OMOP Common Data Model and Standardized Vocabularies

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OHDSI
OBSERVATIONAL HEALTH DATA SCIENCES AND INFORMATICS

Please copy the contents of the
USB drive to your hard disk now if VM not set up previously.
You will need ~45GB free disk space available.

After the Tutorials, you will know…

1. What's OMOP, OHDSI?
2. How does the Standardized Vocabulary work?
3. How do find codes and Concepts?
4. How do I navigate the hierarchy?
5. What is the OMOP CDM?
6. How to use the OMOP CDM

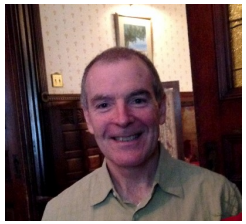
Agenda

Section	Speaker	Time	Room	Item(s)
Registration	-	8:00AM - 9:00AM (1 hour)	Glen Foyer	Glen Foyer
Introduction	George / Mark / Karthik	9:00AM - 10:00AM (1 hour)	Glen Echo	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
Break	-	10:00AM - 10:15AM (15 min)	-	-
Vocabulary – Part 1	Christian	10:15AM - 12:30PM (2 hours & 15 min)	Glen Echo	Basic Relationship, Ancestors, & Descendants How does it work for Drugs SQL Examples
Lunch	-	12:30PM - 1:30PM (1 hour)	Glen Foyer	-

Agenda (cont.)

Section	Speaker	Time	Room	Item(s)
Vocabulary – Part 2	Christian	1:30PM - 2:00PM (30 min)	Glen Echo	Continued
Common Data Model	Mui / Rimma	2:00PM - 3:15PM (1 hour & 15 min)	Glen Echo	History of the model In depth discussion of model Era discussion Real World Scenario ETL Pitfalls
Break	-	3:15PM - 3:30PM (15 min)	-	-
CDM Examples	Erica / Clair	3:30PM - 5:00 PM (1 hour & 30 min)	Glen Echo	Leveraging OHDSI Tools (GitHub/Forums/ Working Group) Exercises OHDSI Community Conclusion Game

Instructors

Rimma Belenkaya, M.A., M.S.	Clair Blacketer, MPH, PMP	George Hripcsak, MD, MS	Karthik Natarajan, PhD	Don O'Hara, MS	
					
Christian Reich, MD, PhD	Gowtham Rao, MD, PhD	Don Torok, MS	Mui Van Zandt	Mark Velez, MA	Erica A. Voss, MPH, PMP
					

Acknowledgements:
Anthony Reckard, Mike Warfe, Dmytry Dymshyts, & Michael Goodman

Ground Rules

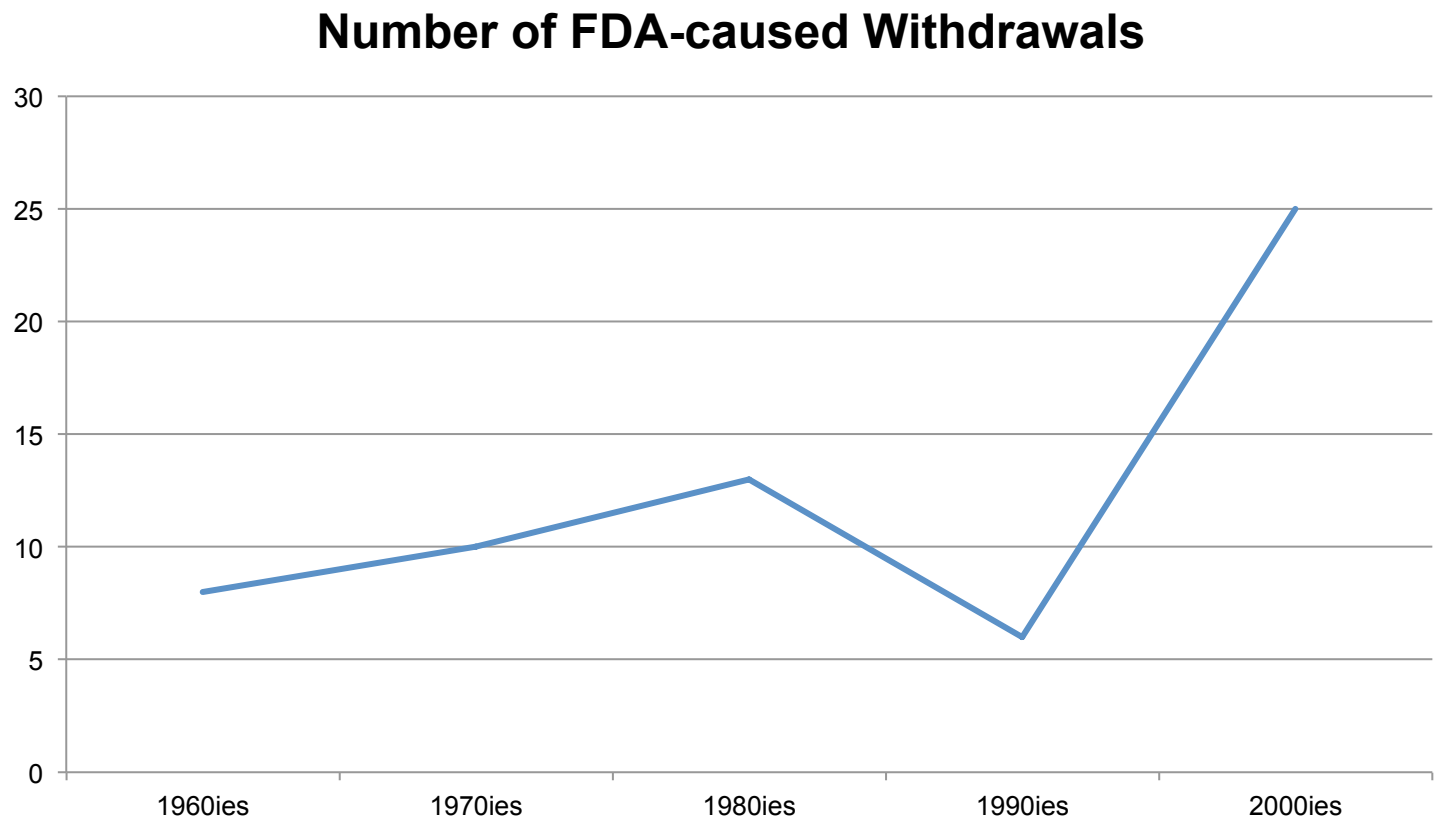
- We are recording today's session, so when asking questions wait for a microphone.
- We may table some questions if they are too specific.
- Please return the Virtual Machine (VM) distributed today, unless you want to use it for some good purpose.
- If we cannot get the VM working on your machine let's try to buddy you up. Do not worry the presentation will still walk you through the content.
- If you do not already have the VM set up, please begin copying over the flash drive to your local computer (local drive).

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);

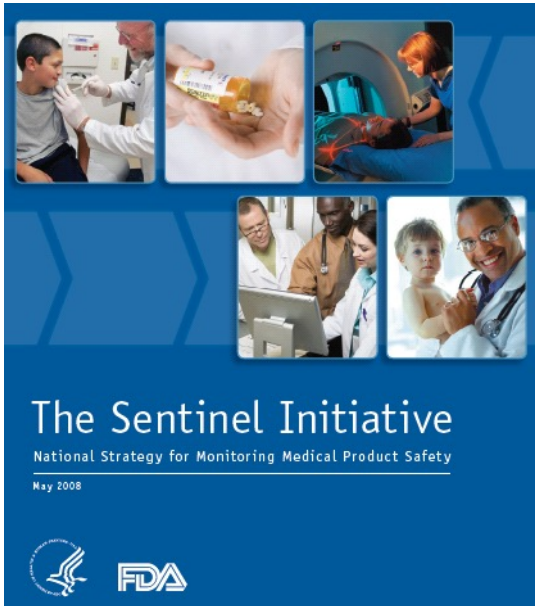
"(ii) develop validated methods for the establishment of a postmarket risk identification and analysis system to link and analyze safety data from multiple sources, with the goals of including, in aggregate—

"(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.

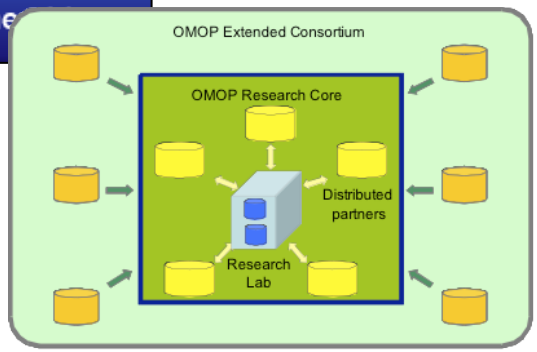
"(C) ESTABLISHMENT OF THE POSTMARKET RISK IDENTIFICATION AND ANALYSIS SYSTEM.—



Risk Identification and Analysis System:

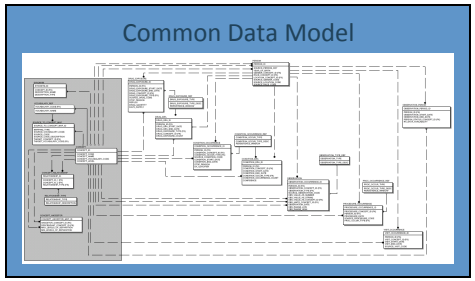
a systematic and reproducible process to efficiently generate evidence to support the characterization of the potential effects of medical products from across a network of disparate observational healthcare data sources

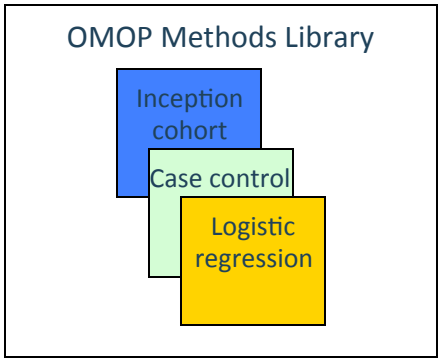
OMOP Experiment 1 (2009-2010)



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

- Open-source
- Standards-based





- 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										

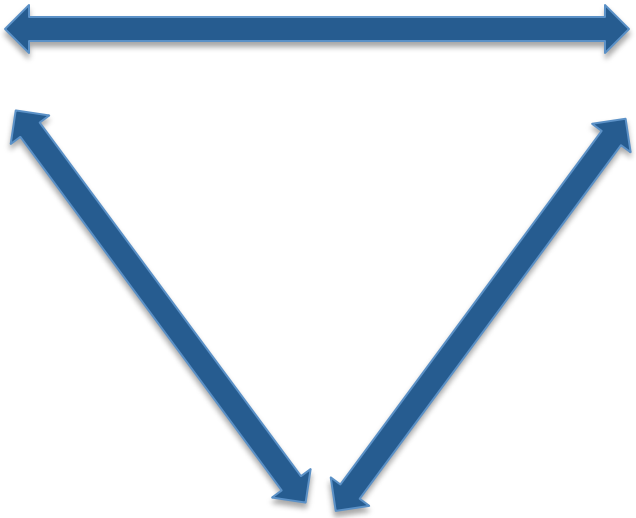
Observational Medical Outcomes Partnership

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

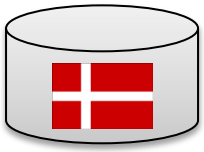
	Positives	Negatives
Total	165	234
Myocardial Infarction	36	66
Upper GI Bleed	24	67
Acute Liver Injury	81	37
Acute Renal Failure	24	64

Observational Medical Outcomes Partnership

European OMOP Experiment

Observational data

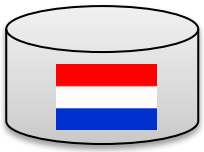
Aarhus



Pedianet

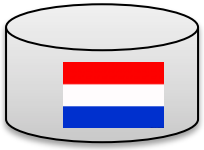
ARS

IPCI

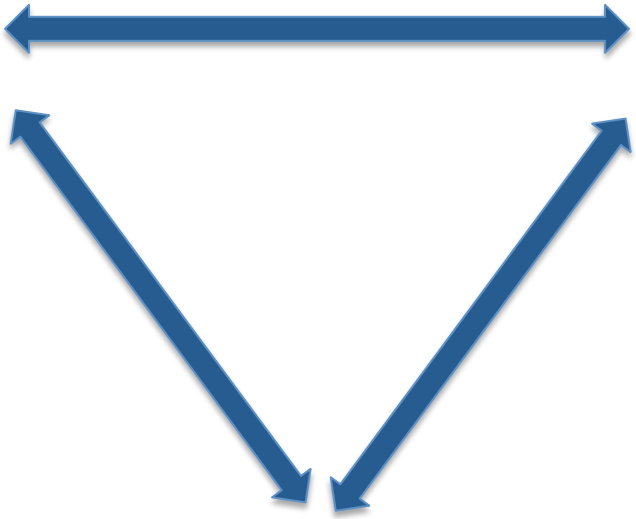


HS

PHARMO



eu-adr



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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

Observational Medical Outcomes Partnership

eu-adr

Used in European Experiment

Name	Description	Population
Aarhus	Danish national health registry, covering the Aarhus region. Includes inhabitant registry, drug dispensations, hospital claims, lab values, and death registry.	2 M 
ARS	Italian record linkage system covering the Tuscany region, including inhabitant registry, drug dispensations, hospital claims, and death registry	4 M 
Health-Search	Italian general practice database (no children)	1 M 
IPCI	Dutch general practice database	0.75 M 
Pedianet	Italian general practice pediatric database	0.14 M 
PHARMO	Dutch record linkage system. Includes inhabitant registry, drug dispensations, hospital claims, and lab values.	1.28 M 

Results

Observational Medical Outcomes Partnership

Main findings in OMOP experiment

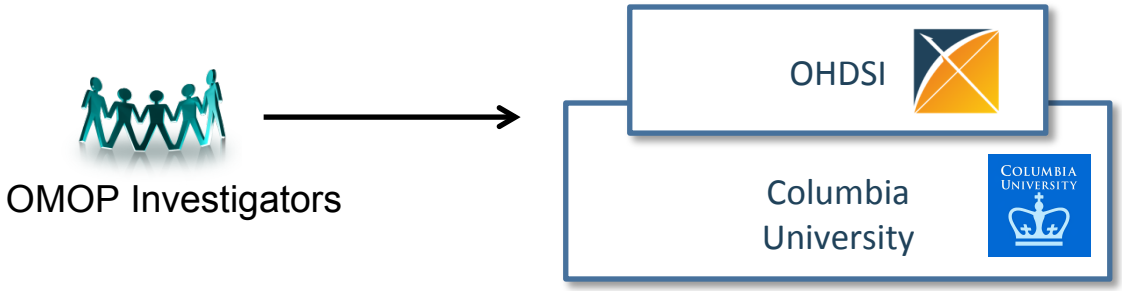
- Heterogeneity in estimates due to choice of database
- Heterogeneity in estimates due to analysis choices
- Except little heterogeneity due to outcome definitions
- Good performance (AUC > 0.7) in distinguishing positive from negative controls for optimal methods when stratifying by outcome and restricting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

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

Letter Soup

- **OMOP:** ended in 2013 with Symposium
- **IMEDS:** Program at Reagan-Udall Foundation of the FDA
  - Methodological research to inform Industry and Agency
  - Research Lab
- **OHDSI:** Open Research Collaborative started by OMOP PIs and coordinated through Columbia University
  - Multiple stakeholders: academia, government, industry
  - Multiple geographies: US, Europe, Asia-Pacific
  - Multiple disciplines: Statistics, epidemiology, informatics, clinical sciences
  - Maintains OMOP CDM and Vocabularies

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

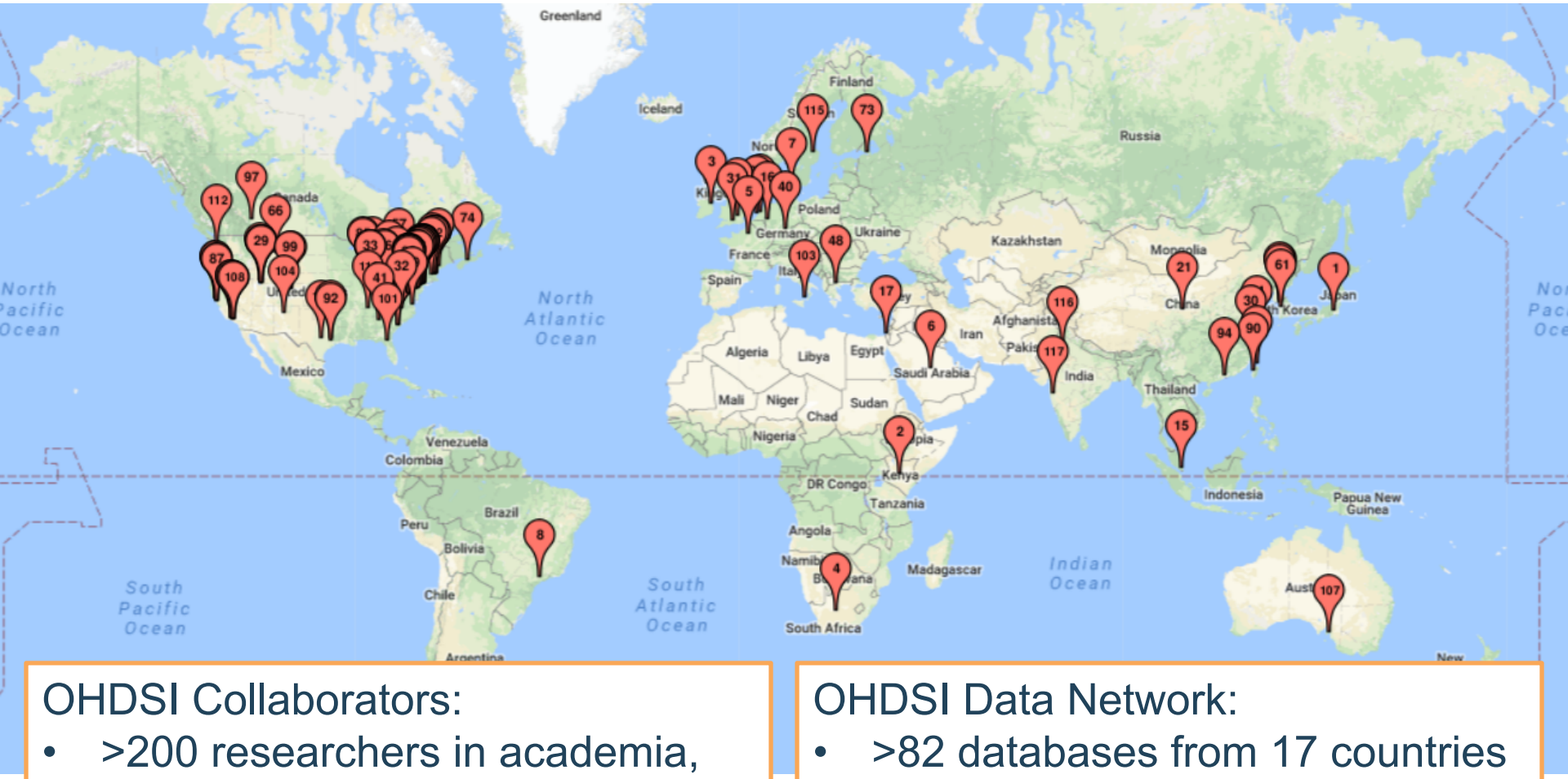
OHDSI's vision

OHDSI collaborators access a network of 1 billion patients to generate evidence about all aspects of healthcare. Patients and clinicians and other decision-makers around the world use OHDSI tools and evidence every day.

Join us on the journey

http://ohdsi.org

OHDSI: a global community



OHDSI Collaborators:

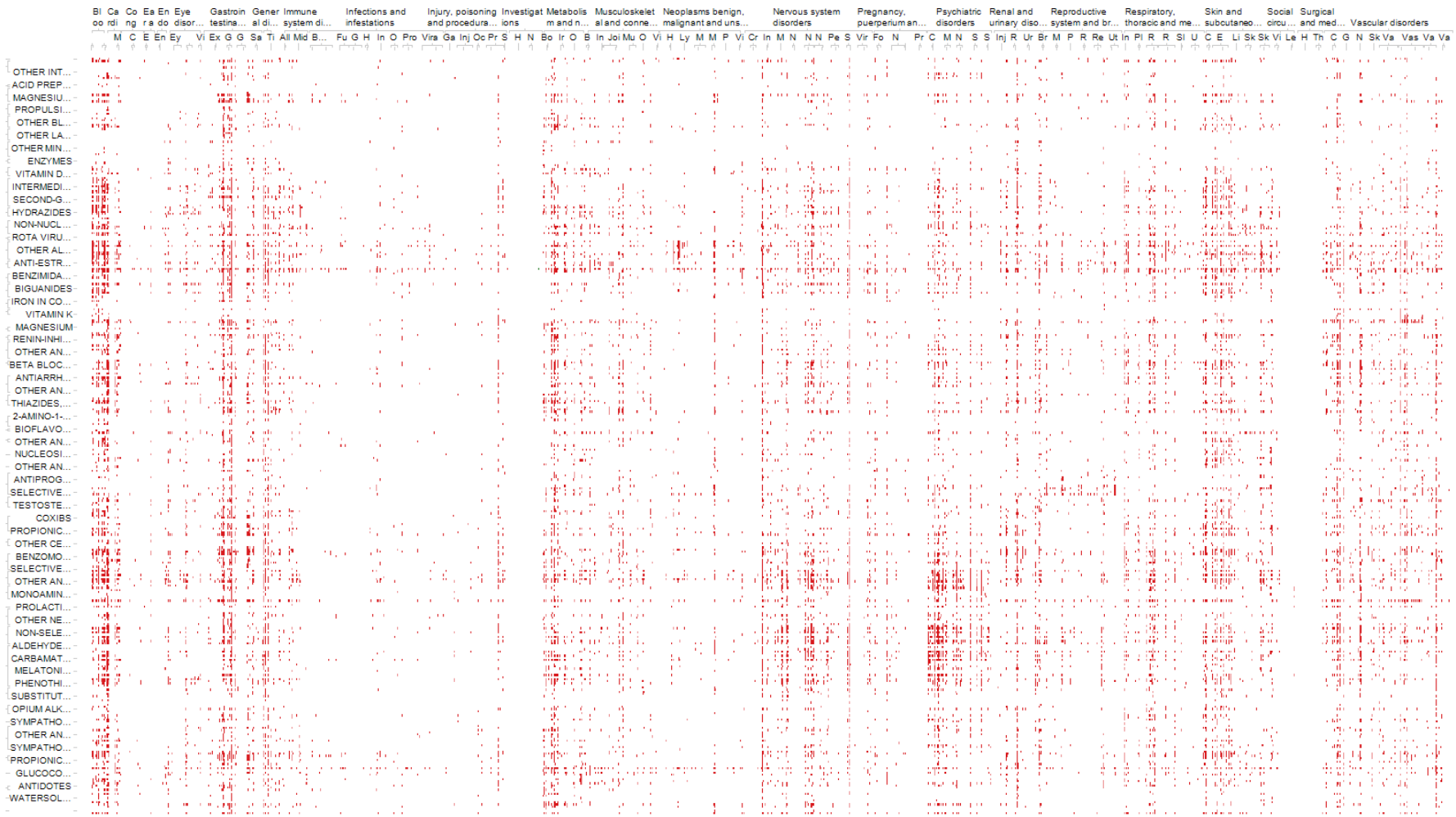
- >200 researchers in academia, industry and government
- >17 countries

OHDSI Data Network:

- >82 databases from 17 countries
- 1.2 billion patients records (duplicates)
- ~115 million non-US patients

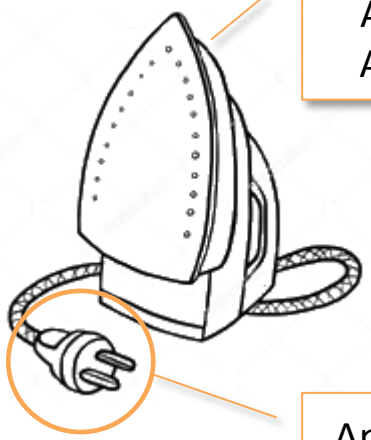
Current pace of evidence generation in healthcare

All health outcomes of interest



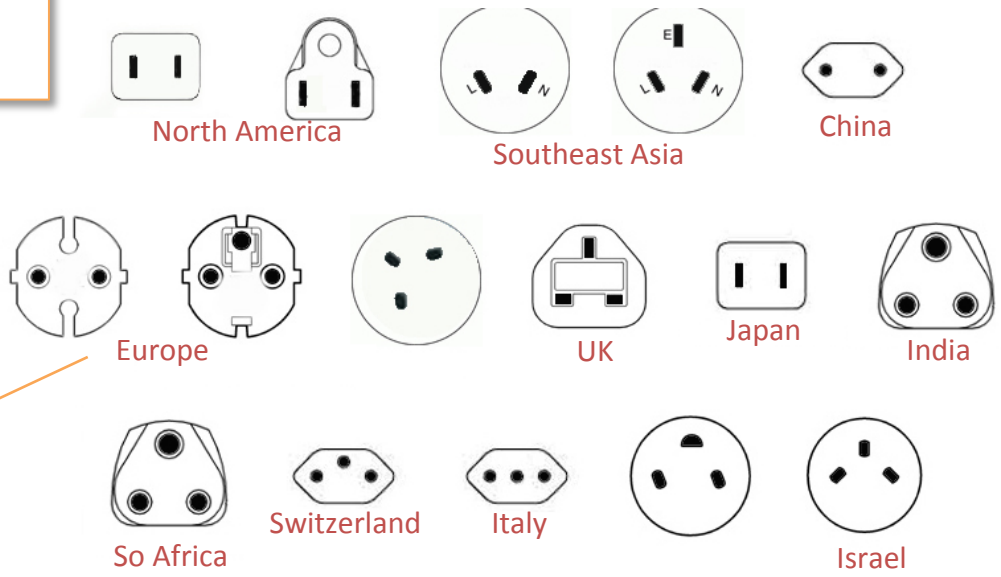
Current Approach: “One Study – One Script“

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

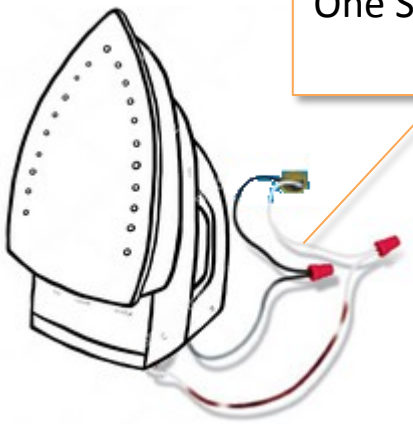


Analytical method: Adherence to Drug

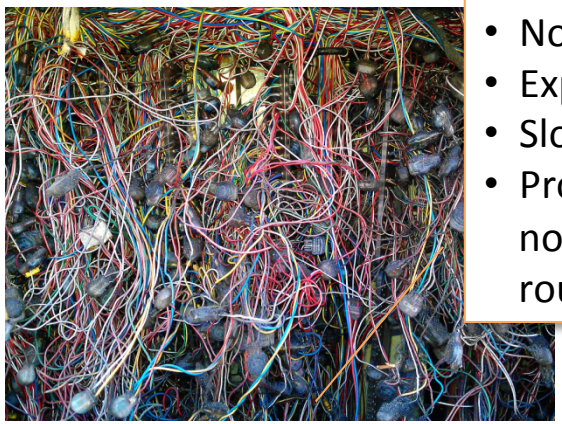
Application to data



Current solution:

