS_ID	STANDARD_ CONCEPT	CONCEPT_ CODE	VALID_START _DATE	VALID_END _DATE	INVALID _REASON
313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004	01-Jan-1970	31-Dec-2099	

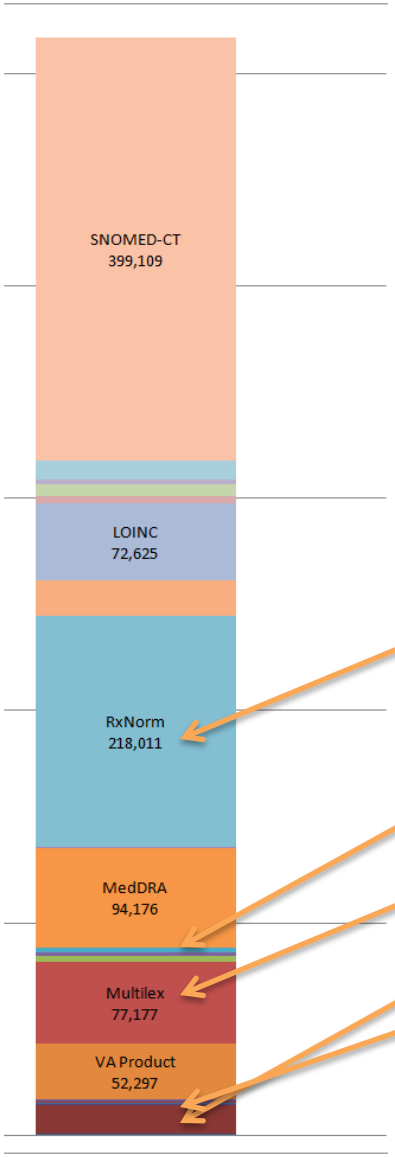
SNOMED code

2. ..if I know the **code**

```
SELECT * FROM concept WHERE concept_code = '49436004'
```

CONCEPT_ID	CONCEPT_ NAME	DOMAIN_ID	VOCABULARY _ID	CONCEPT_ CLASS_ID	STANDARD_ CONCEPT	CONCEPT_ CODE	VALID_START _DATE	VALID_END _DATE	INVALID _REASON
313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004	01-Jan-1970	31-Dec-2099	

Concept ID versus Concept Code




```
SELECT *
FROM concept
WHERE concept_code = '1001';
```

Same code

Concept_Name	Concept Class	Vocabulary_ID	Concept_Code
Antipyrine	Ingredient	RxNorm	1001
Aceprometazine maleate	Ingredient	BDPM	1001
Serum	Specimen	CIEL	1001
methixene hydrochloride	Ingredient	Multilex	1001
Brompheniramine Maleate, 10 mg/mL injectable solution	Multum	Multum	1001
ABBOTT COLD SORE BALM 4%/0.06% W/	Drug Product	LPD_Australia	1001
Residential Treatment - Psychiatric	Revenue Code	Revenue Code	1001

Finding the Right Concept #2

3. ..if I know the **name**

```
SELECT * FROM concept WHERE concept_name = 'Atrial fibrillation';
```

CONCEPT _ID	CONCEPT_ NAME	DOMAIN _ID	VOCABULARY _ID	CONCEPT_ CLASS_ID	STANDARD_ CONCEPT	CONCEPT_ CODE
313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004
44821957	Atrial fibrillation	Condition	ICD9CM	5-dig billing code		427.31
35204953	Atrial fibrillation	Condition	MedDRA	PT	C	10003658
45500085	Atrial fibrillation	Condition	Read	Read		G573000
45883018	Atrial fibrillation	Meas Value	LOINC	Answer	S	LA17084-7

Finding the Right Concept #3

1. if don't know any of this, but I know the code in another vocabulary

ICD-9 is not a Standard Concept

```
SELECT * FROM concept WHERE concept_code = '427.31';
```

CONCEPT _ID	CONCEPT_ NAME	DOMAIN _ID	VOCABULARY _ID	CONCEPT_ CLASS_ID	STANDARD_ CONCEPT	CONCEPT_ CODE
44821957	Atrial fibrillation	Condition	ICD9CM	5-dig billing code		427.31

```
SELECT * FROM concept_relationship WHERE concept_id_1 = 44821957;
```

Mapping to different vocabularies

Kind of relationship

_ID_1	CONCEPT _ID_2	RELATIONSHIP _ID	VALID_START _DATE	VALID_END _DATE	INVALID _REASON
44821957	21001551	ICD9CM - FDB Ind	01-Oct-13	31-Dec-2099	
44821957	35204953	ICD9CM - MedDRA	01-Jan-70	31-Dec-2099	
44821957	44824248	Is a	01-Oct-14	31-Dec-2099	
44821957	44834731	Is a	01-Oct-14	31-Dec-2099	
44821957	313217	Maps to	01-Jan-70	31-Dec-2099	

Why are we mapping?

LANGUAGES

Supporting language learning and linguistic diversity

European Commission > Languages > Policy > Linguistic diversity

Official languages of the EU

What is it?

The European Union has 24 official and working languages. They are:

Bulgarian	French	Maltese
Croatian	German	Polish
Czech	Greek	Portuguese
Danish	Hungarian	Romanian
Dutch	Irish	Slovak
English	Italian	Slovenian
Estonian	Latvian	Spanish
Finnish	Lithuanian	Swedish

What is the Commission doing?

With a permanent staff of 1,750 linguists and 600 support staff, the Commission has one of the largest translation services in the world, bolstered by a further 600 full-time and 3,000 freelance interpreters.

How many different ways do you express one meaning?

Cheers

Mapping = Translating

Step 1. Lookup the Source Concept

```
SELECT * FROM concept WHERE concept_code = '427.31';
```

CONCEPT _ID	CONCEPT_ NAME	DOMAIN _ID	VOCABULARY _ID	CONCEPT_ CLASS_ID	STANDARD_ CONCEPT	CONCEPT_ CODE
44821957	Atrial fibrillation	Condition	ICD9CM	5-dig billing code		427.31

Step 2. Translate to Standard

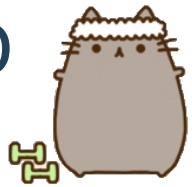
```
SELECT * FROM concept_relationship WHERE concept_id_1 = 44821957 AND
    relationship_id = 'Maps to';
```

CONCEPT _ID_1	CONCEPT _ID_2	RELATIONSHIP _ID	VALID_START _DATE	VALID_END _DATE	INVALID _REASON
44821957	313217	Maps to	01-Jan-1970	31-Dec-2099	

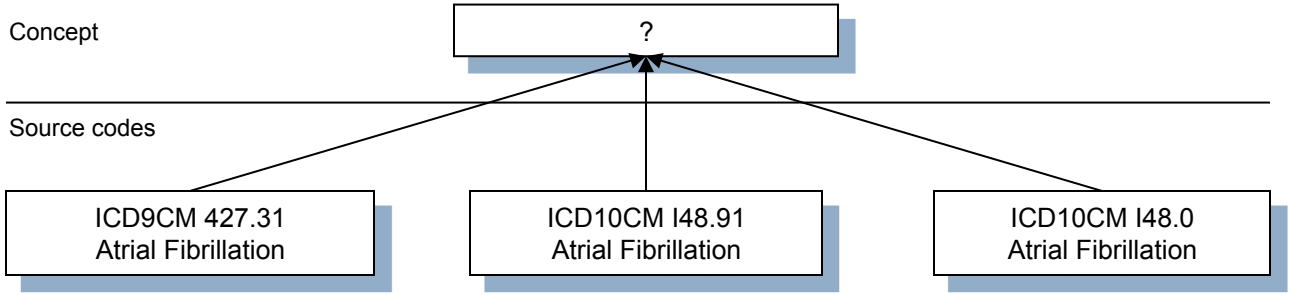
Step 3. Check out the translated Concept

```
SELECT * FROM concept WHERE concept_id = 313217;
```

Exercise: Find Standard Concept ID from Source Concept



```
ICD9:    '427.31'  :      313217
ICD10CM: 'I48.91'  :      313217
ICD10:   'I48.0'   :      4154290 'Paroxysmal Atrial Fibrillation'
```



Step 1. Lookup

```
SELECT * FROM concept WHERE concept_code = ...;
```

Step 2. Translate

```
SELECT * FROM concept_relationship WHERE concept_id_1 = ...
AND relationship_id = 'Maps to';
```

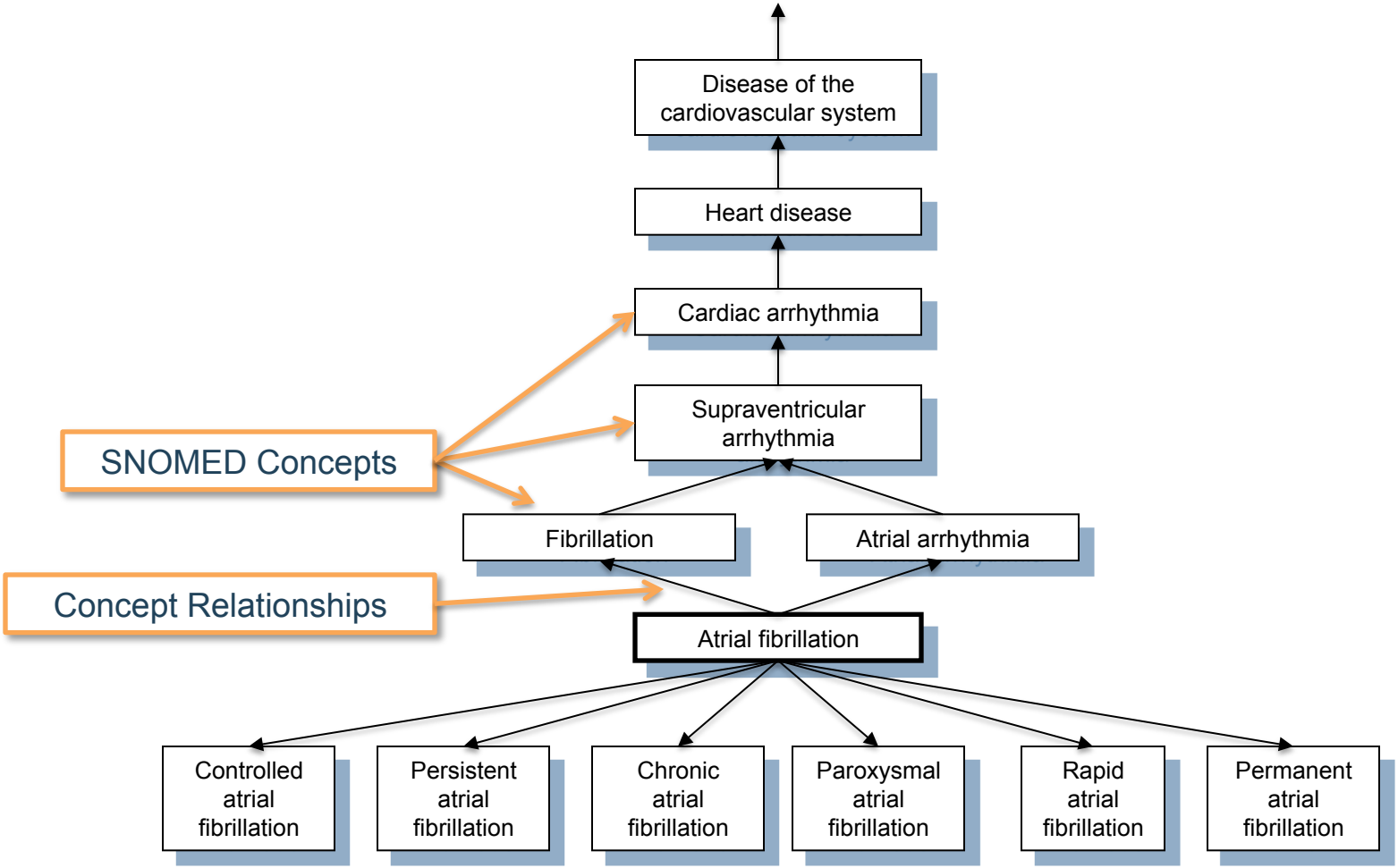
Step 3. Check out

```
SELECT * FROM concept WHERE concept_id = ...;
```

Break

Please return in 15 minutes

Reason #2: Disease Hierarchy



Exploring Relationships

```
SELECT *
FROM concept_relationship
WHERE concept_id_1 = 313217
```

CONCEPT _ID_1	CONCEPT _ID_2	RELATIONSHIP _ID
313217	4232697	Subsumes
313217	4181800	Focus of
313217	35204953	SNOMED - MedDRA eq
313217	4203375	Asso finding of
313217	4141360	Subsumes
313217	4119601	Subsumes
313217	4117112	Subsumes
313217	4232691	Subsumes
313217	4139517	Due to of
313217	4194288	Asso finding of
313217	44782442	Subsumes
313217	44783731	Focus of
313217	21003018	SNOMED - ind/CI
313217	40248987	SNOMED - ind/CI
313217	21001551	SNOMED - ind/CI
313217	21001540	SNOMED - ind/CI
313217	45576876	Mapped from
313217	44807374	Asso finding of
313217	21013834	SNOMED - ind/CI
313217	21001572	SNOMED - ind/CI
313217	21001606	SNOMED - ind/CI
313217	21003176	SNOMED - ind/CI
313217	4226399	Is a
313217	500001801	SNOMED - HOI
313217	500002401	SNOMED - HOI
313217	4119602	Subsumes
313217	40631039	Subsumes
313217	4108832	Subsumes
313217	21013671	SNOMED - ind/CI
313217	21013390	SNOMED - ind/CI
313217	313217	Maps to
313217	44821957	Mapped from
313217	2617597	Mapped from
313217	45500085	Mapped from
313217	313217	Mapped from
313217	45951191	Mapped from
313217	21013856	SNOMED - ind/CI
313217	21001575	SNOMED - ind/CI
313217	21001594	SNOMED - ind/CI

Related Concepts

Relationship ID

Exploring Relationships

```
SELECT cr.relationship_id, c.*
FROM concept_relationship cr
JOIN concept c ON cr.concept_id_2 = c.concept_id
WHERE cr.concept_id_1 = 313217
```

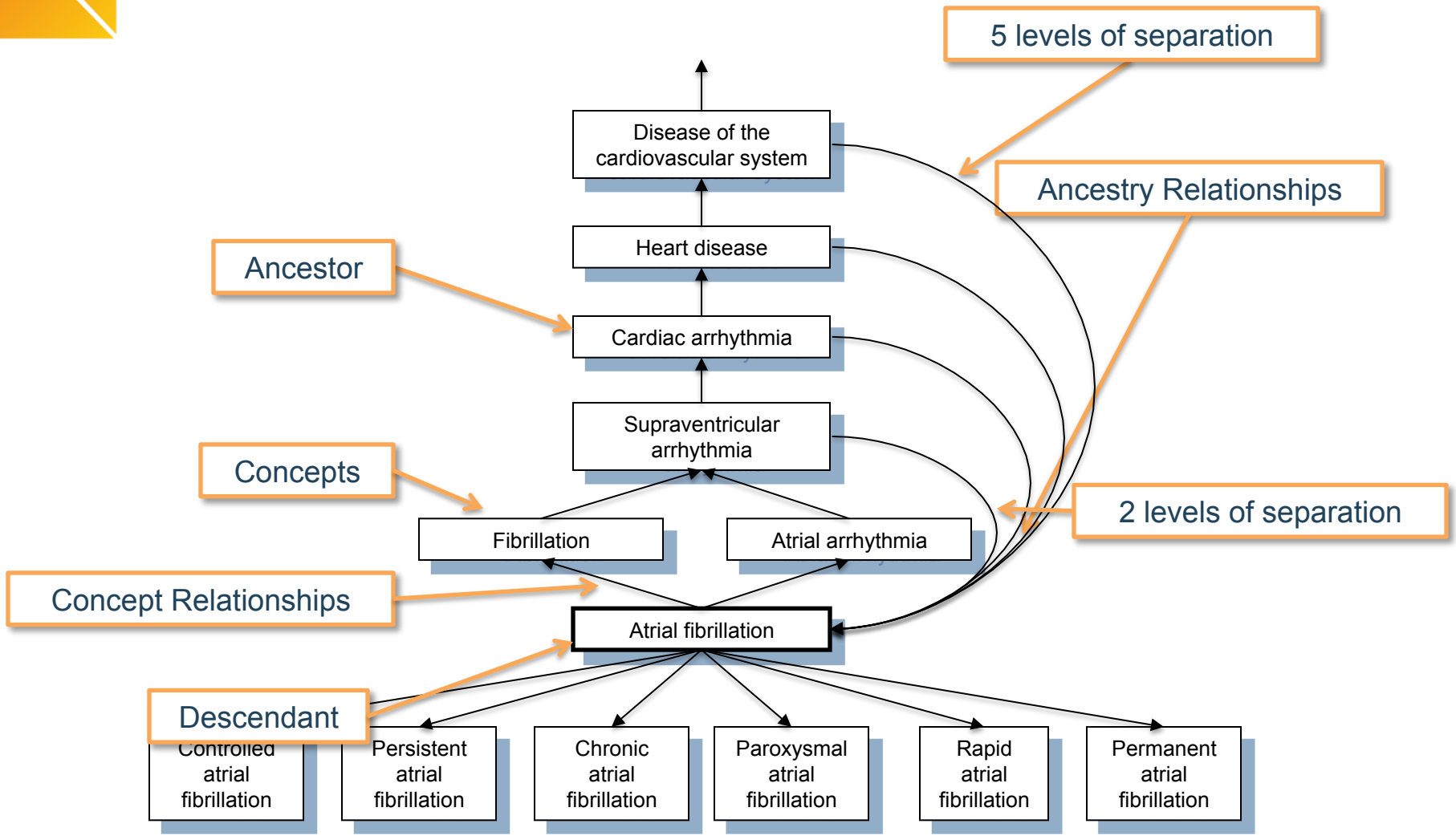
Find out related concept

Ancestor concepts

relationship_id	concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code	valid_start_date	valid_end_date	invalid_reason
Asso finding of	4194288		Observation	SNOMED	Context-dependent	S	312442005	1/1/1970 0:00	12/31/2099 0:00	NULL
Asso finding of	4203375		Observation	SNOMED	Context-dependent	S	433276002	1/31/2009 0:00	12/31/2099 0:00	NULL
Asso finding of	42689685	Atrial fibrillation not d[illegible]cted	Observation	SNOMED	Context-dependent	S	1.06706E+15	4/1/2017 0:00	12/31/2099 0:00	NULL
Asso finding of	44807374	Atrial fibrillation excluded	Observation	SNOMED	Context-dependent	S	8.16401E+14	4/1/2014 0:00	12/31/2099 0:00	NULL
Concept poss_eq from	40323929	Fibrillation - atrial	Condition	SNOMED	Clinical Finding	NULL	155364009	1/1/1970 0:00	3/11/2016 0:00	U
Concept poss_eq from	40345197	Fibrillation - atrial	Condition	SNOMED	Clinical Finding	NULL	266306001	1/1/1970 0:00	3/11/2016 0:00	U
Due to of	4139524	Transient cerebral ischemia due to atrial fibrillation	Condition	SNOMED	Clinical Finding	S	426814001	1/1/1970 0:00	12/31/2099 0:00	NULL
Focus of	4270991	Insertion of pacemaker for control of atrial fibrillation	Procedure	SNOMED	Procedure	S	449863006	1/31/2012 0:00	12/31/2099 0:00	NULL
Has finding site	4242112	Atrial structure	Spec Anatomic Site	SNOMED	Body Structure	S	59652004	1/1/1970 0:00	12/31/2099 0:00	NULL
Is a	4226399	Fibrillation	Condition	SNOMED	Clinical Finding	S	40593004	1/1/1970 0:00	12/31/2099 0:00	NULL
Is a	4068155	Atrial arrhythmia	Condition	SNOMED	Clinical Finding	S	17366009	1/1/1970 0:00	12/31/2099 0:00	NULL
Mapped from	40323929	Fibrillation - atrial	Condition	SNOMED	Clinical Finding	NULL	155364009	1/1/1970 0:00	3/11/2016 0:00	U
Mapped from	2617597	Patient with heart failure and atrial fibrillation documented to be on warfarin therapy	Observation	HCPCS	HCPCS	NULL	G8183	1/1/1970 0:00	11/11/2014 0:00	D
Mapped from	45576876	Unspecified atrial fibrillation	Condition	ICD10CM	5-char billing code	NULL	I48.91	12/30/2006 0:00	12/31/2099 0:00	NULL
Mapped from	45500085	Atrial fibrillation	Condition	Read	Read	NULL	G573000	1/1/1970 0:00	12/31/2099 0:00	NULL
Mapped from	45611600	Atrial Fibrillation	Condition	MeSH	Main Heading	NULL	D001281	1/1/1970 0:00	12/31/2099 0:00	NULL
Mapped from	40345197	Fibrillation - atrial	Condition	SNOMED	Clinical Finding	NULL	266306001	1/1/1970 0:00	3/11/2016 0:00	U
Mapped from	45951191	Atrial Fibrillation	Condition	CIEL	Diagnosis	NULL	148203	11/3/2007 0:00	12/31/2099 0:00	NULL
Mapped from	313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004	1/1/1970 0:00	12/31/2099 0:00	NULL
Mapped from	44821957	Atrial fibrillation	Condition	ICD9CM	5-dig billing code	NULL	427.31	1/1/1970 0:00	12/31/2099 0:00	NULL
Maps to	313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004	1/1/1970 0:00	12/31/2099 0:00	NULL
SNOMED - HOI	500002401	OMOP Atrial Fibrillation 1	Condition	Cohort	Cohort	C	500002401	1/1/1970 0:00	12/31/2099 0:00	NULL
SNOMED - HOI	500001801	OMOP Qt Prolongation/Torsade De Pointes 1	Condition	Cohort	Cohort	C	500001801	1/1/1970 0:00	12/31/2099 0:00	NULL
SNOMED - ind/CI	21005673	Prevention of Thromboembolism in Chronic Atrial Fibrillation	Drug	Indication	Indication	C	5673	1/1/1970 0:00	12/31/2099 0:00	NULL
SNOMED - ind/CI	21003176	Tachyarrhythmia	Drug	Indication	Indication	C	3176	1/1/1970 0:00	12/31/2099 0:00	NULL
SNOMED - ind/CI	21001542	Supraventricular Tachycardia	Drug	Indication	Indication	C	1542	1/1/1970 0:00	12/31/2099 0:00	NULL
SNOMED - ind/CI	21001594	Disease of Cardiovascular System	Drug	Indication	Indication	C	1594	1/1/1970 0:00	12/31/2099 0:00	NULL
SNOMED - MedDRA eq	35204953	Atrial fibrillation	Condition	MedDRA	PT	C	10003658	1/1/1970 0:00	12/31/2099 0:00	NULL
Subsumes	4117112	Controlled atrial fibrillation	Condition	SNOMED	Clinical Finding	S	300996004	1/1/1970 0:00	12/31/2099 0:00	NULL
Subsumes	4119601	Lone atrial fibrillation	Condition	SNOMED	Clinical Finding	S	233910005	1/1/1970 0:00	12/31/2099 0:00	NULL
Subsumes	4232697	Persistent atrial fibrillation	Condition	SNOMED	Clinical Finding	S	440059007	1/31/2009 0:00	12/31/2099 0:00	NULL
Subsumes	4141360	Chronic atrial fibrillation	Condition	SNOMED	Clinical Finding	S	426749004	1/1/1970 0:00	12/31/2099 0:00	NULL
Subsumes	44782442	Atrial fibrillation with rapid ventricular response	Condition	SNOMED	Clinical Finding	S	1.20041E+14	1/31/2014 0:00	12/31/2099 0:00	NULL
Subsumes	4199501	Rapid atrial fibrillation	Condition	SNOMED	Clinical Finding	S	314208002	1/1/1970 0:00	12/31/2099 0:00	NULL
Subsumes	4119602	Non-rheumatic atrial fibrillation	Condition	SNOMED	Clinical Finding	S	233911009	1/1/1970 0:00	12/31/2099 0:00	NULL

