OHDSI Tutorial Program

OMOP Standardized Vocabularies

Version 1.5

© OHDSI

After the Tutorial, 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?

Preparation

OMOP in a Box

Oracle VirtualBox

OMOP in a Box – Setup

1. Open VM VirtualBox Manager

2. Click on
   New

3.
   ## Name and operating system
   Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine.

   Name: OHDSI-1percent
   Type: Linux
   Version: Ubuntu (64-bit)

4.
   ## Memory size
   Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.

   The recommended memory size is **1024** MB.

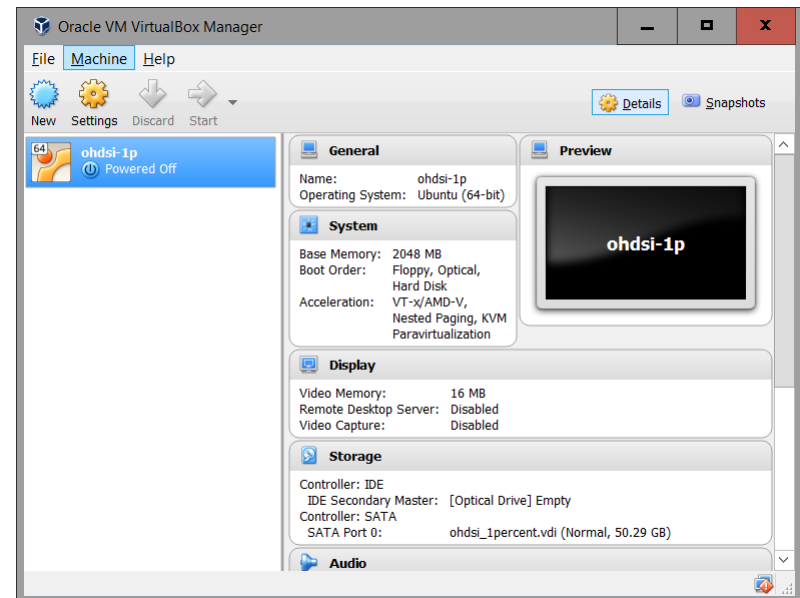   2048 MB

   4 MB   8192 MB

5.
   ○ Do not add a virtual hard disk
   ○ Create a virtual hard disk now
   ● Use an existing virtual hard disk file

   ohdsi - 1k - Final.vdi (Normal, 30.00 GB)

Oracle VM VirtualBox Manager

File   Machine   Help

New   Settings   Discard   Start   Details   Snapshots

ohdsi-1p
Powered Off

General
Name: ohdsi-1p
Operating System: Ubuntu (64-bit)

System
Base Memory: 2048 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization