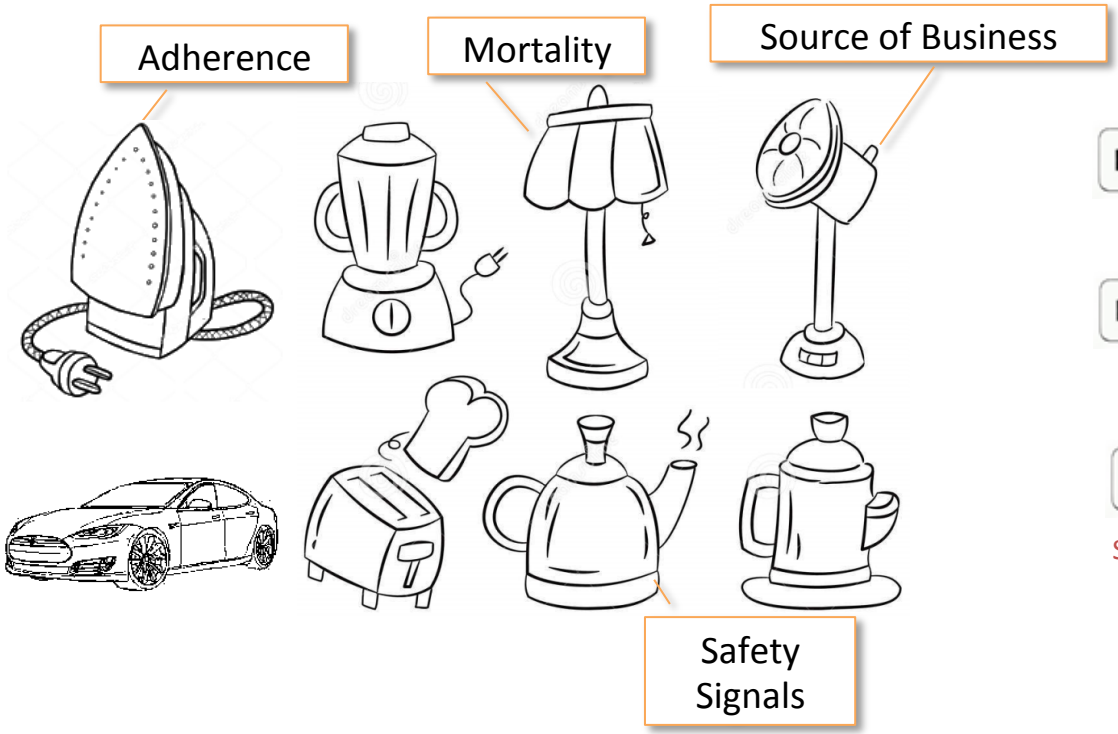


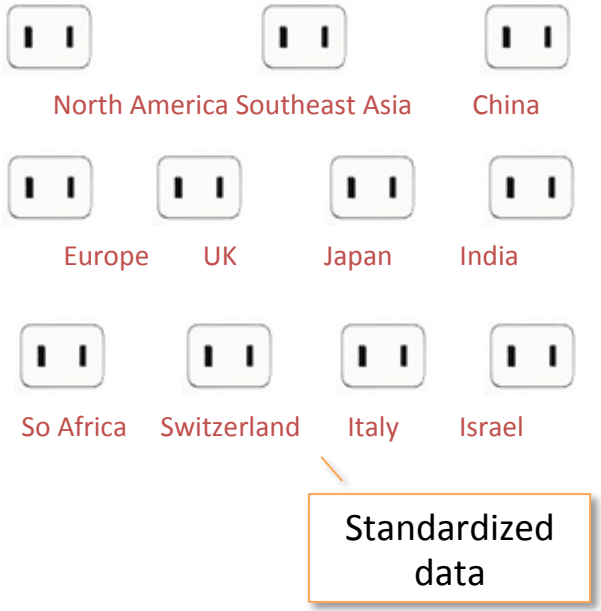
One SAS or R script for each study



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

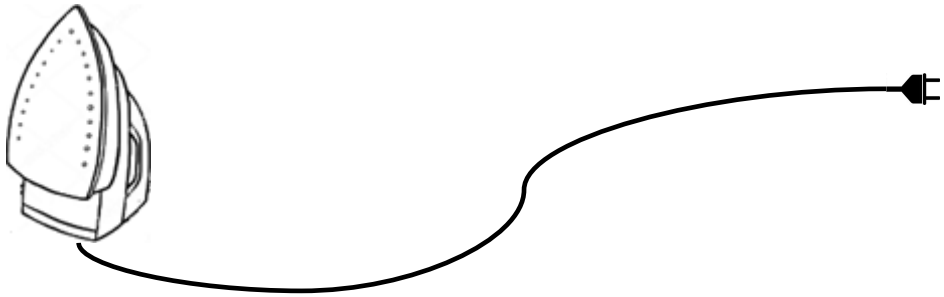
Solution: Data Standardization Enables Systematic Research

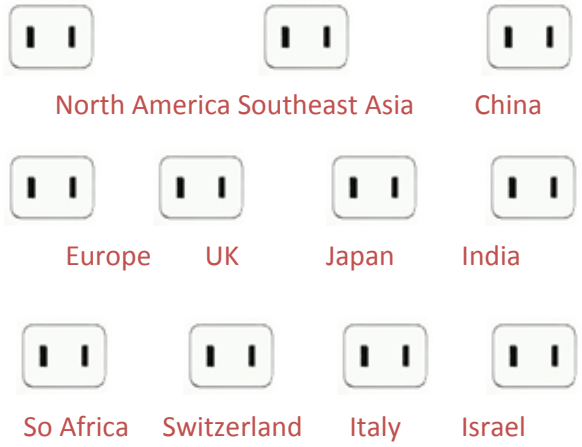




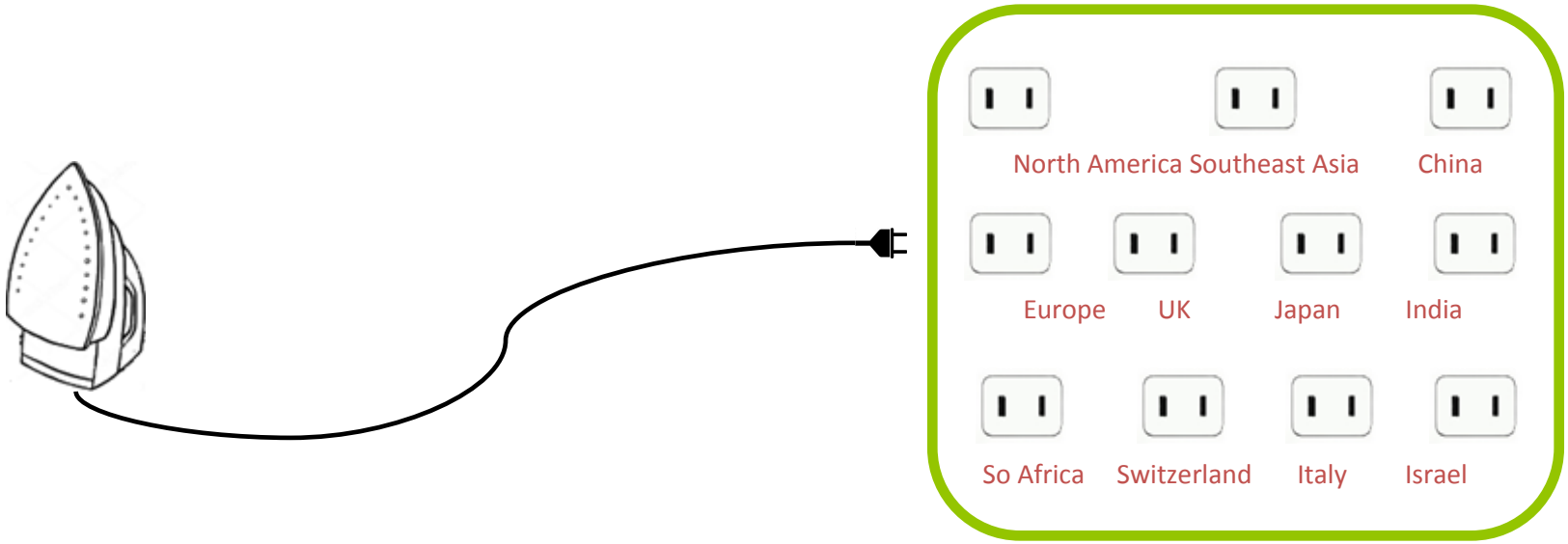
OHDSI Tools

Analytics can be remote

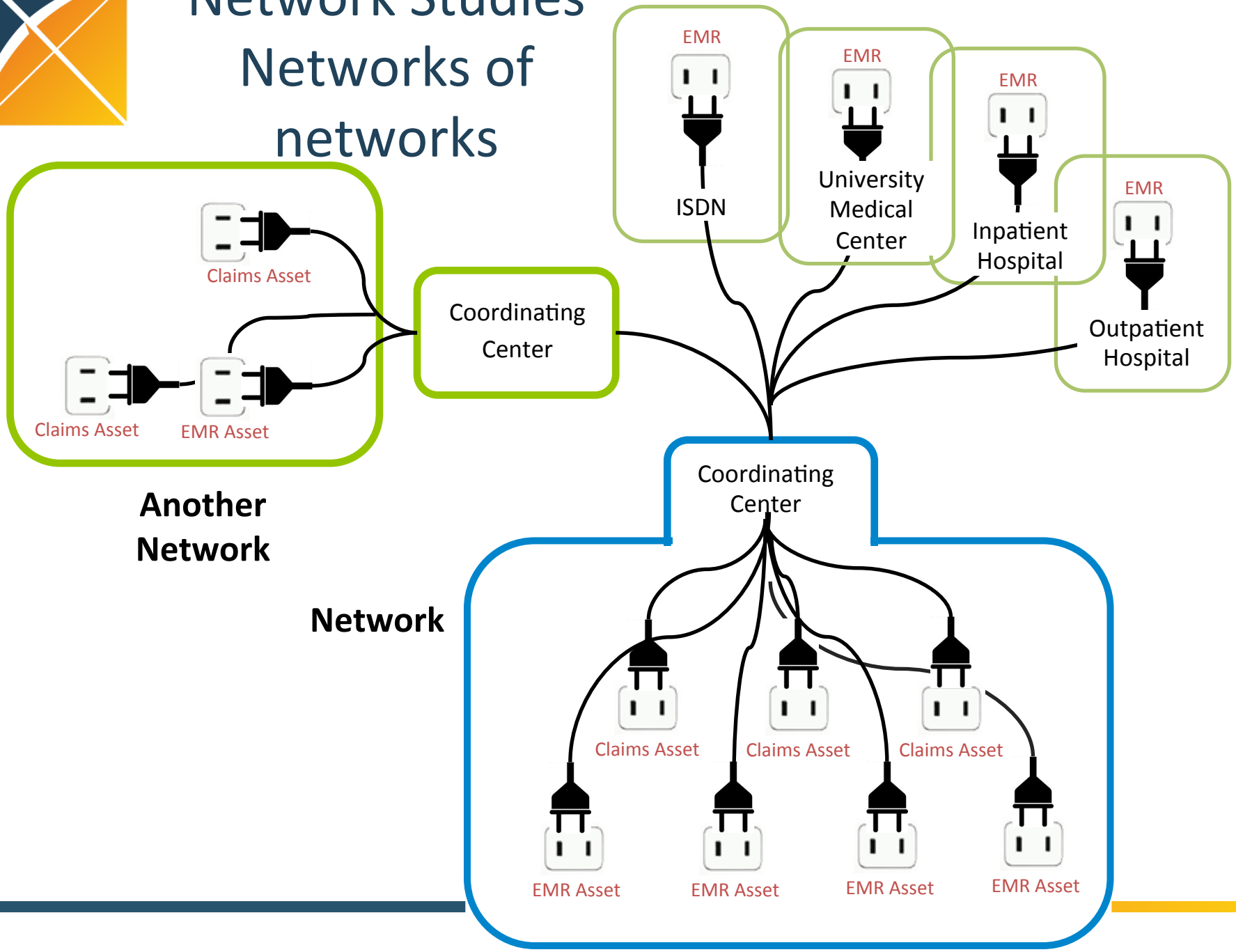




Analytics can be behind firewall



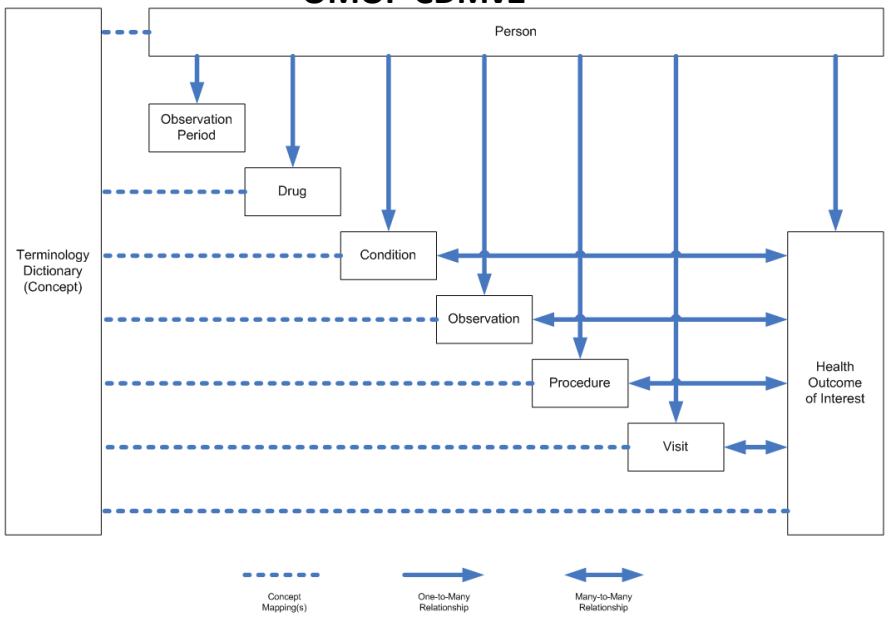
Network Studies
Networks of networks



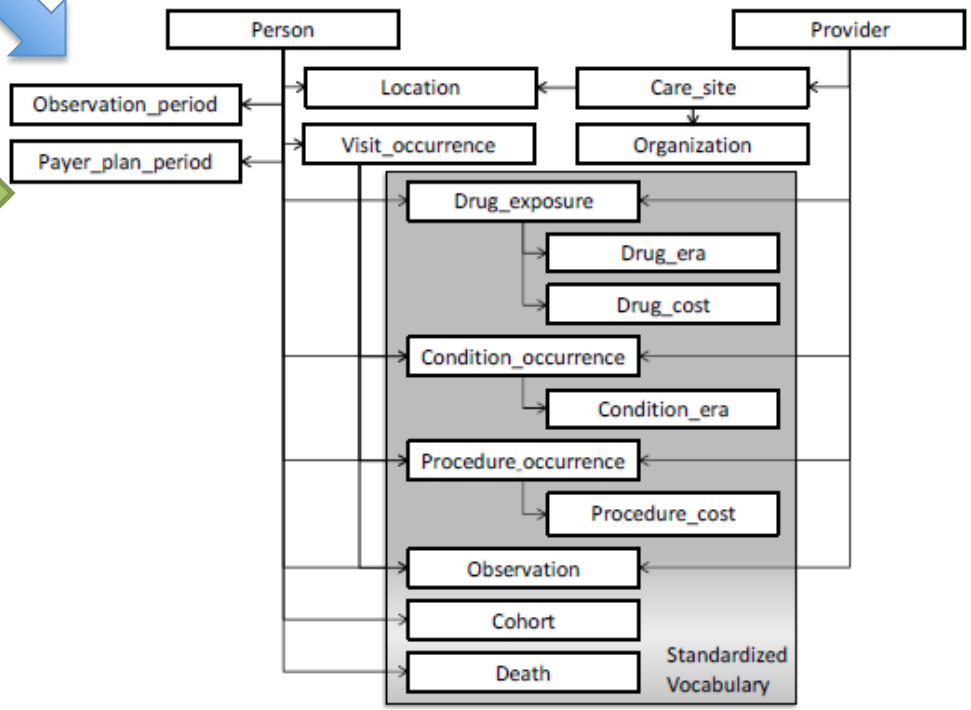
Evolution of the CDM

OMOP CDM now Version 5, following multiple iterations of implementation, testing, modifications, and expansion based on the experiences of the OMOP community who bring on a growing landscape of research use cases.

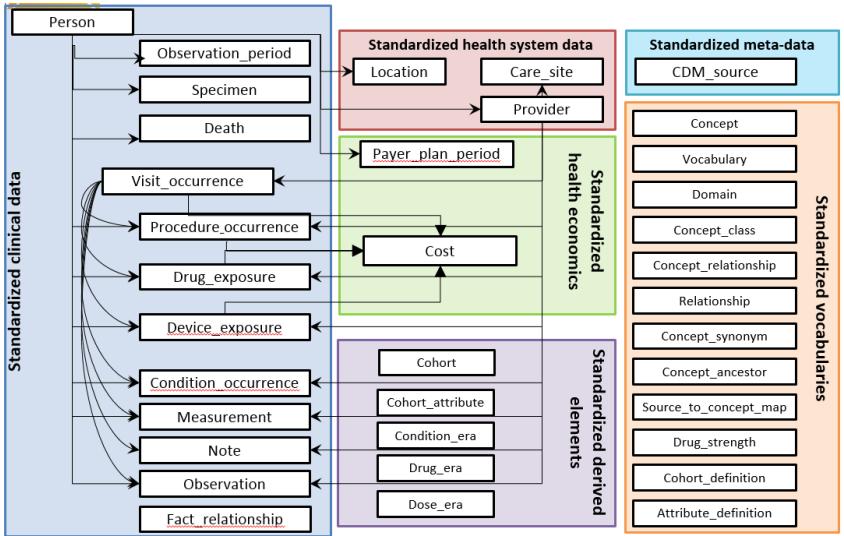
OMOP CDMv2



OMOP CDMv4

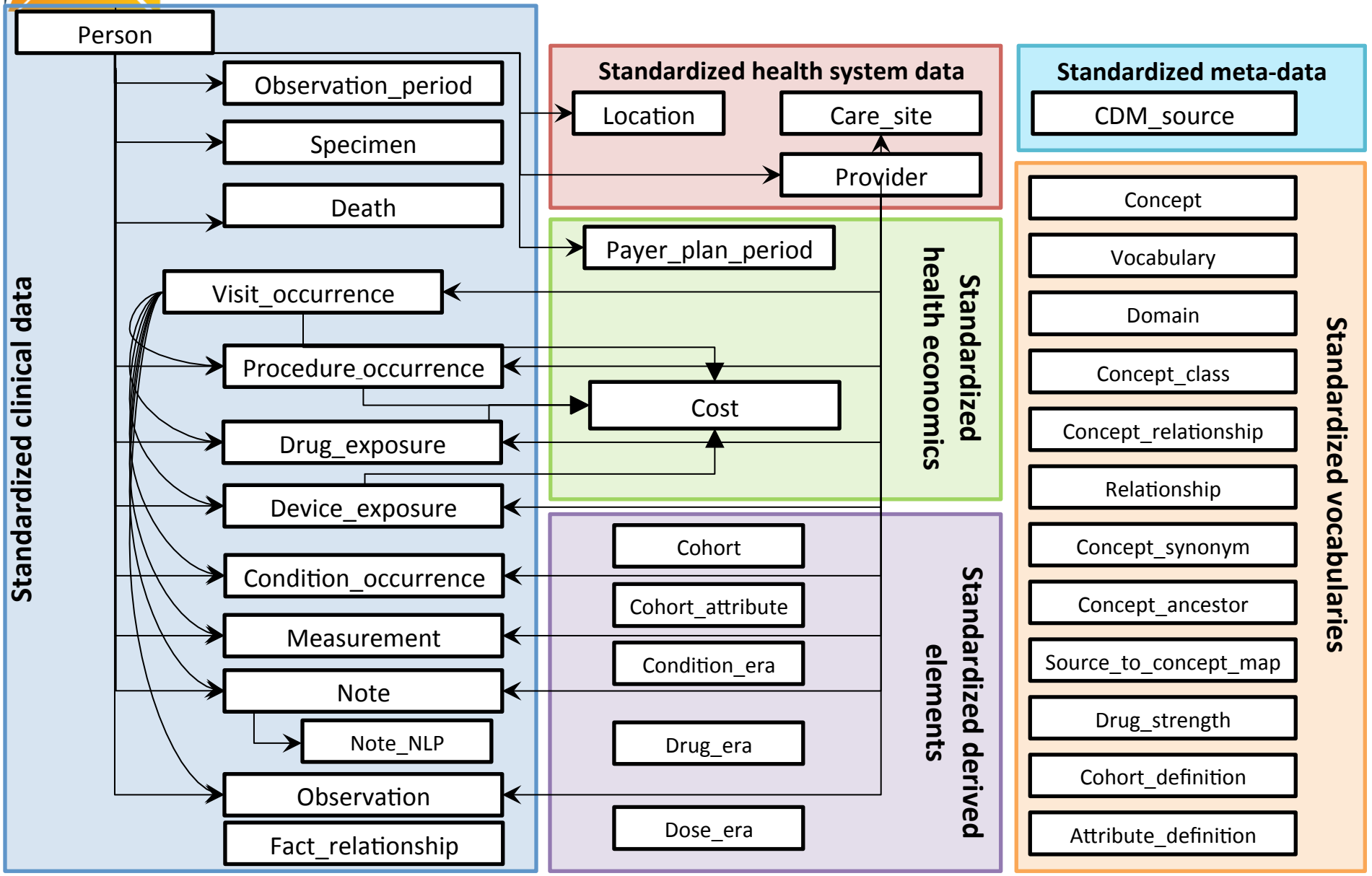


OMOP CDMv5



http://omop.org/CDM

CDM Version 5 Key Domains



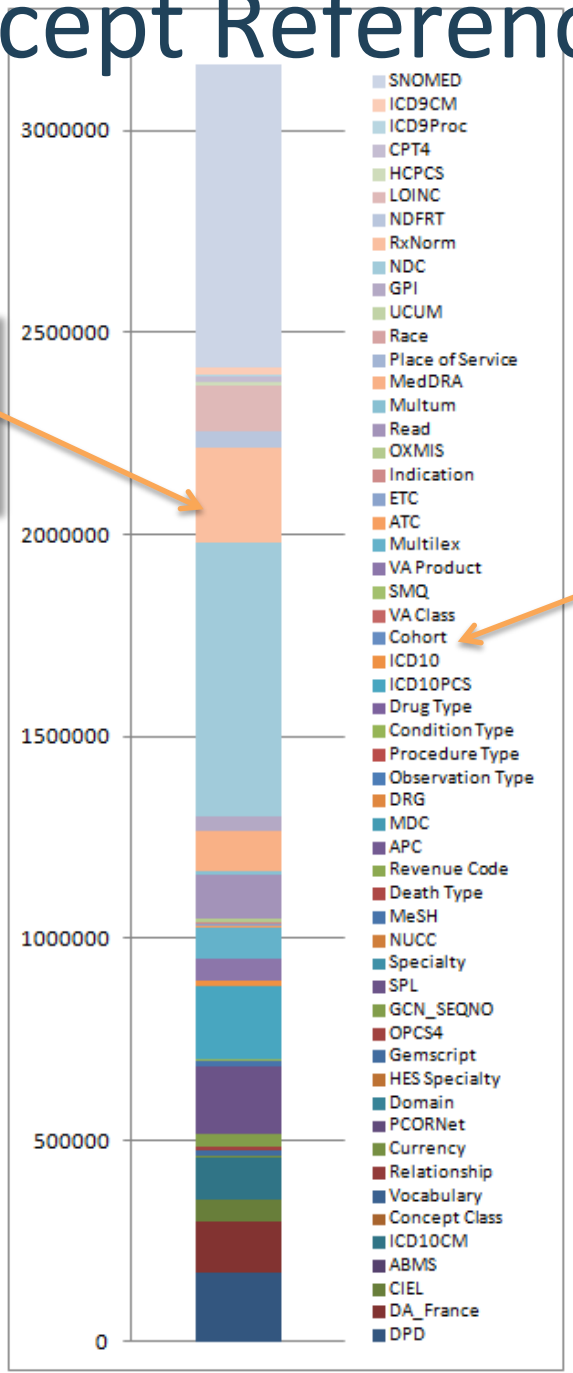
Standard Variable Name Conventions

Field name	Purpose	Example
<entity>**_concept_id**	Foreign key into the Standard Vocabulary for **Standard Concept**	condition_concept_id 313217 (SNOMED "Atrial Fibrillation")
<entity>**_source_concept_id**	Foreign key into the Standard Vocabulary for **Source Concept**	condition_source_concept_id 44821957 (ICD9CM "Atrial Fibrillation")
<entity>**_source_value**	Verbatim information from the source data, **not to be used** by any standard analytics	condition_source_value 427.31 (ICD9CM "Atrial Fibrillation")
<entity>**_type_concept_id**	Foreign key into the Vocabulary for the **origin of the information**	condition_type_concept_id 38000199 ("Inpatient header – primary")
<entity>**_id**	Unique identifiers for **entities** (row numbers, or IDs imported from source)	person_id 1234567 visit_occurrence_id 7654321 could be a person identifier or an autogenerated number by the CDM builder

Single Concept Reference Table

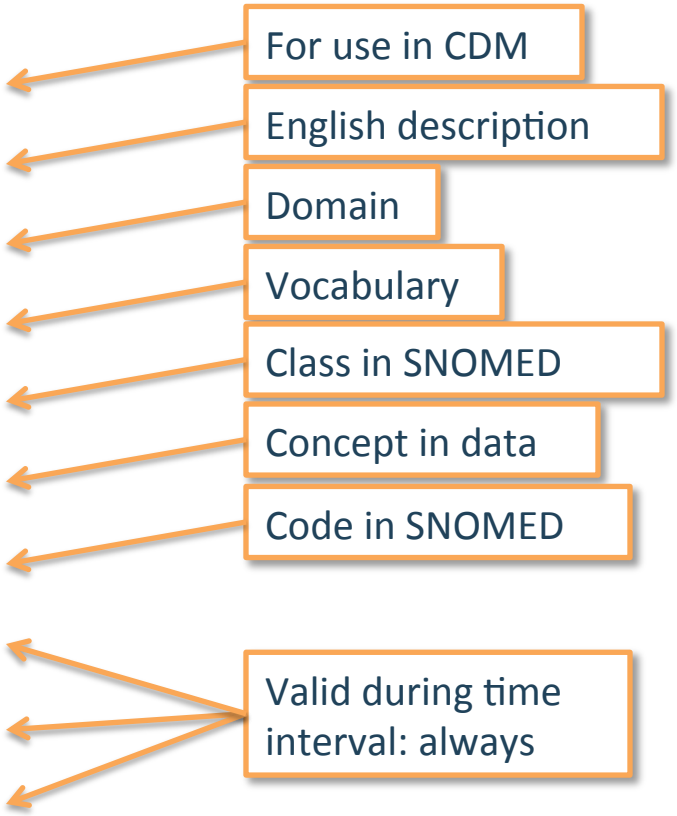
All vocabularies stacked up in one table

Vocabulary ID



What's in a Concept

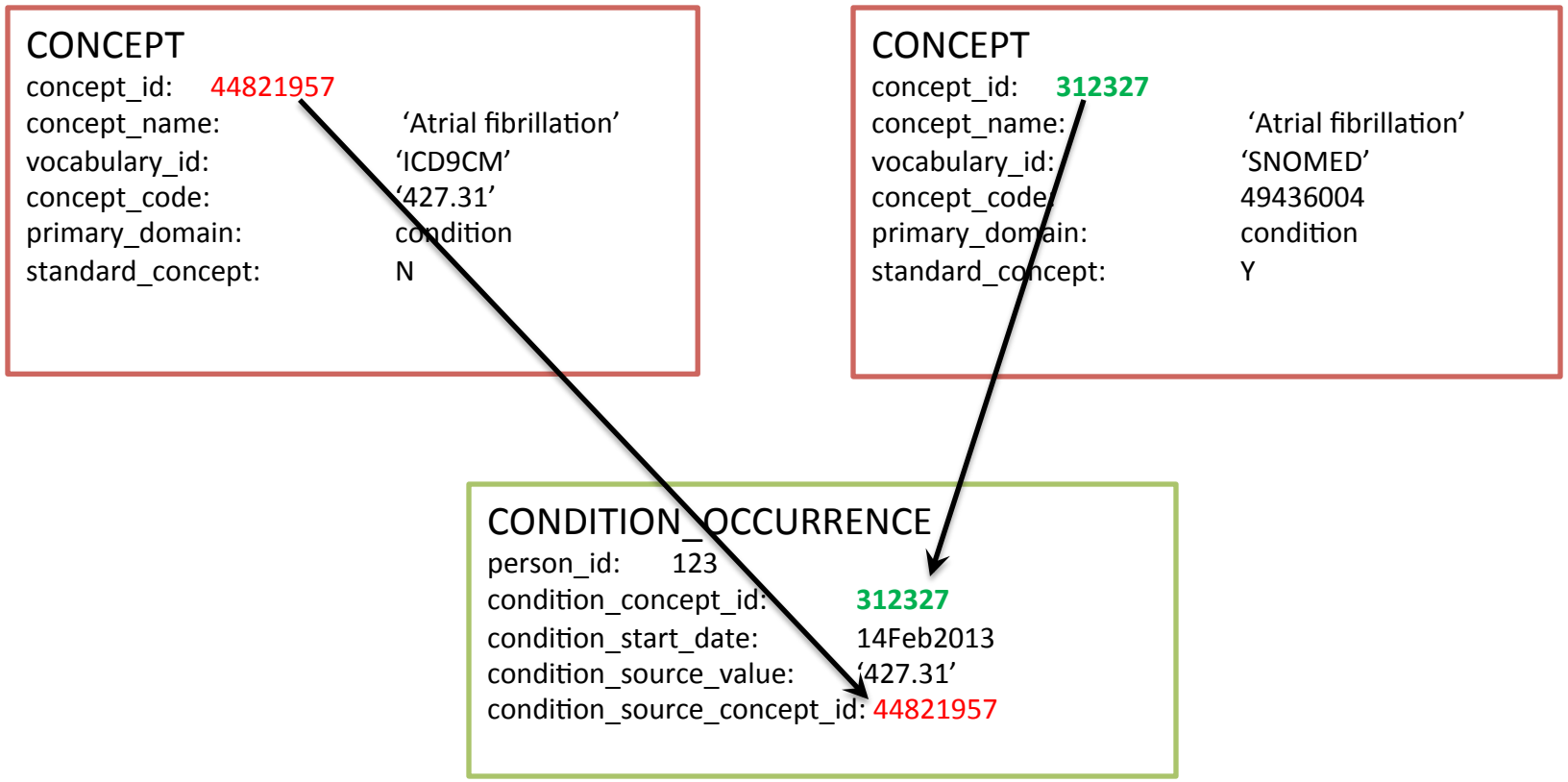
CONCEPT_ID	313217
CONCEPT_NAME	Atrial fibrillation
DOMAIN_ID	Condition
VOCABULARY_ID	SNOMED
CONCEPT_CLASS_ID	Clinical Finding
STANDARD_CONCEPT	S
CONCEPT_CODE	49436004
VALID_START_DATE	01-Jan-1970
VALID_END_DATE	31-Dec-2099
INVALID_REASON	