Descendant concepts

Ancestry Relationships: Higher-Level Relationships



Exploring Ancestors of a Concept

```
SELECT max_levels_of_separation, concept.*
FROM concept_ancestor
JOIN concept ON ancestor_concept_id = concept_id
WHERE descendant_concept_id = 313217 /* Atrial fibrillation */
ORDER BY max_levels_of_separation
```

max_levels_of_separation	concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept
0	313217	Atrial fibrillation	Co			
0	35204953	Atrial fibrillation	Co			
1	4226399	Fibrillation	Condition	SNOMED	Clinical Finding	S
1	4068155	Atrial arrhythmia	Condition	SNOMED	Clinical Finding	S
1	35204969	Cardiac fibrillation	Condition	MedDRA	PT	C
2	4248028	Supraventricular arrhythmia	Condition	SNOMED	Clinical Finding	S
2	35204952	Arrhythmia supraventricular	Condition	MedDRA	PT	C
2	35202454	Rate and rhythm disorders NEC	Condition	MedDRA	HLT	C
3	44784217	Cardiac arrhythmia	Condition	SNOMED	Clinical Finding	S
3	35202455	Supraventricular arrhythmias	Condition	MedDRA	HLT	C
4	321588	Heart disease	Condition	SNOMED	Clinical Finding	S
4	35204989	Cardiac disorder	Condition	MedDRA	PT	C
4	35202050	Cardiac arrhythmias	Condition	MedDRA	HLGT	C
5	4103183	Cardiac finding	Condition	SNOMED	Clinical Finding	S
5	440142	Disorder of mediastinum	Condition	SNOMED	Clinical Finding	S
5	134057	Disorder of cardiovascular system	Condition	SNOMED	Clinical Finding	S
5	35204998	Cardiovascular disorder	Condition	MedDRA	PT	C
5	37219970	Mediastinal disorder	Condition	MedDRA	PT	C
5	37622411	Phlebosclerosis	Condition	MedDRA	PT	C
5	35202457	Cardiac disorders NEC	Condition	MedDRA	HLT	C
6	4115390	Mediastinal finding	Condition	SNOMED	Clinical Finding	S
6	4023995	Cardiovascular finding	Condition	SNOMED	Clinical Finding	S

Hold the descendant

Exploring Descendants of a Concept

```
SELECT max_levels_of_separation, concept.*
FROM concept_ancestor
JOIN concept ON descendant_concept_id = concept_id
WHERE ancestor_concept_id = 44784217 /* cardiac arrythmia */
ORDER BY max_levels_of_separation
```

Hold the ancestor

MAX_LEVELS_OF_SEPARATION	CONCEPT_ID	CONCEPT_NAME	DOMAIN_ID	VOCABULARY_ID	CONCEPT_CLASS_ID	STANDARD_CONCEPT
0	44784217	Cardiac arrhythmia	Condition	SNOMED	Clinical Finding	S
1	313224	Anomalous atrioventricular excitation	Condition	SNOMED	Clinical Finding	S
1	315643	Tachyarrhythmia	Condition	SNOMED	Clinical Finding	S
1	316429	Premature beats	Condition	SNOMED	Clinical Finding	S
1	316999	Conduction disorder of the heart	Condition	SNOMED	Clinical Finding	S
1	321042	Cardiac arrest	Condition	SNOMED	Clinical Finding	S
1	4030583	Pacemaker twiddler's syndrome	Condition	SNOMED	Clinical Finding	S
1	4057008	Accelerated atrioventricular conduction	Condition	SNOMED	Clinical Finding	S
1	4086313	Withdrawal arrhythmia	Condition	SNOMED	Clinical Finding	S
1	4088507	Ventricular escape complex	Condition	SNOMED	Clinical Finding	S
1	4088986	Atrial escape complex	Condition	SNOMED	Clinical Finding	S
1	4091901	Aberrant premature complexes	Condition	SNOMED	Clinical Finding	S
1	4092011	Aberrantly conducted complex	Condition	SNOMED	Clinical Finding	S
1	4124704	Postoperative sinoatrial disease	Condition	SNOMED	Clinical Finding	S
1	4143042	Ectopic beats	Condition	SNOMED	Clinical Finding	S
1	4164083	Ectopic rhythm	Condition	SNOMED	Clinical Finding	S
1	4172863	Fetal dysrhythmia	Condition	SNOMED	Clinical Finding	S
1	4173170	Neonatal dysrhythmia	Condition	SNOMED	Clinical Finding	S
1	4175473	Atrioventricular dissociation	Condition	SNOMED	Clinical Finding	S
1	4185572	Ventricular arrhythmia	Condition	SNOMED	Clinical Finding	S
1	4217221	Nodal rhythm disorder	Condition	SNOMED	Clinical Finding	S
1	4226399	Fibrillation	Condition	SNOMED	Clinical Finding	S
1	4228448	Bradyarrhythmia	Condition	SNOMED	Clinical Finding	S

Let Us find Upper Gastrointestinal Bleeding

1. Find some initiation concept

```
SELECT * FROM concept WHERE concept_name = 'Upper gastrointestinal bleeding'
```

concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
42891225	Upper gastrointest...	Condition	MedDRA	LLT	C	10071910

2. Find standard concepts

```
SELECT * FROM concept WHERE lower(concept_name) LIKE '%upper gastrointestinal%'
  AND domain_id = 'Condition' AND standard_concept = 'S'
```

concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
4308202	Acute upper gastrointestinal hemorrhage	Condition	SNOMED	Clinical Finding	S	38938002
4291649	Upper gastrointestinal hemorrhage	Condition	SNOMED	Clinical Finding	S	37372002
4115581	Finding of upper gastrointestinal gas	Condition	SNOMED	Clinical Finding	S	300370006
4103011	Chronic upper gastrointestinal hemorrhage	Condition	SNOMED	Clinical Finding	S	25349007
4012503	Excessive upper gastrointestinal gas	Condition	SNOMED	Clinical Finding	S	162076009
4000609	Disorder of upper gastrointestinal tract	Condition	SNOMED	Clinical Finding	S	119291004
4332645	Upper gastrointestinal hemorrhage associated with hypercoagulability state	Condition	SNOMED	Clinical Finding	S	430349003

Going up the hierarchy: Finding the right concept

```
SELECT max_levels_of_separation, concept.*
FROM concept_ancestor
JOIN concept ON ancestor_concept_id = concept_id
WHERE descendant_concept_id = 4332645 /* Upper gastrointestinal hemorrhage associated...*/
ORDER BY max_levels_of_separation
```

Hold the descendant

max_levels_of_separation	concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
0	4332645	Upper gastrointestinal hemorrhage associated with hypercoag	Condition	SNOMED	Clinical Finding	S	430349003
1	35708054	Gastritis haemorrhagic	Condition	MedDRA	PT	C	10017866
1	4291649	Upper gastrointestinal hemorrhage	Condition	SNOMED	Clinical Finding	S	37372002
1	35707871	Upper gastrointestinal haemorrhage	Condition	MedDRA	PT	C	10046274
2	35707864	Gastrointestinal haemorrhage	Condition	MedDRA	PT	C	10017955
2	4000609	Disorder of upper gastrointestinal tract	Condition	SNOMED	Clinical Finding	S	119291004
2	35707858	Intestinal haemorrhage	Condition	MedDRA	PT	C	10059175
2	35702752	Gastritis (excl infective)	Condition	MedDRA	HLT	C	10017854
2	192671	Gastrointestinal hemorrhage	Condition	SNOMED	Clinical Finding	S	74474003
3	37604042	Gastrointestinal haemorrhages	Condition	MedDRA	HLT	C	10052742
3	37622518	Haemorrhage	Condition	MedDRA	PT	C	10055798
3	437312	Bleeding	Condition	SNOMED	Clinical Finding	S	131148009
3	4198525	Disorder of upper digestive tract	Condition	SNOMED	Clinical Finding	S	50410009
3	37622515	Extravasation blood	Condition	MedDRA	PT	C	10015867
3	4000610	Disorder of gastrointestinal tract	Condition	SNOMED	Clinical Finding	S	119292006
3	35702116	Gastrointestinal inflammatory conditions	Condition	MedDRA	HLGT	C	10017969
3	35702743	Intestinal haemorrhages	Condition	MedDRA	HLT	C	10022653
3	35702744	Non-site specific gastrointestinal haemorrhages	Condition	MedDRA	HLT	C	10017958
4	35702114	Gastrointestinal haemorrhages NEC	Condition	MedDRA	HLGT	C	10017959
4	4304916	Gastrointestinal tract finding	Condition	SNOMED	Clinical Finding	S	386618008
4	35702767	Nausea and vomiting symptoms	Condition	MedDRA	HLT	C	10028817

Going down the hierarchy : Checking the right content

```
SELECT max_levels_of_separation, concept.*
FROM concept_ancestor
JOIN concept ON descendant_concept_id = concept_id
WHERE ancestor_concept_id = 4291649 /* Upper gastrointestinal hemorrhage */
ORDER BY max_levels_of_separation
```

max_levels_of_separation	concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
0	4291649	Upper gastrointestinal hemorrhage	Condition	SNOMED	Clinical Finding	S	37372002
1	4318535	Duodenal hemorrhage					
1	23245	Esophageal bleeding					
1	4308202	Acute upper gastrointestinal hemorrhage					
1	4271696	Peptic ulcer with hemorrhage	Condition	SNOMED	Clinical Finding	S	64121000
1	4103011	Chronic upper gastrointestinal hemorrhage	Condition	SNOMED	Clinical Finding	S	25349007
1	26727	Hematemesis	Condition	SNOMED	Clinical Finding	S	8765009
1	4332645	Upper gastrointestinal hemorrhage associated with hypercoag	Condition	SNOMED	Clinical Finding	S	430349003
1	193250	Gastric hemorrhage	Condition	SNOMED	Clinical Finding	S	61401005
2	4131525	Hemorrhagic gastropathy	Condition	SNOMED	Clinical Finding	S	413218001
2	4204041	Hematemesis - cause unknown	Condition	SNOMED	Clinical Finding	S	308904008
2	4134808	Hemorrhagic duodenopathy	Condition	SNOMED	Clinical Finding	S	413212000
2	4260059	Hemorrhagic gastroenteritis	Condition	SNOMED	Clinical Finding	S	409506009
2	4099014	Duodenal ulcer with hemorrhage	Condition	SNOMED	Clinical Finding	S	27281001
2	46270145	Gastric hemorrhage due to atrophic gastritis	Condition	SNOMED	Clinical Finding	S	1.5072E+14
2	4096032	Duodenal hematoma	Condition	SNOMED	Clinical Finding	S	262843005
2	4174044	Chronic peptic ulcer with hemorrhage	Condition	SNOMED	Clinical Finding	S	49232000
2	4095555	Esophageal hematoma	Condition	SNOMED	Clinical Finding	S	262790002
2	46269904	Hemorrhage of duodenum co-occurrent and due to diverticulo	Condition	SNOMED	Clinical Finding	S	1.0866E+15
2	45768629	Gastric hemorrhage due to erosive gastritis	Condition	SNOMED	Clinical Finding	S	7.071E+12

Concept 4291649 and all its descendants comprise Upper GI Bleeding

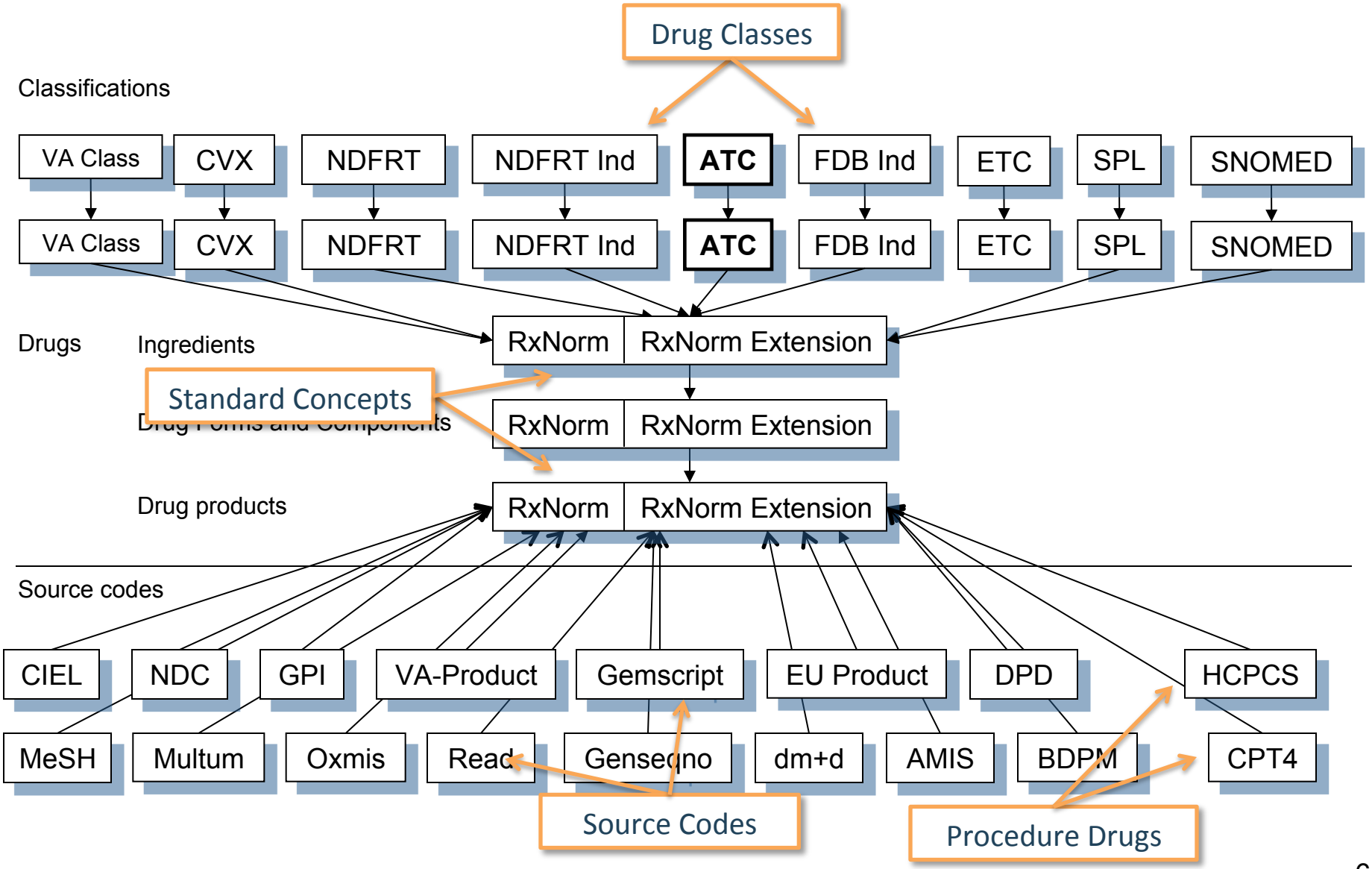
Exercise: Find Standard Concept ID for Conditions

- Asthma — 317009
- Plague — 434271
- Ingrown toenail — 4065236, 4290993
- Your favorite condition here

Does it Work that Way with Drugs?

- Codes
  - NDC, GPI, Multilex, HCPCS, etc.
- Concepts
  - Drug products (Generic and Brand)
  - Drug ingredients
  - Drug Classes
- Relationships
- Ancestry

Drug Hierarchy



Lunch

Please return in 1 hour

Let us find Warfarin

1. Find active compound Warfarin by keyword

```
SELECT * FROM concept WHERE lower(concept_name) = 'warfarin'
```

concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
21253542	Warfarin	Drug	dm+d	VTM	NULL	48603004
40772658	Warfarin	Measurement	LOINC	LOINC Hierarchy	C	LP16309-4
1847834	WARFARIN	Drug	DA_France	Ingredient	NULL	OMOP13547
4293218	WARFARIN	Drug	NDFRT	Pharma Preparation	NULL	N0000148057
35715898	WARFARIN	Drug	LPD_Australia	Ingredient	NULL	OMOP582219
43081820	warfarin	Drug	Multilex	Ingredient	NULL	2849
4187015	Warfarin	Drug	SNOMED	Substance	NULL	372756006
43343324	Warfarin	Drug	AMT	AU Substance	NULL	2714011000036109
4174989	Warfarin	Drug	SNOMED	Pharma/Biol Product	NULL	48603004
4325514	Warfarin	Drug	NDFRT	Chemical Structure	C	N0000006403
1310149	Warfarin	Drug	RxNorm	Ingredient	S	11289
21600965	warfarin	Drug	ATC	ATC 5th	C	B01AA03
45618204	Warfarin	Drug	MeSH	Main Heading	NULL	D014859

Let us find Clopidogrel

1. Find drug product containing Clopidogrel by NDC code:

   Bristol Meyer Squibb's Plavix 75mg capsules: NDC 67544050474

```
SELECT * FROM concept WHERE concept_code = '67544050474'
```

concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code	valid_start_date	valid_end_date	invalid_reason
45867731	clopidogrel 75 MG Oral Tablet [Plavix]	Drug	NDC	11-digit NDC	NULL	67544050474	2014-07-01	2099-12-31	NULL

```
SELECT * FROM concept_relationship WHERE concept_id_1 = 45867731
 AND relationship_id = 'Maps to'
```

concept_id_1	concept_id_2	relationship_id	valid_start_date	valid_end_date	invalid_reason
45867731	1322185	Maps to	2015-01-29	2099-12-31	NULL

```
SELECT * FROM concept WHERE concept_id = 1322185
```

concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code	valid_start_date	valid_end_date	invalid_reason
1322185	clopidogrel 75 MG Oral Tablet [Plavix]	Drug	RxNorm	Branded Drug	S	213169	1970-01-01	2099-12-31	NULL

Let us find Clopidogrel ingredient

2. Find ingredient Clopidogrel as Ancestor of drug product

```
SELECT max_levels_of_separation, concept.*
FROM concept_ancestor
JOIN concept ON ancestor_concept_id = concept_id
WHERE descendant_concept_id = 1322185 /* clopidogrel 75 MG Oral Tablet [Plavix]*/
ORDER BY max_levels_of_separation
```

max_levels_of_separation	concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
0	1322185	clopidogrel 75 MG Oral Tablet [Plavix]	Drug	RxNorm	Branded Drug	S	213169
0	19075601	clopidogrel 75 MG Oral Tablet	Drug	RxNorm	Clinical Drug	S	309362
1	40095879	clopidogrel Oral Tablet [Plavix]	Drug	RxNorm	Branded Drug Form	S	368301
1	19120256	clopidogrel 75 MG [Plavix]	Drug	RxNorm	Branded Drug Comp	S	573094
1	1322187	clopidogrel 75 MG	Drug	RxNo		S	329449
1	40095878	clopidogrel Oral Tablet	Drug	RxNo		S	374583
2	36222254	clopidogrel Oral Product	Drug	RxNorm		C	1163766
2	36229332	Plavix Pill	Drug	RxNorm	Branded Dose Group	C	1181791
2	36229331	Plavix Oral Product	Drug	RxNorm	Branded Dose Group	C	1181790
2	36222255	clopidogrel Pill	Drug	RxNorm	Clinical Dose Group	C	1163767
2	1322184	clopidogrel	Drug	RxNorm	Ingredient	S	32968
3	46319141	CLOPIDOGREL - clopidogrel tablet, film coated	Drug	SPL	Prescription Drug	C	52adfb2c-2062-495c-9954-39eeecae2b41
3	4279519	PLATELET AGGREGATION INHIBITORS	Drug	VA Class	VA Class	C	BL117
3	45796809	clopidogrel 75mg/1 ORAL TABLET, FILM COATED [clopidogrel b	Drug	SPL	Prescription Drug	C	b4e53c96-e280-47c6-baa0-ec676e041d8d
3	45798740	clopidogrel bisulfate 75mg/1 ORAL TABLET, FILM COATED	Drug	SPL	Prescription Drug	C	c7fa330d-d8f1-487e-a730-bafae123e9a8
3	21600985	Platelet aggregation inhibitors excl. heparin	Drug	ATC		C	B01AC