Preview
ohdsi-1p

Display
Video Memory: 16 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

Storage
Controller: IDE
  IDE Secondary Master: [Optical Drive] Empty
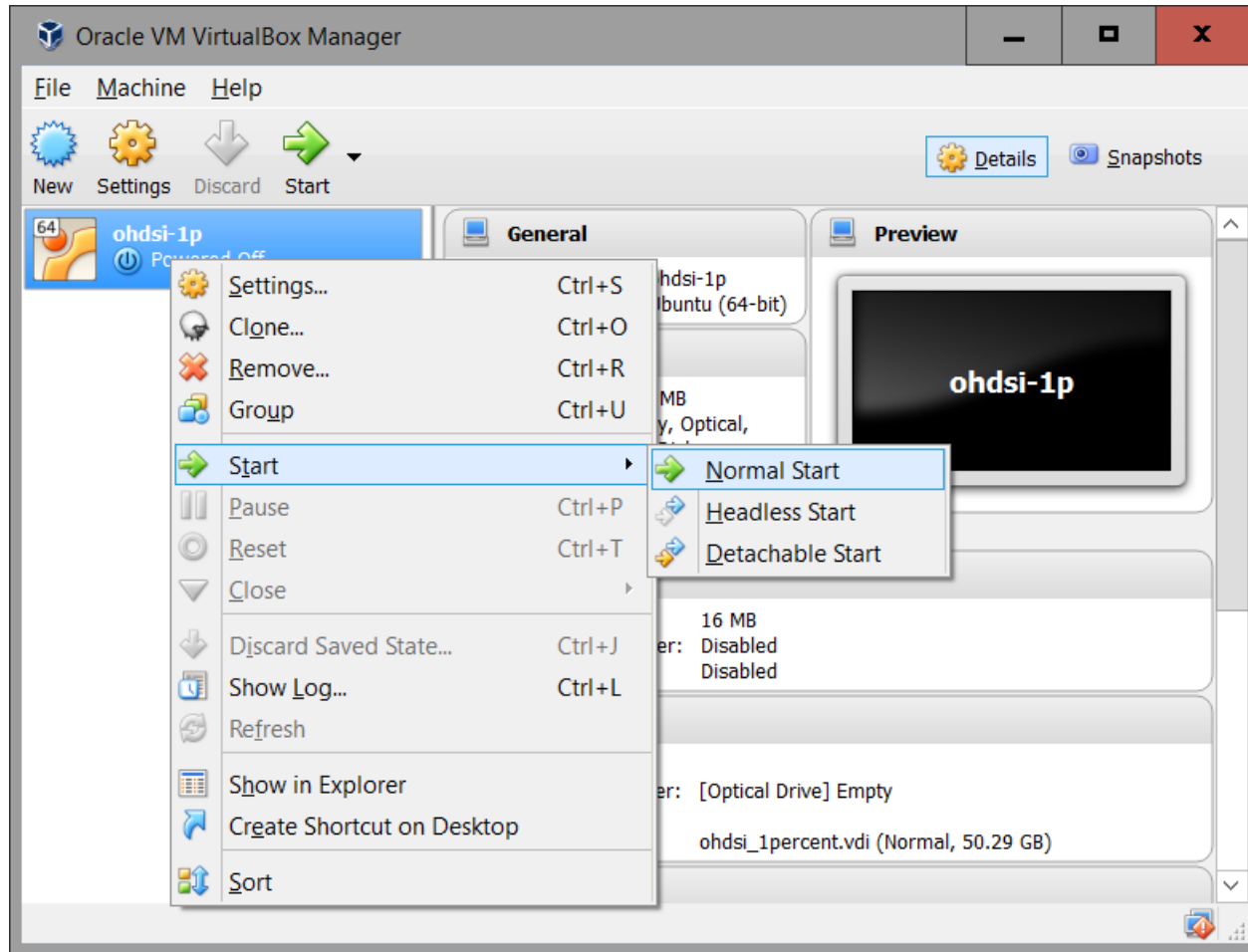Controller: SATA
  SATA Port 0:   ohdsi_1percent.vdi (Normal, 50.29 GB)
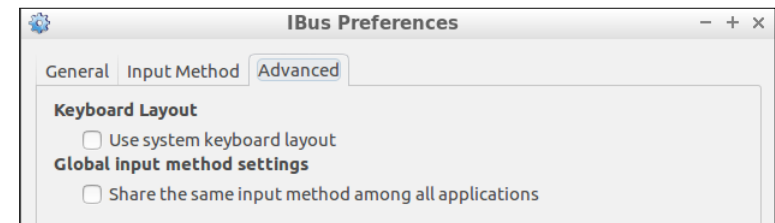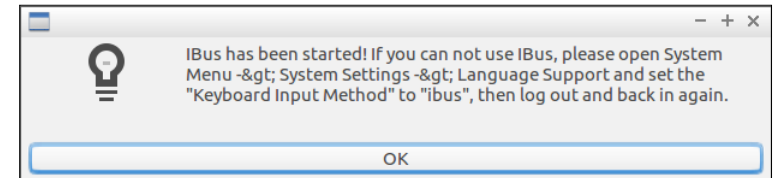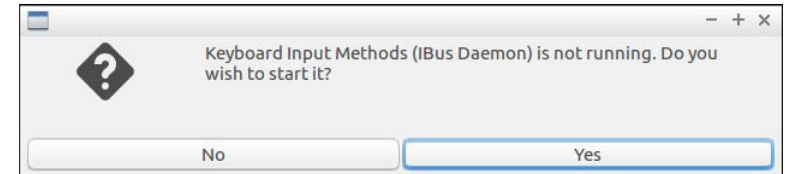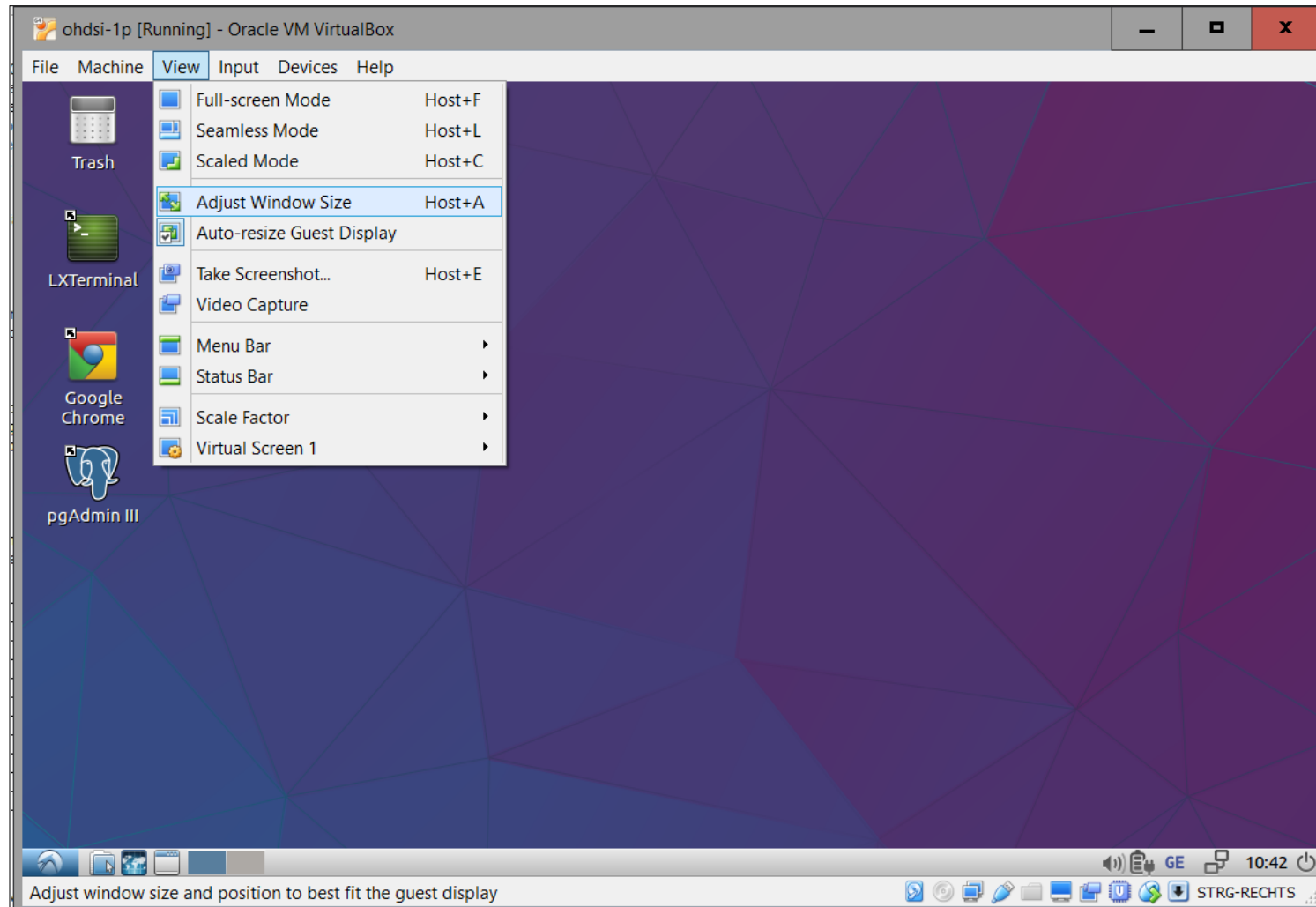
Audio