OMOP CDM Standard Domain Features

Feature	Description and 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 identifier	Every 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 concept from a respective vocabulary domain	Provenance. Foreign key into the Standard Vocabulary for **Source Concept**	<entity>**_source_concept_id**	condition_source_concept_id 44821957 (ICD9CM "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 type	Provenance. Foreign key into the Vocabulary for the **origin of the**	<entity>**_type_concept_id**	condition_type_concept_id 38000199 ("Inpatient header – primary")

Integration of CDM and Vocabulary



Virtual Machine Setup

OHDSI in a Box

VirtualBox

PostgreSQL

cdm

webapi

pgAdmin

docker

Broadsea

WebTools

Atlas | Penelope | Calypso

WebAPI

Tomcat

Methods Library

R | OHDSI R packages | R Studio

synpuf_100k

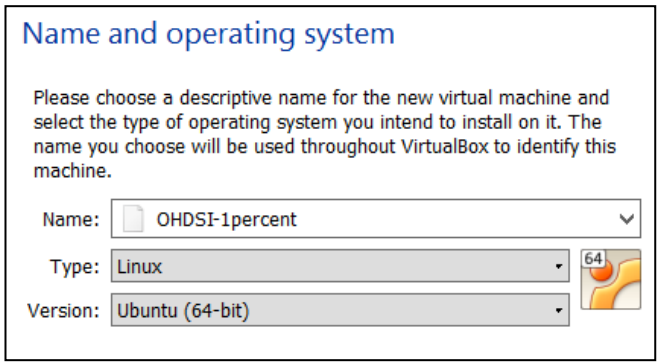
WhiteRabbit

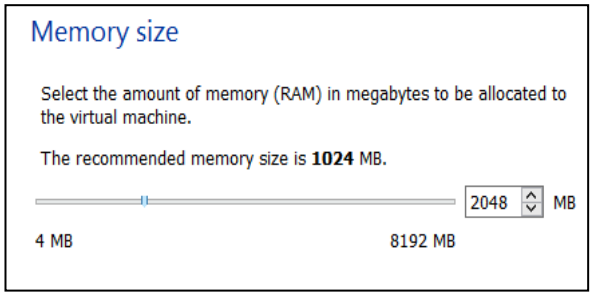
RabbitInAHat

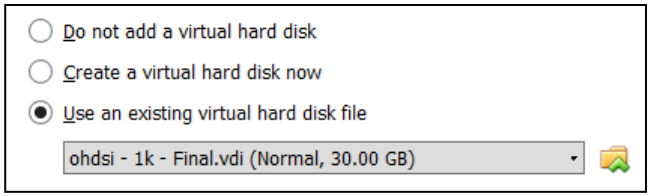
OHDSI in a Box – Setup

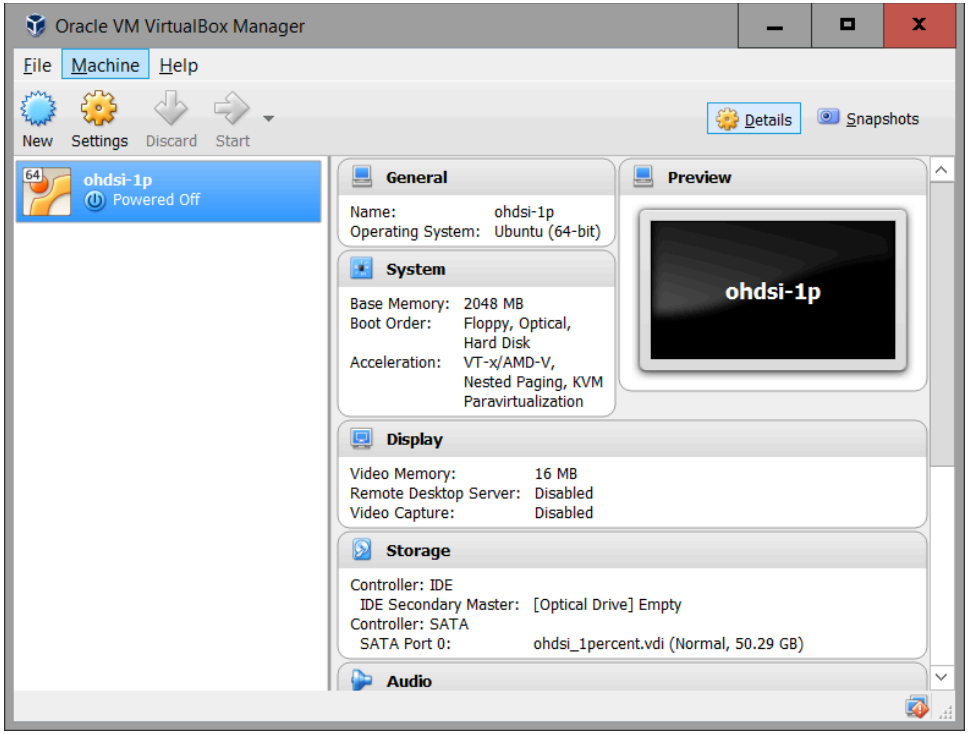
1. Open VM VirtualBox Manager

2. Click on New

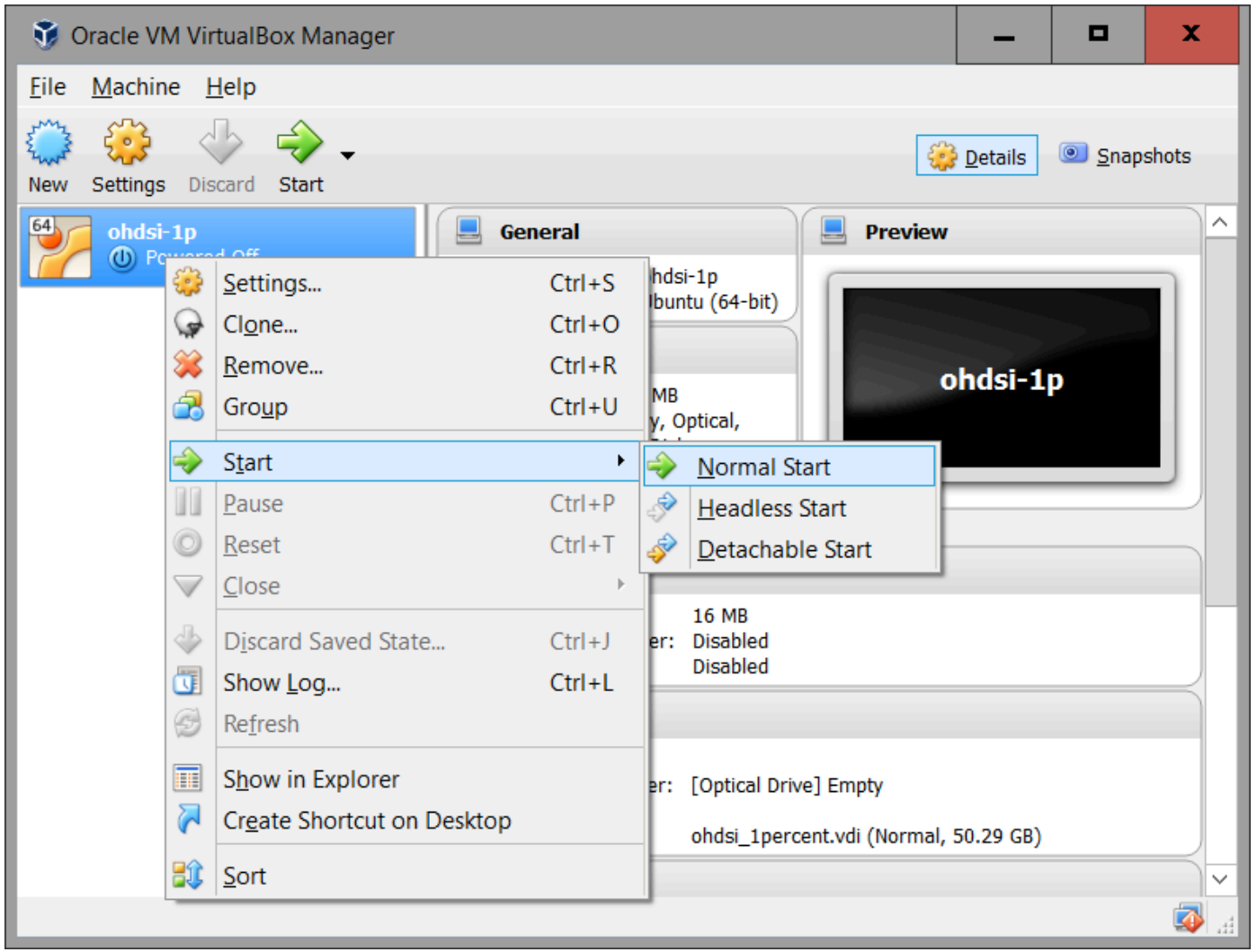




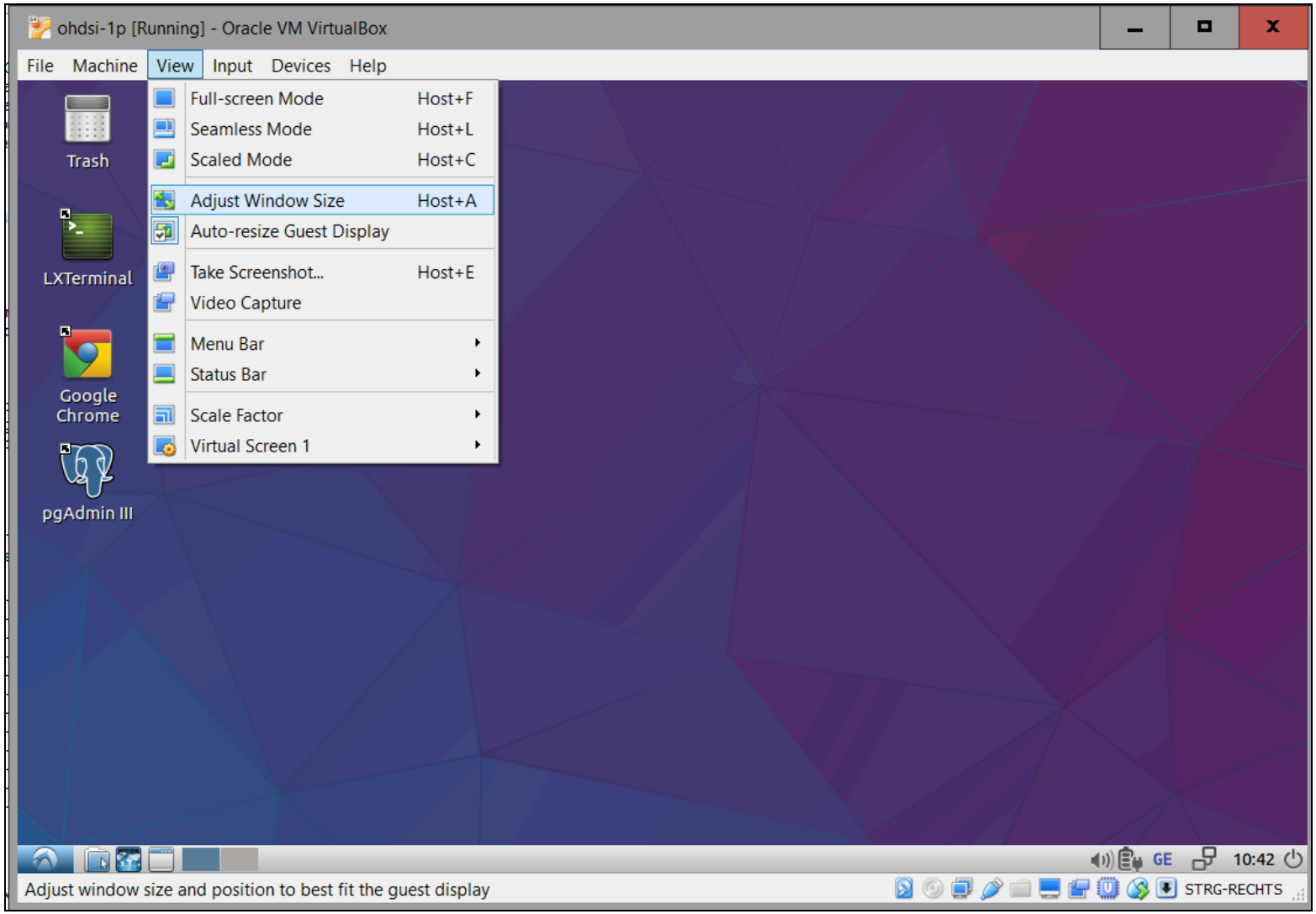




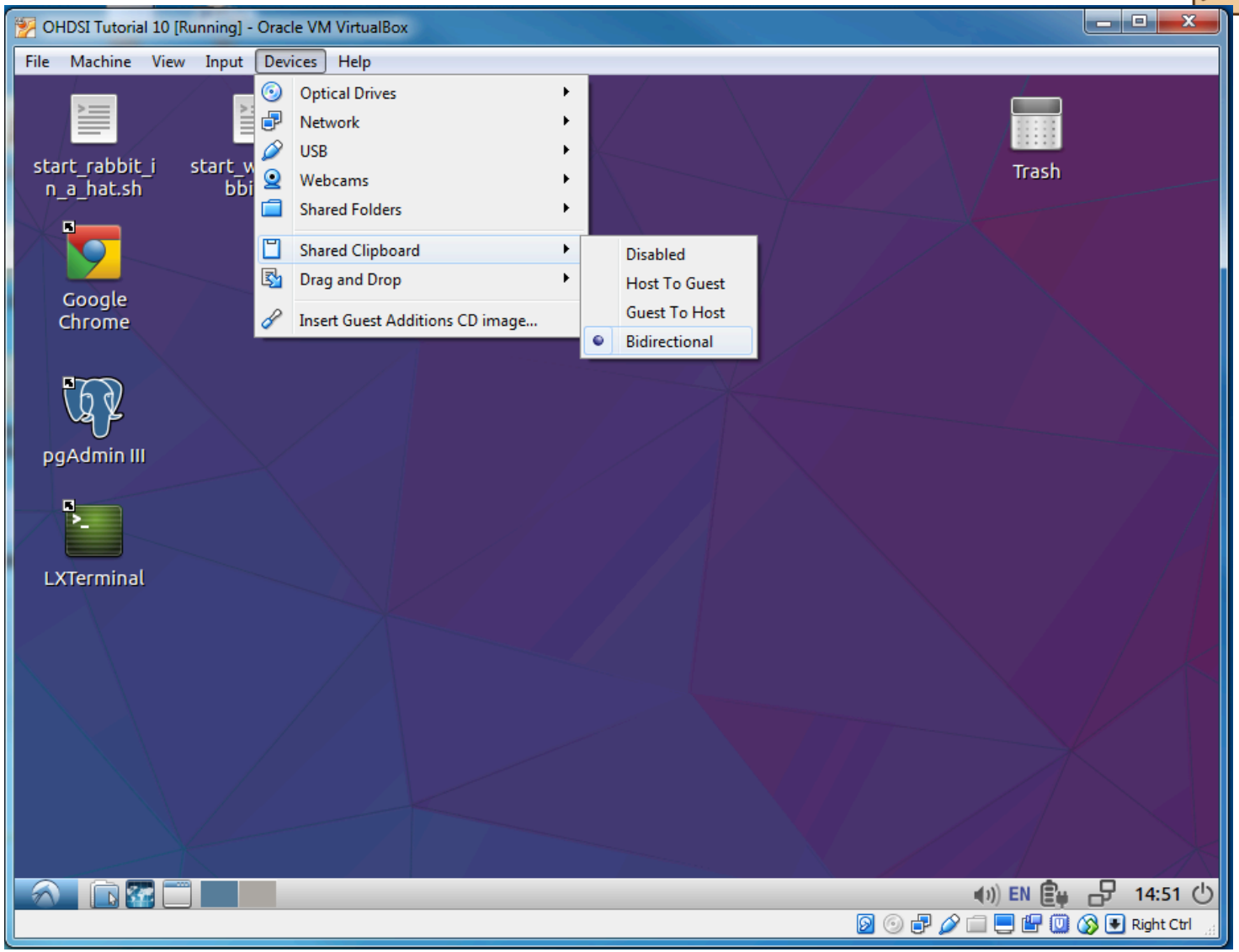
OHDSI in a Box – Start Up



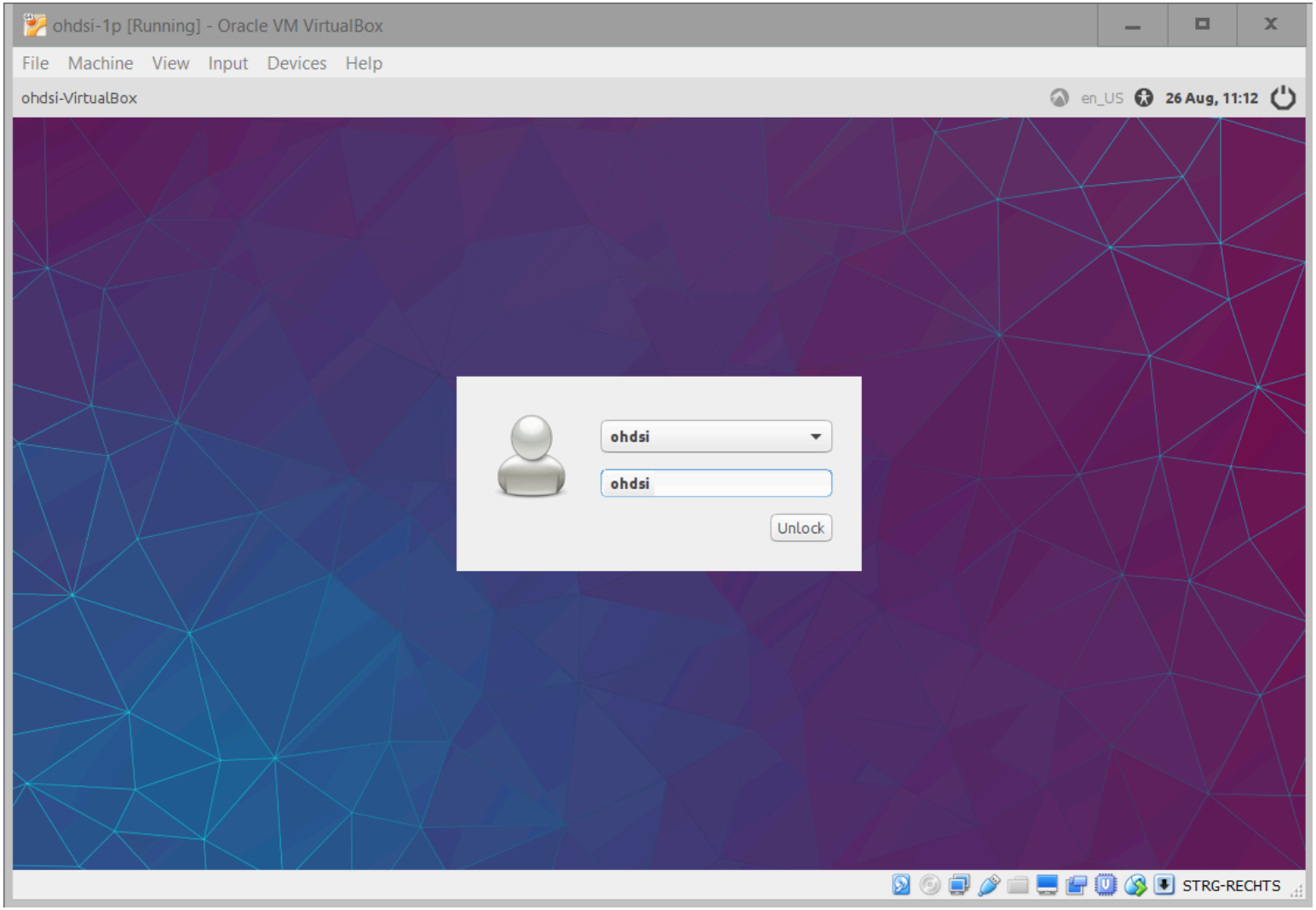
OHDSI in a Box – Adjust Resolution



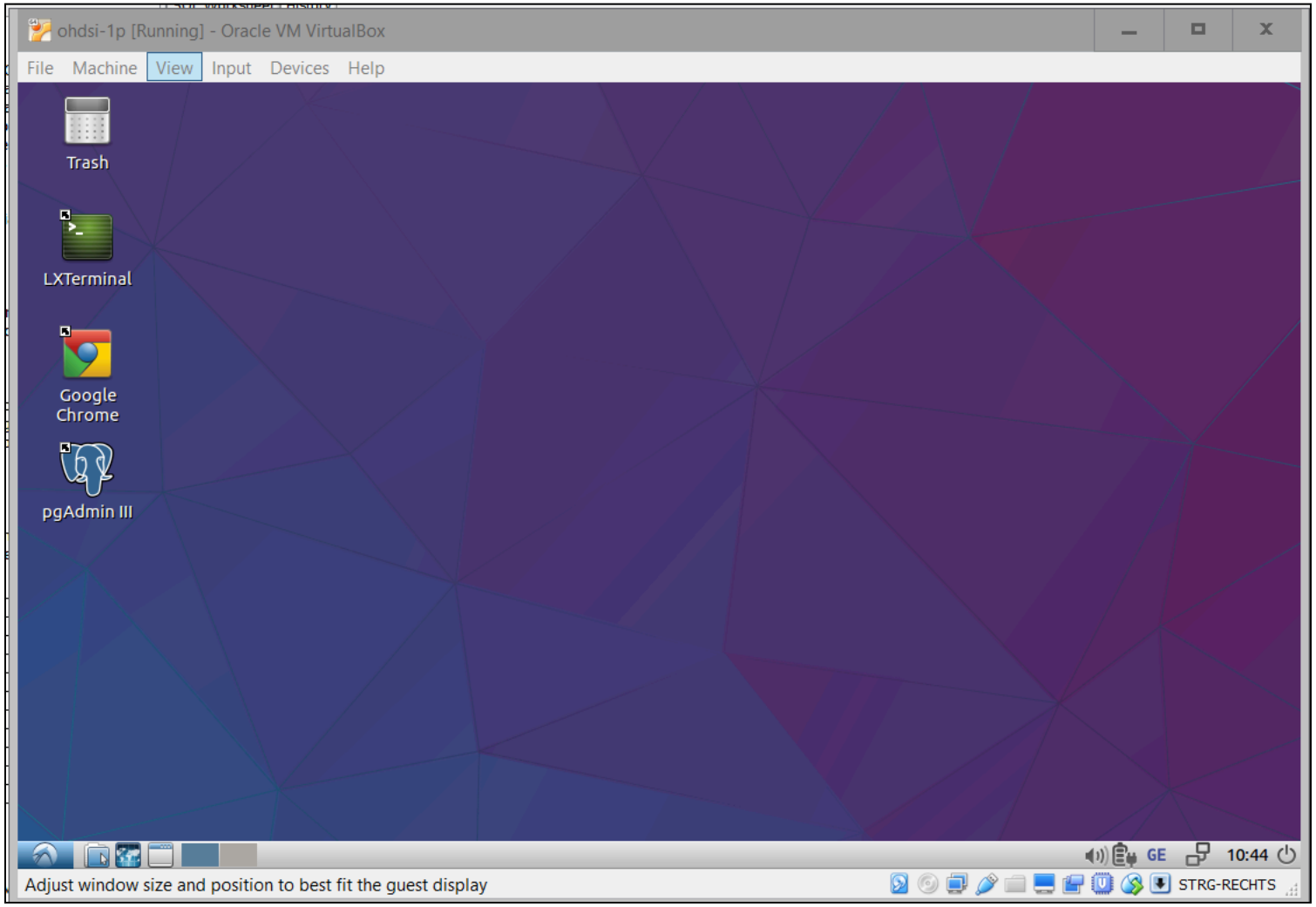
OHDSI in a Box – Clipboard



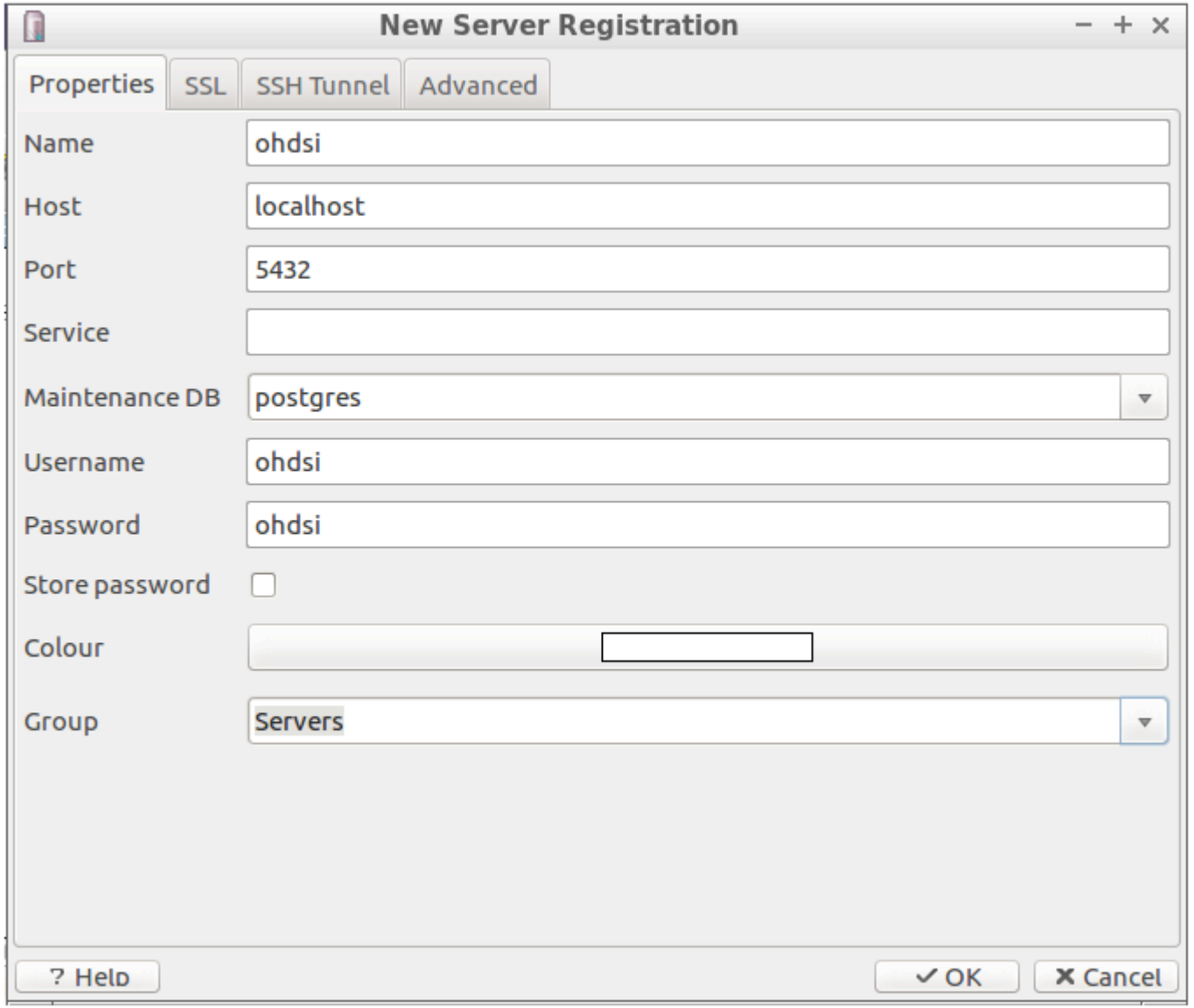
OHDSI in a Box – Timeout



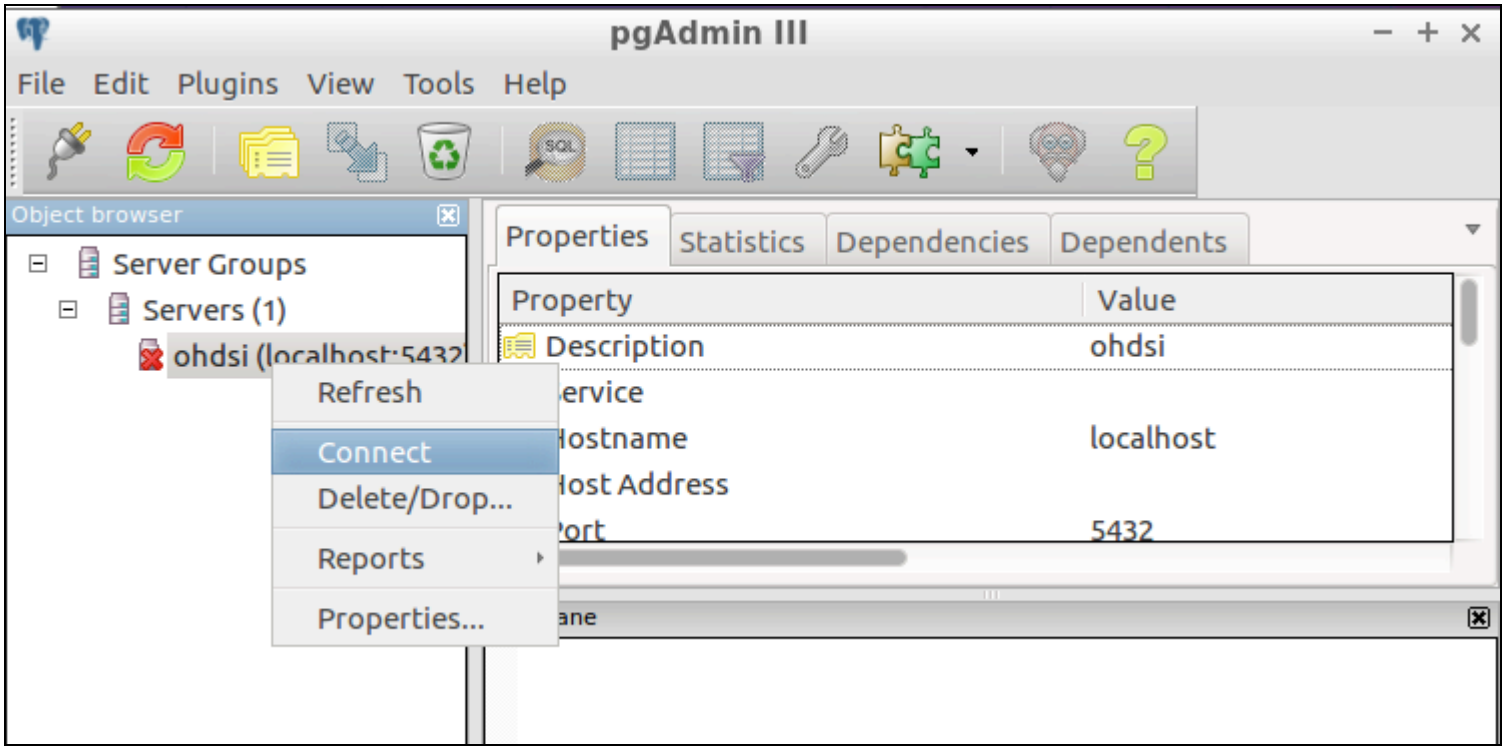
OHDSI in a Box – Ready



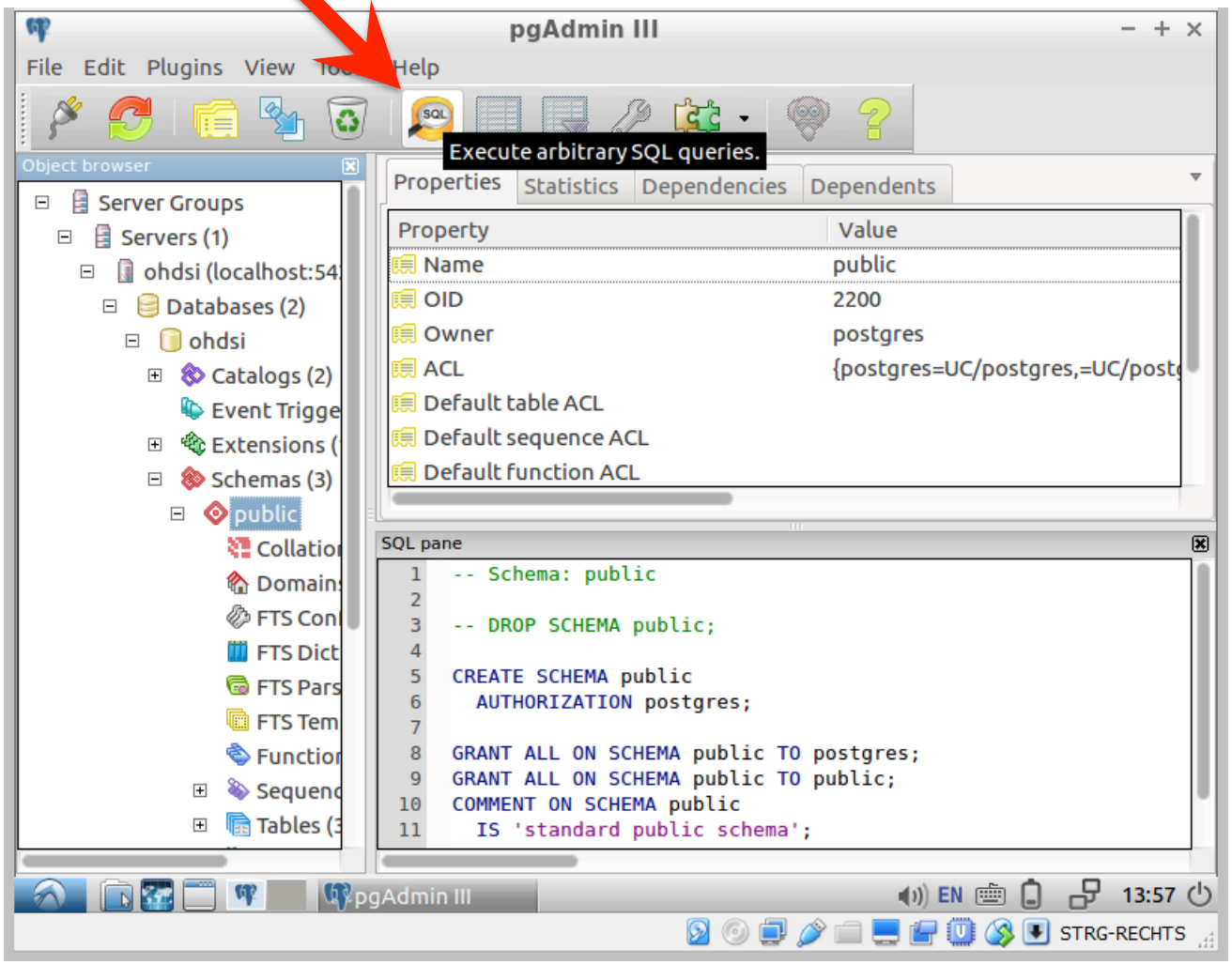
CDM Database – pgAdmin III New Server



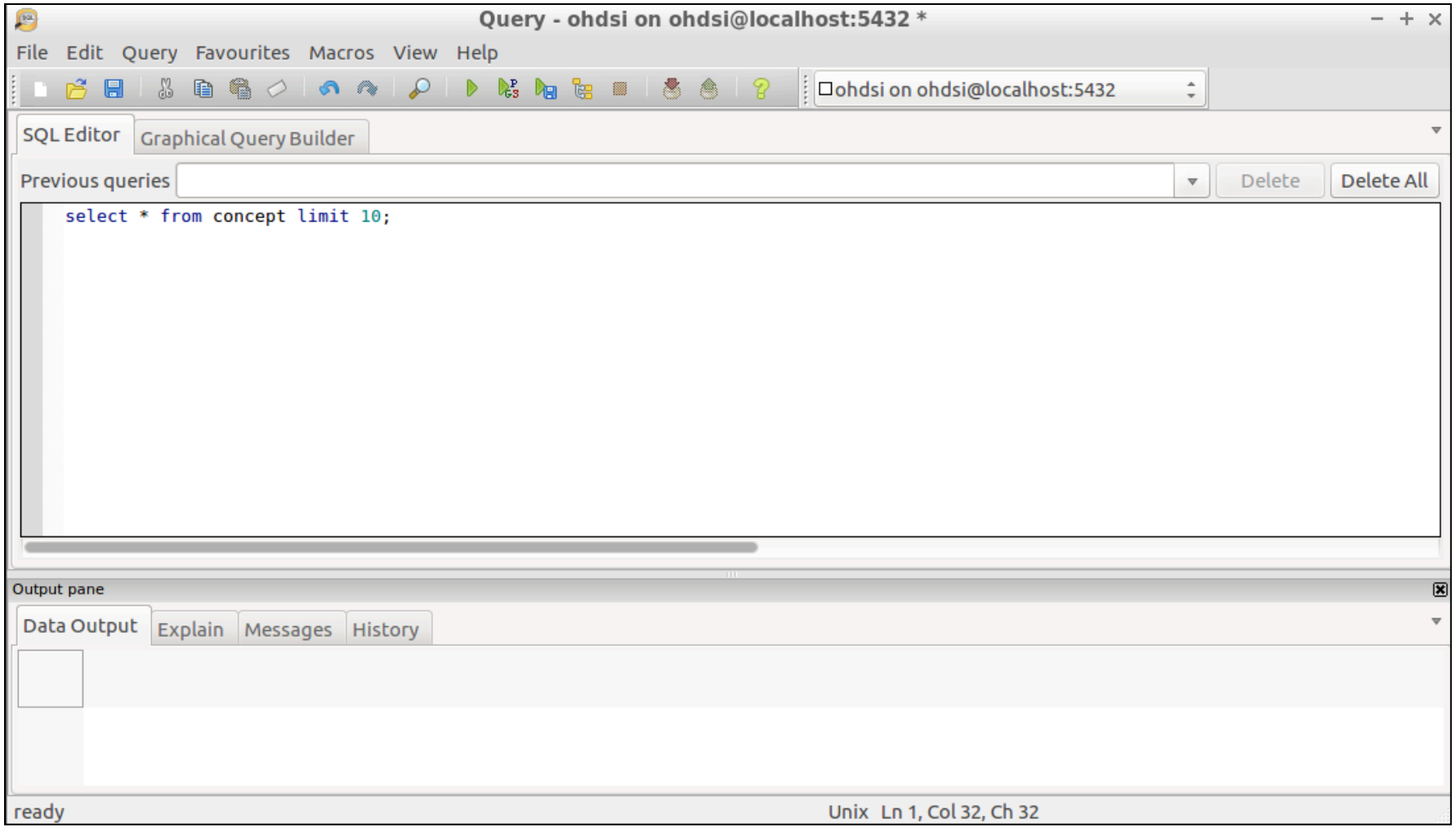
CDM Database – Connect



CDM Database – Open SQL Sheet



CDM Database – Ready



Break

Please return in 15 minutes

Vocabulary

Basic Relationship, Ancestors, & Descendants

How does it work for Drugs

SQL Examples

OMOP Common Vocabulary Model

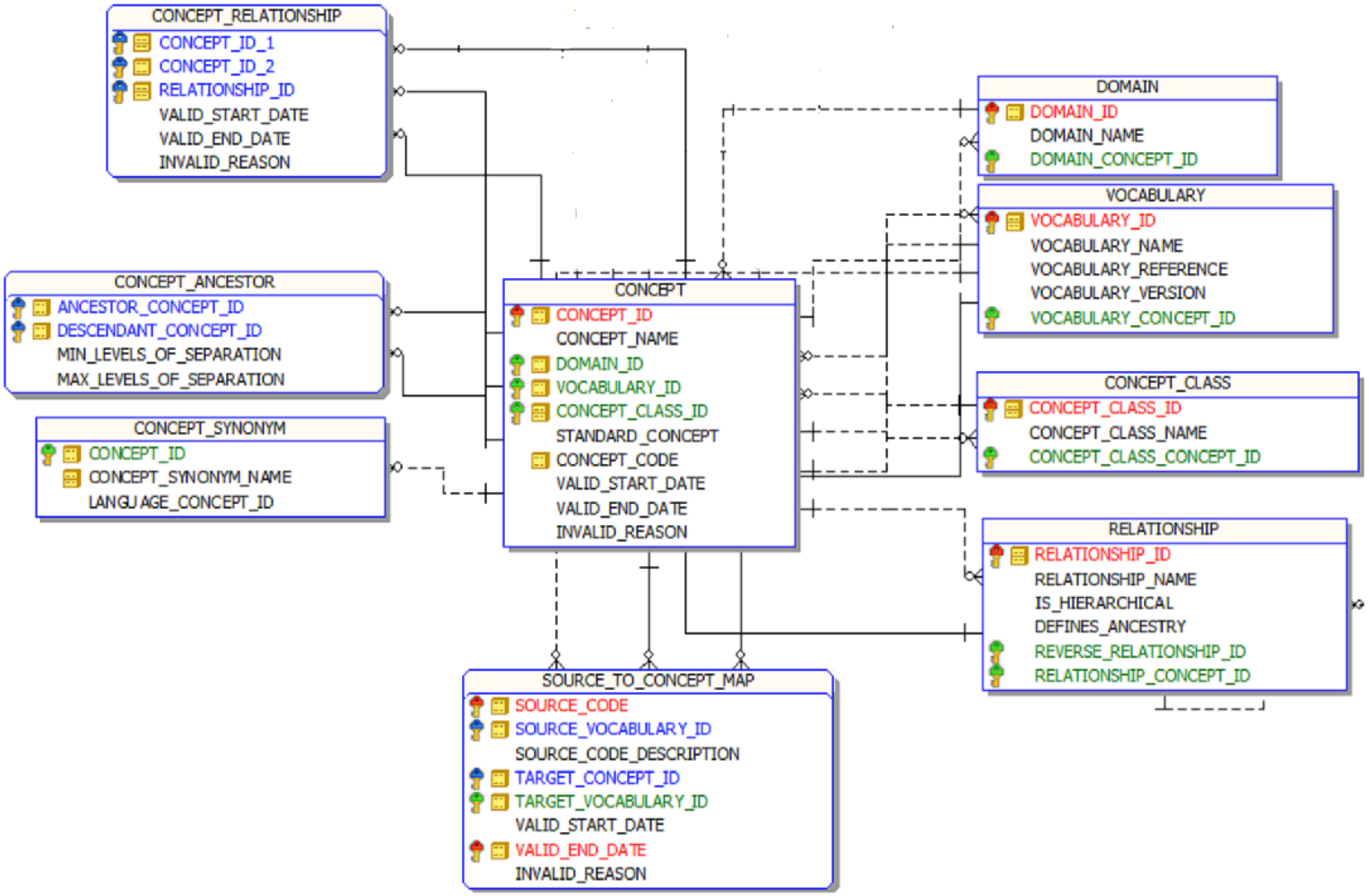
What it is

- **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

OMOP Vocabulary CDM



1. All content: concepts in **`concept`** table
2. Direct relationships between concepts listed in **`concept_relationship`**