Clopidogrel

Drug classes

Check out Ingredients

3. Check Descendants (other drug products containing Warfarin and Dabigatran)

```
SELECT max_levels_of_separation, concept.*
FROM concept_ancestor
JOIN concept ON descendant_concept_id = concept_id
WHERE ancestor_concept_id = 1310149 /* Warfarin or 1322185 Clopidogrel*/
ORDER BY max_levels_of_separation
```

concept_id	concept_name	vocabulary_id	concept_class_id
1310149	Warfarin	RxNorm	Ingredient
36221229	Jantoven Pill	RxNorm	Branded Dose Group
40163559	Warfarin Sodium 6 MG	RxNorm	Clinical Drug Comp
40163544	Warfarin Sodium 3 MG [Jantoven]	RxNorm	Branded Drug Comp
21134746	Warfarin 0.2 MG/ML	RxNorm Extension	Clinical Drug Comp
21105414	Warfarin 5 MG/ML	RxNorm Extension	Clinical Drug Comp
36221228	Jantoven Oral Product	RxNorm	Branded Dose Group
40163565	Warfarin Sodium 7.5 MG	RxNorm	Clinical Drug Comp
21115236	Warfarin 0.3 MG/ML	RxNorm Extension	Clinical Drug Comp
40163509	Warfarin Sodium 1 MG	RxNorm	Clinical Drug Comp
21156284	1 ML Warfarin 0.02 MG/ML Oral Solution	RxNorm Extension	Quant Clinical Drug
21095537	Warfarin 0.3 MG/ML Oral Solution	RxNorm Extension	Clinical Drug
21105427	Warfarin 0.4 MG/ML Oral Solution	RxNorm Extension	Clinical Drug
21046557	Warfarin 1 MG/ML Oral Solution	RxNorm Extension	Clinical Drug
40093133	Warfarin Oral Tablet [Coumadin]	RxNorm	Branded Drug Form
40093134	Warfarin Oral Tablet [Jantoven]	RxNorm	Branded Drug Form
21077698	1 ML Warfarin 1 MG/ML Oral Solution	RxNorm Extension	Quant Clinical Drug
40163534	Warfarin Sodium 2.5 MG Oral Tablet	RxNorm	Clinical Drug
40163530	Warfarin Sodium 2 MG/ML Injectable Solution	RxNorm	Clinical Drug
21066136	Warfarin 5 MG Oral Tablet [Marevan]	RxNorm Extension	Branded Drug
40163542	Warfarin Sodium 3 MG Oral Tablet [Jantoven]	RxNorm	Branded Drug
21116822	1 ML Warfarin 0.6 MG/ML Oral Suspension	RxNorm Extension	Quant Clinical Drug
21175784	1 ML Warfarin 0.1 MG/ML Oral Solution	RxNorm Extension	Quant Clinical Drug
21175783	1 ML Warfarin 0.832 MG/ML Oral Solution	RxNorm Extension	Quant Clinical Drug

concept_id	concept_name	vocabulary_id	concept_class_id
1322184	clopidogrel	RxNorm	Ingredient
21043471	clopidogrel Oral Suspension	RxNorm Extension	Clinical Drug Form
36229332	Plavix Pill	RxNorm	Branded Dose Group
21043470	clopidogrel Oral Solution	RxNorm Extension	Clinical Drug Form
21023802	clopidogrel Injectable Solution	RxNorm Extension	Clinical Drug Form
21023806	clopidogrel 5 MG	RxNorm Extension	Clinical Drug Comp
1322187	clopidogrel 75 MG	RxNorm	Clinical Drug Comp
21141600	clopidogrel 1 MG/ML	RxNorm Extension	Clinical Drug Comp
36222254	clopidogrel Oral Product	RxNorm	Clinical Dose Group
21092477	clopidogrel 5 MG/ML	RxNorm Extension	Clinical Drug Comp
21177192	100 ML clopidogrel 1 MG/ML Oral Suspension	RxNorm Extension	Quant Clinical Drug
21047899	1 ML clopidogrel 5 MG/ML Oral Suspension	RxNorm Extension	Quant Clinical Drug
21121870	clopidogrel 5 MG/ML Oral Suspension	RxNorm Extension	Clinical Drug
21063106	clopidogrel 75 MG Oral Tablet [Grepid]	RxNorm Extension	Branded Drug
1322190	clopidogrel 300 MG Oral Tablet [Plavix]	RxNorm	Branded Drug
21121869	clopidogrel 75 MG Injectable Solution	RxNorm Extension	Clinical Drug
21053280	clopidogrel 6 MG Injectable Solution	RxNorm Extension	Clinical Drug
21023810	clopidogrel 4 MG Injectable Solution	RxNorm Extension	Clinical Drug
21106783	1 ML clopidogrel 1 MG/ML Oral Suspension	RxNorm Extension	Quant Clinical Drug
19075601	clopidogrel 75 MG Oral Tablet	RxNorm	Clinical Drug
21102364	clopidogrel 1 MG/ML Oral Suspension	RxNorm Extension	Clinical Drug
40095879	clopidogrel Oral Tablet [Plavix]	RxNorm	Branded Drug Form
40095878	clopidogrel Oral Tablet	RxNorm	Clinical Drug Form
21088717	100 ML clopidogrel 15 MG/ML Oral Suspension	RxNorm Extension	Quant Clinical Drug

Find members of Drug Classes

4. Check Ingredient Descendants of Drug Class Anticoagulants

```
SELECT max_levels_of_separation, concept.*
FROM concept_ancestor
JOIN concept ON descendant_concept_id = concept_id
WHERE ancestor_concept_id =  21600961 /*  ATC Antithromboic Agent */
  AND concept_class_id = 'Ingredient'
ORDER BY max_levels_of_separation
```

concept_id	concept_name	domain_id	vocabulary_id	concept_class_id
46275677	cangrelor	Drug	RxNorm	Ingredient
45892847	edoxaban	Drug	RxNorm	Ingredient
1322184	clopidogrel	Drug	RxNorm	Ingredient
44818499	vorapaxar	Drug	RxNorm	Ingredient
43013024	apixaban	Drug	RxNorm	Ingredient
42898933	defibrotide	Drug	RxNorm	Ingredient
42801108	Protein C	Drug	RxNorm	Ingredient
40241331	rivaroxaban	Drug	RxNorm	Ingredient
1310149	Warfarin	Drug	RxNorm	Ingredient
40241186	Ticagrelor	Drug	RxNorm	Ingredient
40228152	dabigatran etexilate	Drug	RxNorm	Ingredient
40163718	prasugrel	Drug	RxNorm	Ingredient
35604848	selexipag	Drug	RxNorm	Ingredient
19136187	Streptokinase	Drug	RxNorm	Ingredient

Exercise:
Find Standard Concept ID

Metformin	1503297
Tolazamide	1502809
Telmisartan	1317640

Your favorite ingredient here

Exercise:
Find Standard Concept ID

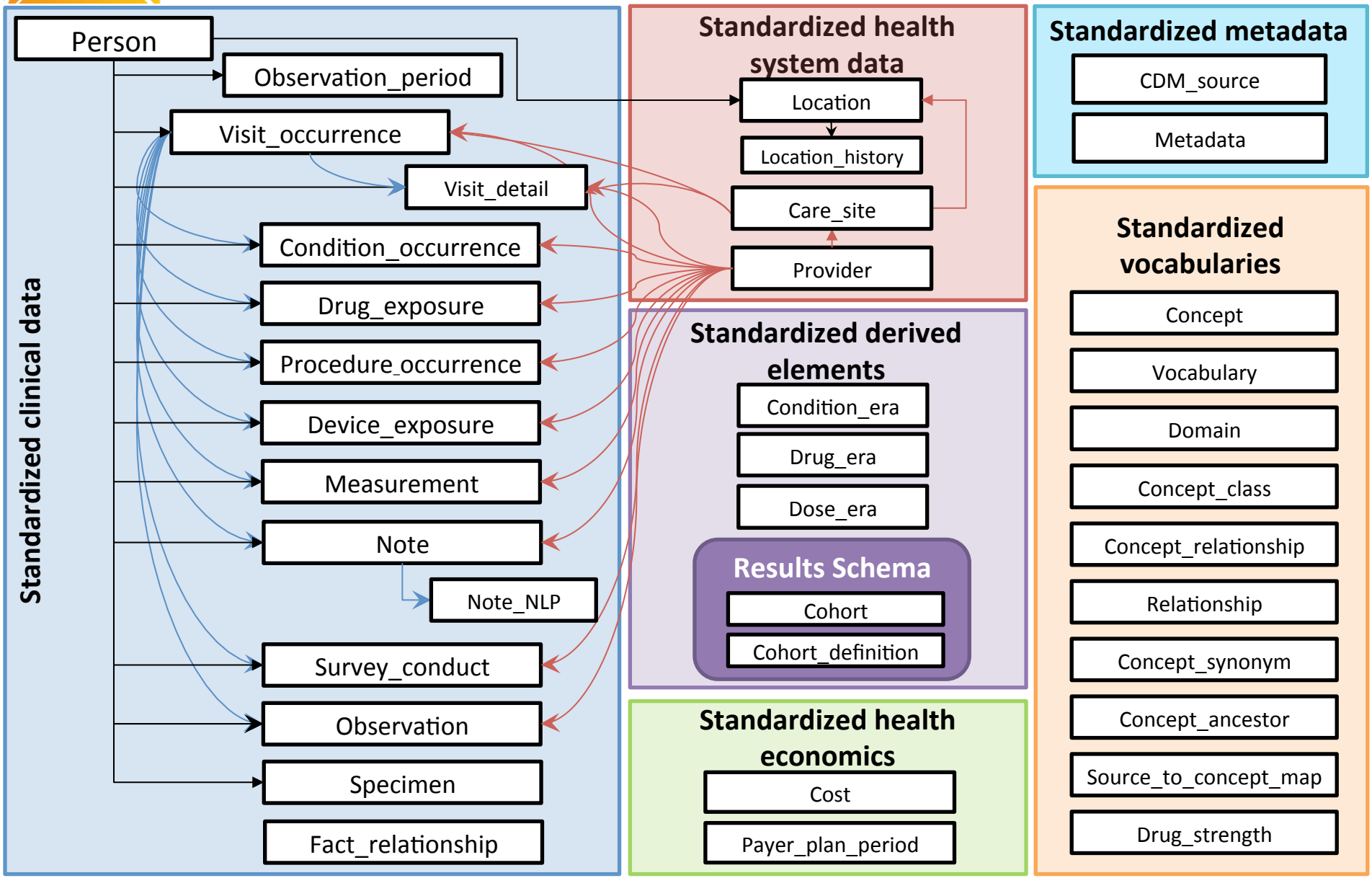
A10AE06	35602717
686450400	19080217
A10BD14	???

Your favorite drug here

Common Data Model

In depth discussion of model & era discussion

CDM Version 6 Key Domains



OMOP CDM Principles

- Patient centric
- Vocabulary and Data Model are blended
- Domain-oriented concepts
- Accommodates data from various sources
- Preserves data provenance
- Extendable & Evolving
- Database Platform Independent

OMOP CDM Standard Domain Features

Feature	Description & Purpose	Field Name Convention	Example
Patient centric	Every domain table has **patient identifier**. Patient data can be retrieved independently from other domains.	**person_id**	person_id 123
Unique domain identifiers	Ever domain table has a unique primary key to identify domain entities.	<entity>**_id**	condition_occurrence_id 470985
Standard concept from a respective vocabulary domain	Integration with the Vocabulary. Foreign key into the Standard Vocabulary for **Standard Concept.**	<entity>_concept_id	condition_concept_id 313217 (SNOMED "Atrial Fibrillation")
Source value	Provenance. Verbatim information from the source data, **not to be used** by any standard analytics.	<entity>**_source_value**	condition_source_value 427.31 (ICD9CM "Atrial Fibrillation")
Source concept from a respective vocabulary domain	Provenance. Foreign key into Standard Vocabulary for **Source Concept**.	<entity>**_source_concept_id**	condition_source_concept_id 44821957 (ICD9CM "Atrial Fibrillation")
Source type	Provenance. Foreign key into Vocabulary for the **origin of the data.**	<entity>**_type_concept_id**	condition_type_concept_id 38000199 ("Inpatient header – primary")

A Patient's Story: Lauren

Lauren's story

endometriosis uk

"Every step of this painful journey I've had to convince everyone how much pain I was in."

"My first surgery taught me that I had to be very patient with my recovery and very patient with myself in general."

https://www.endometriosis-uk.org/laurens-story

What data do we have?

- Guided Exercise:
  - Where and how do we think Lauren's data is generated?
  - Where do we think Lauren's data could go into the CDM?

What data do we have?

dysmenorrhea

abdominal pain

missed work

missed work

acetamino phen

acetamino phen

acetamino phen

GP visit

ultrasound

pelvic exam

cyst of ovary

Hospital Visit

severe pain

temp 103°F

ultrasound

ambulance

Bloated abdomen

ascites

surgery

endometrioma

Endometriosis

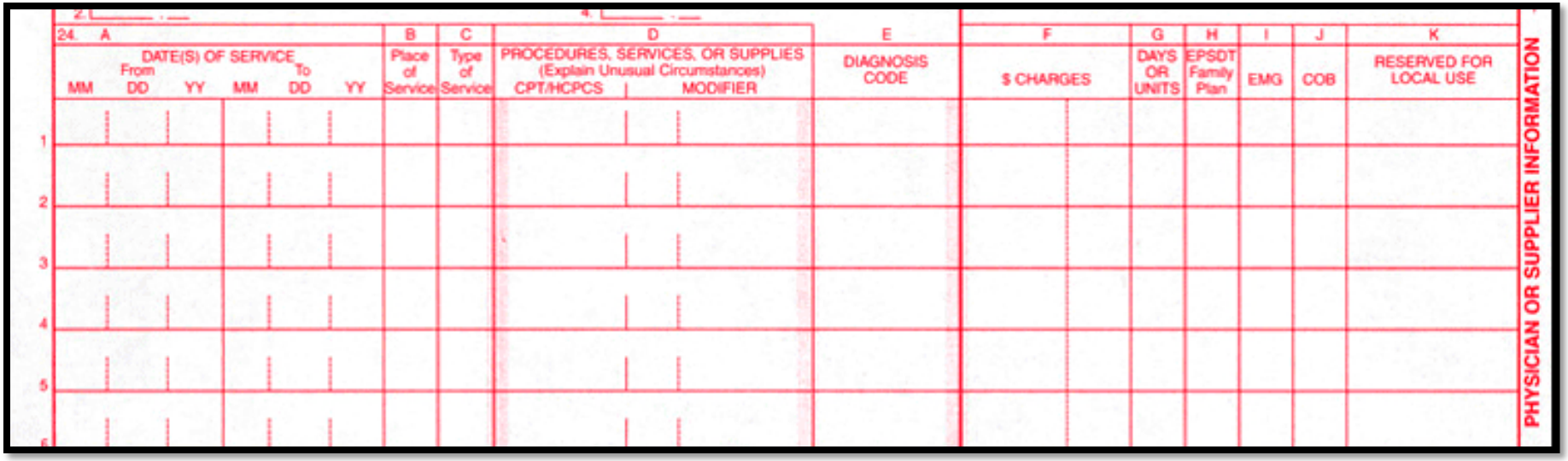
Lauren's Timeline

-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

Examples of how Researchers get Lauren's data?

- Health Insurance Claim Form (HCFA-1500)

- Universal Billing form (UB-92)

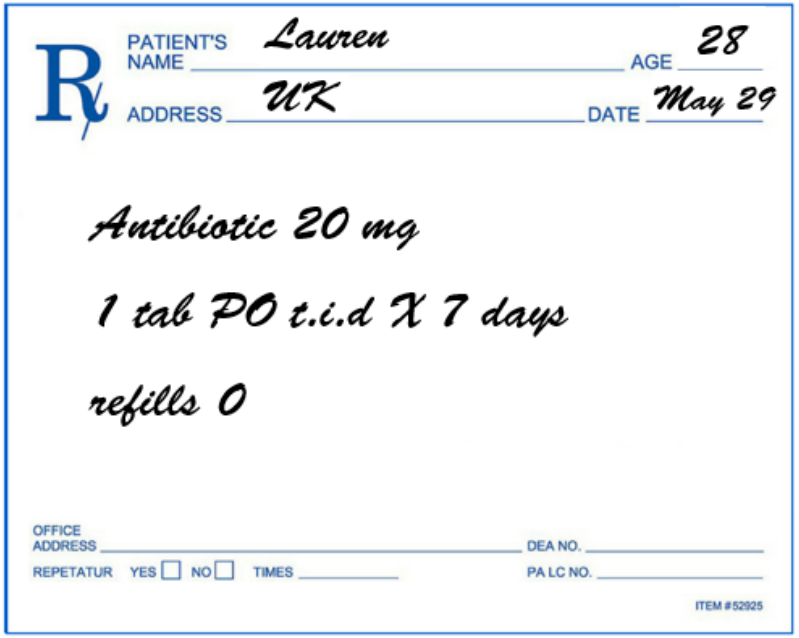


24. A DATE(S) OF SERVICE From MM DD YY	To MM DD YY	B Place of Service	C Type of Service	D PROCEDURES, SERVICES, OR SUPPLIES (Explain Unusual Circumstances) CPT/HCPCS	MODIFIER	E DIAGNOSIS CODE	F $ CHARGES	G DAYS OR UNITS	H EPSDT Family Plan	I EMG	J COB	K RESERVED FOR LOCAL USE
1												
2												
3												
4												
5												
6												

PHYSICIAN OR SUPPLIER INFORMATION

Examples of how Researchers get Lauren's data?

- Health Insurance Claim Form (HCFA-1500)
- Universal Billing form (UB-92)
- Prescriptions



Examples of how Researchers get Lauren's data?

- Health Insurance Claim Form (HCFA-1500)
- Universal Billing form (UB-92)
- Prescriptions
- Doctors notes

Patient: Lauren

Date of Procedure: 12-March

Surgeon: Dr. Patrick Ryan

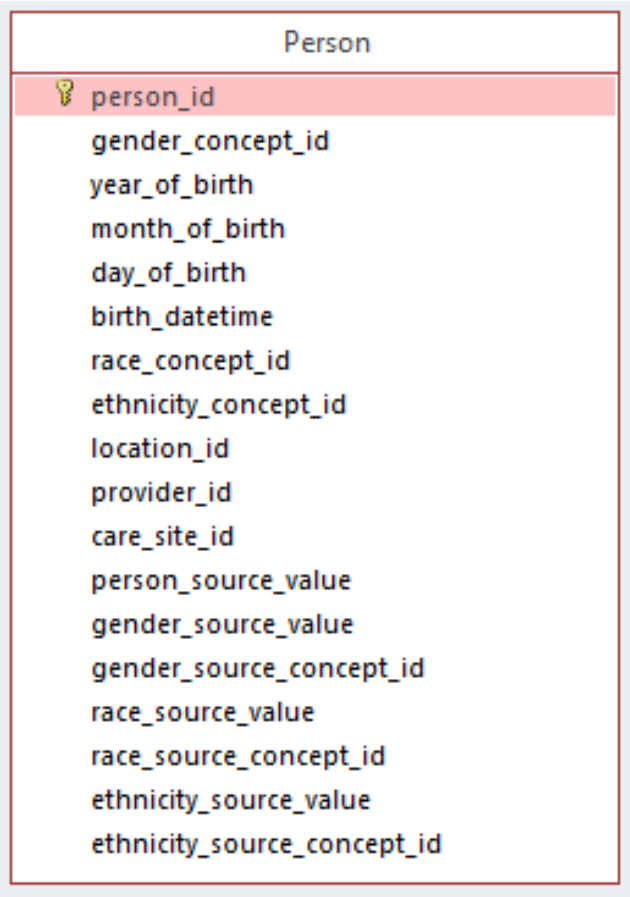
Assistant: Dr. Erica Voss

Procedure: Endometrial biopsy

Operative Summary: Endometrial biopsy performed with sterile technique. Adequate sample.

Presence of endometrial tissues outside the uterus.