OMOP in a Box – IDE/SATA settings

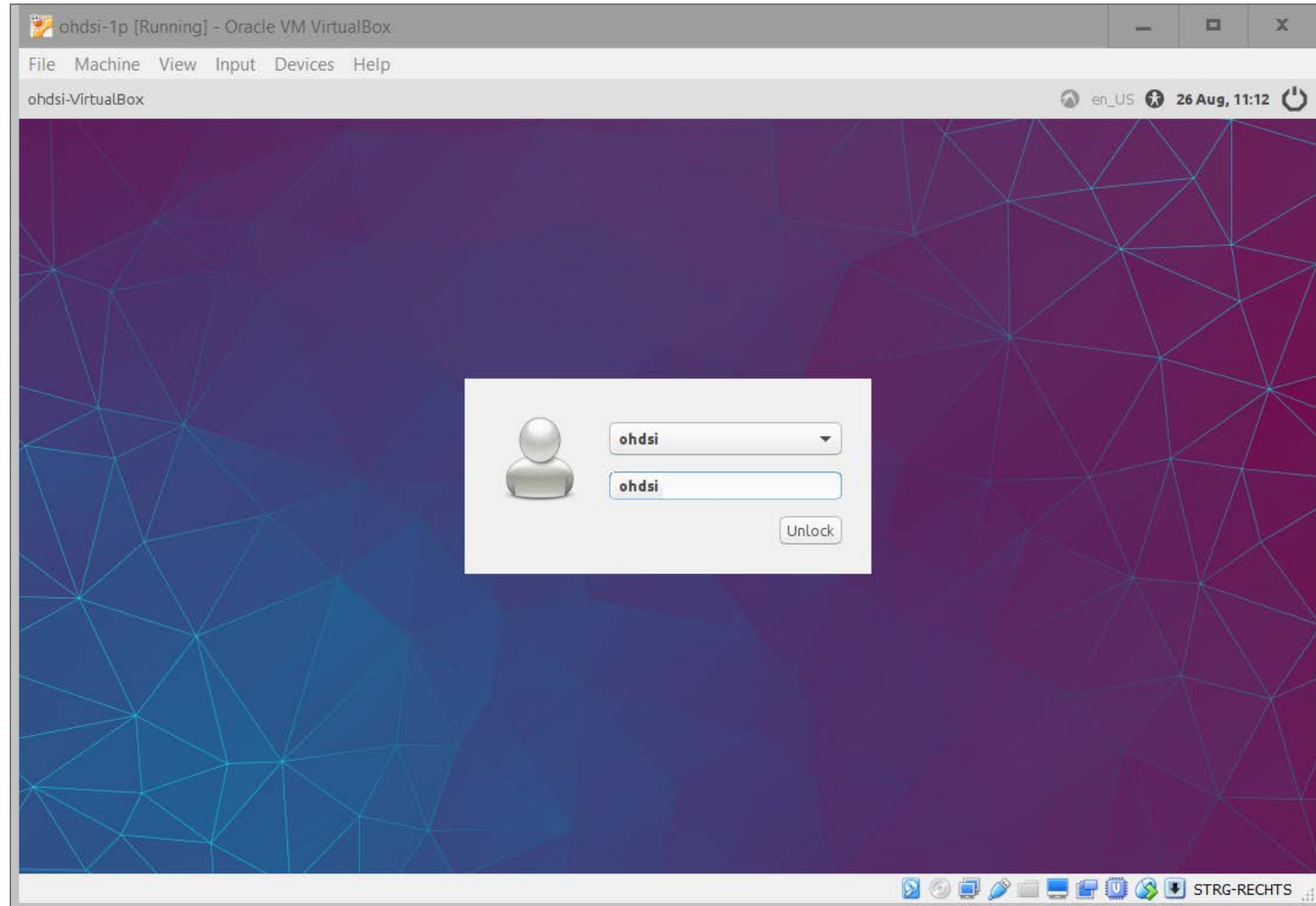# OMOP in a Box – Start Up

OMOP in a Box – International Keyboards

OMOP in a Box – Adjust Resolution

OMOP in a Box – Timeout

OMOP in a Box – Ready
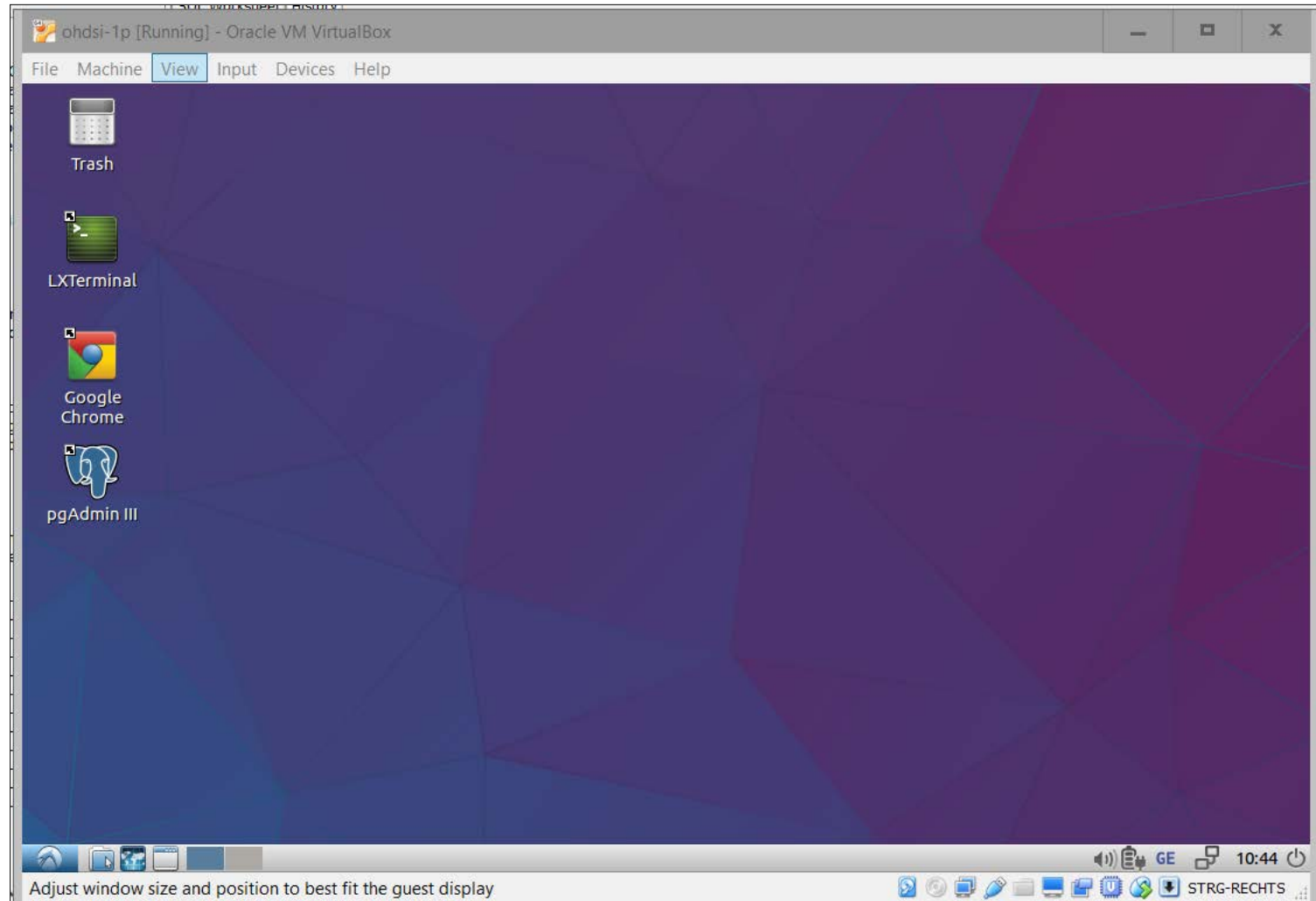