3. Multi-step hierarchical relationships pre-processed in **`concept_ancestor`**

MiniSentinel in use: Dabigatran and bleeding

Dabigatran and Postmarketing Reports of Bleeding

Questions we are regularly asked:

1) What does it take to do an analysis like this?

2) How can this be done against the OMOP CDM?

Intrac … istributed

Analysi …

			dence events/ 100,000 days at risk)			
	Patients	Events		Patients	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	01-Jan-70	31-Dec-99	

Dozens of schemes, formats, rules

LOINC_248_MULTI-AXIAL_HIERARCHY.CSV

PATH_TO_ROOT	SEQUENC	IMMEDIATE_PARENT	CODE	CODE_TEXT
	1		LP31755-9	Microbiology
LP317	1	LP31755-9	LP14559-6	Microorganism
LP317	1	LP14559-6	LP98185-9	Bacteria
LP317	1	LP98185-9	LP14082-9	Bacteria

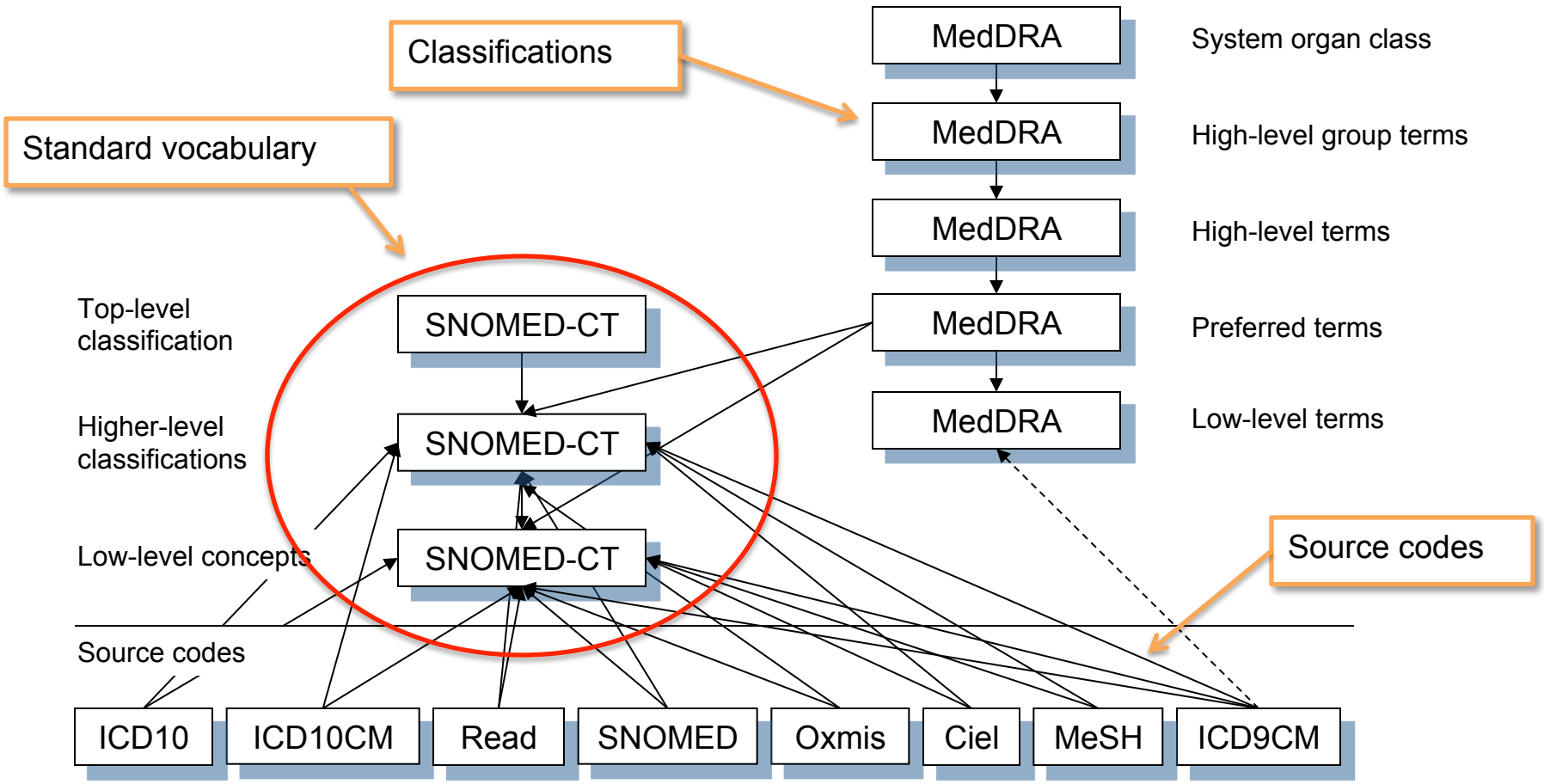
loinc.csv

LOINC_NU	COMPONENT	PROPERTY	TIME_ASPCT	SYSTEM	SCALE_TYP	METHOD_TYP	CLASS	SOURCE	DATE_LAST_CH	CHNG_TY	COMMEN	STATUS
10454-7	Xylose^2H post 25 g xylose PO	MCnc	Pt	Ser/Plas	Qn		CHAL	SH	19961220	ADD		ACTIVE
10455-4	Xylose^30M post 25 g xylose PO	MCnc	Pt	Ser/Plas	Qn		CHAL	SH	19961220	ADD		ACTIVE
10456-2	Xylose^post 6H CFst	MCnc	Pt	Ser/Plas	Qn		CHAL	SH	19961220	ADD		ACTIVE
10457-0	Actin Ag	ACnc	Pt	Tiss	Ord	Immune stain	PATH	SH;DL-M	20060706	MIN		ACTIVE
10458-(					Ord	Immune stain	PATH	DL-M	20060706	MIN		ACTIVE
10459-(					Ord	Immune stain	PATH	DL-M	20060706	MIN		ACTIVE
10460-4									20060706	MIN		ACTIVE
10461-2									20060706	MIN		ACTIVE
1046-2									20130529	MAJ		ACTIVE
10462-(									20060706	MIN		ACTIVE
10463-4									20060706	MIN		ACTIVE
10464-(									20060706	MIN		ACTIVE
10465-2									20060706	MIN		ACTIVE
10466-(									19961220	ADD	[(NA+)]-[(	ACTIVE

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

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	

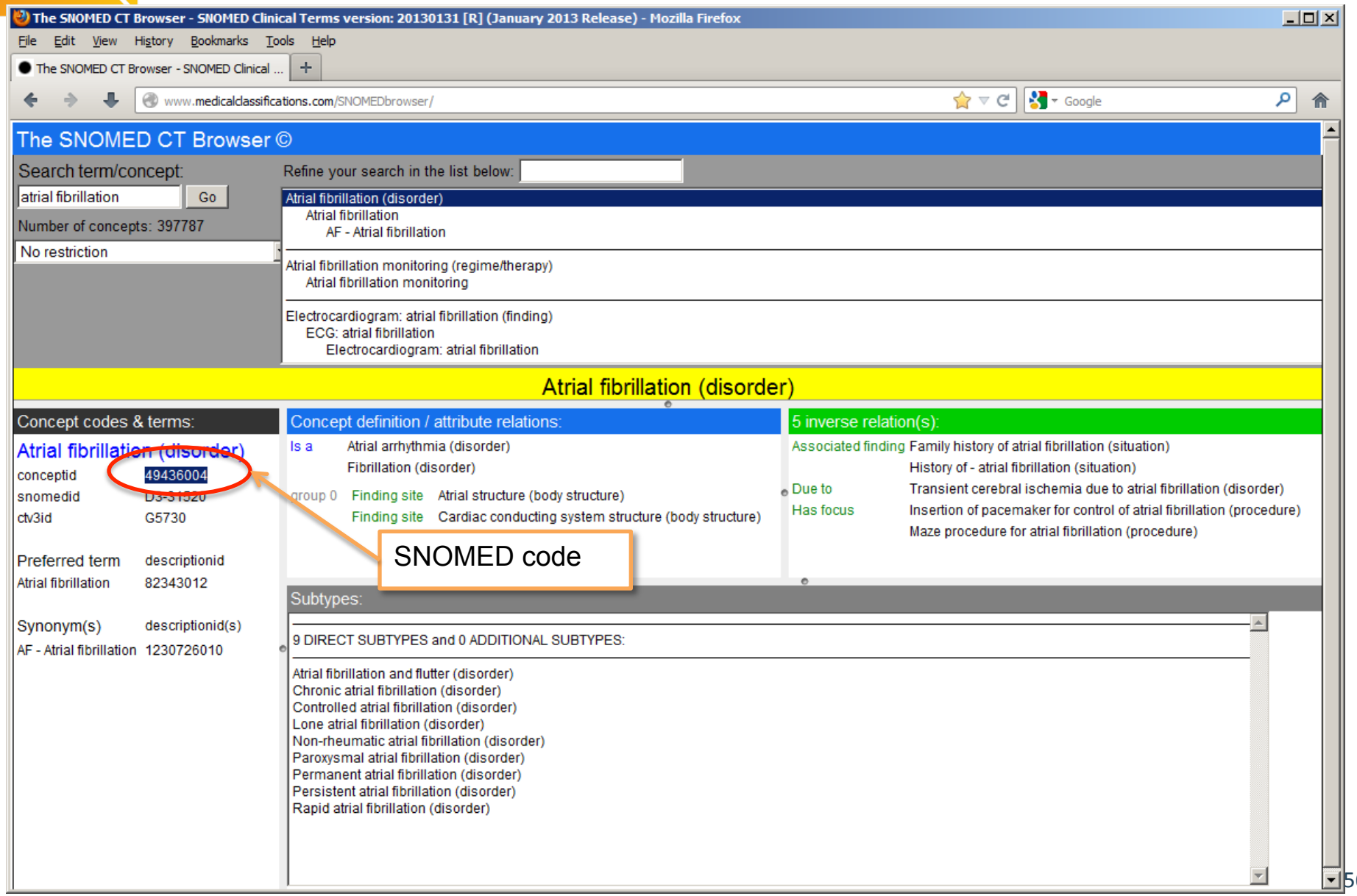
SNOMED code

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

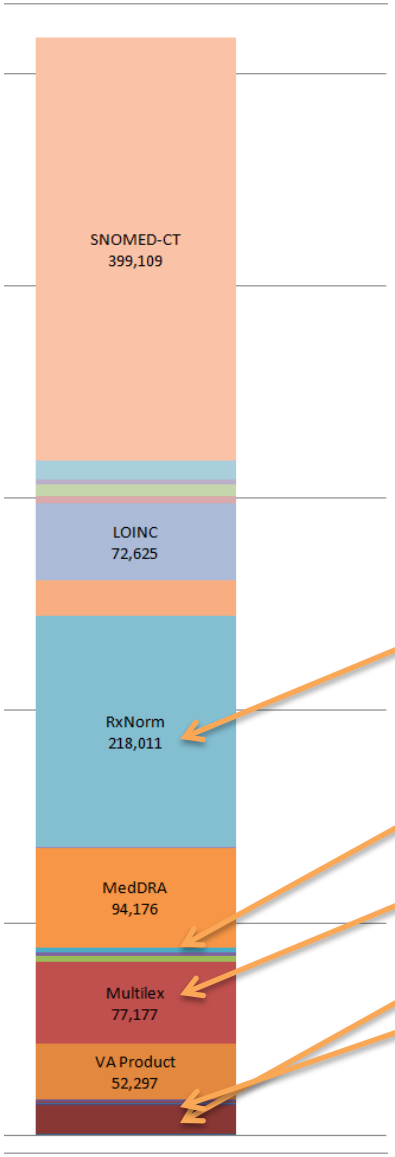
```
SELECT * FROM concept WHERE concept_code = '49436004';
```

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 code 49436004 in SNOMED Browser



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. Find 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