PERSON



- Need to create one unique record per person
  - No history of location/ demographics: need to select latest available
  - Year of birth required…day/month optional
- Foreign key to the LOCATION, PROVIDER, and CARE_SITE table that contains one record

What data do we have?

dysmenorrhea

abdominal pain

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missed work

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acetamino phen

acetamino phen

GP visit

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Bloated abdomen

ascites

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endometrioma

Endometriosis

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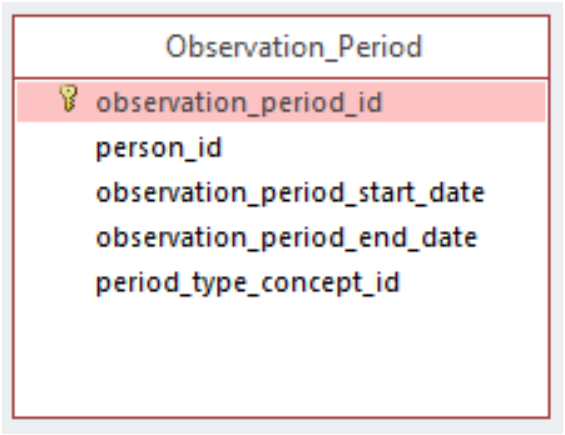
-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

PERSON

COLUMN	EXAMPLE	
person_id	123456	*Lauren's ID*
gender_concept_id	8532	*Female*
year_of_birth	1982	
month_of_birth	NULL	
day_of_birth	NULL	
race_concept_id	8527	*White*
person_source_value	123456	
gender_source_value	F	
race_source_value	W	

sample of table's columns

OBSERVATION_PERIOD



- Spans of time where data source has capture of data
- One person may have multiple periods if there is interruption in data capture
- Required to run analytical methods
- Challenge: determine observation periods based on the source data

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Endometriosis

Lauren's Timeline

-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

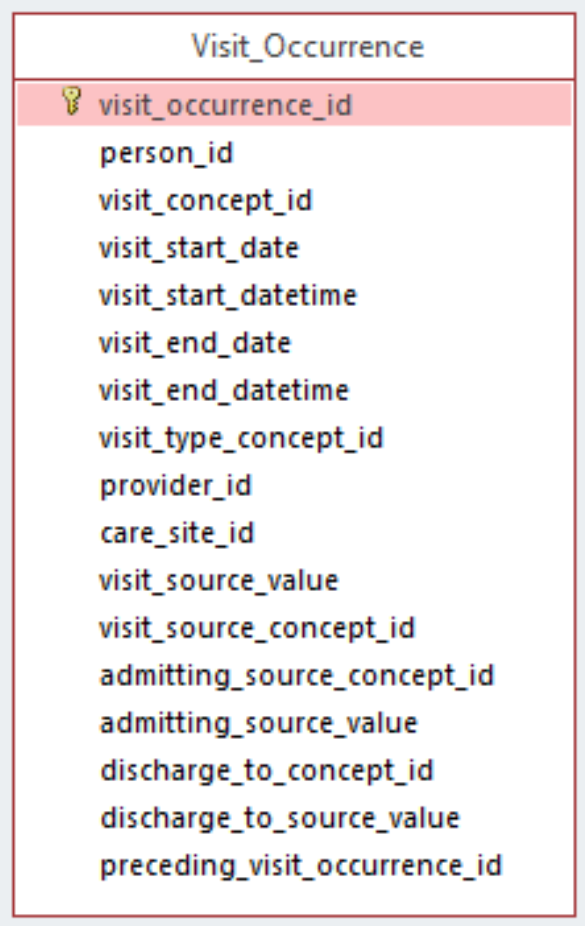
OBSERVATION_PERIOD

COLUMN	EXAMPLE	
observation_period_id	1	
person_id	123456	*Lauren's ID*
observation_periods_start_date	2000-01-01	
observation_periods_start_date	2010-12-31	

COLUMN	EXAMPLE	
observation_period_id	2	
person_id	123456	*Lauren's ID*
observation_periods_start_date	2012-01-01	
observation_periods_start_date	2013-12-31	

sample of table's columns

VISIT_OCCURRENCE



- Visits are 'Encounters'
- Contains spans of time where a person receives medical services
- Visit Types
  - Emergency room
  - Inpatient
  - Inpatient/Emergency
  - Outpatient
  - Long-term care

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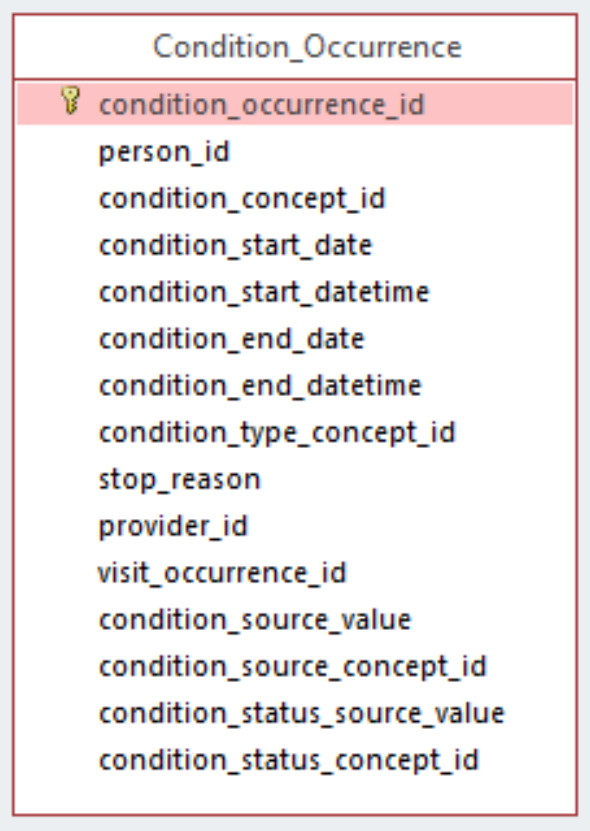
VISIT_OCCURRENCE

COLUMN	EXAMPLE	
visit_occurrence_id	1	
person_id	123456	*Lauren's ID*
visit_start_date	2008-04-07	
visit_end_date	2008-04-07	
visit_concept_id	9202	*Outpatient Visit*
visit_source_value	OP	

COLUMN	EXAMPLE	
visit_occurrence_id	2	
person_id	123456	*Lauren's ID*
visit_start_date	2008-04-21	
visit_end_date	2008-04-26	
visit_concept_id	9201	*Inpatient Visit*
visit_source_value	IP	

sample of table's columns

CONDITION_OCCURRENCE



- Records suggesting the presence of a disease or medical condition stated as a diagnosis, a sign or a symptom
- Examples:
  - Billing diagnosis
  - Problem list

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missed work

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acetamino phen

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Lauren's Timeline

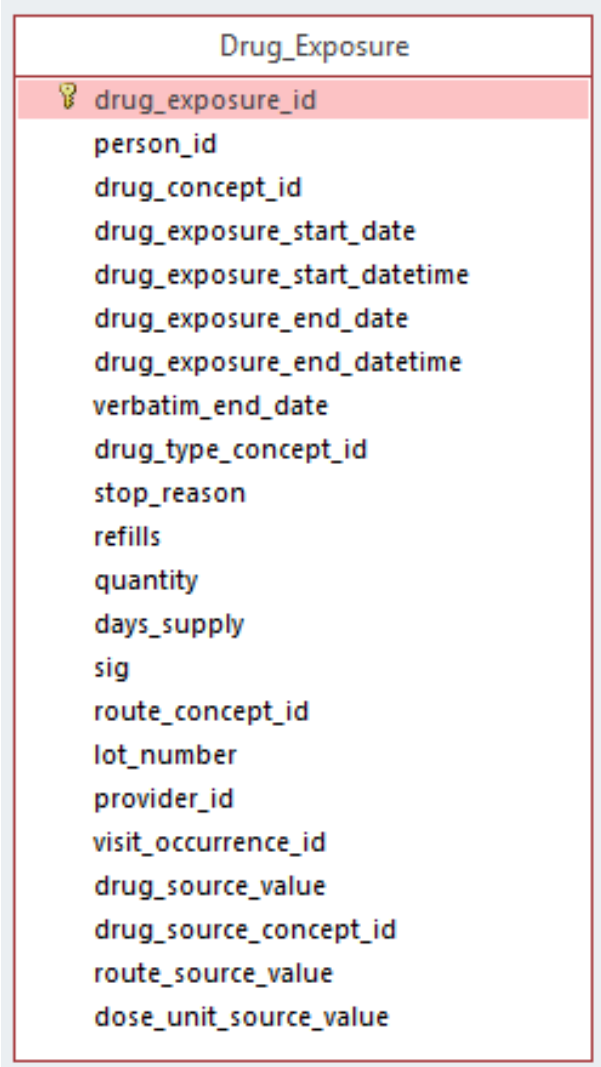
-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

CONDITION_OCCURRENCE

COLUMN	EXAMPLE	
condition_occurrence_id	1	
person_id	123456	*Lauren's ID*
condition_concept_id	433527	*Endometriosis*
condtition_start_date	2008-04-24	
condition_type_concept_id	38000183	*Inpatient detail - primary*
visit_occurrence_id	2	
condition_source_value	6171	*ICD9, missing decimal*
condition_source_concept_id	44832501	*Endometriosis of ovary*

sample of table's columns

DRUG_EXPOSURE



- Records about the utilization of a drug when ingested or otherwise introduced into the body
- Data sources:
  - Pharmacy dispensing
  - Prescriptions written
  - Medication history
- If drug is represented as a procedure, the OMOP Vocabulary realigns as drug

What data do we have?

dysmenorrhea

abdominal pain

missed work

missed work

acetamino phen

acetamino phen

acetamino phen

GP visit

ultrasound

pelvic exam

cyst of ovary

Hospital Visit

severe pain

temp 103°F

ultrasound

ambulance

Bloated abdomen

ascites

surgery

endometrioma

Endometriosis

Lauren's Timeline

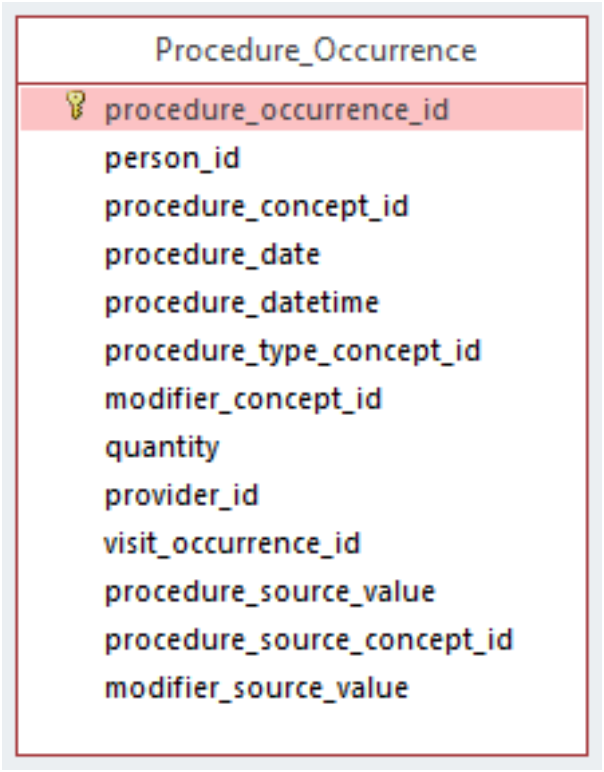
-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

DRUG_EXPOSURE

COLUMN	EXAMPLE	
drug_exposure_id	1	
person_id	123456	*Lauren's ID*
drug_concept_id	40162494	*Acetaminophen 500 MG / Hydrocodone Bitartrate 5 MG Oral Tablet*
drug_exposure_start_date	2007-02-01	
drug_exposure_end_date	2007-02-08	*Drug_exposure_start_date + days_supply*
verbatim_end_date	NULL	
drug_type_concept_id	38000183	*Prescription dispensed in pharmacy*
refills	0	
quantity	14	
days_supply	7	
drug_source_value	54348001301	*NDC 11-digit code*
drug_source_concept_id	45904353	*Acetaminophen 500 MG / Hydrocodone Bitartrate 5 MG Oral Tablet*

sample of table's columns

PROCEDURE_OCCURRENCE



- Contains records of activities or processes ordered by, or carried out by, a healthcare provider on the patient to have a diagnostic or therapeutic purpose
- Vocabularies include CPT-4, HCPCS, ICD-9 Procedures, ICD-10 Procedures, LOINC, SNOMED
- Procedures have the least standardized vocabularies that causes some redundancy

What data do we have?

dysmenorrhea

abdominal pain

missed work

missed work

acetamino phen

acetamino phen

acetamino phen

GP visit

ultrasound

pelvic exam

cyst of ovary

Hospital Visit

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Bloated abdomen

ascites

surgery

endometrioma

Endometriosis

Lauren's Timeline

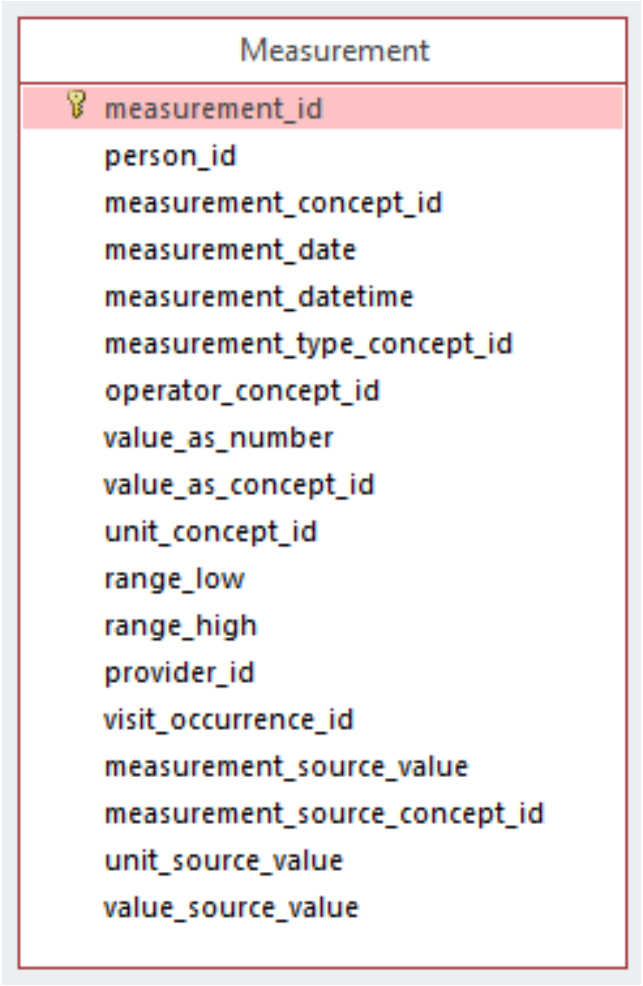
-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

PROCEDURE_OCCURRENCE

COLUMN	EXAMPLE	
procedure_occurrence_id	1	
person_id	123456	*Lauren's ID*
procedure_concept_id	2211740	*Ultrasound, abdominal, real time with image documentation; complete*
procedure_date	2008-04-08	
procedure_type_concept_id	38000267	*Outpatient detail - 1st position*
visit_occurrence_id	1	
procedure_source_value	76700	*CPT4*
procedure_source_concept_id	2211740	*Ultrasound, abdominal, real time with image documentation; complete*

sample of table's columns

MEASUREMENT



- Contains records of Measurement, i.e. structured values (numerical or categorical) obtained through systematic and standardized examination or testing of a Person or Person's sample
- Data sources: structured, quantitative measures, such as laboratory tests
- Measures have associated units

What data do we have?

dysmenorrhea

abdominal pain

missed work

missed work

acetamino phen

acetamino phen

acetamino phen

GP visit

ultrasound

pelvic exam

cyst of ovary

Hospital Visit

severe pain

temp 103°F

ultrasound

ambulance

Bloated abdomen

ascites

surgery

endometrioma

Endometriosis

Lauren's Timeline

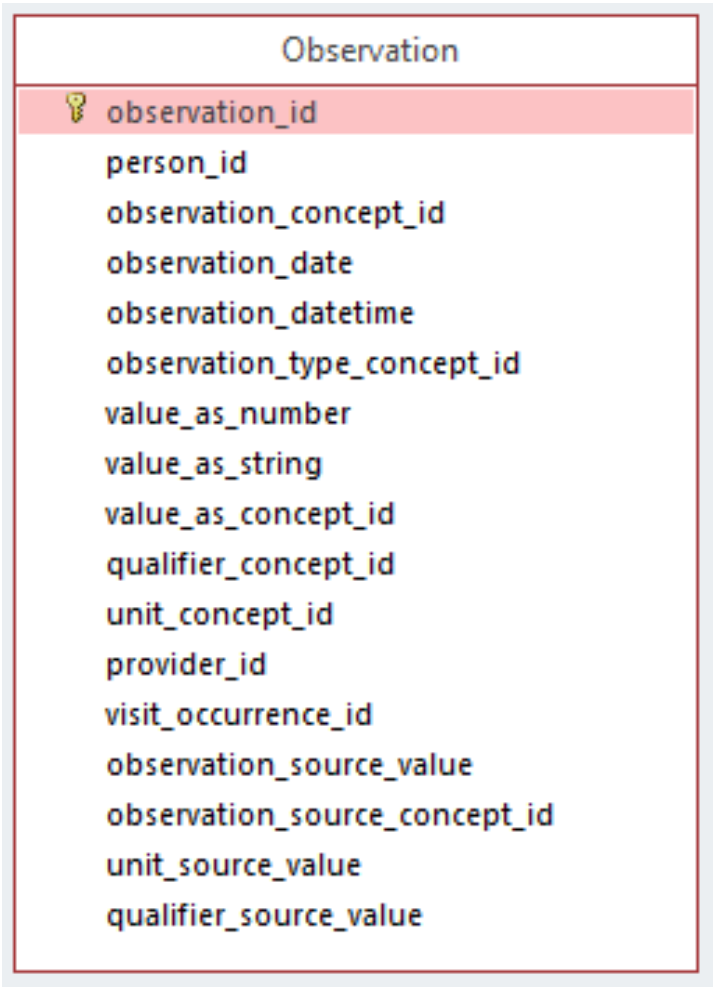
-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

MEASUREMENT

COLUMN	EXAMPLE	
measurement_id	1	
person_id	123456	*Lauren's ID*
measurement_concept_id	3020891	*Body temperature*
measurement_date	2008-04-21	
measurement_type_concept_id	44818701	*From physical examination*
value_as_number	103	
unit_concept_id	9289	*Degree Fahrenheit*
measurement_source_value	8310-5	*LOINC*
measurement_source_concept_id	3020891	*Body temperature*

sample of table's columns

OBSERVATION



- Captures clinical facts about a Person obtained in the context of examination, questioning or a procedure
- Any data that cannot be represented by any other domains, such as social and lifestyle facts, medical history, family history, etc. are recorded here
- Instrument for CDM extension, playpen

What data do we have?

dysmenorrhea

abdominal pain

missed work

missed work

acetamino phen

acetamino phen

acetamino phen

GP visit

ultrasound

pelvic exam

cyst of ovary

Hospital Visit

severe pain

temp 103°F

ultrasound

ambulance

Bloated abdomen

ascites

surgery

endometrioma

Endometriosis

Lauren's Timeline

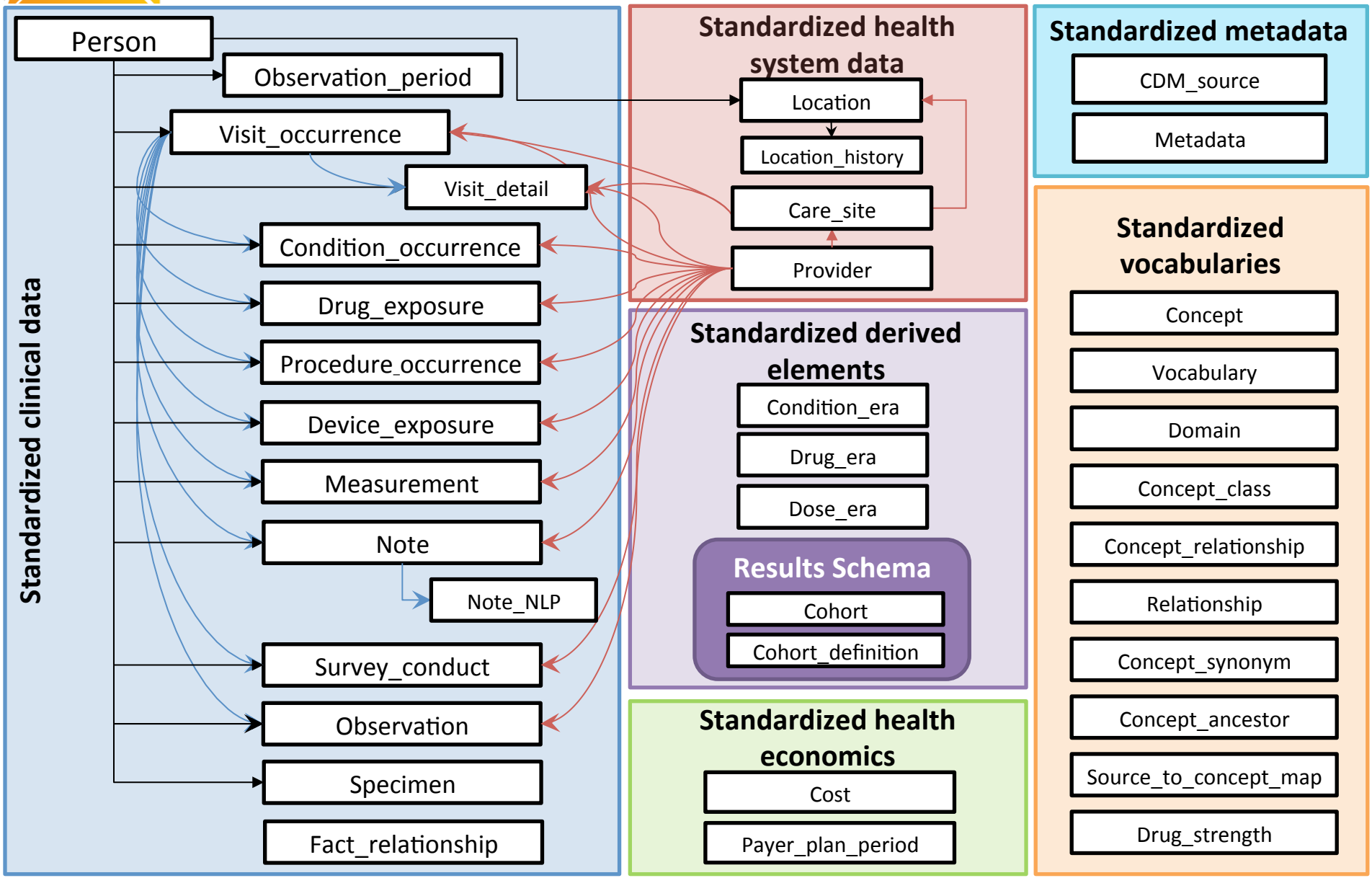
-3 Years *-2 Years* *-1 Years* *-2 Weeks* *-3 Days* *Day 0*

OBSERVATION

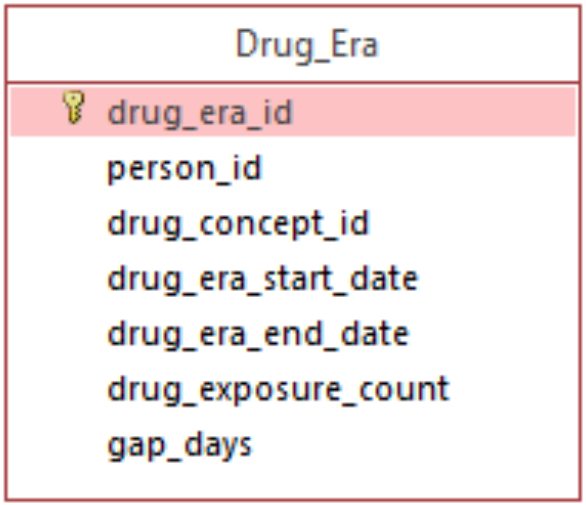
COLUMN	EXAMPLE	
observation_id	1	
person_id	123456	*Lauren's ID*
observation_concept_id	0	*No matching concept*
observation_date	2006-01-20	
observation_type_concept_id	44814721	*Patient reported*
value_as_number	8	
value_as_string	Work Hours Missed	
observation_source_value	Work Hours Missed	
observation_source_concept_id	0	*No matching concept*

sample of table's columns

CDM Version 6 Key Domains



DRUG_ERA



- Standardized inference of length of exposure to product for all active ingredients
- Derived from records in DRUG_EXPOSURE under certain rules to produce continuous Drug Eras

DRUG_ERA

DRUG_EXPOSURE
Acetaminophen 500 MG / Hydrocodone Bitartrate 5 MG Oral Tablet

COLUMN	EXAMPLE
drug_exposure_id	1
person_id	123456
drug_concept_id	40162494
drug_exposure_start_date	2007-02-01
drug_exposure_end_date	2007-02-08