CDM Database – pgAdmin III New Server
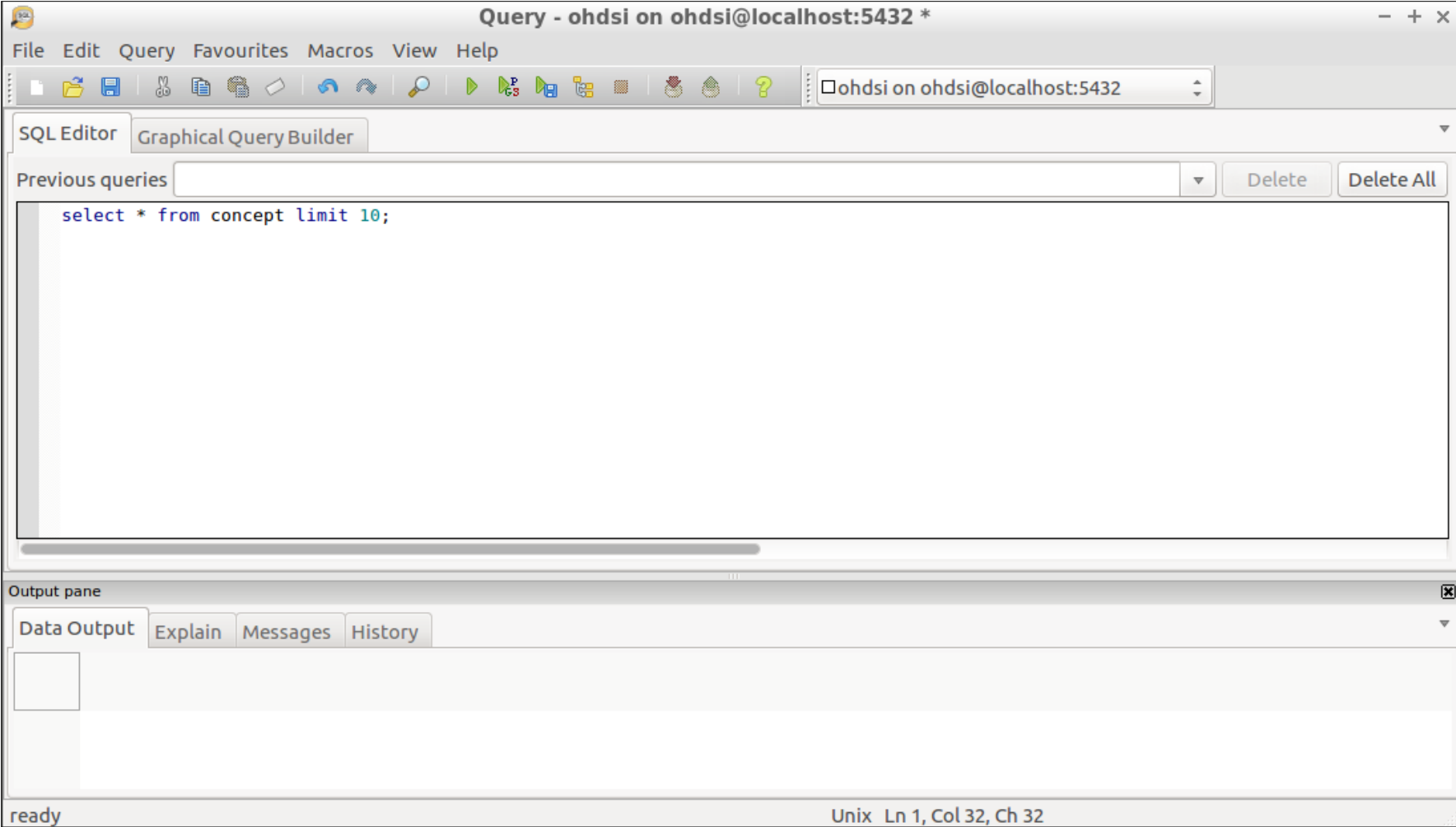
CDM Database – Connect
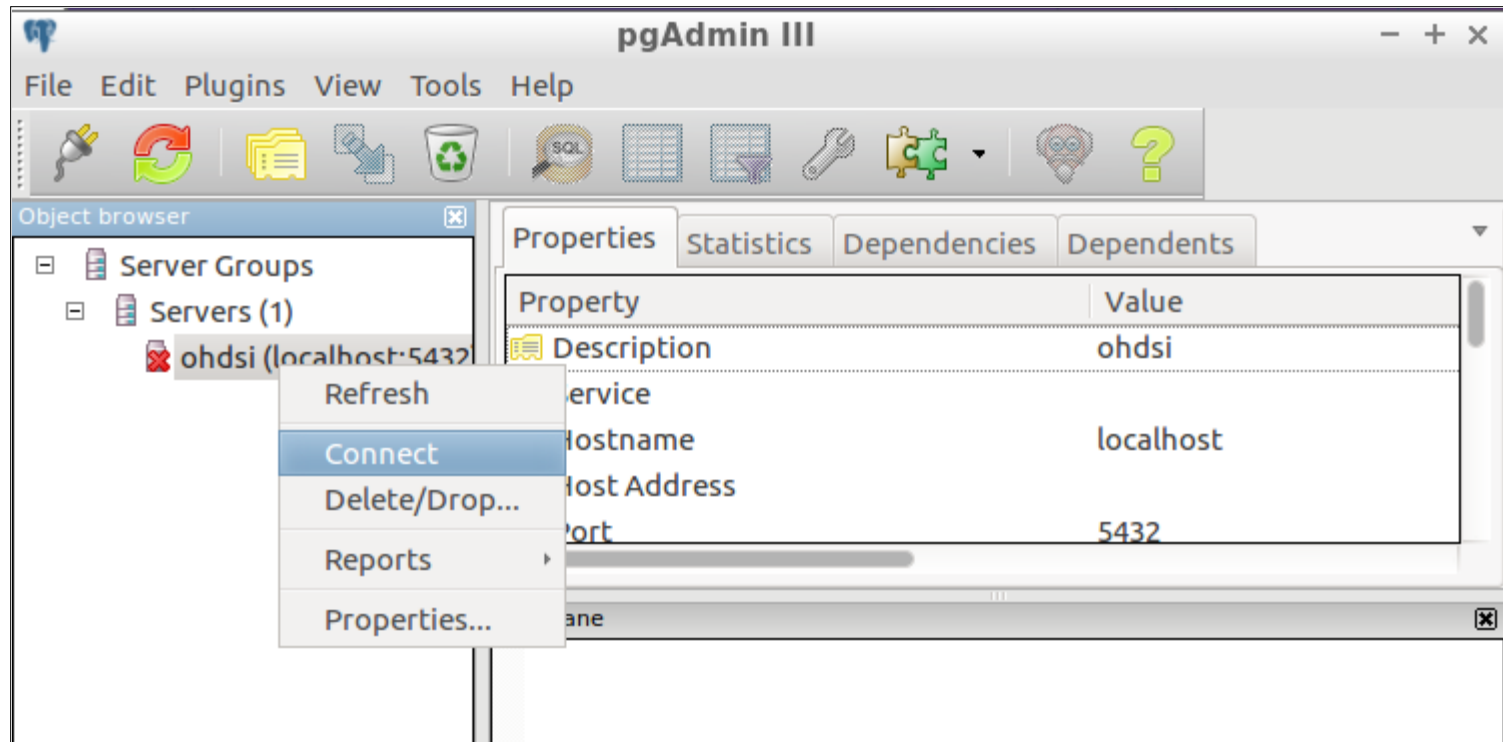
CDM Database – Open SQL Sheet
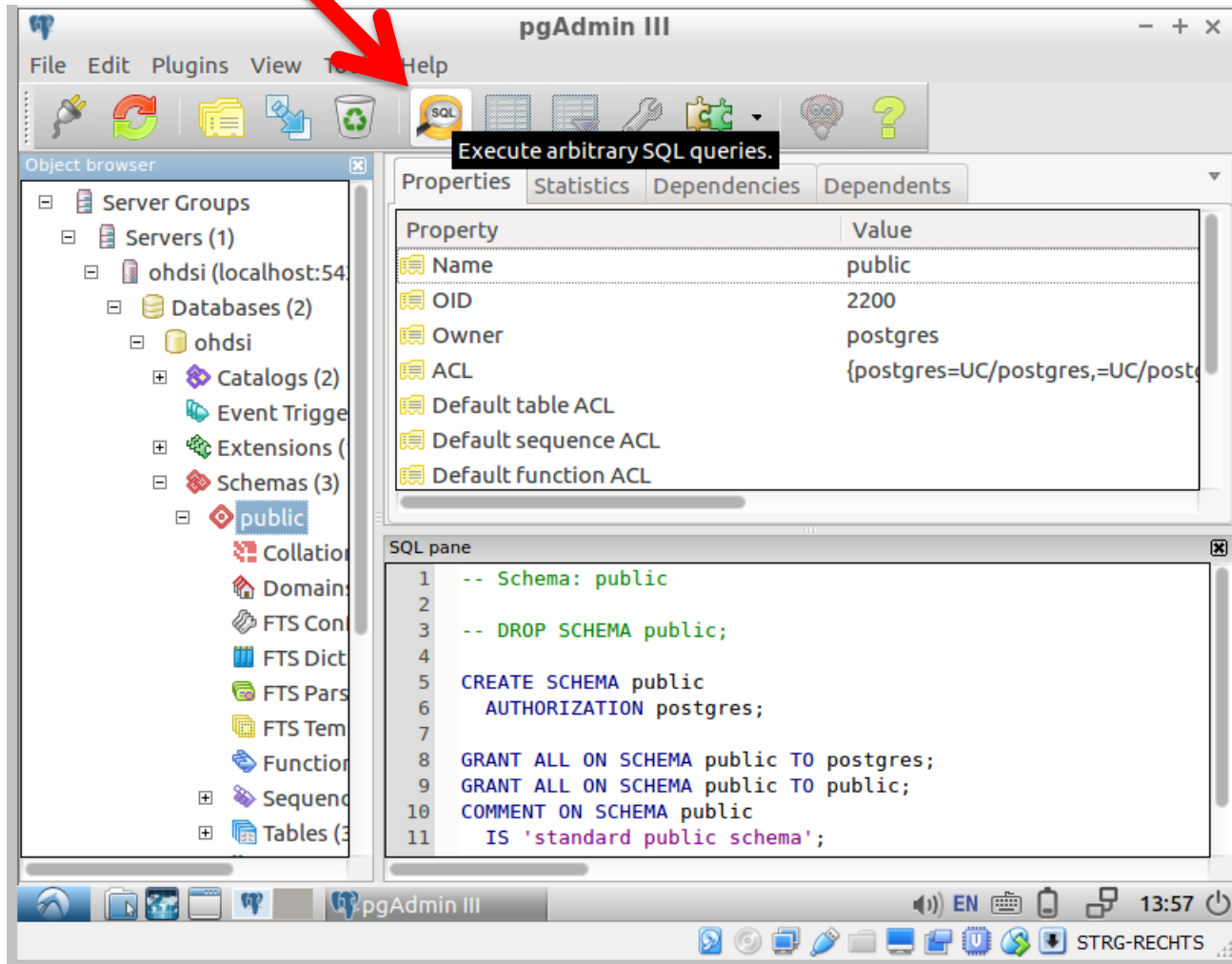
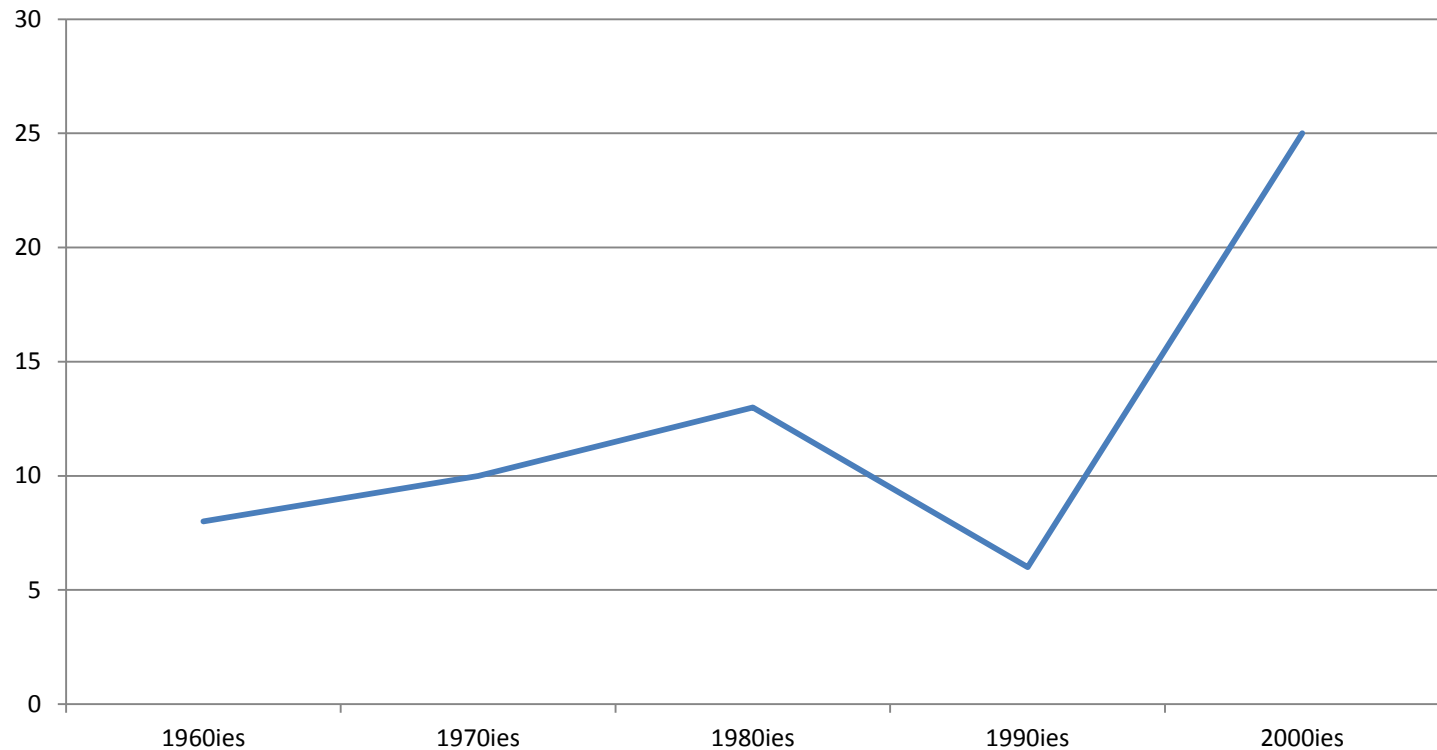# CDM Database – Ready