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

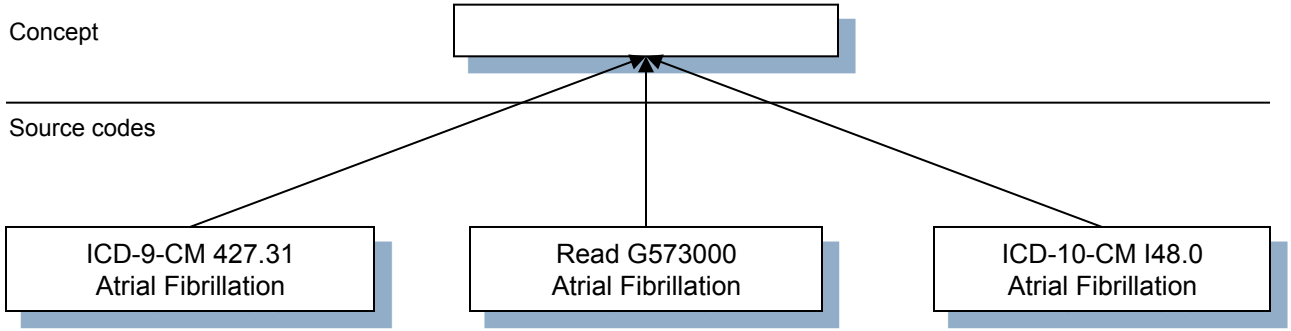
CONCEPT _ID_1	CONCEPT _ID_2	RELATIONSHIP _ID	VALID_START _DATE	VALID_END _DATE	INVALID _REASON
44821957	313217	Maps to	01-Jan-1970	31-Dec-2099	

Step 3. Check out the translated Concept

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

Exercise: Find Standard Concept ID from Source Concept

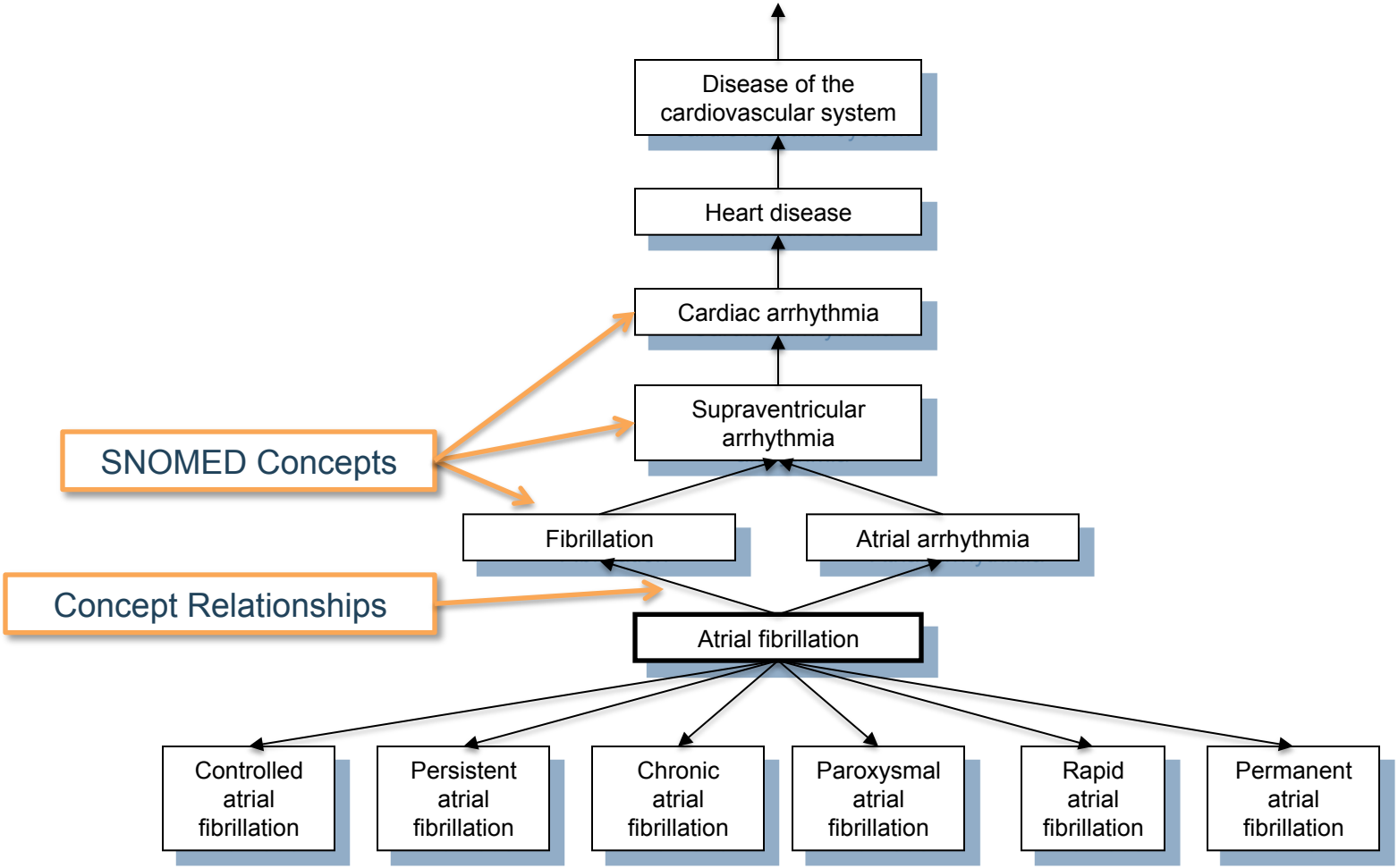
```
ICD-9: '427.31'  : 313217
Read: 'G573000'  : 313217
ICD-10: 'I48.0'  : 4154290 'Paroxysmal Atrial Fibrillation'
```



Codes Used in the World

- Conditions
  - READ, OXMIS, ICD-9-CM, ICD-10-CM, ICPC, MedDRA, free text in different languages
- Drugs
  - Multilex, dm+d, BDPM, AMIS, AMT, ATC, NPI, NDC, free text in different languages

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 #2

```
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;
```

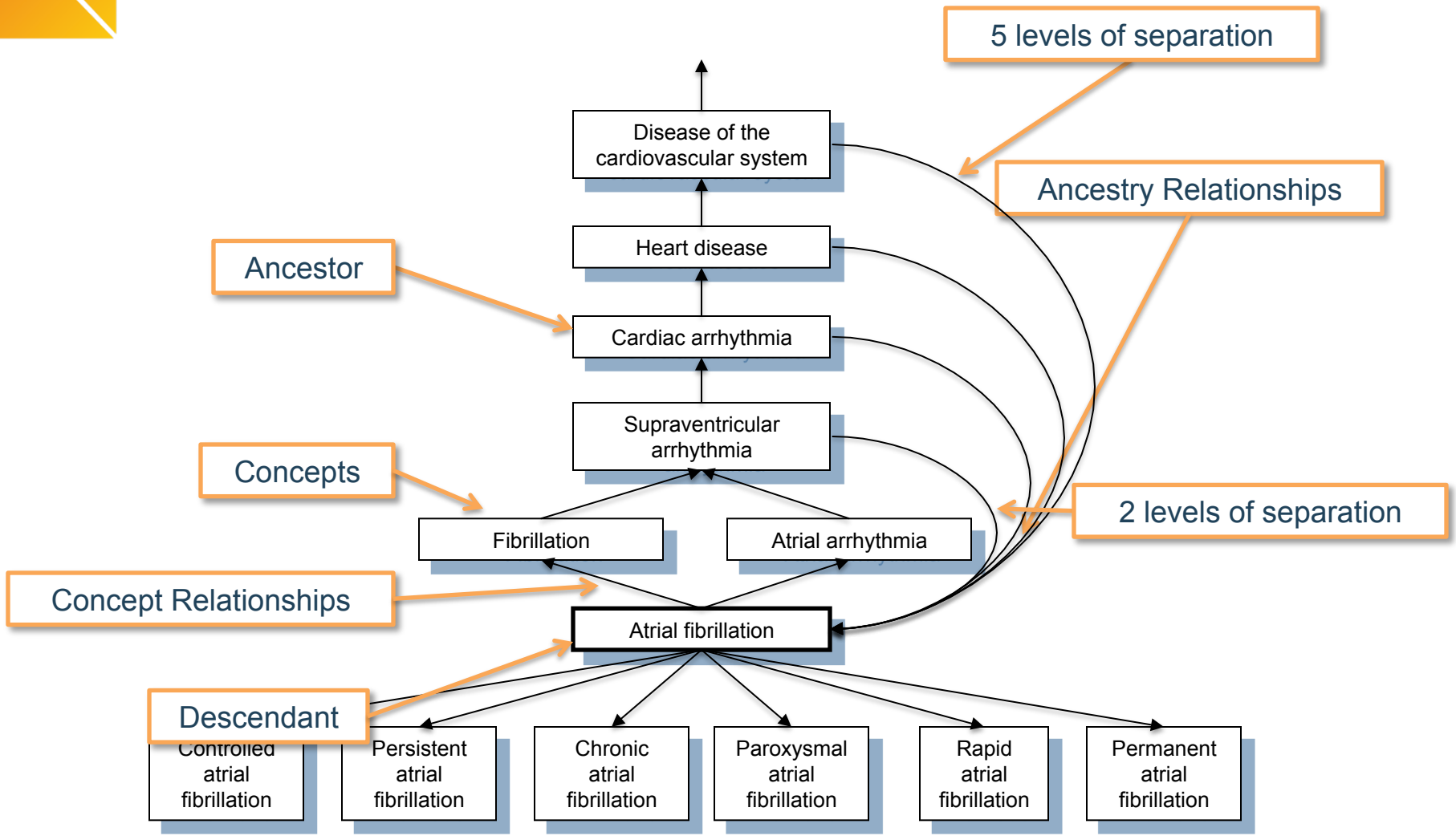
Find out related concept

Ancestor concepts

Descendant concepts

relatinship _id	concetp_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	4203375	Family his	Observation	SNOMED	Context-dependent	S	433276002	31-Jan-2009	31-Dec-2099	
Asso finding of	44807374	Atrial fibr	Observation	SNOMED	Context-dependent	S	816401000000	1-Apr-2014	31-Dec-2099	
Asso finding of	4194288	H/O: atrial fibrillation	Observation	SNOMED	Context-dependent	S	312442005	1-Jan-1970	31-Dec-2099	
Due to of	4139517	Transient cerebral ischemia due to atrial fibrillation	Condition	SNOMED	Clinical Finding	S	426814001	1-Jan-1970	31-Dec-2099	
Focus of	42709991	Insertion of pacemaker for control of atrial fibrillation	Procedure	SNOMED	Procedure	S	449863006	31-Jan-2012	31-Dec-2099	
Focus of	4181800	Maze procedure for atrial fibrillation	Procedure	SNOMED	Procedure	S	429211003	31-Jan-2008	31-Dec-2099	
Focus of	44783731	Provision of written information about atrial fibrillation	Procedure	SNOMED	Procedure	S	699833006	31-Jan-2014	31-Dec-2099	
Has finding site	4242112	Atrial structure	Spec Anatomic Site	SNOMED	Body Structure	S	59652004	1-Jan-1970	31-Dec-2099	
Has finding site	4093357	Cardiac conducting system structure	Spec Anatomic Site	SNOMED	Body Structure	S	24964005	1-Jan-1970	31-Dec-2099	
Is a	4226399	Fibrillation	Condition	SNOMED	Clinical Finding	S	40593004	1-Jan-1970	31-Dec-2099	
Is a	4068155	Atrial arrhythmia	Condition	SNOMED	Clinical Finding	S	17366009	1-Jan-1970	31-Dec-2099	
Mapped from	45576876	Unspecified atrial fibrillation	Condition	ICD10CM	5-char billing code		I48.91	30-Dec-2006	31-Dec-2099	
Mapped from	45611600	Atrial Fibrillation	Condition	MeSH	Main Heading		D001281	1-Jan-1970	31-Dec-2099	
Mapped from	313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004	1-Jan-1970	31-Dec-2099	
Mapped from	45951191	Atrial Fibrillation	Condition	CIEL	Diagnosis		148203	3-Nov-2007	31-Dec-2099	
Mapped from	44821957	Atrial fibrillation	Condition	ICD9CM	5-dig billing code		427.31	1-Jan-1970	31-Dec-2099	
Mapped from	2617597	Patient with heart failure and atrial fibrillation documented to be on warfarin therapy	Observation	HCPCS	HCPCS		G8183	1-Jan-1970	11-Nov-2014	D
Mapped from	45500085	Atrial fibrillation	Condition	Read	Read		G573000	1-Jan-1970	31-Dec-2099	
Maps to	313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S	49436004	1-Jan-1970	31-Dec-2099	
SNOMED - HOI	500002401	OMOP Atrial Fibrillation 1	Condition	Cohort	Cohort	C	500002401	1-Jan-1970	31-Dec-2099	
SNOMED - HOI	500001801	OMOP Qt Prolongation/Torsade De Pointes 1	Condition	Cohort	Cohort	C	500001801	1-Jan-1970	31-Dec-2099	
SNOMED - ind/CI	4344544	Atrial Fibrillation	Drug	NDFRT	Ind / CI	C	N0000000507	1-Jan-1970	31-Dec-2099	
SNOMED - MedDR	35204953	Atrial fibrillation	Condition	MedDRA	PT	C	10003658	1-Jan-1970	31-Dec-2099	
Subsumes	4232697	Persistent atrial fibrillation	Condition	SNOMED	Clinical Finding	S	440059007	31-Jan-2009	31-Dec-2099	
Subsumes	4119601	Lone atrial fibrillation	Condition	SNOMED	Clinical Finding	S	233910005	1-Jan-1970	31-Dec-2099	
Subsumes	4117112	Controlled atrial fibrillation	Condition	SNOMED	Clinical Finding	S	300996004	1-Jan-1970	31-Dec-2099	
Subsumes	4232691	Permanent atrial fibrillation	Condition	SNOMED	Clinical Finding	S	440028005	31-Jan-2009	31-Dec-2099	
Subsumes	4154290	Paroxysmal atrial fibrillation	Condition	SNOMED	Clinical Finding	S	282825002	1-Jan-1970	31-Dec-2099	
Subsumes	4119602	Non-rheumatic atrial fibrillation	Condition	SNOMED	Clinical Finding	S	233911009	1-Jan-1970	31-Dec-2099	
Subsumes	4199501	Rapid atrial fibrillation	Condition	SNOMED	Clinical Finding	S	314208002	1-Jan-1970	31-Dec-2099	
Subsumes	40631039	Atrial flutter fibrillation	Condition	SNOMED	Clinical Finding		81216002	1-Jan-1970	11-Mar-2016	U
Subsumes			Condition	SNOMED	Clinical Finding	S	195080001	1-Jan-1970	31-Dec-2099	
Subsumes		esponse	Condition	SNOMED	Clinical Finding	S	1.20041E+14	31-Jan-2014	31-Dec-2099	
Subsumes		Chronic atrial fibrillation	Condition	SNOMED	Clinical Finding	S	426749004	1-Jan-1970	31-Dec-2099	

Ancestry Relationships: Higher-Level Relationships



Exploring Ancestors of a Concept

```
SELECT max_levels_of_separation, c.*
FROM concept_ancestor ca, concept c
WHERE ca.descendant_concept_id = 313217 /* Atrial fibrillation */
  AND ca.ancestor_concept_id = c.concept_id
ORDER BY max_levels_of_separation
;
```

Hold the descendant

Query Concept

Standard Concepts

Query Concept

max_levels_of_separation	concept_id	concept_na	domain_i	vocabulary	concept_class	standard_concept
0	313217	Atrial fibrillation	Condition	SNOMED	Clinical Finding	S
0	35204953	Atrial fibrillation	Condition	MedDRA	PT	C
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		
5	134057	Disorder of cardiovascular system	Condition	SNOMED		
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

Exploring Descendants of a Concept

Hold the ancestor

```
SELECT max_levels_of_separation, c.*
FROM concept_ancestor ca, concept c
WHERE ca.ancestor_concept_id = 44784217 /* cardiac arrythmia */
  AND ca.descendant_concept_id = c.concept_id
ORDER BY max_levels_of_separation
;
```

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's find Upper Gastrointestinal Bleeding

1. Find some initiation concept

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

concetp_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
42891225	Upper gastrointestinal bleeding	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';
```

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

Going up the hierarchy: Finding the right concept

Hold the descendant

```
SELECT max_levels_of_separation, c.*
FROM concept_ancestor ca, concept c
WHERE ca.descendant_concept_id = 4332645 /* Upper gastrointestinal hemorrhage
  associated...*/
  AND ca.ancestor_concept_id = c.concept_id
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	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: Checking the right content

```
SELECT max_levels_of_separation, c.*
FROM concept_ancestor ca, concept c
WHERE ca.ancestor_concept_id = 4291649 /* Upper gastrointestinal hemorrhage */
  AND ca.descendant_concept_id = c.concept_id
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

Lunch

In Glen Foyer, please return in 1 hour

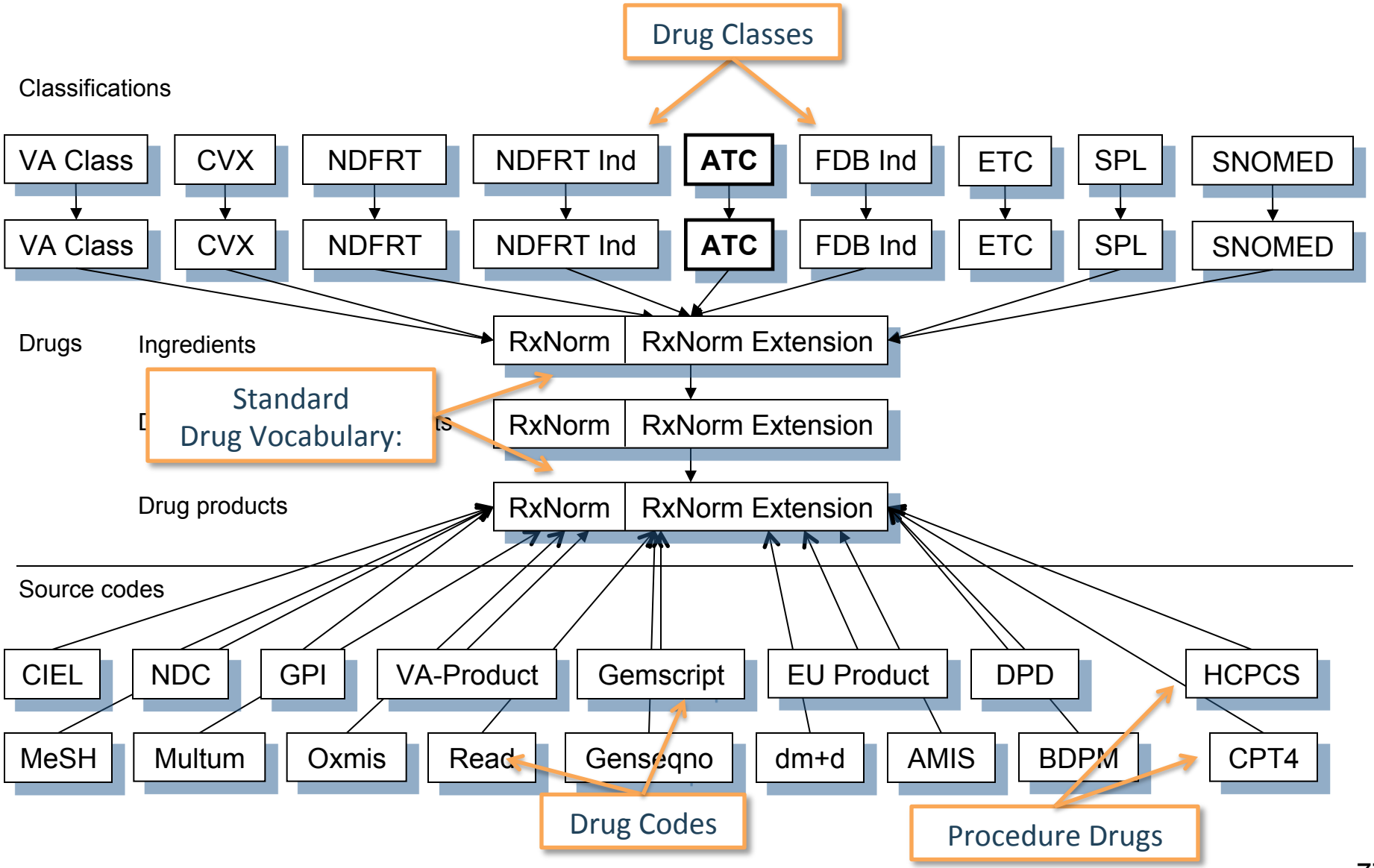
Exercise: Find Standard Concept ID for Conditions

- 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



Let's 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's 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's find Clopidogrel ingredient

2. Find ingredient Clopidogrel as Ancestor of drug product