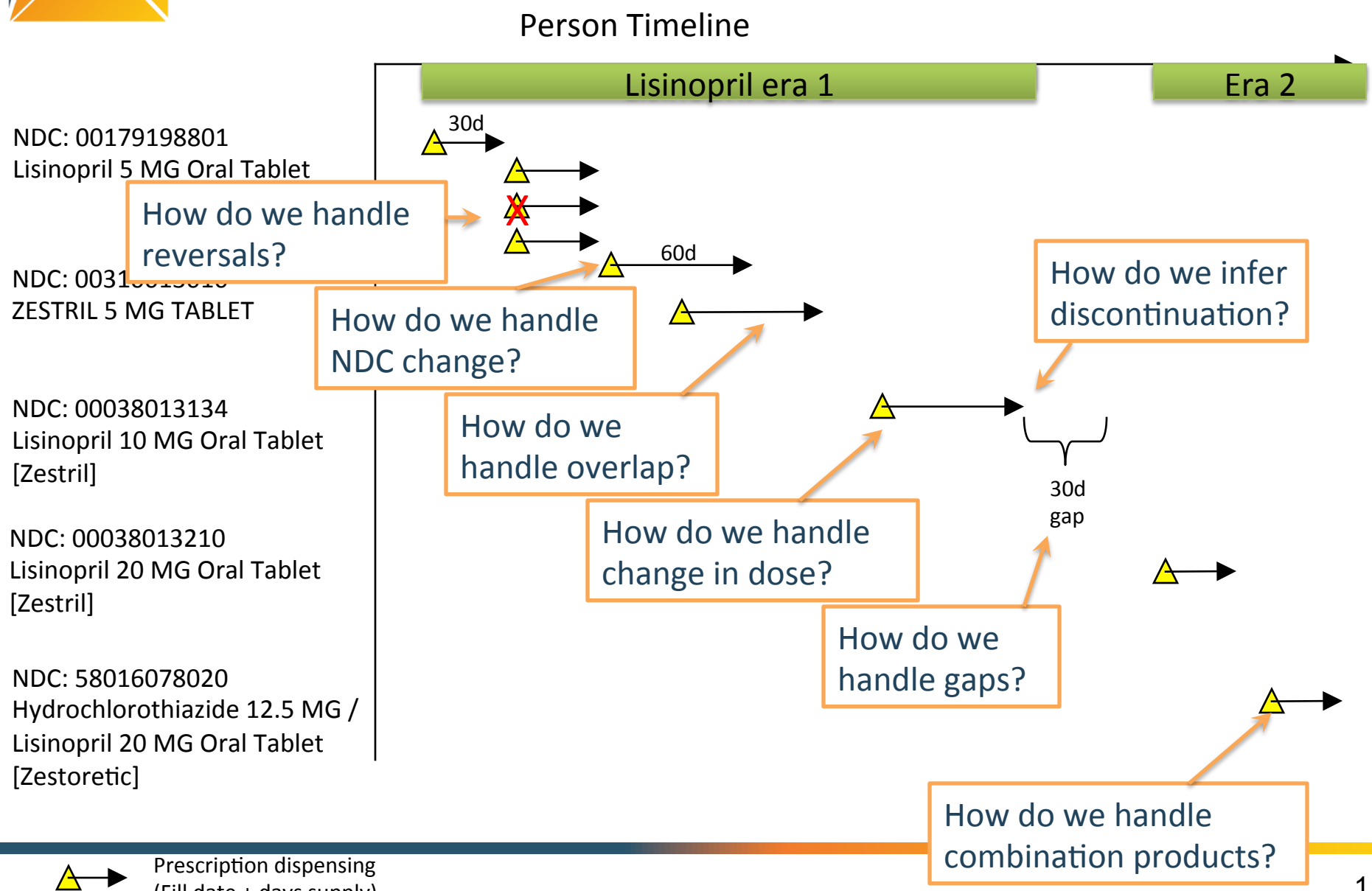
COLUMN	EXAMPLE
drug_exposure_id	2
person_id	123456
drug_concept_id	40162494
drug_exposure_start_date	2007-02-10
drug_exposure_end_date	2007-02-17

COLUMN	EXAMPLE
drug_era_id	1
person_id	123456
drug_concept_id	1125315 *Acetaminophen*
drug_era_start_date	2007-02-01
drug_era_end_date	2007-02-17

COLUMN	EXAMPLE
drug_era_id	2
person_id	123456
drug_concept_id	1174888 *Hydrocodone*
drug_era_start_date	2007-02-01
drug_era_end_date	2007-02-17

sample of table's columns

Illustrating inferences needed within longitudinal pharmacy claims data for one patient



CDM Tables Not Covered in Detail

- VISIT_DETAIL
- SPECIMEN
- DEATH
- DEVICE_EXPOSURE
- NOTE
- NOTE_NLP
- FACT_RELATIONSHIP
- LOCATION
- CARE_SITE
- PROVIDER
- PAYER_PLAN_PERIOD
- COST
- COHORT
- COHORT_ATTRIBUTES
- CONDITITION_ERA
- DOSE_ERA
- CDM_SOURCE

Standards

- Patients without transaction
- Cleaning dirty data
  - Patient IDs reused
  - Bogus code records (e.g. '000')
- How to handle tobacco information

THEMIS

https://github.com/OHDSI/CommonDataModel/wiki

CDM Version Control

- Working group meets once a month to discuss proposed changes to the CDM
- All CDM documentation, versions, and proposals located on GitHub
  - https://github.com/OHDSI/CommonDataModel
  - Proposals tracked and discussed as GitHub issues
- Meeting information can be found on the working group wiki page
- Please contact Clair Blacketer (mblacke@its.jnj.com) for more information

Break

Please return in 15 minutes

CDM Examples

Leveraging OHDSI Tools
(GitHub /Forums/
Working Group)
Exercises

ETL: Real world scenario

PharMetrics Plus

CLAIMS

pat_id	claimno	from_dt	to_dt	diagprc_ind	Diag_admit	diag1
05917921689	IPA333393946	1/5/2006	1/5/2006	1	41071	41071

LRx/Dx

MEDICAL_CLAIMS

md_clm_id	ims_pat_nbr	dt_of_service	rxer_id	diag_cd
95963982102	80445908	8/1/2012 0:00	680488	41071

German DA

Problem Events

db_country	international_ practice_num	international_ doctor_num	international_ patient_num	age
GE	GE6326	GE8784	GE46478747	

Diagnosis

db_country	international_dia gnosis_num	diagnosis_num	icd10_4_
GE	GE2397573	2397573	I21.4

Ambulatory EMR

Problem

Patient_id_synth	Diag_dt	Icd10_cd
271138	4/11/2013	I214

4 real observational databases, all containing an inpatient admission for a patient with a diagnosis of 'acute subendocardial infarction'

- Not a single table name the same…
- Not a single variable name the same….
- Different table structures (rows vs. columns)
- Different conventions (with and without decimal points)
- Different coding schemes (ICD9 vs. ICD10)

What does it mean to ETL to OMOP CDM? Standardize **structure** and **content**

PharMetrics Plus

Inpatient Claims

pat_id	claimno	from_dt	to_dt	diagprc_ind	Diag_admit
05917921689	IPA333393946	1/5/2006	1/5/2006	1	41071

Structure optimized for large-scale analysis for clinical characterization, population-level estimation, and patient-level prediction

PharMetrics Plus

CONDITION_OCCURRENCE

PERSON_ID	CONDITION_START_DATE	CONDITION_SOURCE_VALUE	CONDITION_TYPE_CONCEPT_ID
05917921689	1/5/2006	41071	Inpatient claims - primary position

Content using international vocabulary standards that can be applied to any data source

PharMetrics Plus

CONDITION_OCCURRENCE

PERSON_ID	CONDITION_START_DATE	CONDITION_SOURCE_VALUE	CONDITION _TYPE_CONCEPT_ID	CONDITION_SOURCE_CONCEPT_ID	CONDITION_CONCEPT_ID
05917921689	1/5/2006	41071	Inpatient claims - primary position	44825429	444406

OMOP CDM = Standardized structure: same tables, same fields, same datatypes, same conventions across disparate sources

PharMetrics Plus

CLAIMS

pat_id	claimno	from_dt	to_dt	diagprc_ind	Diag_admit	diag1
05917921689	IPA333393946	1/5/2006	1/5/2006	1	41071	41071

LRx/Dx

MEDICAL_CLAIMS

md_clm_id	ims_pat_nbr	dt_of_service	rxer_id	diag_cd
95963982102	80445908	8/1/2012 0:00	680488	41071

German DA

Problem Events

db_country	international_ practice_num	international_ doctor_num	international_ patient_num	age_at_event	date_of_event	international_ diagnosis_nu m
GE	GE6326	GE8784	GE46478747	20	11/19/2014 0:00	GE2397573

Diagnosis

db_country	international_dia gnosis_num	diagnosis_num	icd10_4_code	icd10_3_text	diagnosis_conf idence
GE	GE2397573	2397573	I21.4	Non-ST elevation (NSTEMI) myocardial infarction	Confirmed

Ambulatory EMR

Problem

Patient_id_synth	Diag_dt	icd10_cd
271138	4/11/2013	I214

- Consistent structure optimized for large-scale analysis
- Structure preserves all source content and provenance

PharMetrics Plus: CONDITION_OCCURRENCE

PERSON_ID	CONDITION_ START_DATE	CONDITION _SOURCE_V ALUE	CONDITION_TYPE_CONCEPT_ID
157033702	1/5/2006	41071	Inpatient claims - primary position

LRX/DX: CONDITION_OCCURRENCE

PERSON_ID	CONDITION_ START_DATE	CONDITION _SOURCE_V ALUE	CONDITION_TYPE_CONCEPT_ID
80445908	8/1/2012	41071	Primary Condition

German DA : CONDITION_OCCURRENCE

PERSON_ID	CONDITION_ START_DATE	CONDITION _SOURCE_V ALUE	CONDITION_TYPE_CONCEPT_ID
46478747	11/19/2014	I21.4	EHR problem list entry

Ambulatory EMR : CONDITION_OCCURRENCE

PERSON_ID	CONDITION_ START_DATE	CONDITION _SOURCE_V ALUE	CONDITION_TYPE_CONCEPT_ID
271138	4/11/2013	I214	Primary Condition

OMOP CDM = Standardized content: common vocabularies across disparate sources

PharMetrics Plus: CONDITION_OCCURRENCE

PERSON_ID	CONDITION_START_DATE	CONDITION_SOURCE_VALUE	CONDITION_TYPE_CONCEPT_ID	CONDITION_SOURCE_CONCEPT_ID	CONDITION_CONCEPT_ID
05917921689	1/5/2006	41071	Inpatient claims - primary position	4482542	444406

LRx/Dx: CONDITION_OCCURRENCE

PERSON_ID	CONDITION_START_DATE	CONDITION_SOURCE_VALUE	CONDITION_TYPE_CONCEPT_ID	CONDITION_SOURCE_CONCEPT_ID	CONDITION_CONCEPT_ID
80445908	8/1/2012	41071	Primary Condition	4482542	444406

German DA : CONDITION_OCCURRENCE

PERSON_ID	CONDITION_START_DATE	CONDITION_SOURCE_VALUE	CONDITION_TYPE_CONCEPT_ID	CONDITION_SOURCE_CONCEPT_ID	CONDITION_CONCEPT_ID
6478747	11/19/2014	I21.4	EHR problem list entry	4557208	444406

Ambulatory EMR : CONDITION_OCCURRENCE

PERSON_ID	CONDITION_START_DATE	CONDITION_SOURCE_VALUE	CONDITION_TYPE_CONCEPT_ID	CONDITION_SOURCE_CONCEPT_ID	CONDITION_CONCEPT_ID
271138	4/11/2013	I214	Primary Condition	4557208	444406

- Standardize across vocabularies to a common referent standard (ICD9/10→SNOMED)
- Source codes mapped into each domain standard so that now you can talk across different languages

- Standardize source codes to be uniquely defined across all vocabularies
- No more worries about formatting or code overlap

Data Used for Demonstration

- Medicare Claims Synthetic Public Use Files (SynPUFs)
  - synthetic US Medicare insurance claims database
  - Medicare is a government based insurance program for primarily 65 and older but also individuals with disabilities
  - SynPUF not for research but rather demonstration/development purposes
  - Has been converted to the Common Data Model

CMS.gov
Centers for Medicare & Medicaid Services

https://www.cms.gov/research-statistics-data-and-systems/downloadable-public-use-files/synpufs/

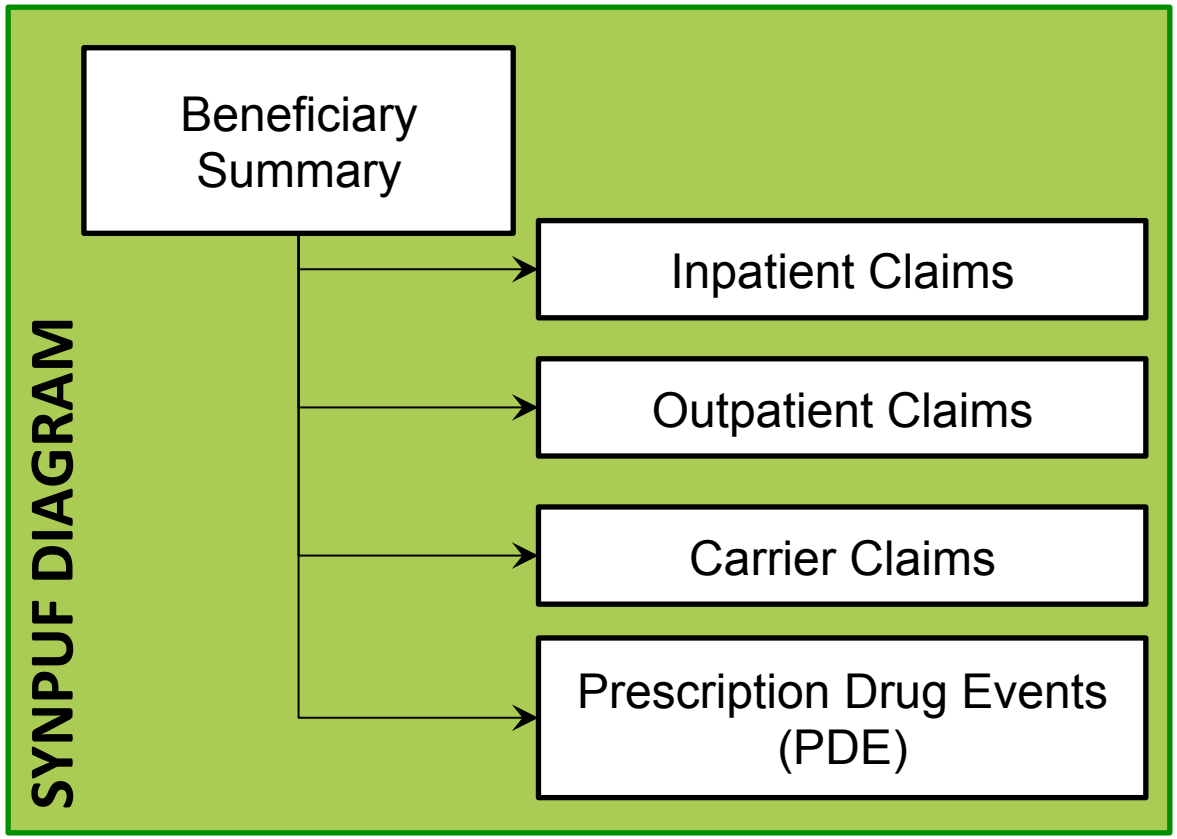
Data Used for Demonstration

- Five types of data:

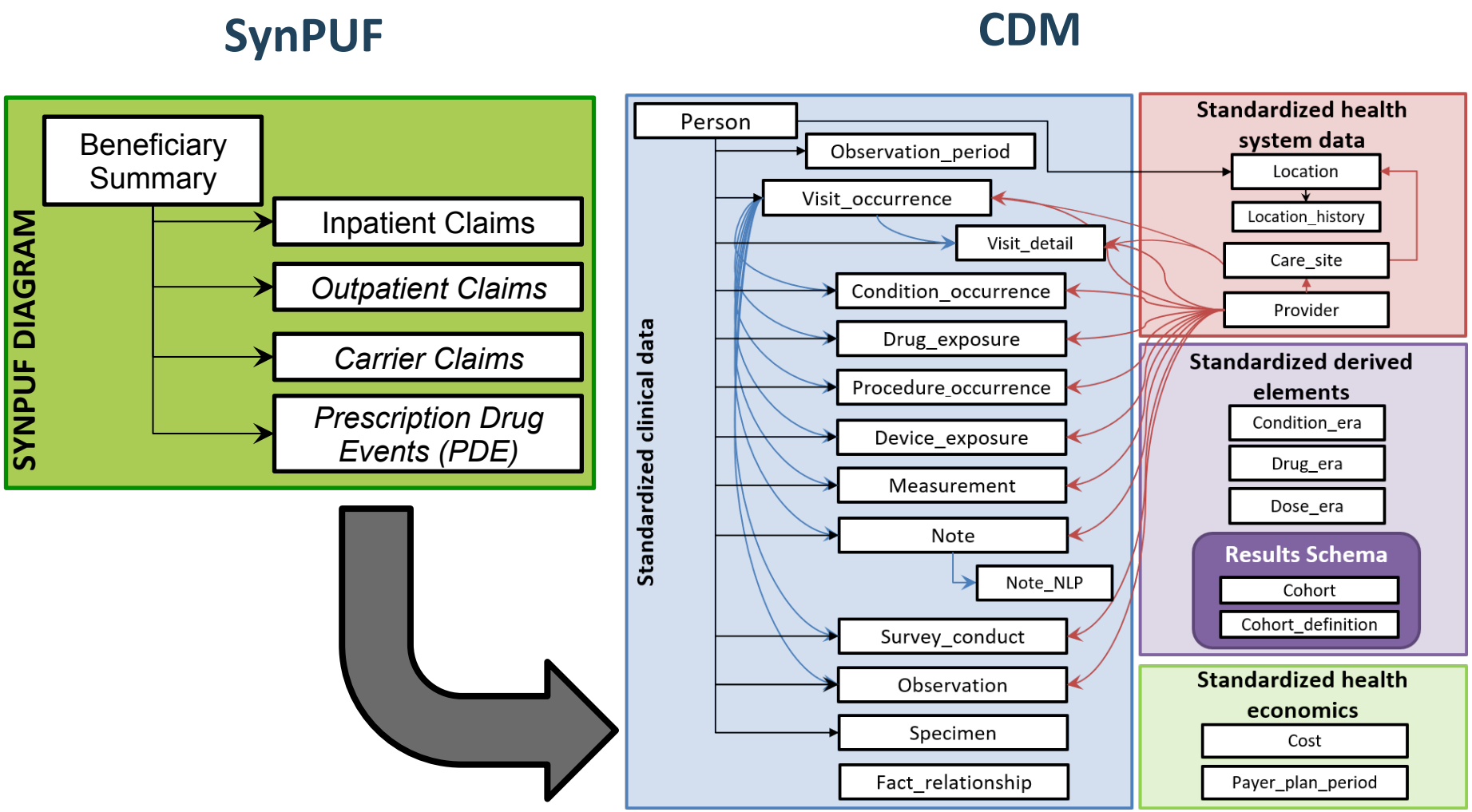
	DE-SynPUF	Unit of record	Number of Records 2008	Number of Records 2009	Number of Records 2010
1	*Beneficiary Summary*	Benefi-ciary	2,326,856	2,291,320	2,255,098
2	*Inpatient Claims*	claim	547,800	504,941	280,081
3	*Outpatient Claims*	claim	5,673,808	6,519,340	3,633,839
4	*Carrier Claims*	claim	34,276,324	37,304,993	23,282,135
5	*Prescription Drug Events (PDE)*	event	39,927,827	43,379,293	27,778,849

https://www.cms.gov/Research-Statistics-Data-and-Systems/Downloadable-Public-Use-Files/SynPUFs/DE_Syn_PUF.html