OBSERVATIONAL **M**EDICAL **O**UTCOMES **P**ARTNERSHIP

Results

FDA Regulatory Action over Time

Number of FDA-caused Withdrawals

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 IDENTIFICA-TION 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 establish-ment 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 IDENTI-FICATION AND ANALYSIS SYSTEM.—

The Sentinel Initiative
National Strategy for Monitoring Medical Product Safety
May 2008

FDA
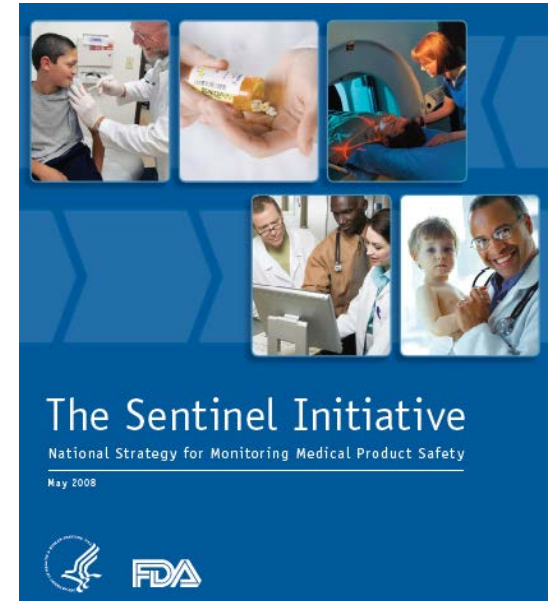
Risk Identification and Analysis System:

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)