```
SELECT a.max_levels_of_separation, c.*
FROM concept_ancestor ca, concept c
WHERE ca.descendant_concept_id = 1322185 /* clopidogrel 75 MG Oral Tablet [Plavix] */
  AND ca.ancestor_concept_id = c.concept_id;
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	RxNor		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, c.*
FROM concept_ancestor ca, concept c
WHERE ca.ancestor_concept_id = 1310149 /* Warfarin or 1322185 Clopidogrel*/
  AND ca.descendant_concept_id = c.concept_id
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,  c.*
FROM concept_ancestor ca, concept c
WHERE ca.ancestor_concept_id = 21600961 /* ATC Antithromboic Agent */
  AND ca.descendant_concept_id = c.concept_id
  AND c.concept_class_id = 'Ingredient'
ORDER BY max_levels_of_separation;
```

concetp_id	concept_name	domain_id	vocabulary_id	concept_class_id
1344992	Iloprost	Drug	RxNorm	Ingredient
19084670	bivalirudin	Drug	RxNorm	Ingredient
19069137	bemiparin	Drug	RxNorm	Ingredient
1315865	fondaparinux	Drug	RxNorm	Ingredient
1350310	cilostazol	Drug	RxNorm	Ingredient
19026343	danaparoid	Drug	RxNorm	Ingredient
40163718	prasugrel	Drug	RxNorm	Ingredient
19098548	Tenecteplase	Drug	RxNorm	Ingredient
1322184	clopidogrel	Drug	RxNorm	Ingredient
1367571	Heparin	Drug	RxNorm	Ingredient
1310149	Warfarin	Drug	RxNorm	Ingredient
1308473	tinzaparin	Drug	RxNorm	Ingredient
1322199	eptifibatide	Drug	RxNorm	Ingredient
40241331	rivaroxaban	Drug	RxNorm	Ingredient
19024191	Reteplase	Drug	RxNorm	Ingredient
1301065	Dalteparin	Drug	RxNorm	Ingredient
1731597	drotrecogin alfa	Drug	RxNorm	Ingredient
35604848	selexipag	Drug	RxNorm	Ingredient

Exercise:
Find Standard Concept ID

- Metformin 1503297
- Tolazamide 1502809
- Telmisartan 1317640
- Your favorite ingredient here

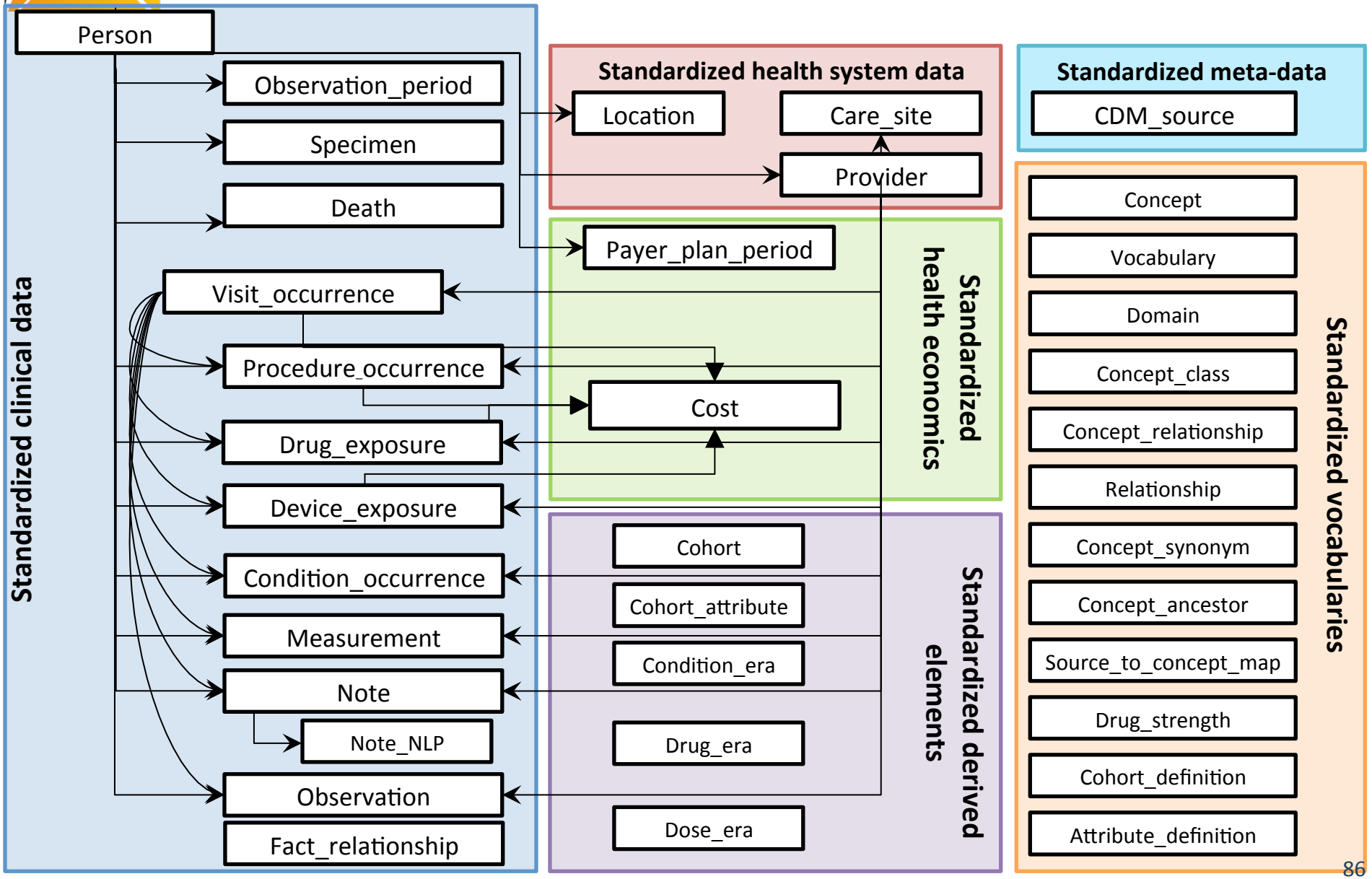
Exercise:
Find Standard Concept ID

- A10AE06 — 35602717
- 686450400 — 19080217
- A10BD14
- Your favorite drug here

Common Data Model

History of the model
In depth discussion of model
Era discussion

CDM Version 5 Key Domains



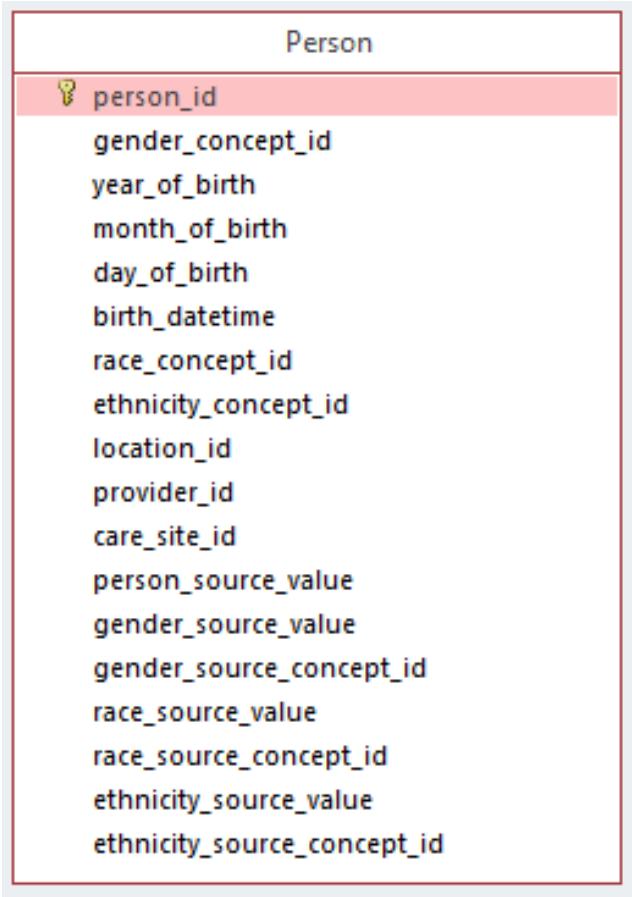
OMOP CDM Principles

- OMOP model is an information model
  - Vocabulary(Conceptual) and Data Model are blended
  - Domain-oriented concepts
- Patient centric
- Accommodates data from various sources
- Preserves data provenance
- Extendable
- Evolving

OMOP CDM Standard Domain Features

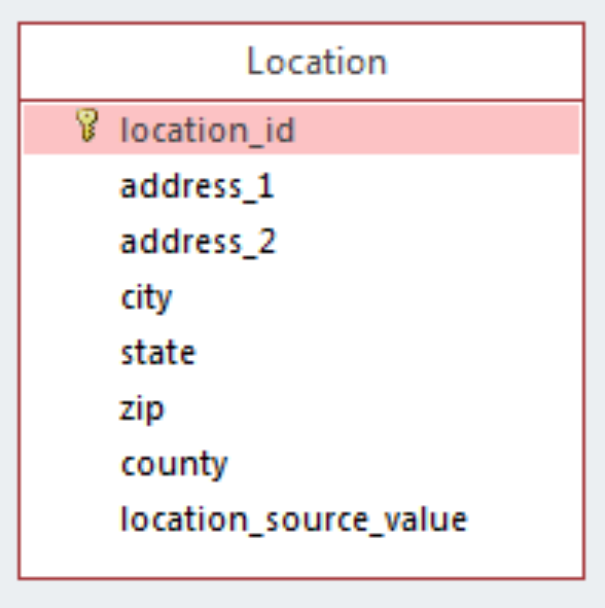
Feature	Description and purpose	Field name convention	Example
Patient centric	Every domain table has **patient identifier**. Patient data can be retrieved independently from other domains.	**person_id**	person_id 123
Unique domain identifier	Every domain table has a unique primary key to identify domain **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 concept from a respective vocabulary domain	Provenance. Foreign key into the Standard Vocabulary for **Source Concept**	<entity>**_source_concept_id**	condition_source_concept_id 44821957 (ICD9CM "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 type	Provenance. Foreign key into the Vocabulary for the **origin of the**	<entity>**_type_concept_id**	condition_type_concept_id 38000199 ("Inpatient header – primary")

PERSON



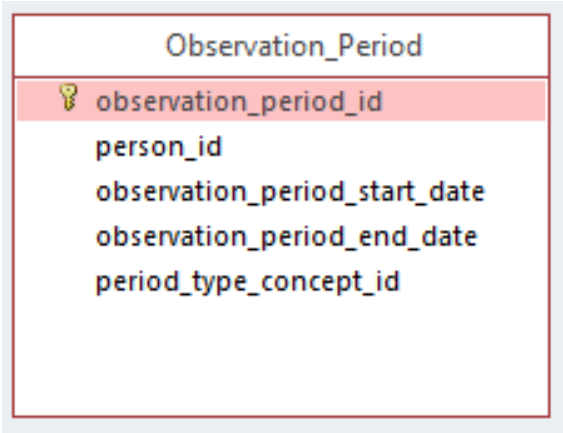
- Need to create one unique record per person (not multiple rows per move)
- Vocabulary for gender, race, ethnicity: HL7 administrative
- No history of location/ demographics: need to select latest available
- Location peculiarity: foreign key to the LOCATION table that contains one record per each unique location
- Year of birth required…day/month optional

LOCATION



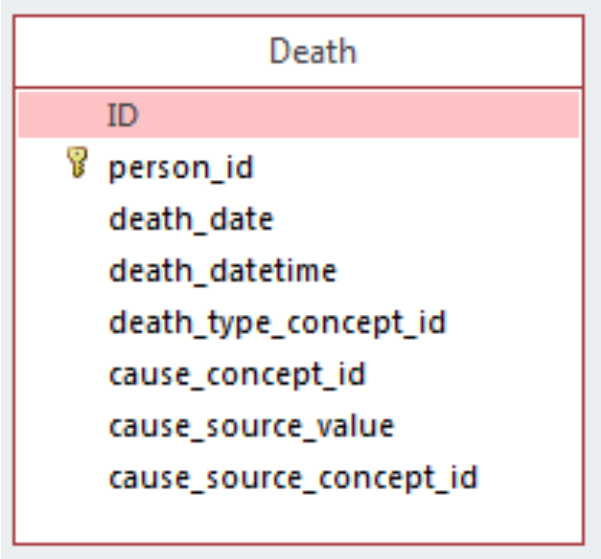
- Contains one record per each unique location
- Location is highly variable across sources, of limited use thus far

OBSERVATION_PERIOD



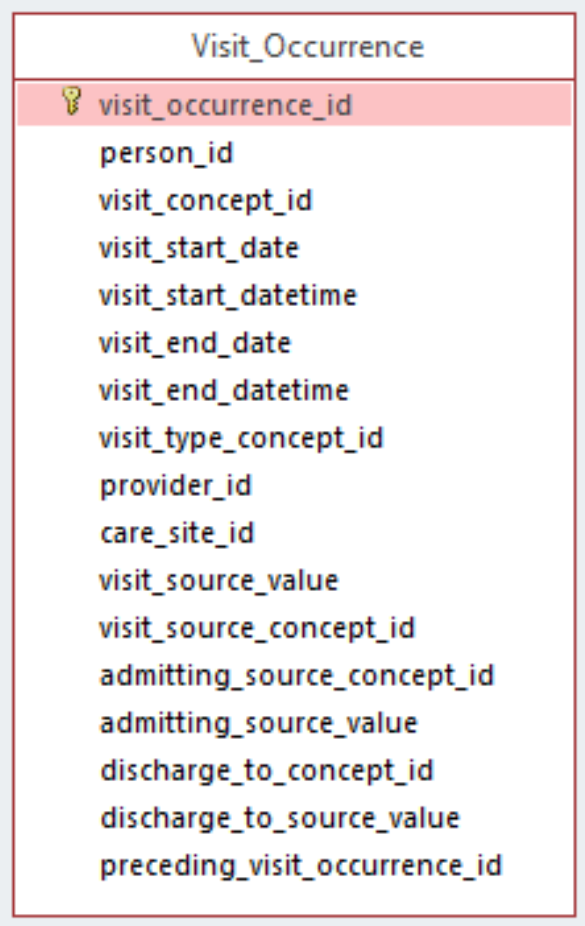
- Spans of time where data source has capture of data
- Required to run analytical methods
- One person may have multiple periods if there is interruption in data capture
- Challenge: determine observation periods based on the source data

DEATH



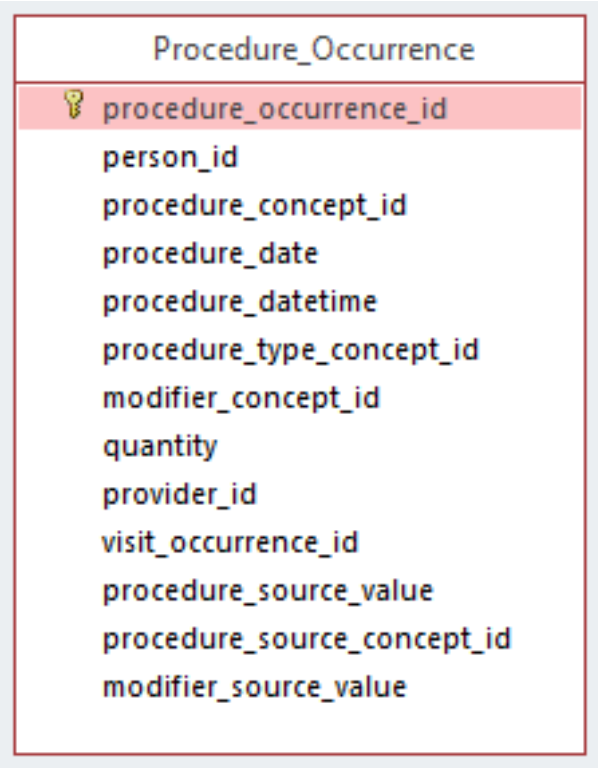
- Can have death without cause
- Can only have 1 death per person

VISIT_OCCURRENCE



- Visits <> 'Encounters':
  - claims often need to be consolidated to minimize double-counting
  - inpatient transitions are not covered
- Visit Types
  - Inpatient
  - Emergency room
  - Inpatient/Emergency - **new**
  - Outpatient
  - Long-term care
- Vocabulary: OMOP
- Other attributes: time of visit start/end, provider, admitting source, discharge disposition

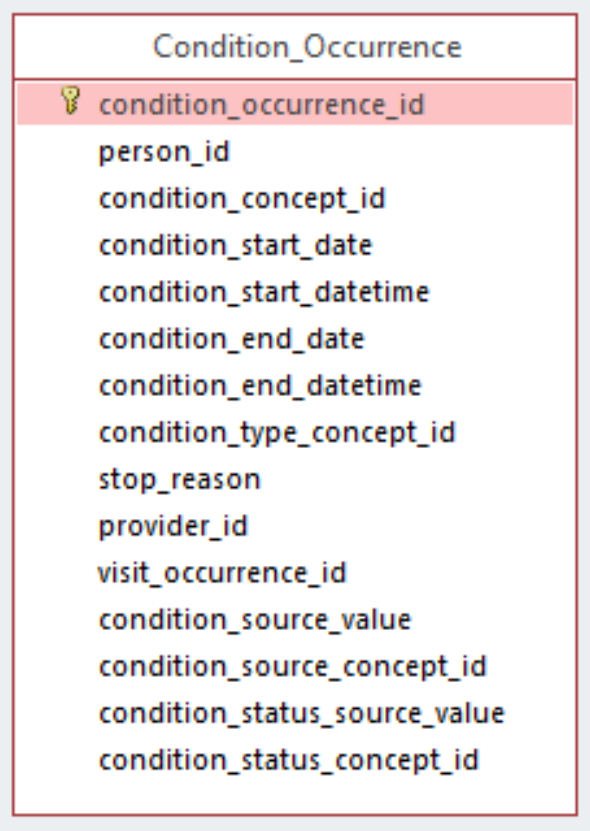
PROCEDURE_OCCURRENCE



- Vocabularies: CPT-4, HCPCS, ICD-9 Procedures, ICD-10 Procedures, LOINC, SNOMED

- Procedures have the least standardized vocabularies that causes some redundancy

CONDITION_OCCURRENCE



- Vocabulary: SNOMED -> classification
- Data sources:
  - Billing diagnosis (inpatient, outpatient)
  - Problem list
- Individual records <> distinct episodes

‘Dirty’ Conditions

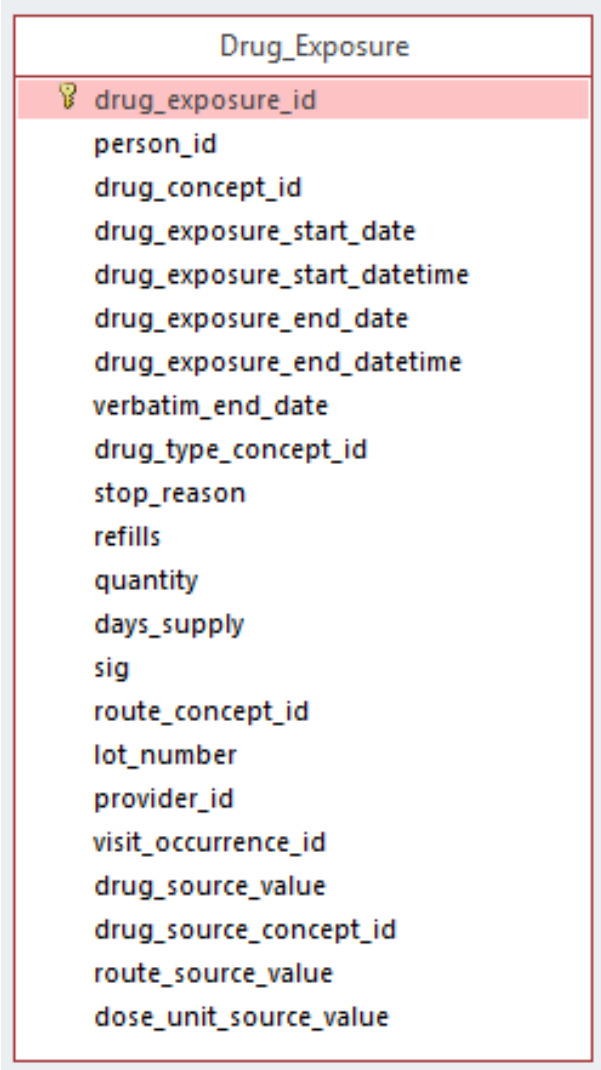
Codes mapped to domains other than the original source domain

Description	AUT MESUR CHIMIO PROPHYL
CIM10	0Z2920
CIM10 Description	OTH PROPHYLACTIC CHEMO
Maps to	**DRUG**

Description	EXSPEC DEPS AUT MAL PREC
CIM10	0Z1380
CIM10 Description	SPEC SCR OTHER SPEC DIS
Maps to	**OBSERVATION**

Description	GRSS CONSTT FORTUITMT
CIM10	0Z3300
CIM10 Description	PREG STATE INCIDENT
Maps to	**CONDITION**

DRUG_EXPOSURE

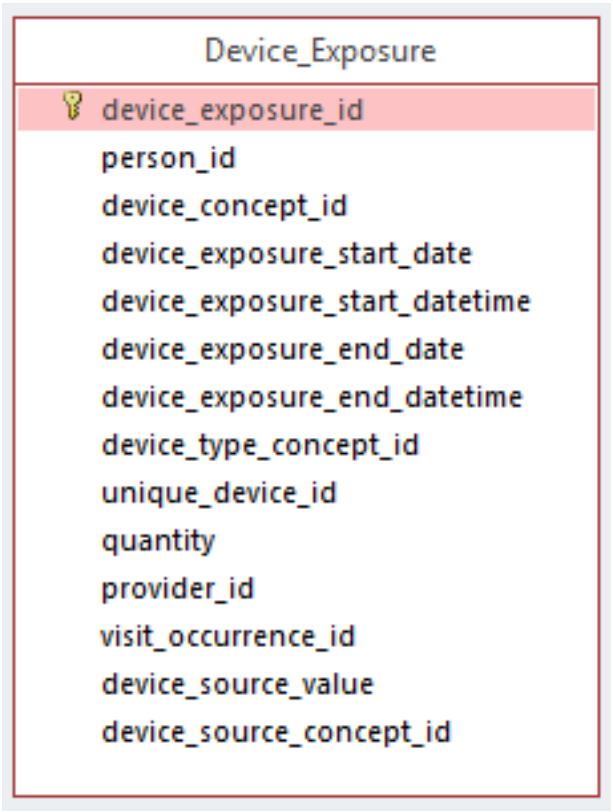


- Vocabulary: RxNorm-> classifications by drug class and indication
- Data sources:
  - Pharmacy dispensing
  - Prescriptions written
  - Medication history
- Source fields may vary, but so inference of drug exposure end may vary

‘Dirty’ Drugs

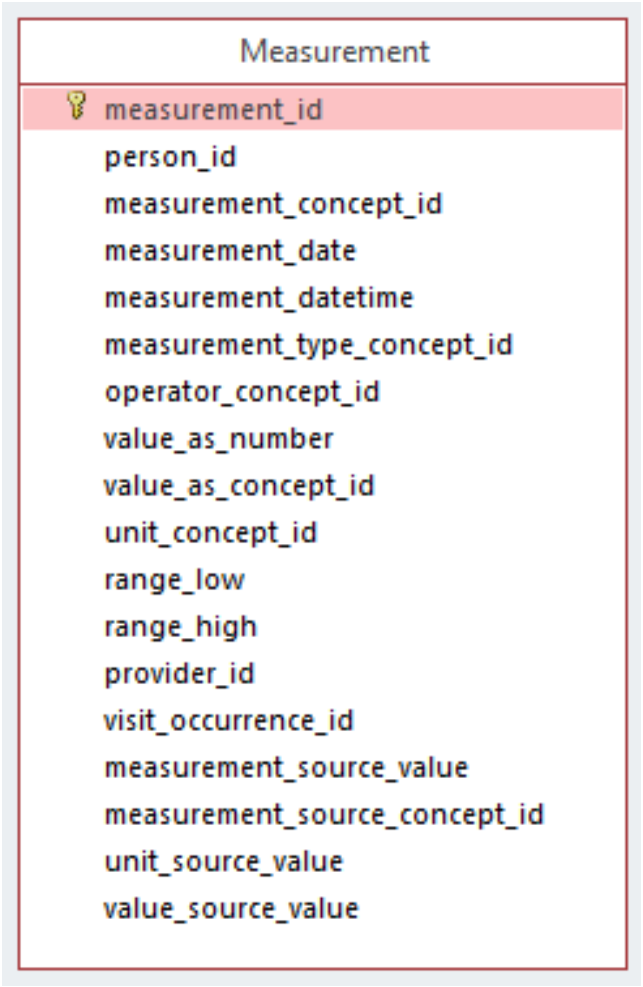
Drug Source Description	Form Desc	Admin Route Description	Generic Name	Maps To
OBSERVATION PERIOD	Miscellaneous	Unspecified	Documentation	OBSERVATION
LUMBAR DDS BELT	Miscellaneous	Unspecified	Unspecified	DEVICE
JOBST KNEE HIGH COMPRESSION STOCKING	Miscellaneous	Unspecified	Antiembolism stockings	DEVICE
MASKS	Miscellaneous	Unspecified	Masks	DEVICE
PEN NEEDLES	Miscellaneous	Unspecified	Needle	DEVICE

DEVICE_EXPOSURE



- OMOP CDM is the only data model supporting devices
- Accommodates FDA unique device identifiers (UDI) even though most data sources don’t have them yet

MEASUREMENT



- Entity-Attribute-Value (EAV) design
- Vocabulary: LOINC, SNOMED
- Data sources: structured, quantitative measures, such as laboratory tests
- Measures have associated units
  - Measurement units vocabulary: UCUM
- No free format for measurement results

Measurement Data Issues

- The unit of measure is inconsistent in the source data
  - –Makes evaluation and studies hard to do

```
select distinct unit_source_value
from measurement
where measurement_concept_id IN
 (
   SELECT concept_id
   FROM concept
   WHERE concept_name like '%LDL%'
     AND standard_concept = 'S'
     AND domain_id = 'Measurement'
 )
```

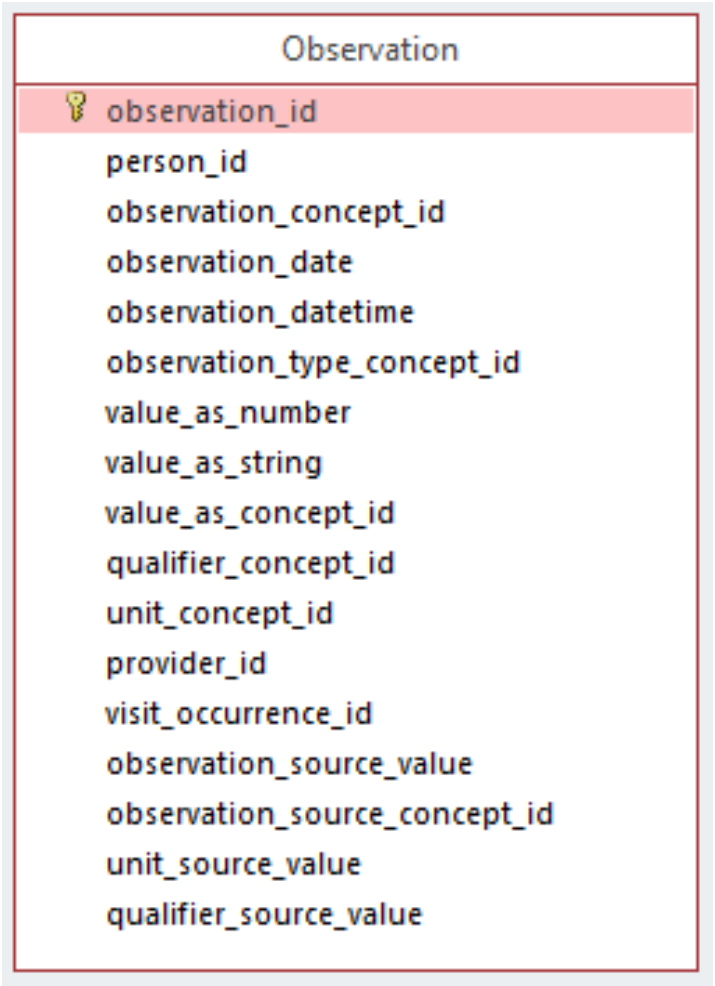
unit_source_value
N < 3.5
g/l
NULL
< 3,2
ng/ml
mmol/l
N < 3.6

Measurement Data Issues