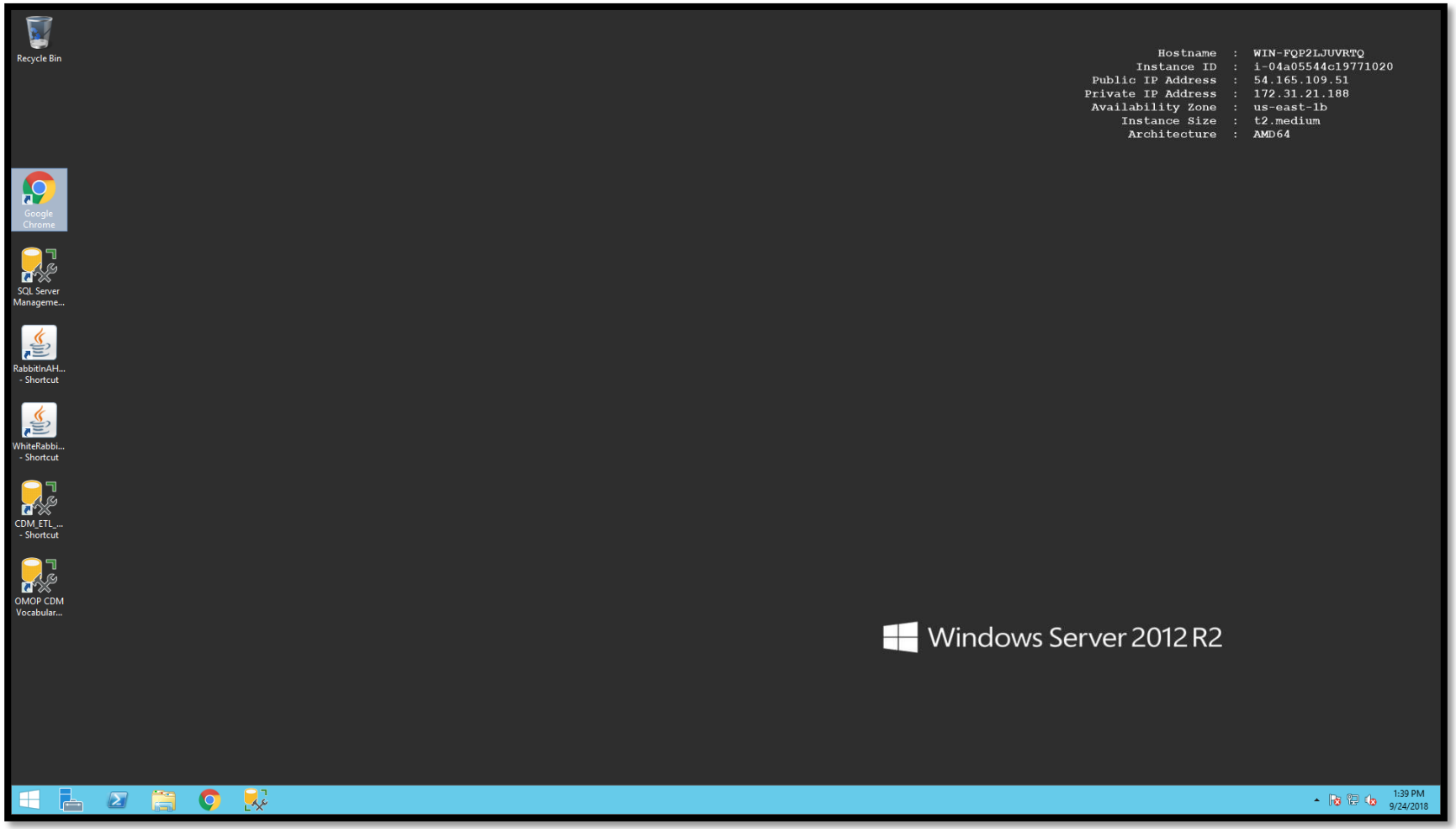
SynPUF High Level Diagram



Mapping SynPUF to CDM

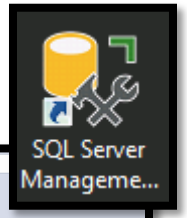


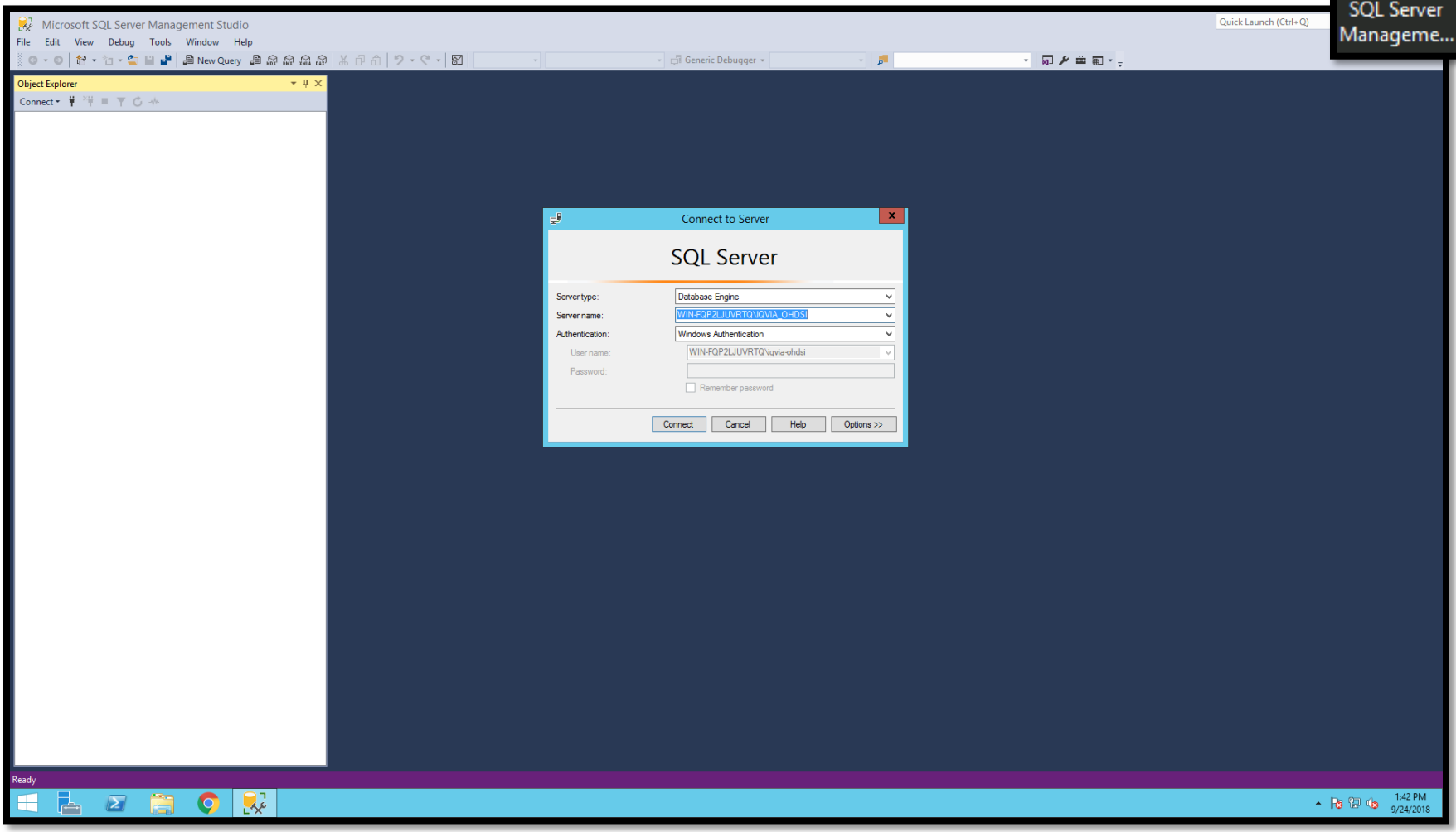
OHDSI in a Box



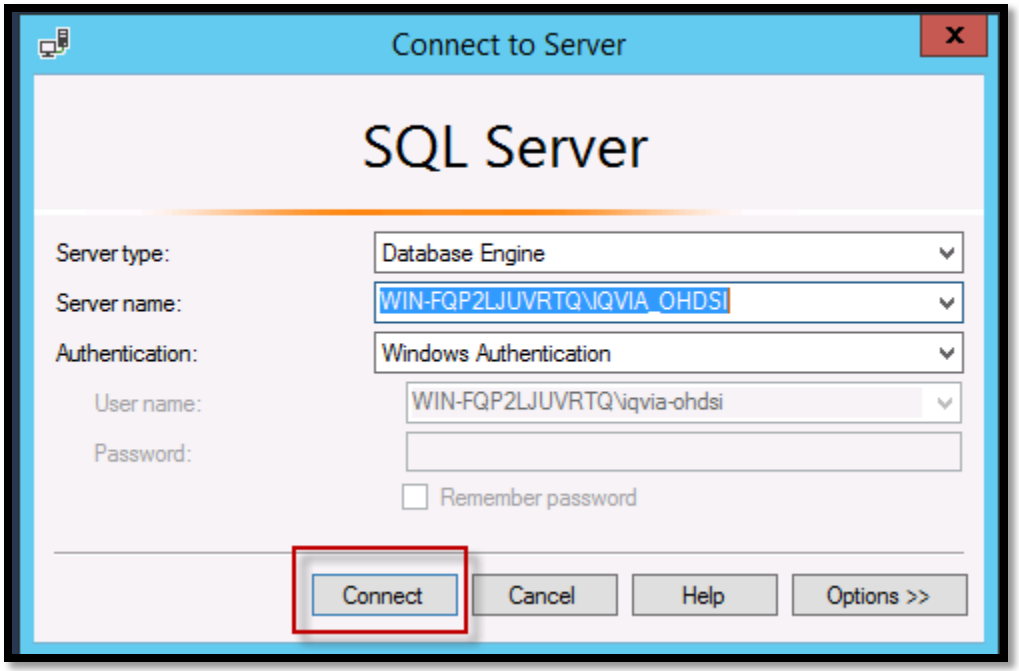
CDM Database: Open Query Tool

- Click on “SQL Server management Studio”



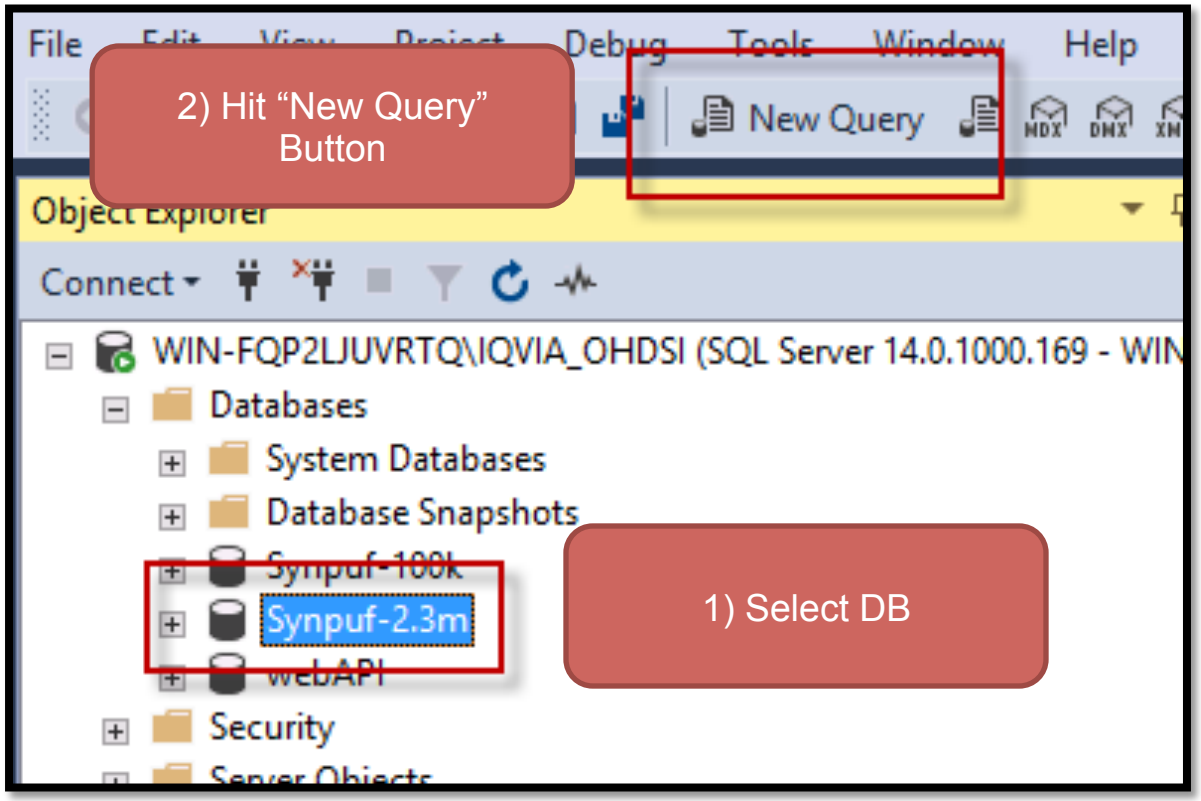


CDM Database: Connect to DB

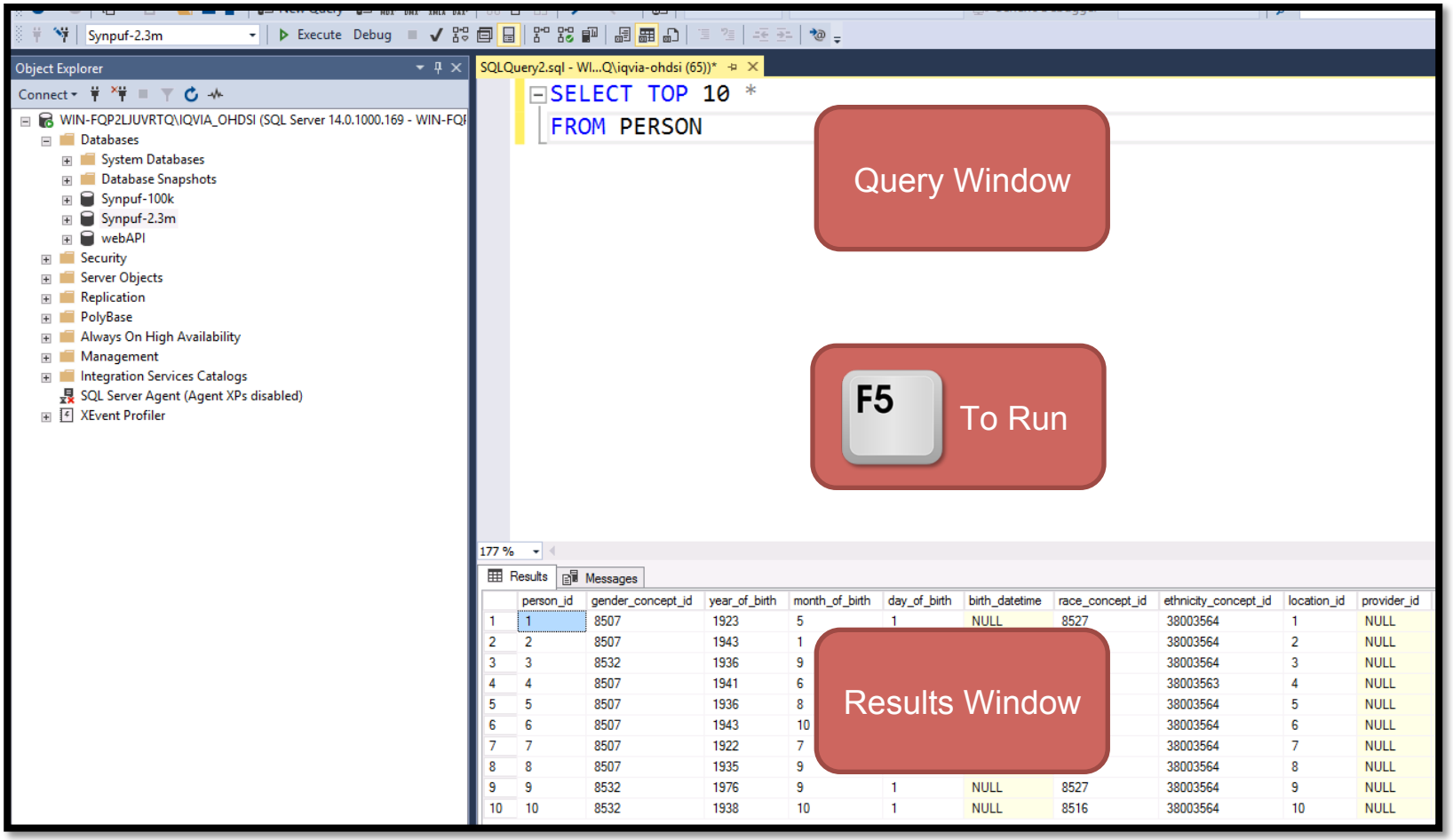


Connect the DB

CDM Database: Open Query Window

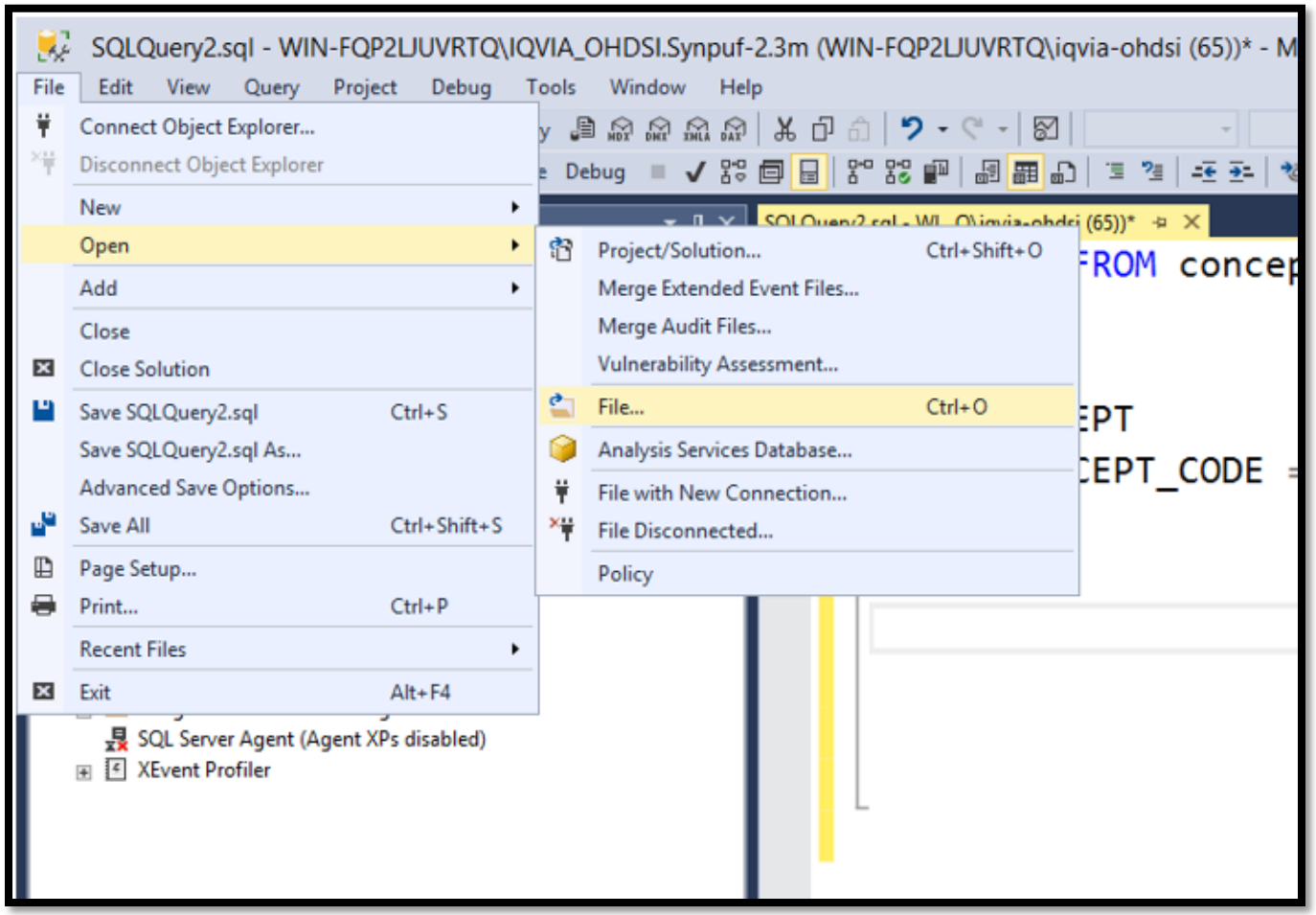


OHDSI in a Box



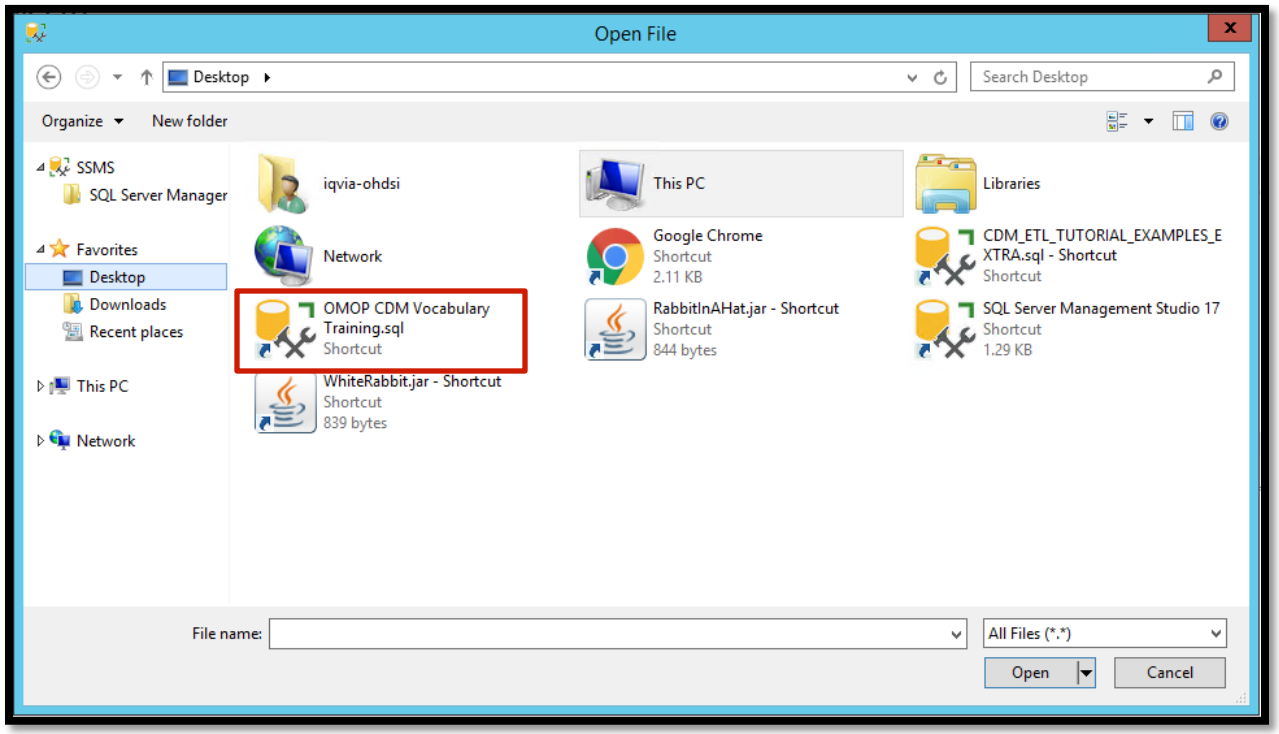
	person_id	gender_concept_id	year_of_birth	month_of_birth	day_of_birth	birth_datetime	race_concept_id	ethnicity_concept_id	location_id	provider_id
1	1	8507	1923	5	1	NULL	8527	38003564	1	NULL
2	2	8507	1943	1				38003564	2	NULL
3	3	8532	1936	9				38003564	3	NULL
4	4	8507	1941	6				38003563	4	NULL
5	5	8507	1936	8				38003564	5	NULL
6	6	8507	1943	10				38003564	6	NULL
7	7	8507	1922	7				38003564	7	NULL
8	8	8507	1935	9				38003564	8	NULL
9	9	8532	1976	9	1	NULL	8527	38003564	9	NULL
10	10	8532	1938	10	1	NULL	8516	38003564	10	NULL