OMOP Extended Consortium

OMOP Research Core

Distributed partners

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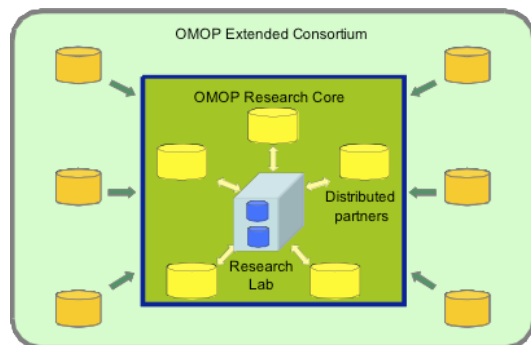
- 10 data sources
- Claims and EHRs
- 200M+ lives

- Open-source
- Standards-based

Common Data Model

OMOP Methods Library

Inception cohort

Case control

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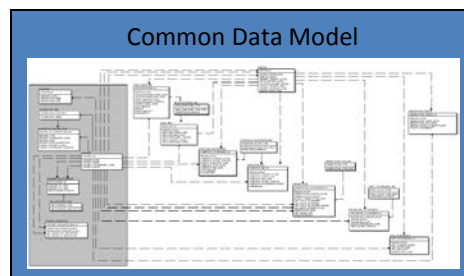
- 14 methods
- Epidemiology designs
- Statistical approaches adapted for longitudinal data

Drug

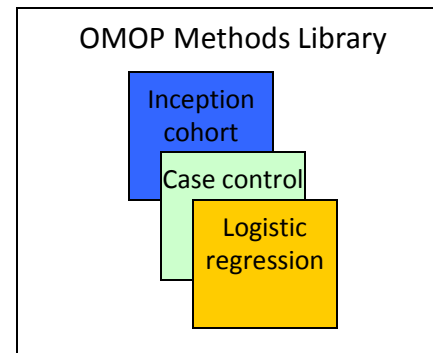| Outcome	ACE Inhibitors	Amphotericin B	Antibiotics: erythromycins, sulfonamides, tetracyclines	Antiepileptics: carbamazepine, phenytoin	Benzodiazepines	Beta blockers	Bisphosphonates: alendronate	Tricyclic antidepressants	Typical antipsychotics	Warfarin
Angioedema	red	blue		blue	blue					blue
Aplastic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

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

European OMOP Experiment

Observational data

Aarhus

Pedianet

ARS

IPCI

HS

PHARMO

eu-adr

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

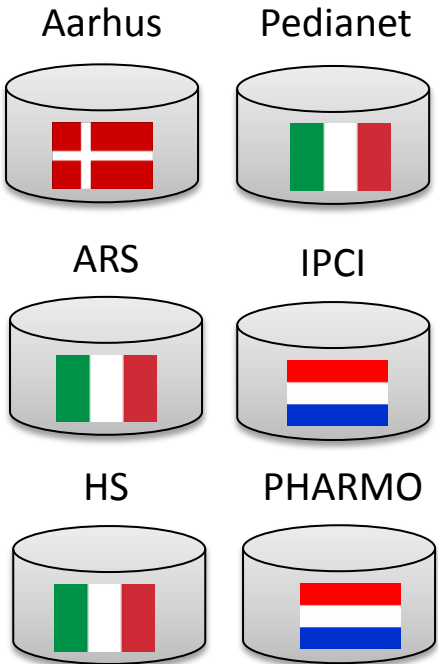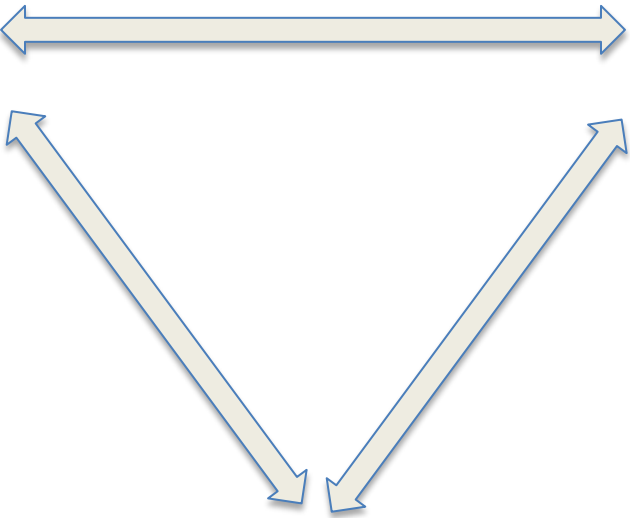**Drug-outcome pairs**