```
select distinct(round (value_as_number/10))*10 as value,
       count (*)
from measurement
where measurement_concept_id in
 (
   SELECT concept_id
   FROM concept
   WHERE concept_name like '%LDL%'
      AND standard_concept = 'S'
      AND domain_id = 'Measurement'
  )
group by value
```

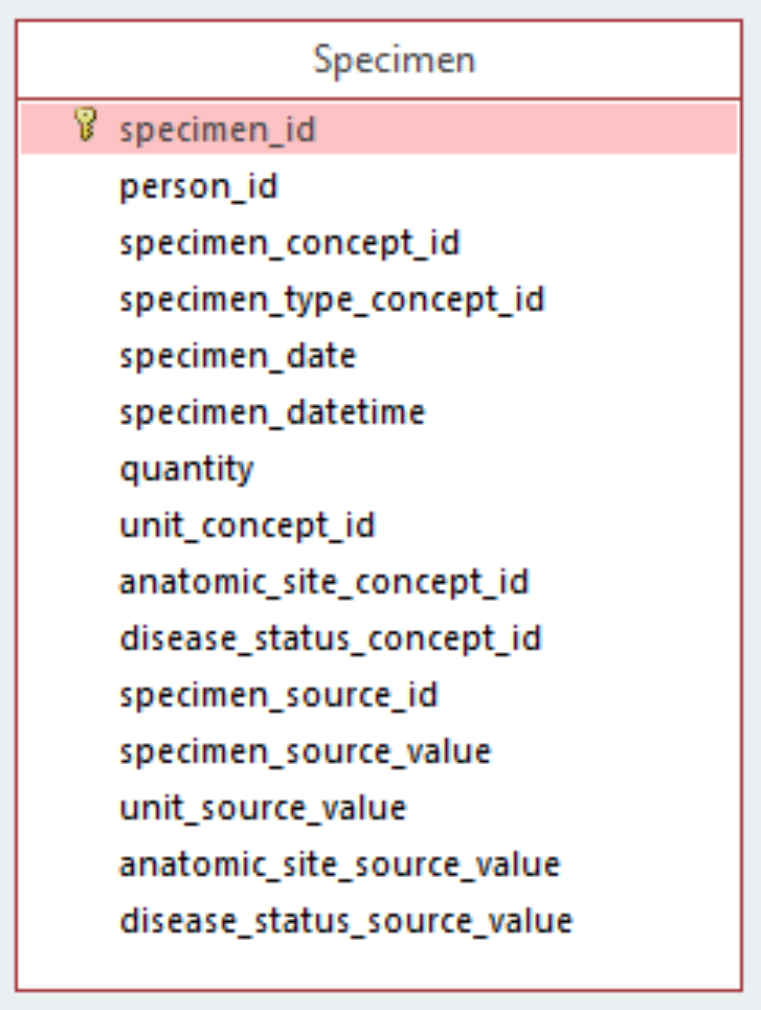
value	count
0	39784
10	302
180	1
20	1
120	1
30	2
NULL	2
4380	1
50	2
60	1
430	1

OBSERVATION



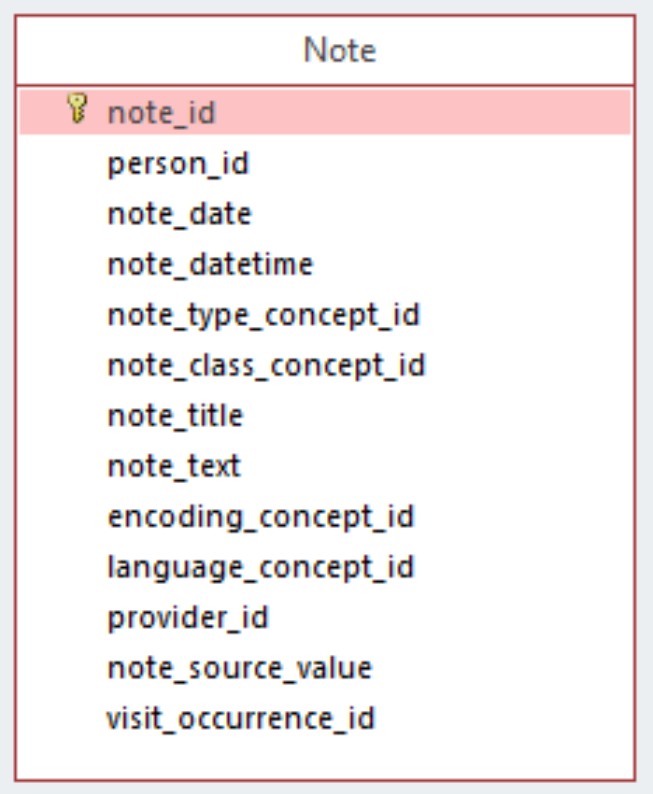
- Catch-all EAV design to capture all other data:
  - observation: 'question'
  - value: 'answer'
    - Can be numeric, concept, or string (e.g. free text)
- Instrument for CDM extension, playpen
- Not all 'questions' are standardized, source value can accommodate 'custom' observations (particularly pertinent in registries)

SPECIMEN



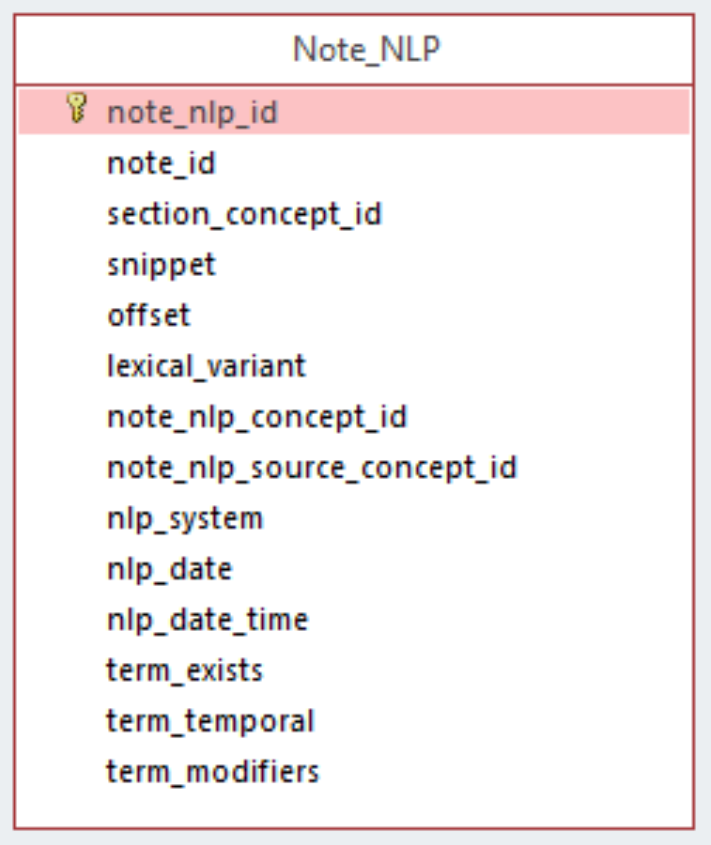
- To capture biomarkers / tissue bank

NOTE



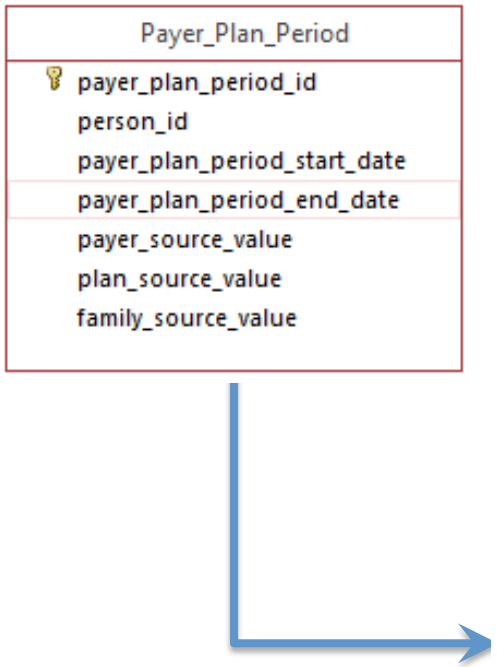
- To capture unstructured free text

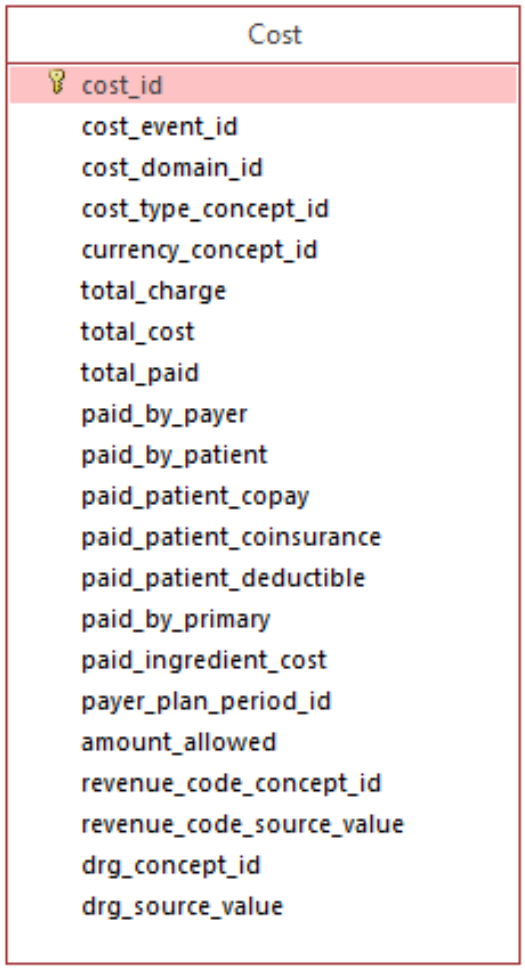
Note_NLP



- The NOTE_NLP table will encode all output of NLP on clinical notes. Each row represents a single extracted term from a note.

Health Economics





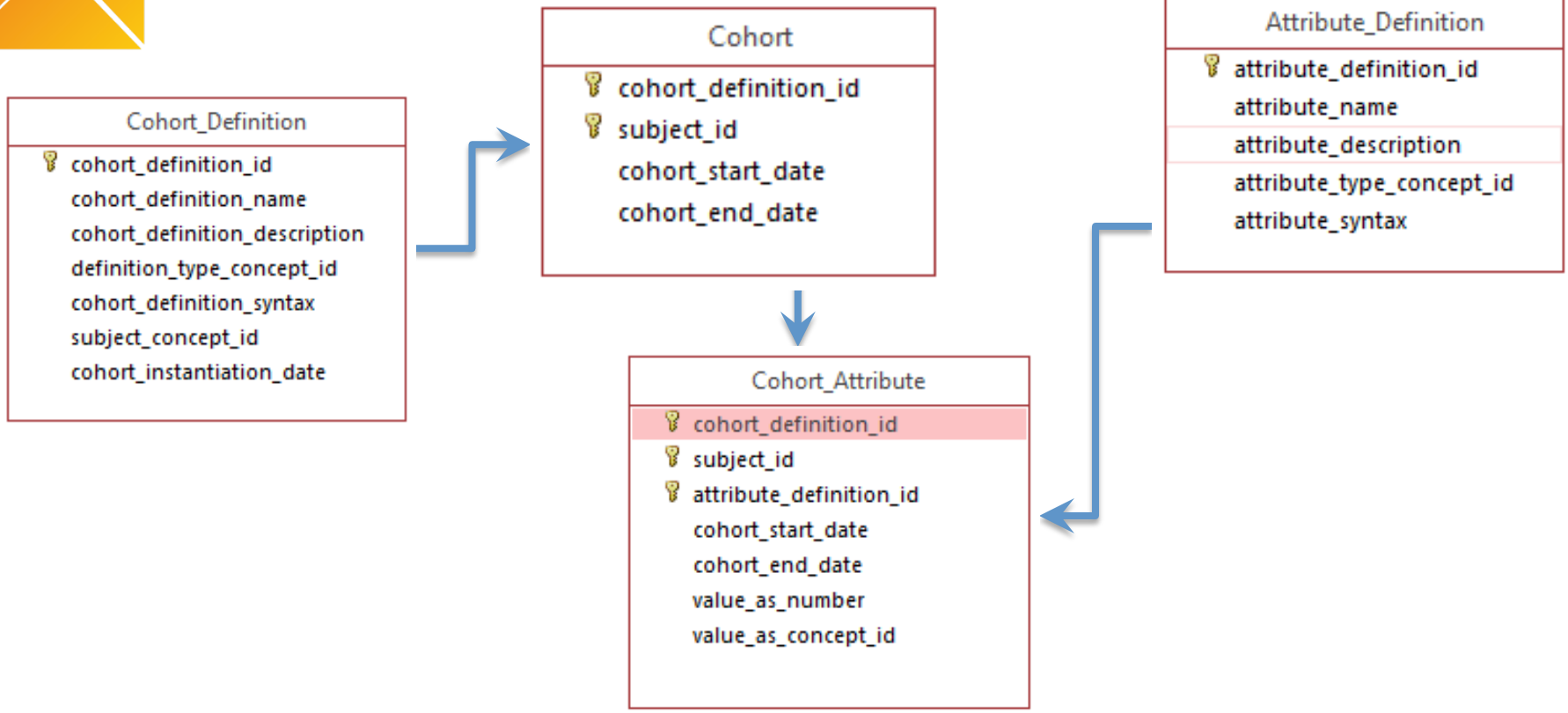
- All costs consolidated into one table COST table
- Costs tied to respective observation records
- Domain is determined by cost_domain_id (e.g. visit, condition, etc.)

OMOP CDM Service Tables

- CDM_SOURCE
  - Provenance, integration, metadata
  - Future extension to individual domains

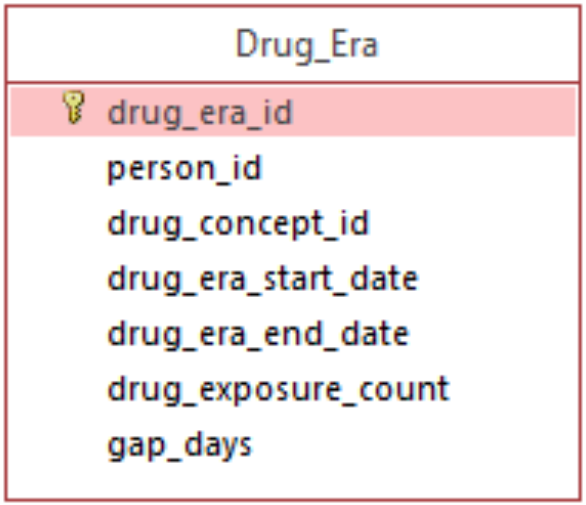
- FACT_RELATIONSHIP
  - Linkage between related observations
  - Example: systolic and diastolic blood pressure

Cohorts



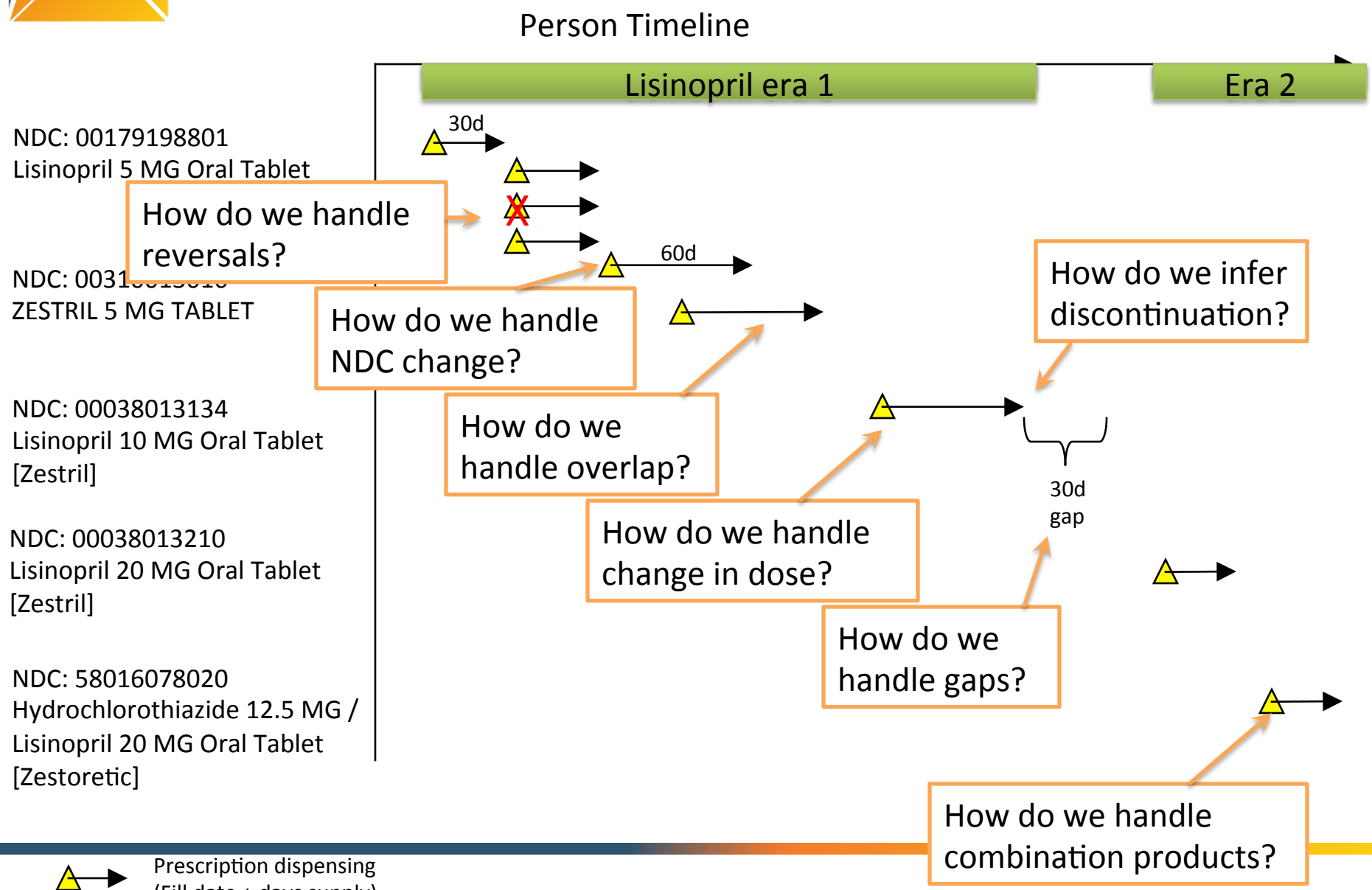
1. **COHORT** table contains records of subjects that satisfy a given set of criteria for a duration of time.
2. The definition of the cohort is contained within the **COHORT_DEFINITIO**N table. It provides a standardized structure for maintaining the rules governing the inclusion of a subject into a cohort, and can store programming code to instantiate the cohort within the OMOP CDM.
3. **COHORT_ATTRIBUTE** table contains attributes associated with each subject within a cohort, as defined by a given set of criteria for a duration of time.
4. The definition of the Cohort Attribute is contained in the **ATTRIBUTE_DEFINITION** table.

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

Illustrating inferences needed within longitudinal pharmacy claims data for one patient



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_at_event
GE	GE6326	GE8784	GE46478747	20

Diagnosis

db_country	international_diagnosis_num	diagnosis_num	icd10_4_code	
GE	GE2397573	2397573	I21.4	No

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
05917921689	1/5/2006	41071	Inpatient claims - 1st 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
157033702	1/5/2006	41071	Inpatient claims - 1st 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

Lesson Learned

- Date Shifting
  - Added logic to shift date of actual patient transactions
- Encrypt/De-identify Provider or Plan information within a link dataset
  - Encrypted provider ID information when linked claims with EMR dataset
- Privacy ICD9/10 Codes
  - Removal of ICD9/10 codes that are considered privacy issues, such as death or sexual abuse
  - Using “fake” date in Death table to indicate a death
- Data unable to leave a specific country
- Pilot Patients
  - Removal of patients that were are “dummy patients”

Lesson Learned (cont.)

- Patients without transaction
  - –Adding an observation period
- Local country vocabulary mapping
- Local knowledge of each countries health system
- Knowledge of local data and business rules
- Ability to extract patient level data
- Cleaning dirty data
- Standardize measurement and unit of measure
- Source field not transferring to OMOP CDM

THEMIS

What makes OMOP CDM unique

- Specialized CDM - reflective of clinical domain, granular, well structured
- Vocabulary - uniformly structured and well curated
- Information Model - formalized connection between data model and conceptual model (Vocabulary)
- Specialized yet Extendable – new attributes and concepts can be added
- Supportive Community of developers and researchers
- Development driven by analytic use cases

Break

Please return in 15 minutes

CDM Examples

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

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

Resources

1. Download

http://athena.ohdsi.org

2. Rebuild (not for the faint of heart)

https://github.com/OHDSI/Vocabulary-v5.0

3. Documentation

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

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/

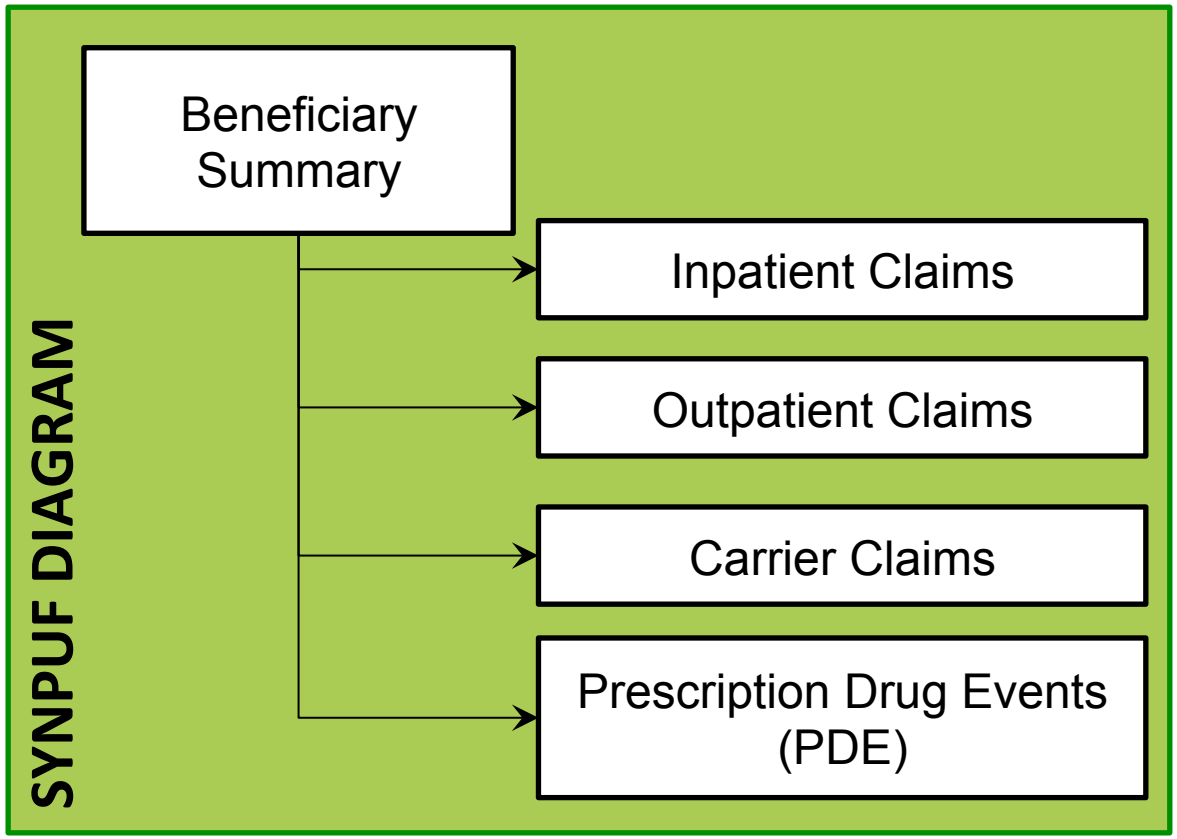
Data Used for Demonstration

- Five types of data:

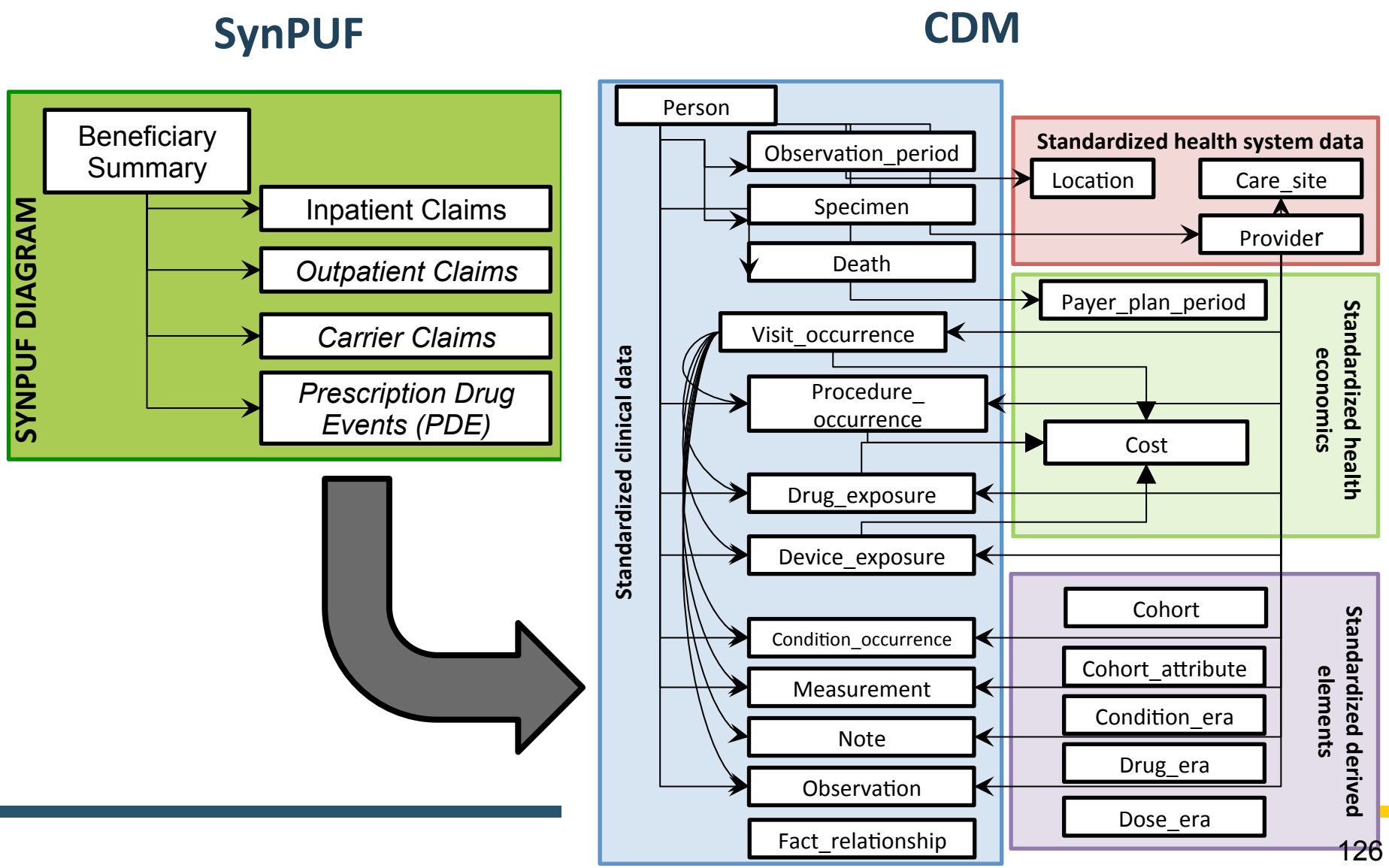
	DE-SynPUF	Unit of record	Number of Records 2008	Number of Records 2009	Number of Records 2010
1	*Beneficiary Summary*	Benefi-ciary	2,326,856	2,291,320	2,255,098
2	*Inpatient Claims*	claim	547,800	504,941	280,081
3	*Outpatient Claims*	claim	5,673,808	6,519,340	3,633,839
4	*Carrier Claims*	claim	34,276,324	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



Some Example Questions

Ex 0

Finding Warfarin

Ex 1

New Users of Warfarin

Ex 2

New Users of Warfarin who are >=65?

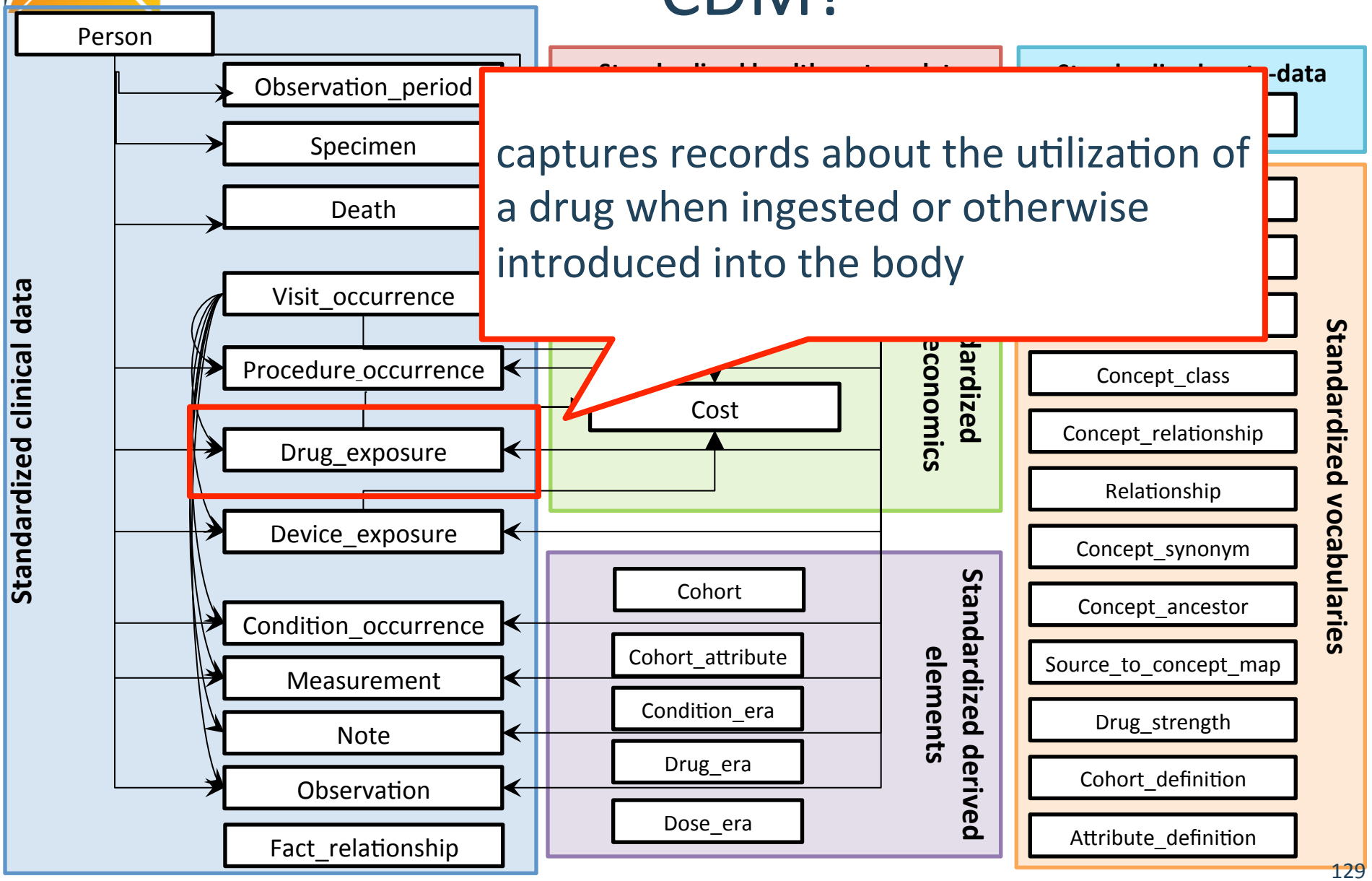
Ex 3

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?

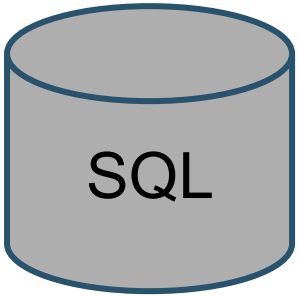
Where are Drug Exposures in the CDM?



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 concepts 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

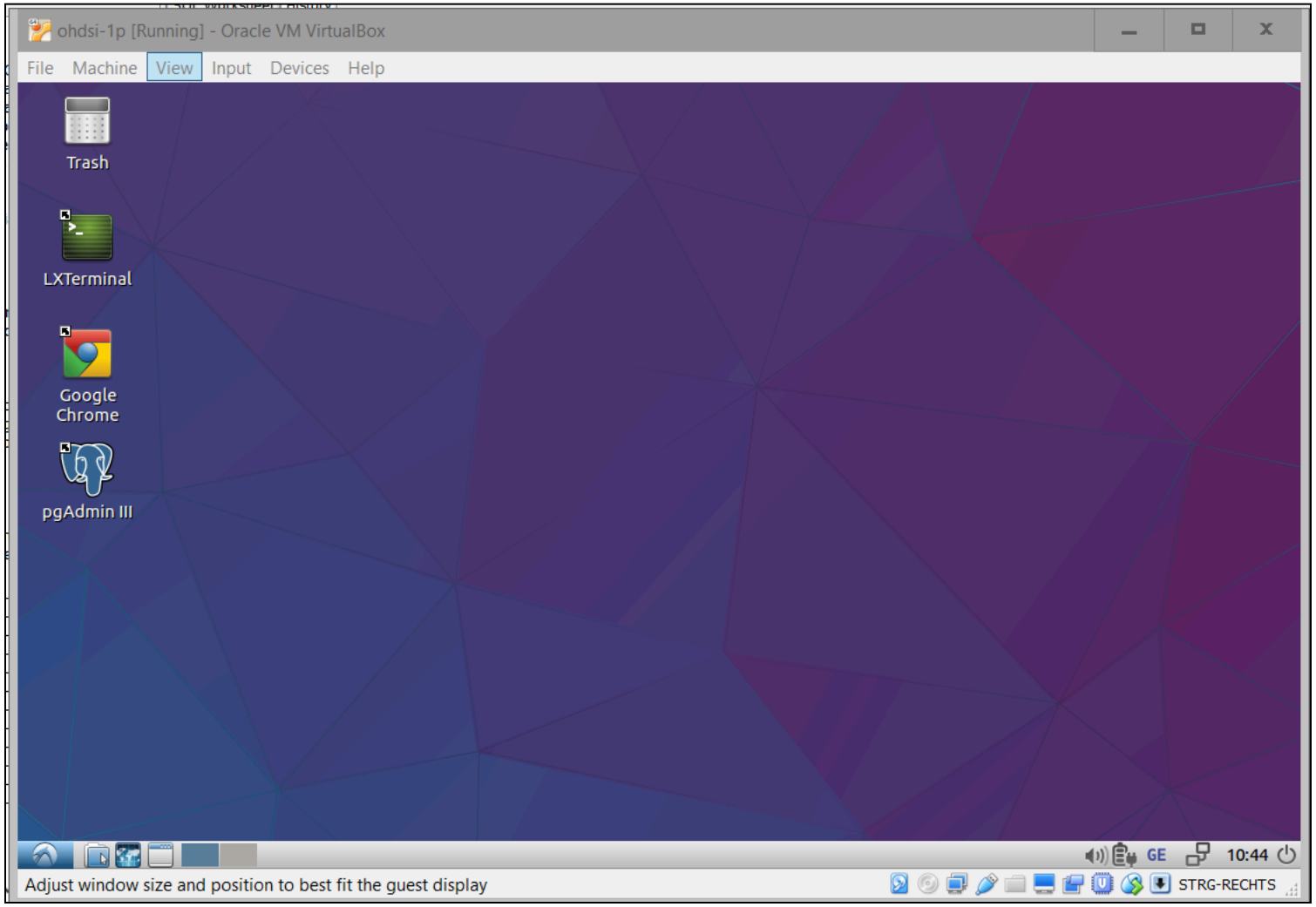
How do I define Warfarin?



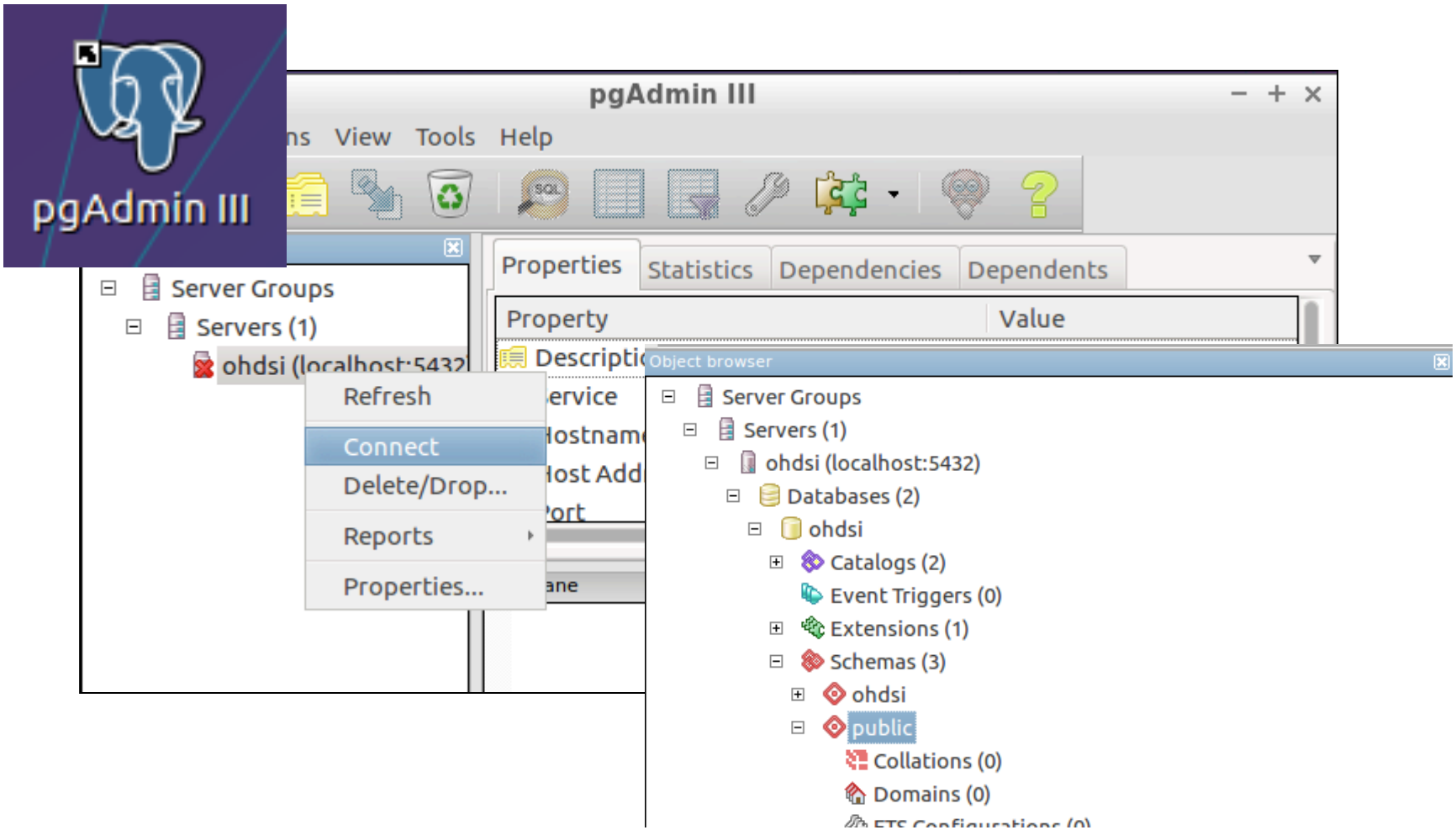
- Writing SQL Statement

- OHDSI Tool ATLAS

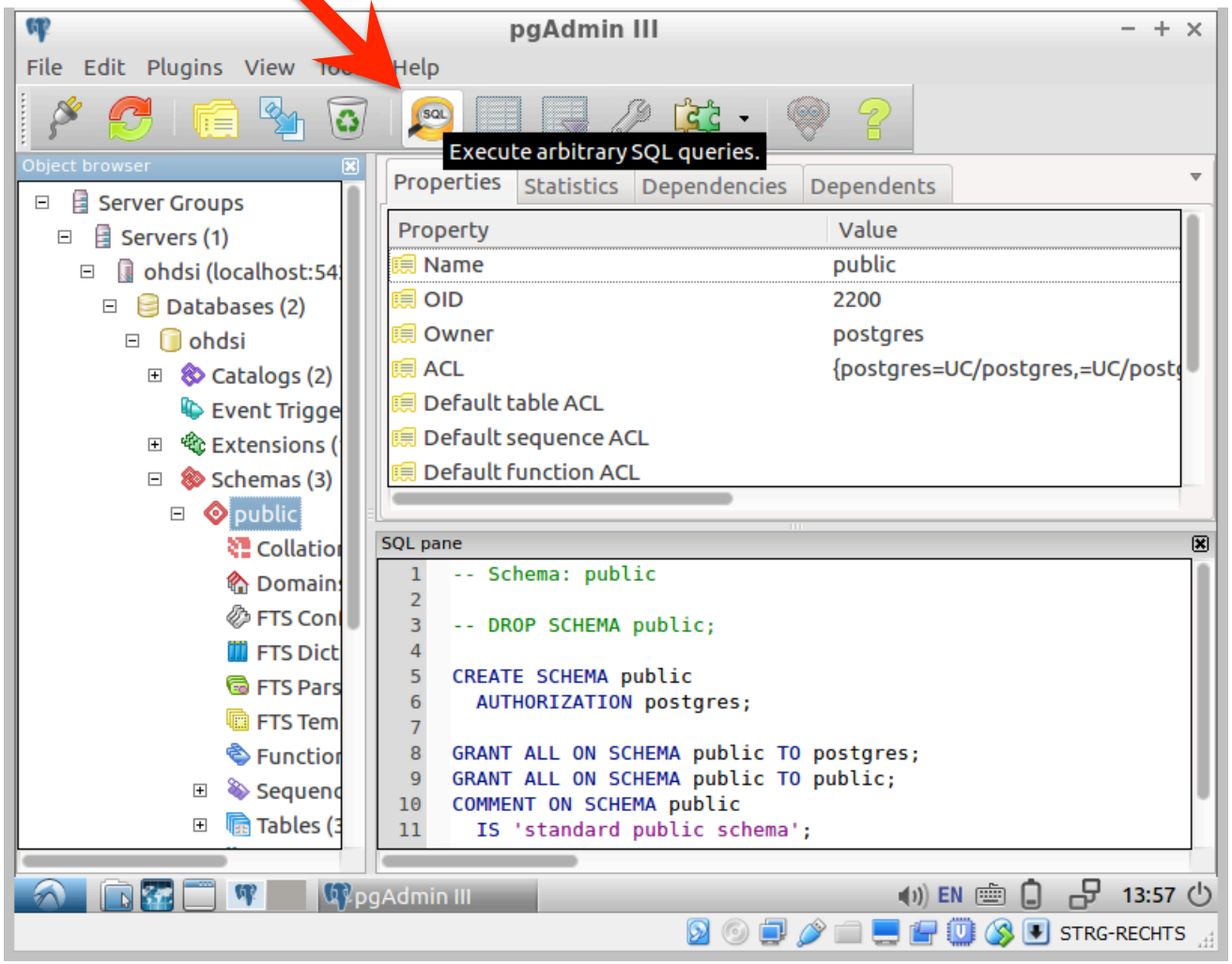
OHDSI in a Box



CDM Database – Connect



CDM Database – Open SQL Sheet



Finding Warfarin

Ex 0