Open Up SQL File

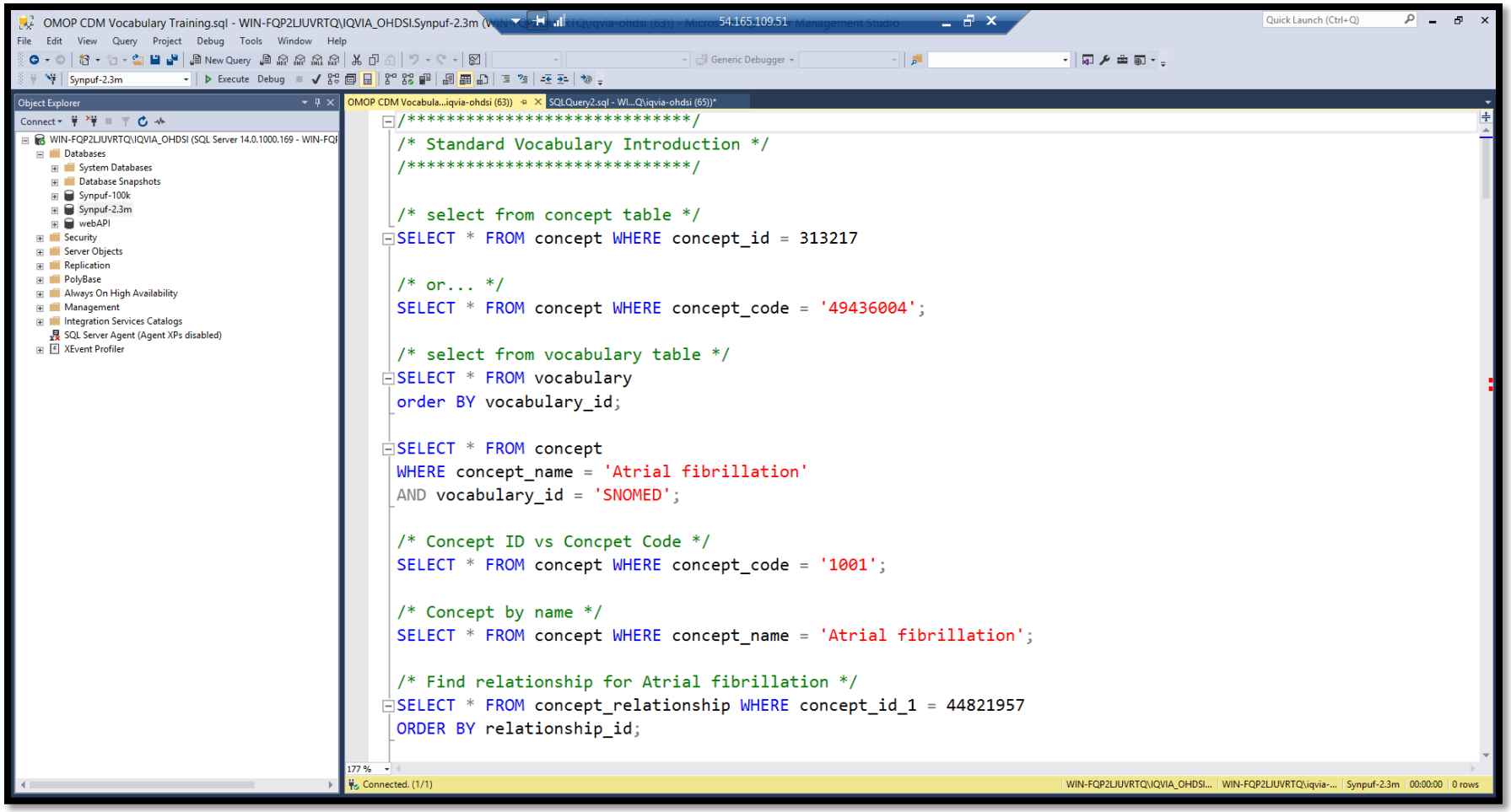


Open Up SQL File

Navigate to your desktop and open the file – OMOP CDM Vocabulary Training.sql



Open Up SQL File



Some Example Questions

Ex 1

Finding Warfarin

Ex 2

New Users of Warfarin

Ex 3

New Users of Warfarin who are >=65?

Ex 4

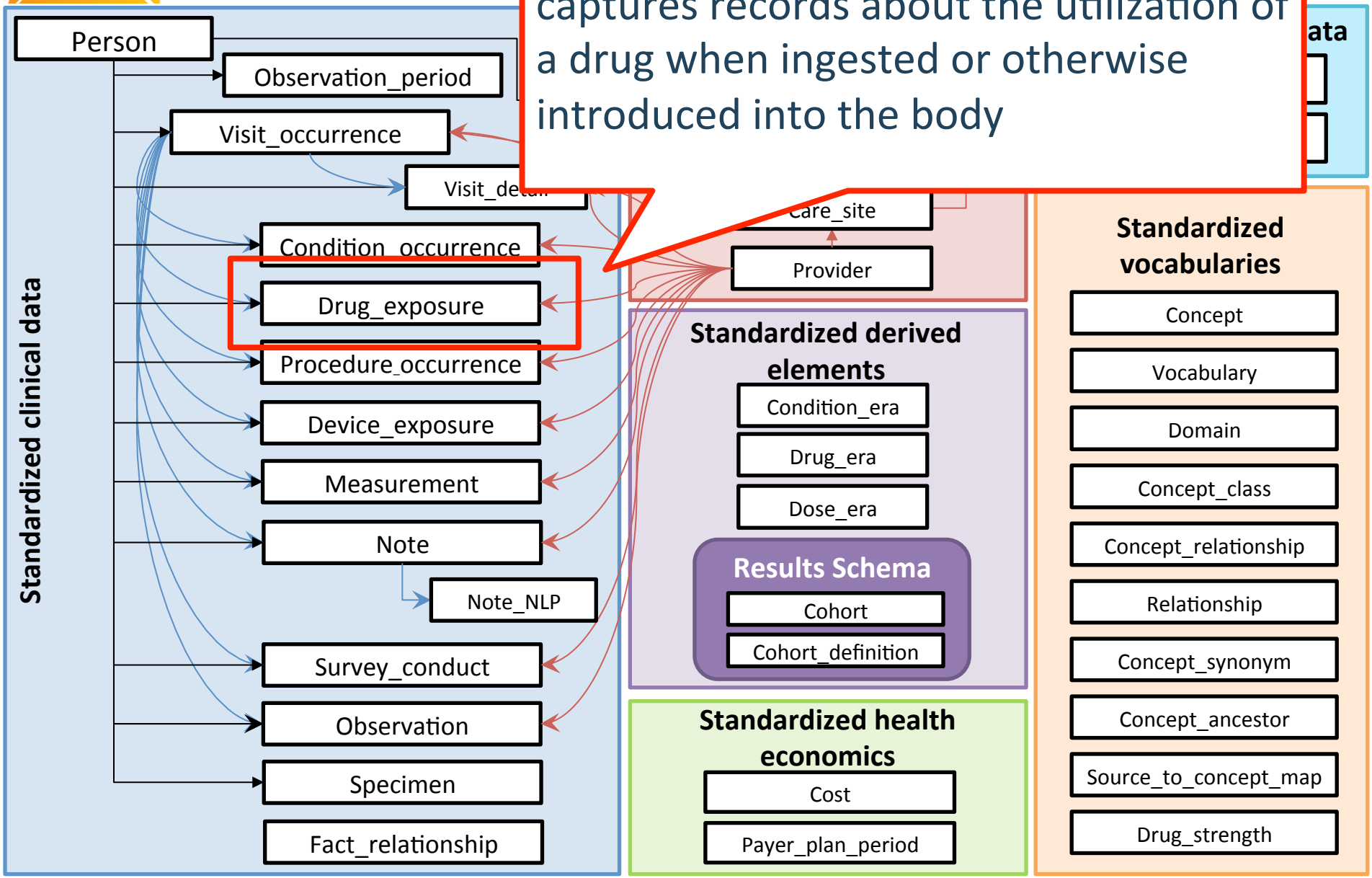
New Users of Warfarin with prior Atrial Fibrillation?

Warfarin Exposure

- Warfarin is a blood thinner that is used to treat/prevent blood clots.
  - Where do you find drug data in the CDM?
  - What codes do I use to define drugs?

Where are D

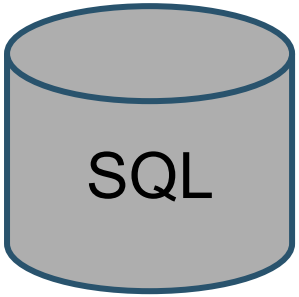
captures records about the utilization of a drug when ingested or otherwise introduced into the body



How do I define Warfarin?

- When raw data is transformed into the CDM raw source codes are transformed into standard OMOP Vocabulary concepts
- In the CDM, we no longer care what source codes existed in the raw data, we just need to use concept identifiers
- We can use the OMOP Vocabulary to identify all concepts that contain the ingredient warfarin

How do I define Warfarin?



- Writing SQL Statement

- OHDSI Tool ATLAS

Finding Warfarin

Ex 1

```
/*********************************************************************************
*   (Exercise 1) Finding Warfarin
*********************************************************************************/

/*Just looking for the ingredient concept*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE DRUG_CONCEPT_ID = 1310149 /*warfarin*/;

/*Looking for drugs associated with the ingredient*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE de.DRUG_CONCEPT_ID IN (
    SELECT DESCENDANT_CONCEPT_ID
    FROM CONCEPT_ANCESTOR
    WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
);

/*looking for anticoagulants, a class of drugs warfarin belongs*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE de.DRUG_CONCEPT_ID IN (
    SELECT DESCENDANT_CONCEPT_ID
    FROM CONCEPT_ANCESTOR
    WHERE ANCESTOR_CONCEPT_ID = 4283987 /*ANTICOAGULANTS (VA Class)*/
);
```

0 individuals

Finding Warfarin

Ex 1

```
/*********************************************************************************
*   (Exercise 1) Finding Warfarin
*********************************************************************************/

/*Just looking for the ingredient concept*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE DRUG_CONCEPT_ID = 1310149 /*warfarin*/;

/*Looking for drugs associated with the ingredient*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE de.DRUG_CONCEPT_ID IN (
    SELECT DESCENDANT_CONCEPT_ID
    FROM CONCEPT_ANCESTOR
    WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
);

/*looking for anticoagulants, a class of drugs warfarin belongs*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE de.DRUG_CONCEPT_ID IN (
    SELECT DESCENDANT_CONCEPT_ID
    FROM CONCEPT_ANCESTOR
    WHERE ANCESTOR_CONCEPT_ID = 4283987 /*ANTICOAGULANTS (VA Class)*/
);
```

0 individuals

512,836 individuals

Finding Warfarin

Ex 1

```
/*********************************************************************************
*   (Exercise 1) Finding Warfarin
*********************************************************************************/

/*Just looking for the ingredient concept*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE DRUG_CONCEPT_ID = 1310149 /*warfarin*/;

/*Looking for drugs associated with the ingredient*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE de.DRUG_CONCEPT_ID IN (
    SELECT DESCENDANT_CONCEPT_ID
    FROM CONCEPT_ANCESTOR
    WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
);

/*looking for anticoagulants, a class of drugs warfarin belongs*/
SELECT COUNT(DISTINCT de.PERSON_ID)
FROM DRUG_EXPOSURE de
WHERE de.DRUG_CONCEPT_ID IN (
    SELECT DESCENDANT_CONCEPT_ID
    FROM CONCEPT_ANCESTOR
    WHERE ANCESTOR_CONCEPT_ID = 4283987 /*ANTICOAGULANTS (VA Class)*/
);
```

0 individuals

512,836 individuals

764,953 individuals

Some Example Questions

Ex 1 Finding Warfarin

Ex 2 New Users of Warfarin

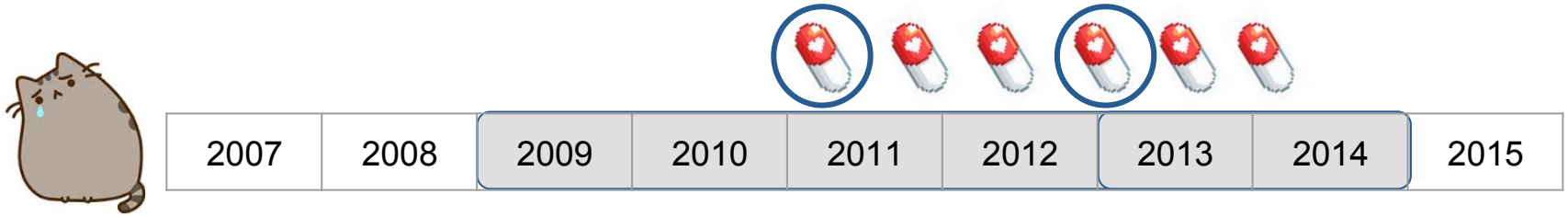
Ex 3 New Users of Warfarin who are >=65?

Ex 4 New Users of Warfarin with prior Atrial Fibrillation?

How do I define new users of a drug?

Ex 2

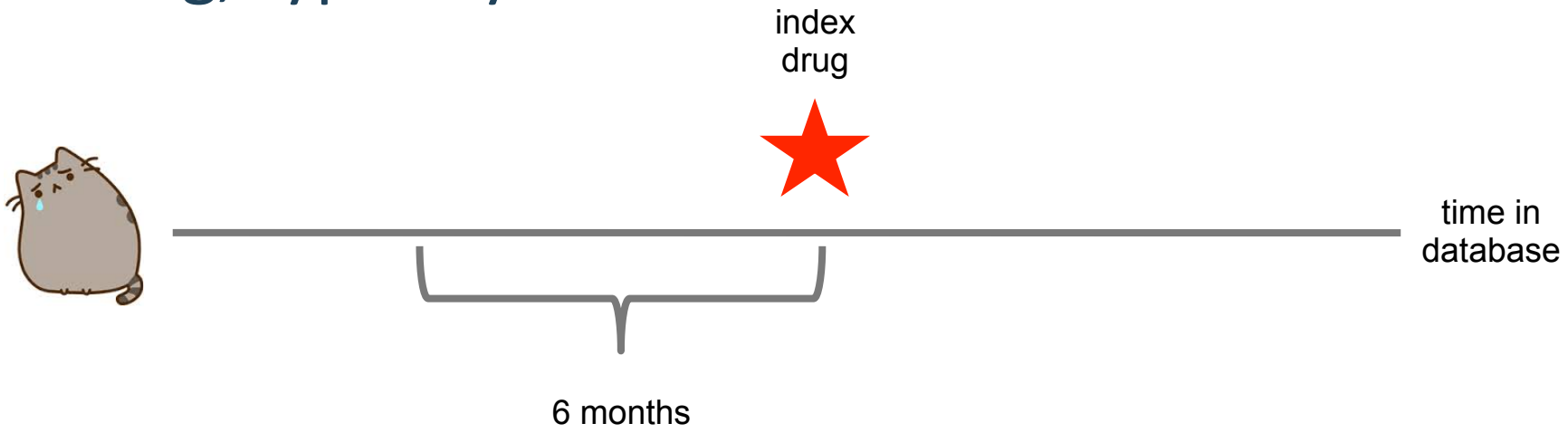
Someone who has recently started taking the drug, typically with a 6 or 12 month wash out



How do I define new users of a drug?

Ex 2

Someone who has recently started taking the drug, typically with a 6 or 12 month wash out



What is Needed in the CDM?

Ex 2

- **OMOP Vocabulary**
  to find the concepts
- **CDM Table DRUG_EXPOSURE**
  to find individuals with exposure
- **CDM Table OBSERVATION_PERIOD**
  to know people's time within the database

New Users of Warfarin

Ex 2

```
/**************************************************************************
*             (Exercise 2) Warfarin New Users
**************************************************************************/

WITH CTE_DRUG_INDEX AS (
               SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
               FROM DRUG_EXPOSURE de
               WHERE de.DRUG_CONCEPT_ID IN (
                              SELECT DESCENDANT_CONCEPT_ID
                              FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
               )
               GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
                DATEDIFF (DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
FROM CTE_DRUG_INDEX i
              INNER JOIN OBSERVATION_PERIOD op
                              ON op.PERSON_ID = i.PERSON_ID
                              AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
ORDER BY i.PERSON_ID
```

Step 1: Get the codes you need

Ex 2

```
/**************************************************************************
*             (Exercise 2) Warfarin New Users
**************************************************************************/

WITH CTE_DRUG_INDEX AS (
              SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
              FROM DRUG_EXPOSURE de
              WHERE de.DRUG_CONCEPT_ID IN (
                            SELECT DESCENDANT_CONCEPT_ID
                            FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
              )
              GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
               DATEDIFF (DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
FROM CTE_DRUG_INDEX i
              INNER JOIN OBSERVATION_PERIOD op
                            ON op.PERSON_ID = i.PERSON_ID
                            AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
ORDER BY i.PERSON_ID
```

Step 2: Find Drug Exposures

Ex 2

```
/**************************************************************************
*             (Exercise 2) Warfarin New Users
**************************************************************************/

WITH CTE_DRUG_INDEX AS (
              SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
              FROM DRUG_EXPOSURE de
              WHERE de.DRUG_CONCEPT_ID IN (
                            SELECT DESCENDANT_CONCEPT_ID
                            FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
              )
              GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
               DATEDIFF (DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
FROM CTE_DRUG_INDEX i
              INNER JOIN OBSERVATION_PERIOD op
                            ON op.PERSON_ID = i.PERSON_ID
                            AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
ORDER BY i.PERSON_ID
```

Step 3: Find New Users

Ex 2

```
/**************************************************************************
*             (Exercise 2) Warfarin New Users
**************************************************************************/

WITH CTE_DRUG_INDEX AS (
              SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
              FROM DRUG_EXPOSURE de
              WHERE de.DRUG_CONCEPT_ID IN (
                            SELECT DESCENDANT_CONCEPT_ID
                            FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
              )
              GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
               DATEDIFF (DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
FROM CTE_DRUG_INDEX i
              INNER JOIN OBSERVATION_PERIOD op
                            ON op.PERSON_ID = i.PERSON_ID
                            AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
ORDER BY i.PERSON_ID
```

New Users of Warfarin

Ex 2

```
/**********************************************************************************
*             (Exercise 2) Warfarin New Users
**********************************************************************************/

WITH CTE_DRUG_INDEX AS (
               SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
               FROM DRUG_EXPOSURE de
               WHERE de.DRUG_CONCEPT_ID IN (
                              SELECT DESCENDANT_CONCEPT_ID
                              FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
               )
               GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
                DATEDIFF (DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
FROM CTE_DRUG_INDEX i
              INNER JOIN OBSERVATION_PERIOD op
                              ON op.PERSON_ID = i.PERSON_ID
                              AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
ORDER BY i.PERSON_ID
```

New Users of Warfarin

Ex 2

Try running this on your own!

How many people do you get?

361,007 individuals

Results | Messages

	PERSON_ID	INDEX_DATE	OBSERVATION_PERIOD_START_DATE	OBSERVATION_PERIOD_END_DATE	DAYS_BEFORE_INDEX
1	11	2009-01-23	2008-02-04	2010-12-19	354
2	12	2009-02-17	2008-01-20	2010-11-23	394
3	17	2009-11-04	2008-03-04	2010-11-11	610
4	31	2009-01-16	2008-01-26	2010-12-14	356
5	51	2008-10-22	2008-01-03	2010-03-31	293
6	58	2008-10-20	2008-01-31	2010-09-17	263
7	61	2009-12-29	2008-01-05	2010-11-15	724
8	66	2009-08-01	2008-02-28	2010-10-29	520
9	68	2010-06-26	2008-01-21	2010-12-28	887
10	88	2008-08-31	2007-12-19	2010-12-14	256
11	91	2008-11-17	2008-04-14	2010-12-19	217

Query executed successfully. | WIN-FQP2LJUVRTQ\IQVIA_OHDSI... | WIN-FQP2LJUVRTQ\iqvia-... | Synpuf-2.3m | 00:04:54 | 361007 rows

Some Example Questions

Ex 1 Finding Warfarin

Ex 2 New Users of Warfarin

Ex 3

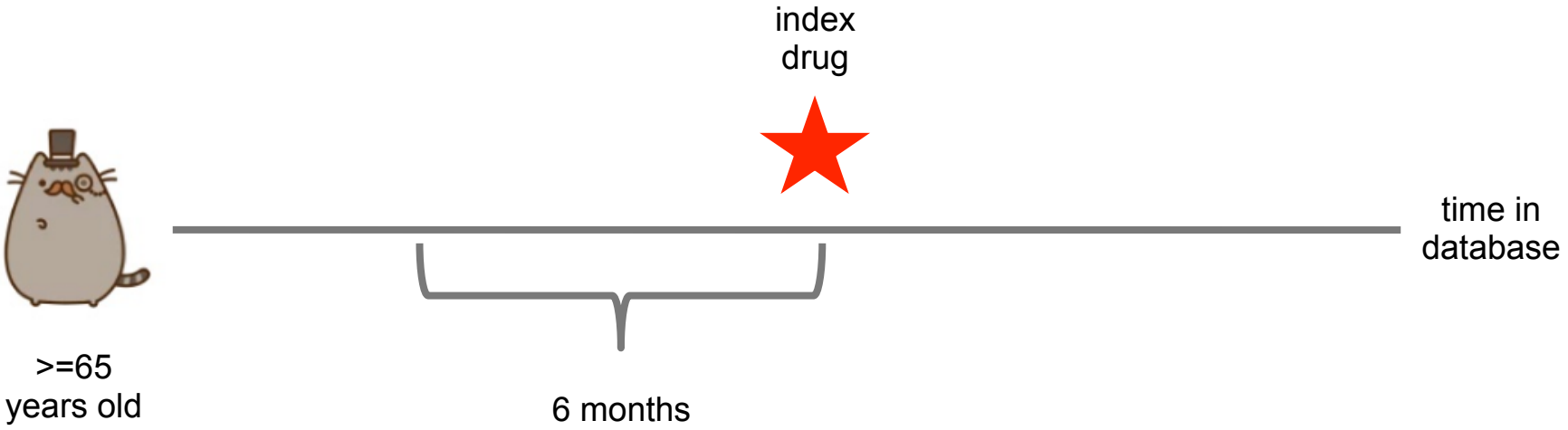
New Users of Warfarin who are >=65?

Ex 4 New Users of Warfarin with prior Atrial Fibrillation?

How do I define new users of warfarin who are >=65?

Ex 3

Someone who has recently started taking the drug, typically with a 6 or 12 month wash out



What is Needed in the CDM?