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

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

Data 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

OBSERVATIONAL MEDICAL OUTCOMES PARTNERSHIP

Results

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

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

OBSERVATIONAL
MEDICAL
OUTCOMES
PARTNERSHIP

CDM Version 5
Introduction into the Model

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
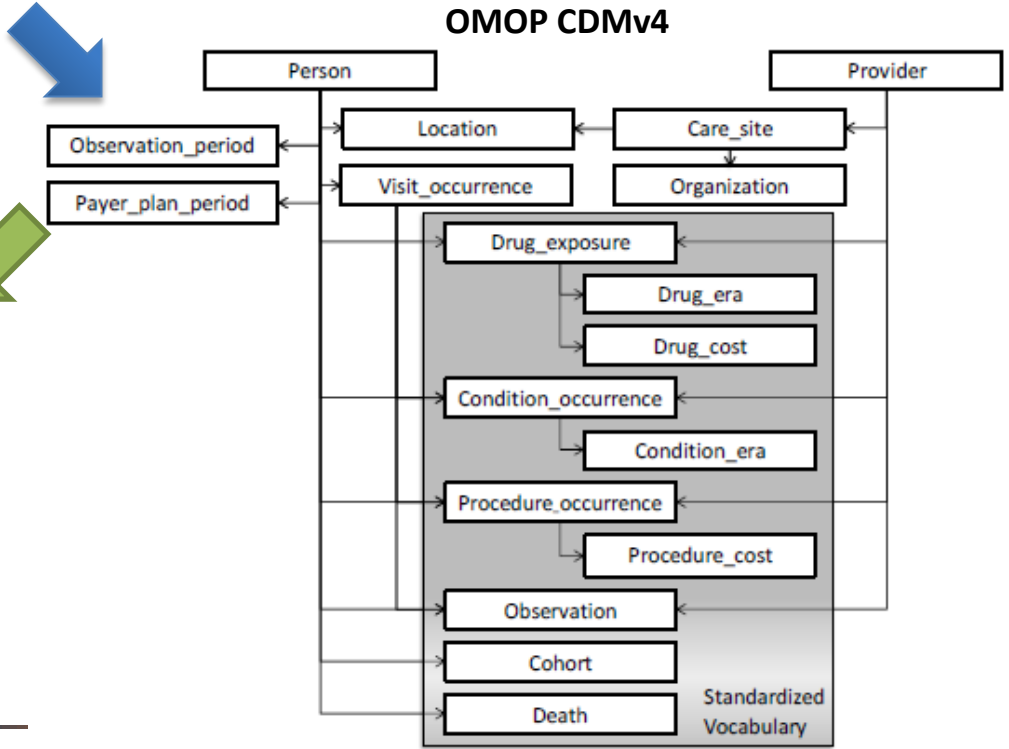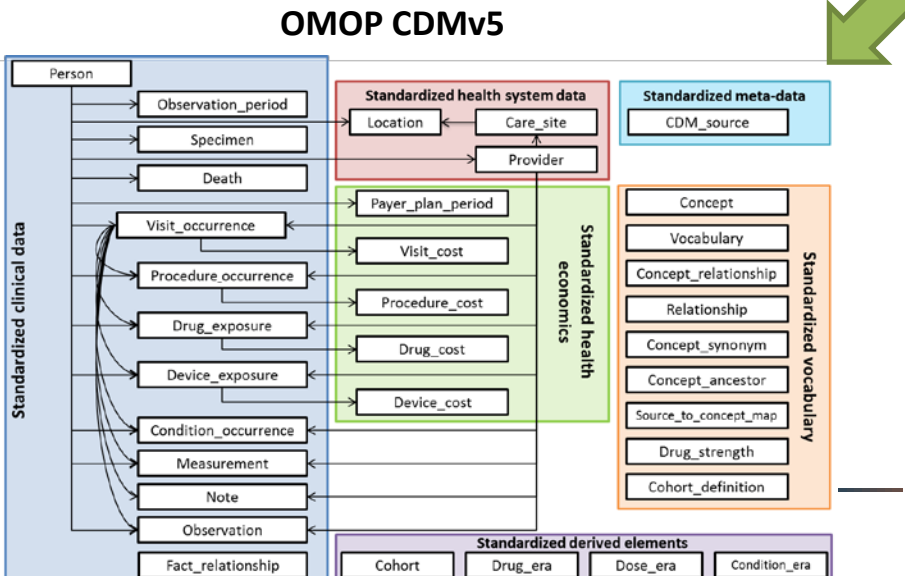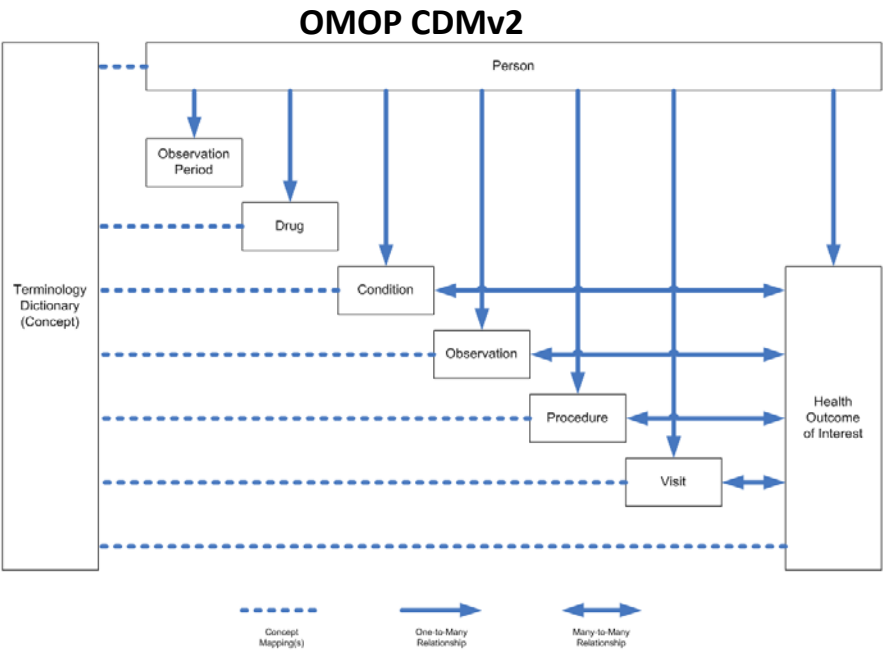
CDM Version 5 Key Domains
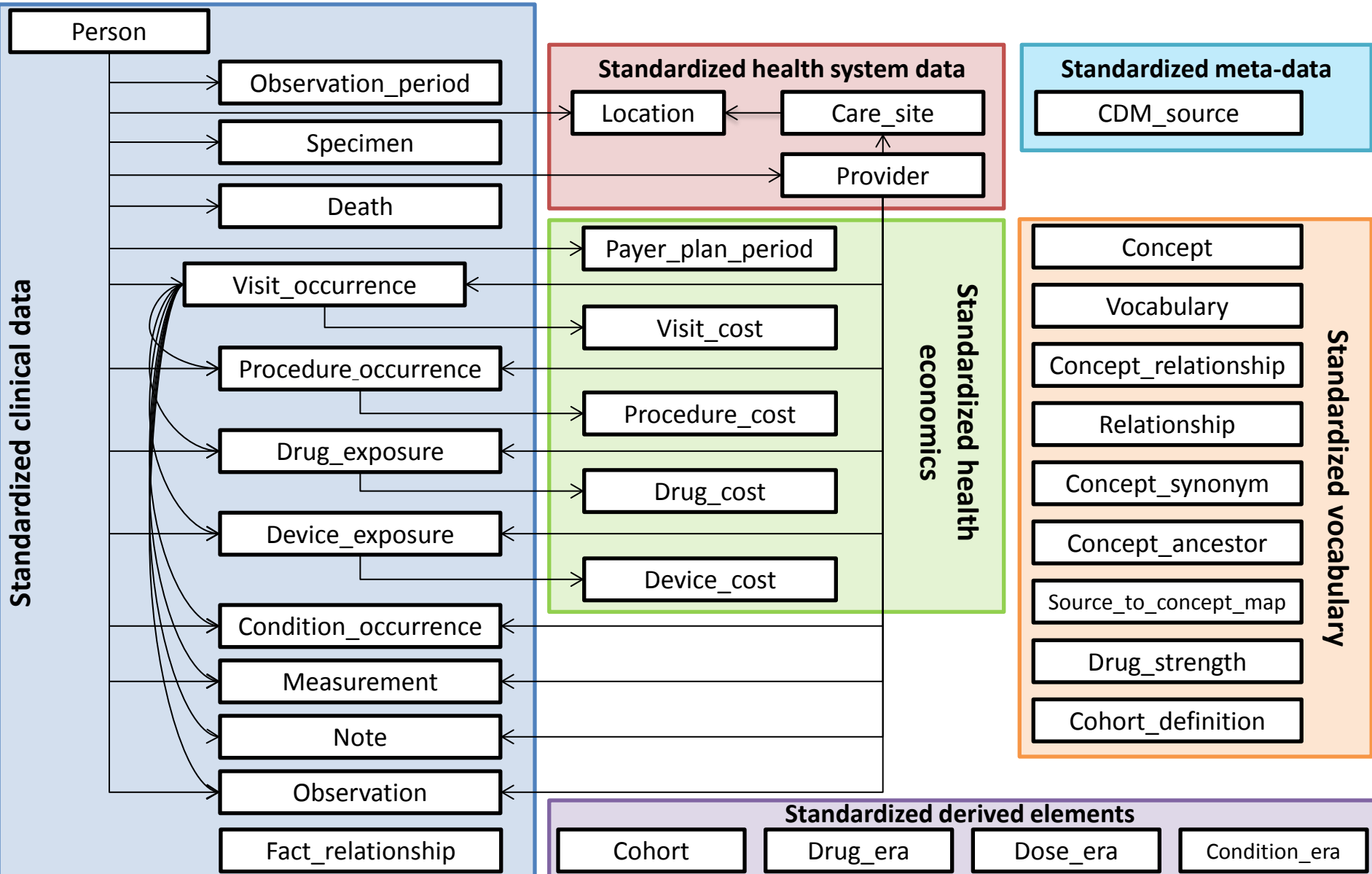
Standard Variable Name Conventions

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)	