```
/*********************************************************************************
*       (Exercise 0) Finding Warfarin
*********************************************************************************/

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

0 individuals

```
/*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)*/
);
```

Finding Warfarin

Ex 0

```
/*********************************************************************************
*       (Exercise 0) 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

25,602 individuals

Finding Warfarin

Ex 0

```
/*********************************************************************************
*       (Exercise 0) 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

25,602 individuals

38,027 individuals

Some Example Questions

Ex 0 Finding Warfarin

Ex 1 **New Users of Warfarin**

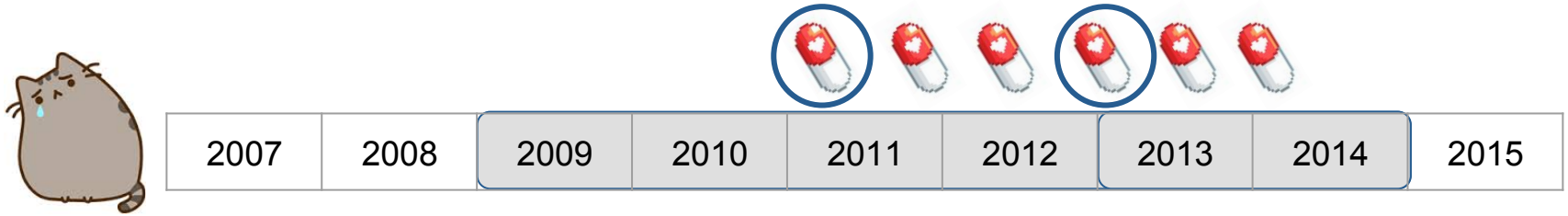
Ex 2 New Users of Warfarin who are >=65?

Ex 3 New Users of Warfarin with prior Atrial Fibrillation?

How do I define new users of a drug?

Ex 1

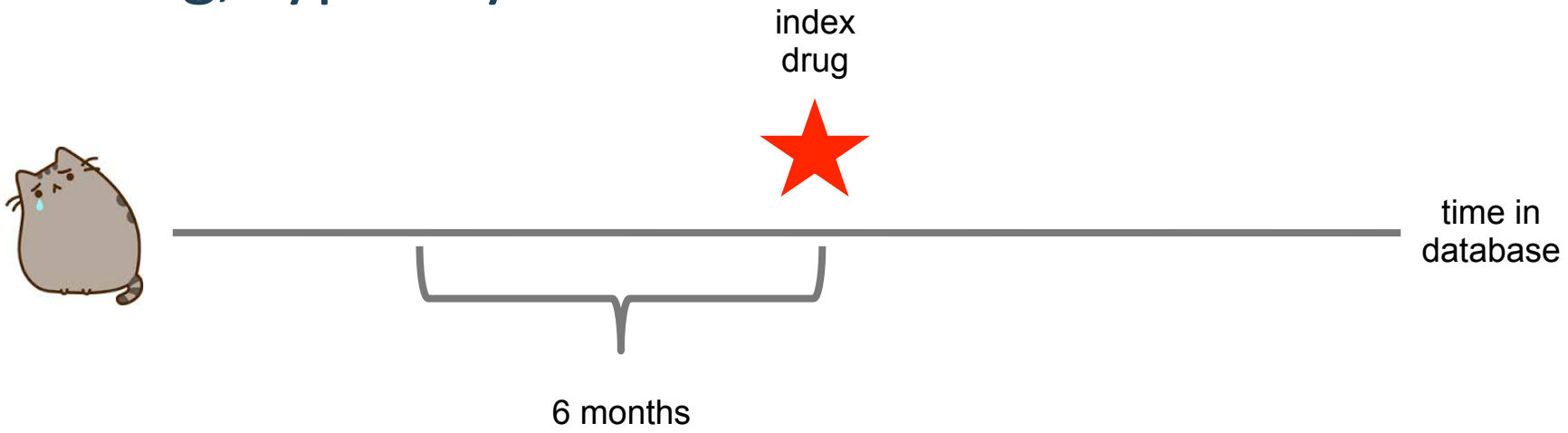
Someone who has recently started taking the drug, typically with a 6 or 12 month wash out



How do I define new users of a drug?

Ex 1

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



What is Needed in the CDM?

Ex 1

- **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 1

```
/**************************************************************************************
*    (Exercise 1) 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,
    (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
ORDER BY i.PERSON_ID
```

Step 1: Get the codes you need

Ex 1

```
/**********************************************************************************
*    (Exercise 1) 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,
    (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
ORDER BY i.PERSON_ID
```

Step 2: Find Drug Exposures

Ex 1

```
/**********************************************************************************
*    (Exercise 1) 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,
    (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
ORDER BY i.PERSON_ID
```

Step 3: Find New Users

Ex 1

```
/**********************************************************************************
*    (Exercise 1) 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,
    (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
ORDER BY i.PERSON_ID
```

New Users of Warfarin

Ex 1

```
/**********************************************************************************
*    (Exercise 1) 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,
    (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
ORDER BY i.PERSON_ID
```

New Users of Warfarin

Ex 1

Try running this on your own!

How many people do you get?

18,080 individuals

Output pane

Data Output | Explain | Messages | History

	person_id integer	index_date date	observation_period_start_date date	observation_period_end_date date	days_before_index integer
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

OK. Unix Ln 17, Col 21, Ch 710 18080 ro... 2.5 secs

Some Example Questions

Ex 0

Finding Warfarin

Ex 1

New Users of Warfarin

Ex 2

New Users of Warfarin who are >=65?

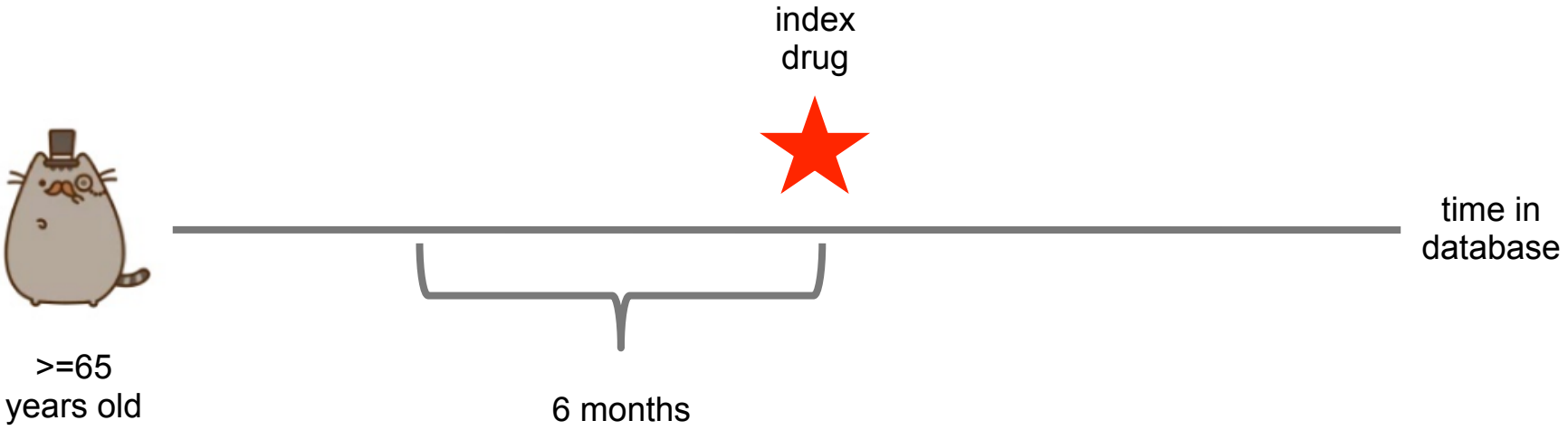
Ex 3

New Users of Warfarin with prior Atrial Fibrillation?

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

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
- **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 2

```
/*********************************************************************************
*       (Exercise 2) 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,
        (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) AS DAYS_BEFORE_INDEX,
        EXTRACT(YEAR FROM 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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
AND EXTRACT(YEAR FROM i.INDEX_DATE)-p.YEAR_OF_BIRTH >= 65
ORDER BY i.PERSON_ID
```

Step 2: Add the Person Table to calculate age

Ex 2

```
/**********************************************************************************
*       (Exercise 2) 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,
        (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) AS DAYS_BEFORE_INDEX,
        EXTRACT(YEAR FROM 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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
AND EXTRACT(YEAR FROM i.INDEX_DATE)-p.YEAR_OF_BIRTH >= 65
ORDER BY i.PERSON_ID
```

New Users of Warfarin >= 65 years of age

Ex 2

Try running this on your own!

```
/**********************************************************************************
*       (Exercise 2) 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,
        (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) AS DAYS_BEFORE_INDEX,
        EXTRACT(YEAR FROM 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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
AND EXTRACT(YEAR FROM i.INDEX_DATE)-p.YEAR_OF_BIRTH >= 65
ORDER BY i.PERSON_ID
```

Some Example Questions

Ex 0 Finding Warfarin

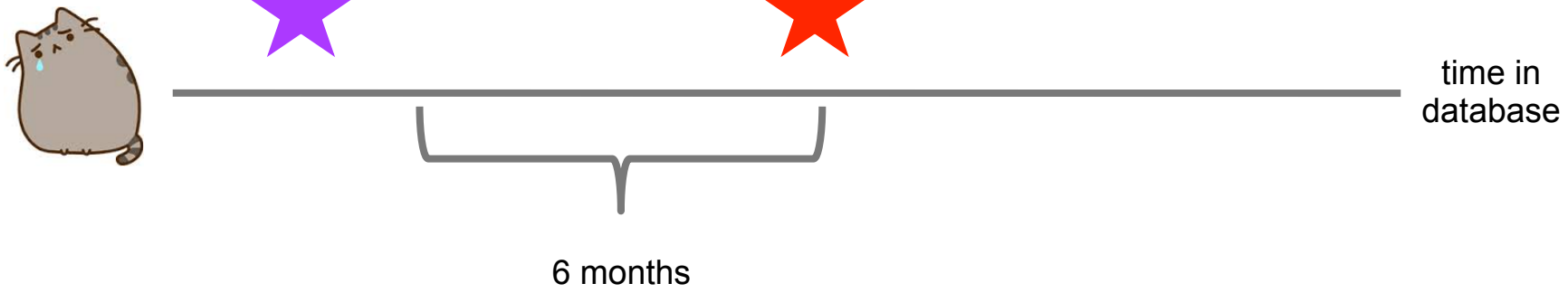
Ex 1 New Users of Warfarin

Ex 2 New Users of Warfarin who are >=65?

Ex 3 New Users of Warfarin with prior Atrial Fibrillation?

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

Ex 3



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
- **CONDITION_OCCURRENCE**
  to find presence of a disease

Step 1: Start with the Ex 1 query

Ex 3

```
/*********************************************************************************
*       (Exercise 3) 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,
                (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
)
SELECT nu.*, MIN(nu.INDEX_DATE-co.CONDITION_START_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 3

```
/**************************************************************************
*       (Exercise 3) 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,
                (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
)
SELECT nu.*, MIN(nu.INDEX_DATE-co.CONDITION_START_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 3

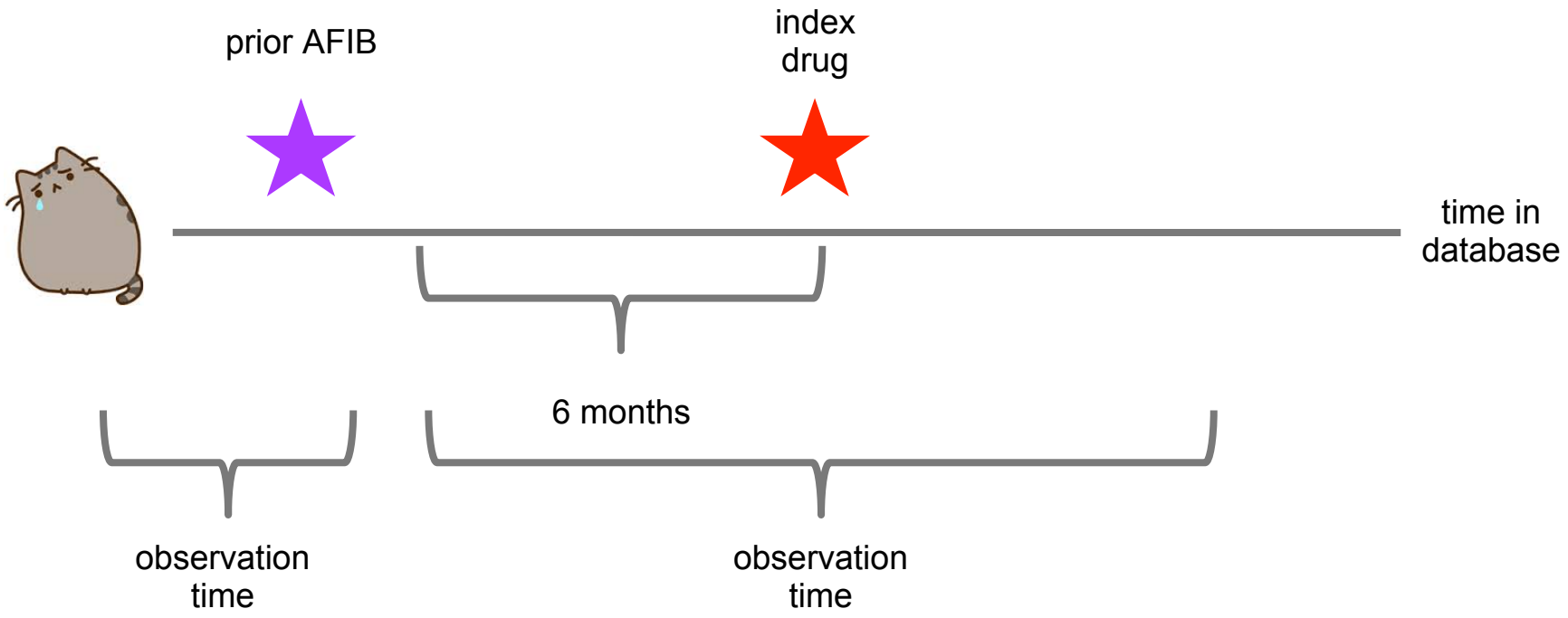
```
/**********************************************************************************
*       (Exercise 3) Warfarin New Users With Prior AFIB
**********************************************************************************/

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,
                (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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
        WHERE (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
)
SELECT nu.*, MIN(nu.INDEX_DATE-co.CONDITION_START_DATE) AS DAYS_OF_CLOSEST_AFIB_PRIOR_
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 3



New Users of Warfarin with prior Atrial Fibrillation

Ex 3

```
/**********************************************************************************
*       (Exercise 3) 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,
                (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_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 (i.INDEX_DATE-op.OBSERVATION_PERIOD_START_DATE) >= 180
)
SELECT nu.*, MIN(nu.INDEX_DATE-co.CONDITION_START_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

8,207 individuals

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

3,148 individuals

Queries Can Be Automated

- Open up Google Chrome 

- Navigate to: http://127.0.0.1:8080/atlas/

- Example cohort:
  "Warfarin New Users 65 or Older at Index with Prior Atrial Fibrillation"

Cohort

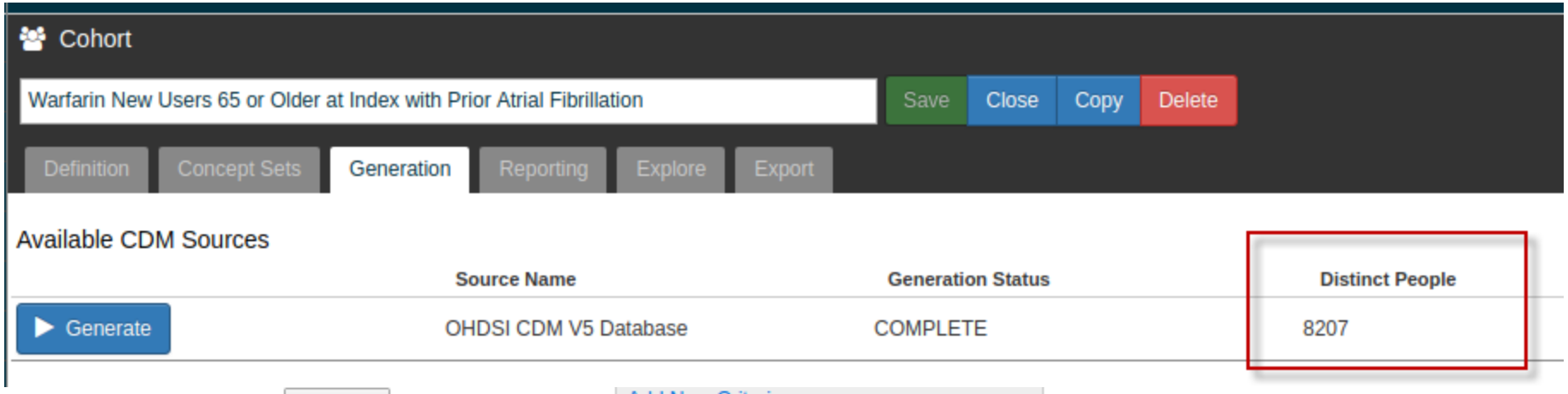
Warfarin New Users 65 or Older at Index with Prior Atrial Fibrillation

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.

All | Cohort Entry Criteria | Cohort Exit Criteria



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

with the following event criteria:

with age Greater or Equal To 65

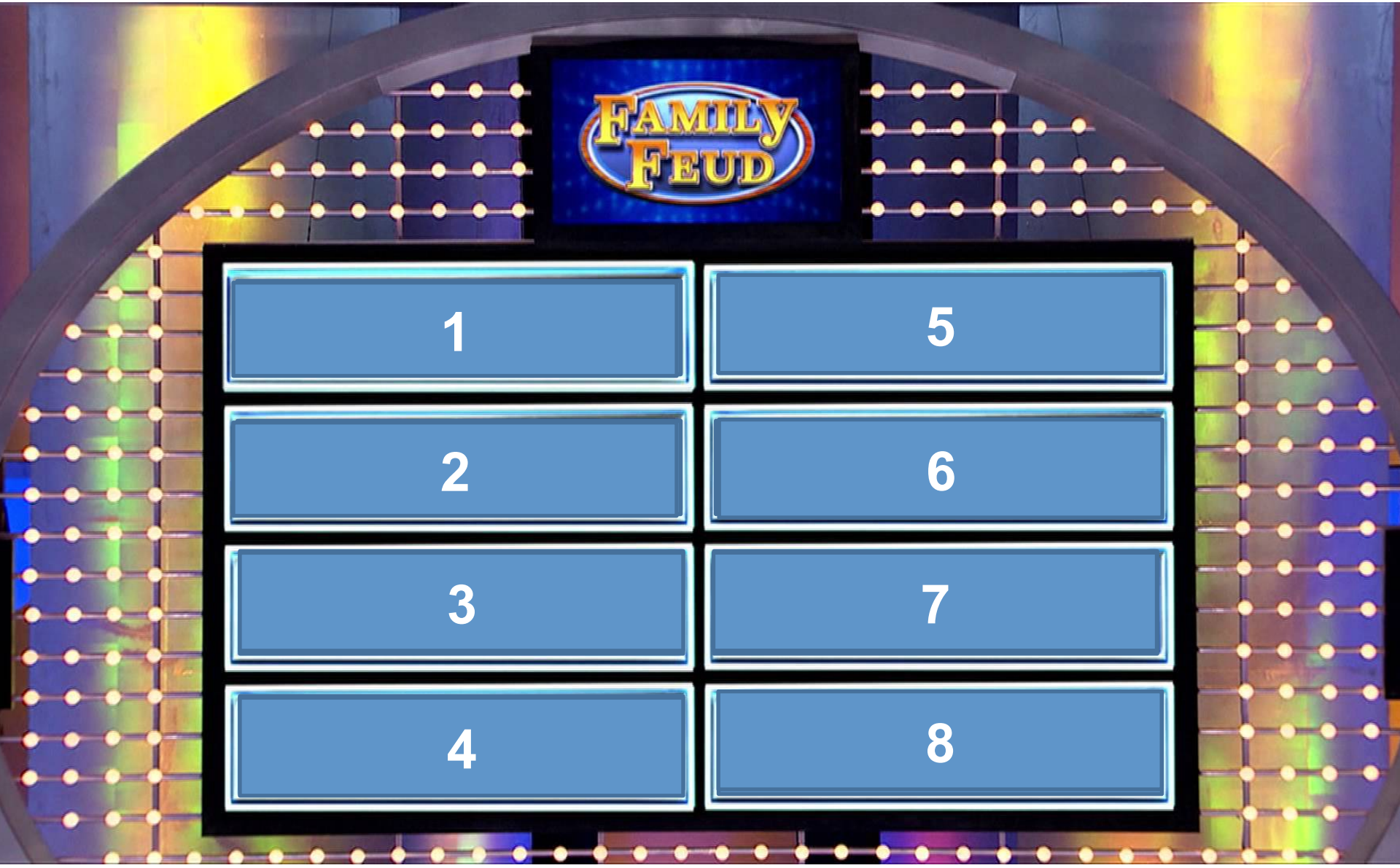
and with at least 1 using all occurrences of:

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.

Conclusion



Extra Slides

OHDSI in a Box – International Keyboards