Ex 3

- **OMOP Vocabulary**
  to find the concepts
- **DRUG_EXPOSURE**
  to find individuals with exposure
- **OBSERVATION_PERIOD**
  to know people's time within the database
- **PERSON**
  to know year of birth

Step 1: Start with the previous query

Ex 3

```
/*************************************************************************
*             (Exercise 3) Warfarin New Users 65 or Older at Index
*************************************************************************/

;WITH CTE_DRUG_INDEX AS (
               SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
               FROM DRUG_EXPOSURE de
               WHERE de.DRUG_CONCEPT_ID IN (
                              SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
               )
               GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
               DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX,
               (YEAR(i.INDEX_DATE)-p.YEAR_OF_BIRTH) AS AGE_AT_INDEX
FROM CTE_DRUG_INDEX i
               JOIN OBSERVATION_PERIOD op
                              ON op.PERSON_ID = i.PERSON_ID
                              AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
               JOIN PERSON p
                              ON p.PERSON_ID = i.PERSON_ID
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
AND (YEAR(i.INDEX_DATE)-p.YEAR_OF_BIRTH )>= 65
ORDER BY i.PERSON_ID
```

Step 2: Add the Person Table to calculate age

Ex 3

```
/*********************************************************************************
*             (Exercise 3) Warfarin New Users 65 or Older at Index
*********************************************************************************/

;WITH CTE_DRUG_INDEX AS (
              SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
              FROM DRUG_EXPOSURE de
              WHERE de.DRUG_CONCEPT_ID IN (
                            SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
              )
              GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
              DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX,
              (YEAR(i.INDEX_DATE)-p.YEAR_OF_BIRTH) AS AGE_AT_INDEX
FROM CTE_DRUG_INDEX i
              JOIN OBSERVATION_PERIOD op
                            ON op.PERSON_ID = i.PERSON_ID
                            AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
              JOIN PERSON p
                            ON p.PERSON_ID = i.PERSON_ID
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
AND (YEAR(i.INDEX_DATE)-p.YEAR_OF_BIRTH )>= 65
ORDER BY i.PERSON_ID
```

New Users of Warfarin >= 65 years of age

Ex 3

```
/**************************************************************************
*             (Exercise 3) Warfarin New Users 65 or Older at Index
**************************************************************************/

;WITH CTE_DRUG_INDEX AS (
               SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
               FROM DRUG_EXPOSURE de
               WHERE de.DRUG_CONCEPT_ID IN (
                              SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
               )
               GROUP BY de.PERSON_ID
)
SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
               DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX,
               (YEAR(i.INDEX_DATE)-p.YEAR_OF_BIRTH) AS AGE_AT_INDEX
FROM CTE_DRUG_INDEX i
               JOIN OBSERVATION_PERIOD op
                              ON op.PERSON_ID = i.PERSON_ID
                              AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
               JOIN PERSON p
                              ON p.PERSON_ID = i.PERSON_ID
WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
AND (YEAR(i.INDEX_DATE)-p.YEAR_OF_BIRTH )>= 65
ORDER BY i.PERSON_ID
```

How many people do you get?

Some Example Questions

Ex 1 Finding Warfarin

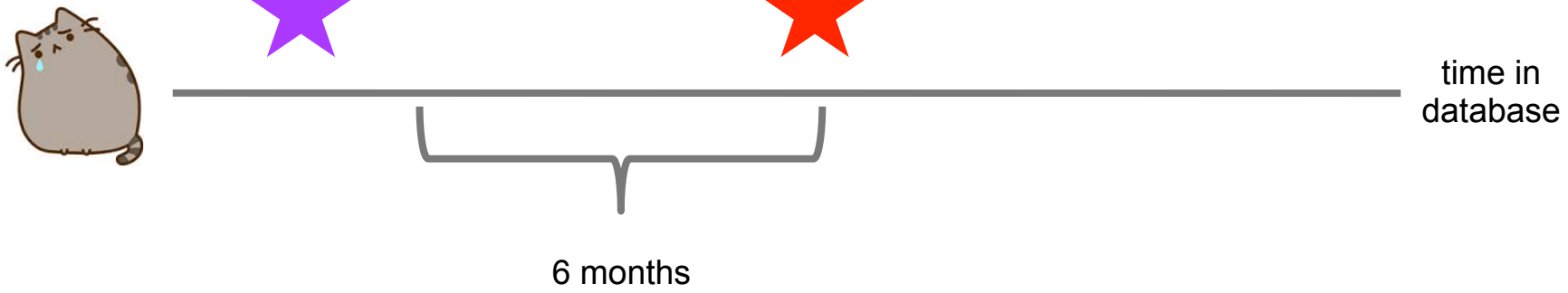
Ex 2 New Users of Warfarin

Ex 3 New Users of Warfarin who are >=65?

Ex 4 New Users of Warfarin with prior Atrial Fibrillation?

How do I define new users of Warfarin with prior Atrial Fibrillation?

Ex 4



What is Needed in the CDM?

Ex 4

- **OMOP Vocabulary**
  to find the concepts
- **DRUG_EXPOSURE**
  to find individuals with exposure
- **OBSERVATION_PERIOD**
  to know people's time within the database
- **PERSON**
  to know year of birth
- **CONDITION_OCCURRENCE**
  to find presence of a disease

Step 1: Start with the Ex 1 query

Ex 4

```
/*************************************************************************
*             (Exercise 4) Warfarin New Users With Prior AFIB
*************************************************************************/

;WITH CTE_DRUG_INDEX AS (
                SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
                FROM DRUG_EXPOSURE de
                WHERE de.DRUG_CONCEPT_ID IN (
                                SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
                )
                GROUP BY de.PERSON_ID
),
CTE_DRUG_NEW_USERS AS (
                SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
                                DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
                FROM CTE_DRUG_INDEX i
                                JOIN OBSERVATION_PERIOD op
                                                ON op.PERSON_ID = i.PERSON_ID
                                                AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
                WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
)
SELECT nu.*, MAX(DATEDIFF(DAY,co.CONDITION_START_DATE,nu.INDEX_DATE)) AS DAYS_OF_CLOSEST_AFIB_PRIOR_TO_INDEX
FROM CTE_DRUG_NEW_USERS nu
                JOIN CONDITION_OCCURRENCE co
                                ON co.PERSON_ID = nu.PERSON_ID
                                AND co.CONDITION_START_DATE BETWEEN nu.OBSERVATION_PERIOD_START_DATE AND nu.OBSERVATION_PERIOD_END_DATE
WHERE co.CONDITION_CONCEPT_ID IN (
                                SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID =          313217 /*Atrial fibrillation*/
)
AND co.CONDITION_START_DATE < nu.INDEX_DATE
GROUP BY nu.PERSON_ID, nu.INDEX_DATE, nu.OBSERVATION_PERIOD_START_DATE, nu.OBSERVATION_PERIOD_END_DATE, nu.DAYS_BEFORE_INDEX
ORDER BY nu.PERSON_ID
```

Step 2: Define Atrial Fibrillation

Ex 4

```
/**************************************************************************
*            (Exercise 4) Warfarin New Users With Prior AFIB
**************************************************************************/

;WITH CTE_DRUG_INDEX AS (
              SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
              FROM DRUG_EXPOSURE de
              WHERE de.DRUG_CONCEPT_ID IN (
                            SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
              )
              GROUP BY de.PERSON_ID
),
CTE_DRUG_NEW_USERS AS (
              SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
                            DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
              FROM CTE_DRUG_INDEX i
                            JOIN OBSERVATION_PERIOD op
                                          ON op.PERSON_ID = i.PERSON_ID
                                          AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
              WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
)
SELECT nu.*, MAX(DATEDIFF(DAY,co.CONDITION_START_DATE,nu.INDEX_DATE)) AS DAYS_OF_CLOSEST_AFIB_PRIOR_TO_INDEX
FROM CTE_DRUG_NEW_USERS nu
              JOIN CONDITION_OCCURRENCE co
                            ON co.PERSON_ID = nu.PERSON_ID
                            AND co.CONDITION_START_DATE BETWEEN nu.OBSERVATION_PERIOD_START_DATE AND nu.OBSERVATION_PERIOD_END_DATE
WHERE co.CONDITION_CONCEPT_ID IN (
                            SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID =          313217 /*Atrial fibrillation*/
)
AND co.CONDITION_START_DATE < nu.INDEX_DATE
GROUP BY nu.PERSON_ID, nu.INDEX_DATE, nu.OBSERVATION_PERIOD_START_DATE, nu.OBSERVATION_PERIOD_END_DATE, nu.DAYS_BEFORE_INDEX
ORDER BY nu.PERSON_ID
```

Step 3: Prior Atrial Fibrillation

Ex 4

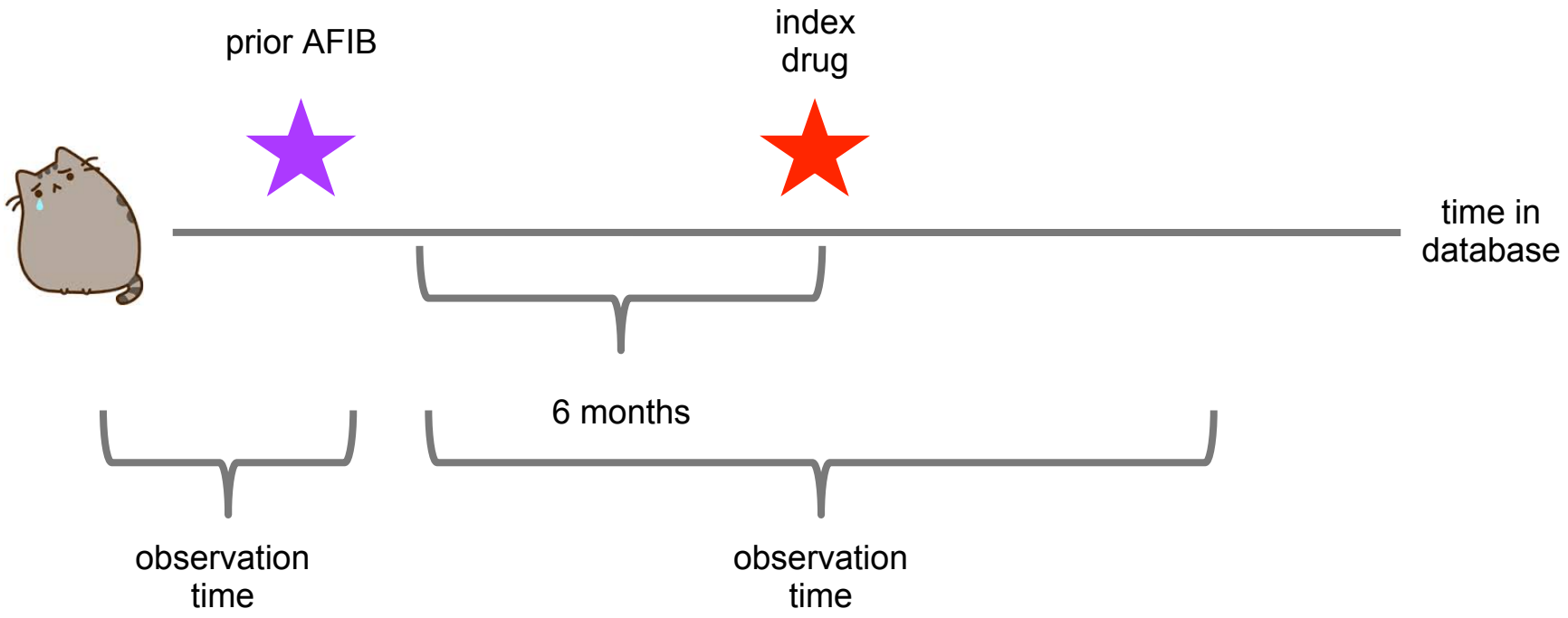
```
/**************************************************************************
*            (Exercise 4) Warfarin New Users With Prior AFIB
**************************************************************************/

;WITH CTE_DRUG_INDEX AS (
            SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
            FROM DRUG_EXPOSURE de
            WHERE de.DRUG_CONCEPT_ID IN (
                        SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
            )
            GROUP BY de.PERSON_ID
),
CTE_DRUG_NEW_USERS AS (
            SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
                        DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
            FROM CTE_DRUG_INDEX i
                        JOIN OBSERVATION_PERIOD op
                                    ON op.PERSON_ID = i.PERSON_ID
                                    AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE
            WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
)
SELECT nu.*, MAX(DATEDIFF(DAY,co.CONDITION_START_DATE,nu.INDEX_DATE)) AS DAYS_OF_CLOSEST_AFIB_PRIOR_TO
FROM CTE_DRUG_NEW_USERS nu
            JOIN CONDITION_OCCURRENCE co
                        ON co.PERSON_ID = nu.PERSON_ID
                        AND co.CONDITION_START_DATE BETWEEN nu.OBSERVATION_PERIOD_START_DATE AND nu.OBSERVATION_PERIOD_END_DATE
WHERE co.CONDITION_CONCEPT_ID IN (
                        SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID =          313217 /*Atrial fibrillation*/
)
AND co.CONDITION_START_DATE < nu.INDEX_DATE
GROUP BY nu.PERSON_ID, nu.INDEX_DATE, nu.OBSERVATION_PERIOD_START_DATE, nu.OBSERVATION_PERIOD_END_DATE, nu.DAYS_BEFORE_INDEX
ORDER BY nu.PERSON_ID
```

Keeps condition within the same observable time, exclude if you want all time prior

How do I define new users of Warfarin with prior Atrial Fibrillation?

Ex 4



New Users of Warfarin with prior Atrial Fibrillation

Ex 4

Try running this on your own!

```
/*************************************************************************
*             (Exercise 4) Warfarin New Users With Prior AFIB
*************************************************************************/

;WITH CTE_DRUG_INDEX AS (
                SELECT de.PERSON_ID, MIN(de.DRUG_EXPOSURE_START_DATE) AS INDEX_DATE
                FROM DRUG_EXPOSURE de
                WHERE de.DRUG_CONCEPT_ID IN (
                                SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID = 1310149 /*warfarin*/
                )
                GROUP BY de.PERSON_ID
),
CTE_DRUG_NEW_USERS AS (
                SELECT i.PERSON_ID, i.INDEX_DATE, op.OBSERVATION_PERIOD_START_DATE, op.OBSERVATION_PERIOD_END_DATE,
                                DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) AS DAYS_BEFORE_INDEX
                FROM CTE_DRUG_INDEX i
                                JOIN OBSERVATION_PERIOD op
                                                ON op.PERSON_ID = i.PERSON_ID
                                                AND i.INDEX_DATE BETWEEN op.OBSERVATION_PERIOD_START_DATE AND op.OBSERVATION_PERIOD_END_DATE
                WHERE DATEDIFF(DAY,op.OBSERVATION_PERIOD_START_DATE,i.INDEX_DATE) >= 180
)
SELECT nu.*, MAX(DATEDIFF(DAY,co.CONDITION_START_DATE,nu.INDEX_DATE)) AS DAYS_OF_CLOSEST_AFIB_PRIOR_TO_INDEX
FROM CTE_DRUG_NEW_USERS nu
                JOIN CONDITION_OCCURRENCE co
                                ON co.PERSON_ID = nu.PERSON_ID
                                AND co.CONDITION_START_DATE BETWEEN nu.OBSERVATION_PERIOD_START_DATE AND nu.OBSERVATION_PERIOD_END_DATE
WHERE co.CONDITION_CONCEPT_ID IN (
                                SELECT DESCENDANT_CONCEPT_ID FROM CONCEPT_ANCESTOR WHERE ANCESTOR_CONCEPT_ID =          313217 /*Atrial fibrillation*/
)
AND co.CONDITION_START_DATE < nu.INDEX_DATE
GROUP BY nu.PERSON_ID, nu.INDEX_DATE, nu.OBSERVATION_PERIOD_START_DATE, nu.OBSERVATION_PERIOD_END_DATE, nu.DAYS_BEFORE_INDEX
ORDER BY nu.PERSON_ID
```

Try on your own!

- Warfarin New Users 65 or Older at Index with Prior Atrial Fibrillation

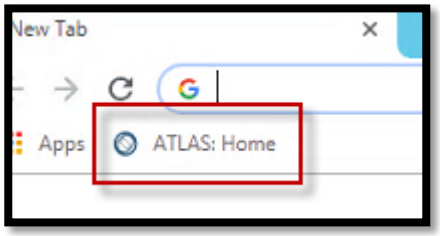
163,271 individuals

- Bonus: Clopidogrel New Users 65 or Older at Index with Prior Atrial Fibrillation

63,462 individuals

Queries Can Be Automated

- Open up Google Chrome 

- Open up ATLAS 

- Example cohort under “Cohort Definitions”: “Warfarin New Users 65 or Older at Index with Prior Atrial Fibrillation”

Cohort

Warfarin New Users 65 or Older at Index with Prior Atrial Fibrillation

Save | Close | Copy | Delete

Definition | Concept Sets | Generation | Reporting | Explore | Export

Cohort definition: A cohort is defined as the set of persons satisfying one or more inclusion criteria for a duration of time. criteria and cohort exit criteria. Cohort entry criteria involve selecting one or more initial events, which determine the start d entry record to determine the end date when the person's episode no longer qualifies for the cohort.

Cohort #2

Warfarin New Users 65 or Older at Index with Prior Atrial Fibrillation

Definition | Concept Sets | Generation | Reporting | Export

Available CDM Sources

	Source Name	Generation Status	People	Records	Generated	Generation Duration	
Generate	Synpuf-100k	COMPLETE	7,067	7,067	4/25/2018 2:37:23 PM	45.727s	View Reports
Generate	Synpuf-2.3m	COMPLETE	163,271	163,271	4/25/2018 2:38:17 PM	1218.763s	View Reports

having all of the following criteria: Add New Criteria...

with the following event criteria:

with age Greater or Equal To 65

and with at least 1 using all occurrences of:

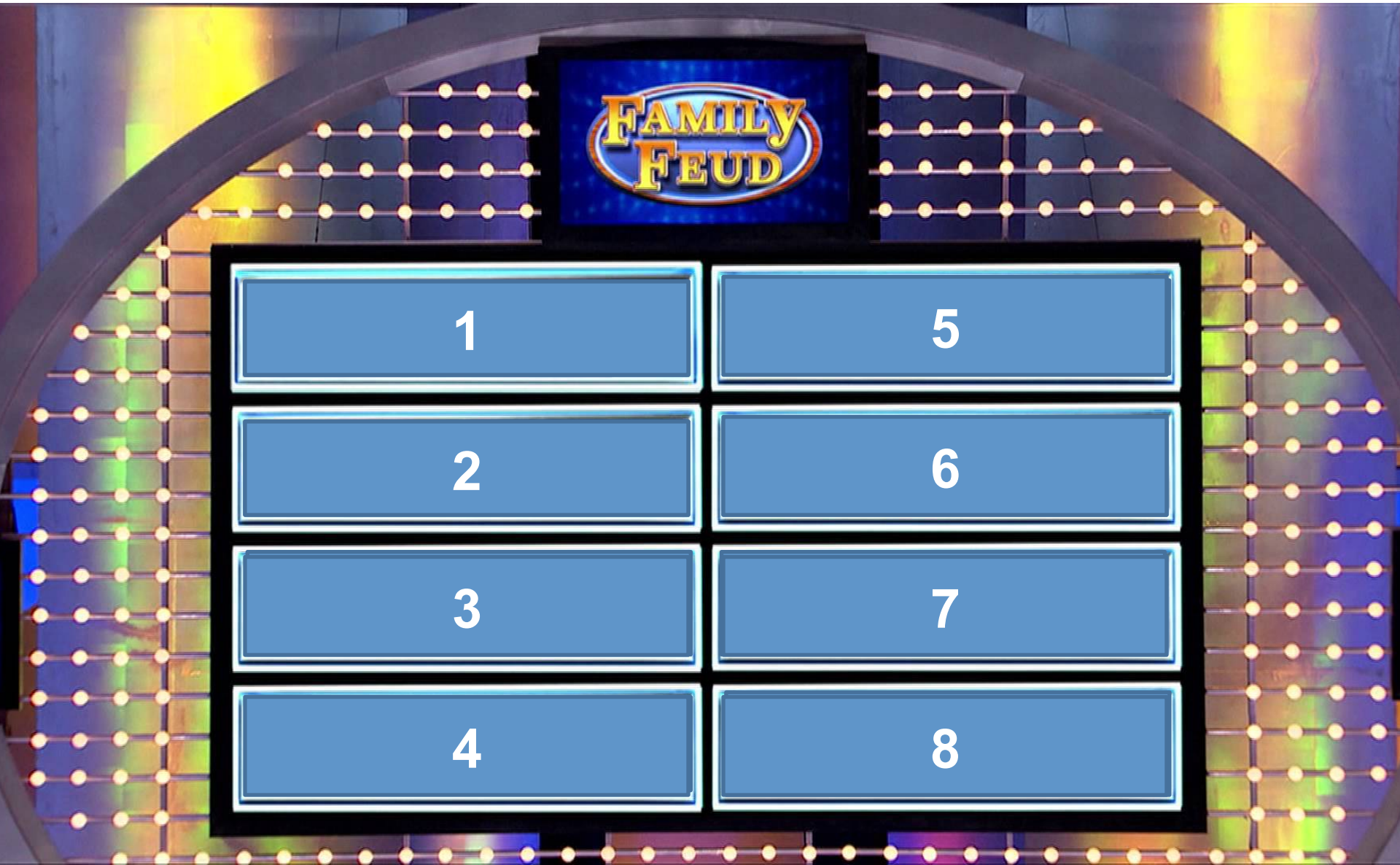
a condition occurrence of Atrial Fibrillation Add

starting between All days Before and 1 days Before event index date and ending any time.

Limit cohort of initial events to: earliest event per person.

Conclusions

Conclusion Game



OMOP Vocabulary

- Is used to **standardize terminology**
- **Compiles standards** from disparate public and private sources and some OMOP-grown concepts
- Has **one uniform structure** to house multiple vocabularies used in the public domain
- Is designed to **facilitate efficient queries**
- Is **regularly updated, maintained,** and **improved**

OMOP CDM

- Is used to **standardize structure** and **queries**
- **Integrated with Controlled Vocabulary**
- **Consolidates data from heterogeneous data sources**: EMR, claims, registries
- **Patient centric**
- **Domain** (subject area) **based**: concepts decide what table each piece of data lands on
- **Preserves data provenance**
- **Database platform independent**

What Makes OMOP CDM Unique

- **Supports collaborative research** across data sources both within and outside of US
- Developed **based on analytic use cases** by community of collaborators
- **Specialized:** reflective of clinical domain, granular, well structured
- **Integrated with Vocabulary** that is uniformly structured and well curated
- **Extendable**: new concepts and attributes can be added
- **Supported by Community** of interdisciplinary developers and researches