OBSERVATIONAL MEDICAL OUTCOMES PARTNERSHIP

CDM Version 5
Vocabulary Tables

OMOP Vocabulary Common Data Model
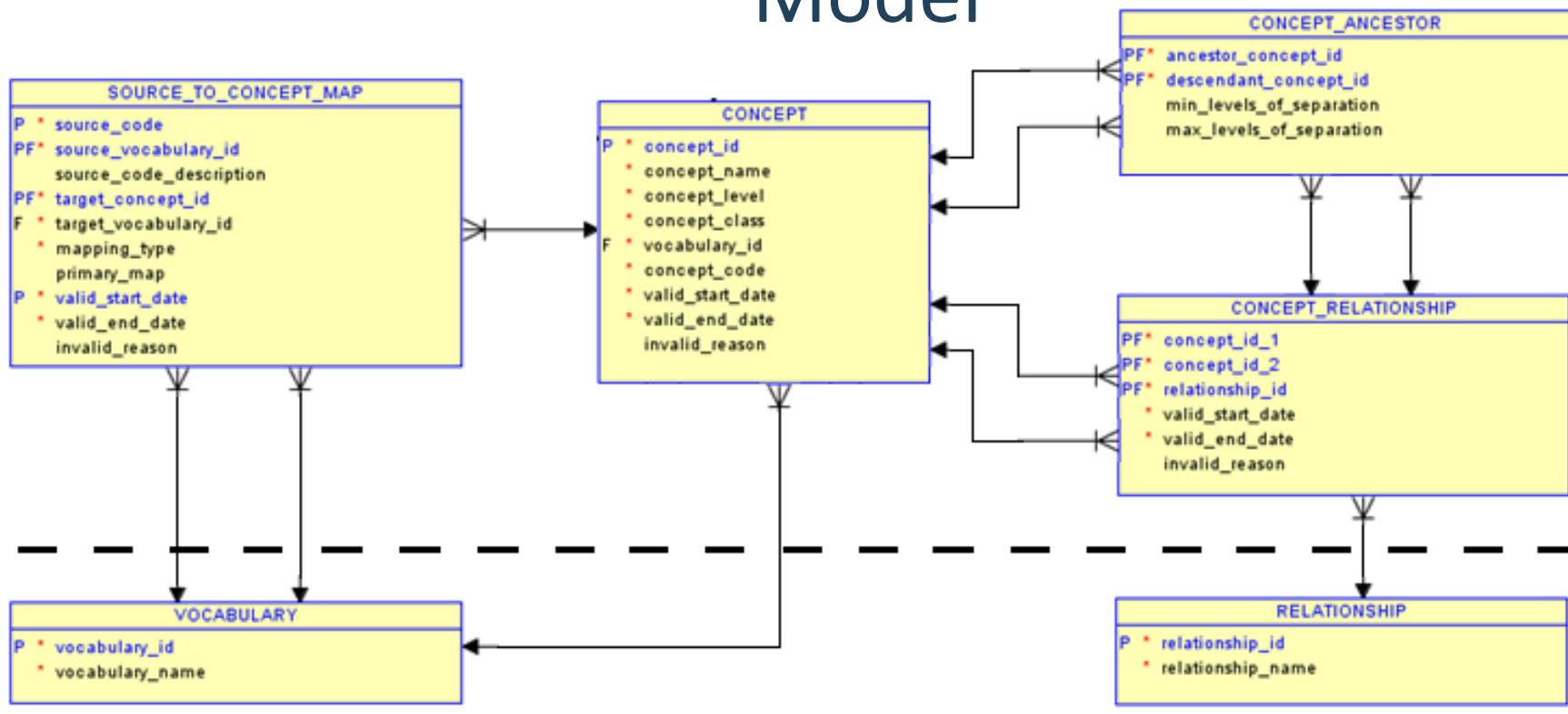
1. All content: concepts in `concept` table
2. Direct relationships between concepts listed in `concept_relationship`
3. Multi-step hierarchical relationships pre-processed in `concept_ancestor`
4. Local codes mapped to concepts trough `source_to_concept_map`

All Content in CDM is Coded as Concepts

- Concepts are referred to by concept_id
- All details are in the **CONCEPT** table:

```sql
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	

Single standardized   Reference Table

All vocabularies stacked up in one table
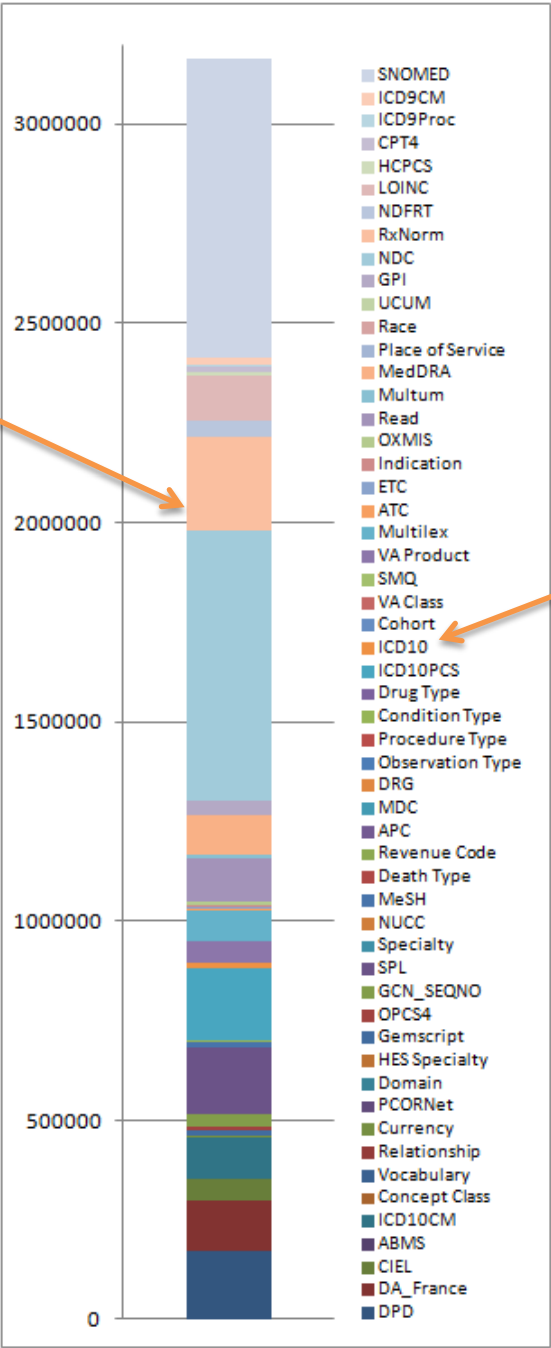
Vocabulary ID

Dozens of schemes, formats, rules

LOINC_248_MULTI-AXIAL_HIERARCHY.CSV

PATH_TO_ROOT	SEQUENCI	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_NL	COMPONENT	PROPERTY	TIME_ASPCT	SYSTEM	SCALE_TYP	METHOD_TYP	CLASS	SOURCE	DATE_LAST_CH	CHNG_TYI	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-									20060706	MIN		ACTIVE
10461-									20060706	MIN		ACTIVE
1046-2									20130529	MAJ		ACTIVE
10462-									20060706	MIN		ACTIVE
10463-									20060706	MIN		ACTIVE
10464-									20060706	MIN		ACTIVE
10465-									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

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-70
VALID_END_DATE	31-Dec-99
INVALID_REASON	

For use in CDM

English description

Domain

Vocabulary

Class in SNOMED

Concept in data

Code in SNOMED

Valid during time interval: always
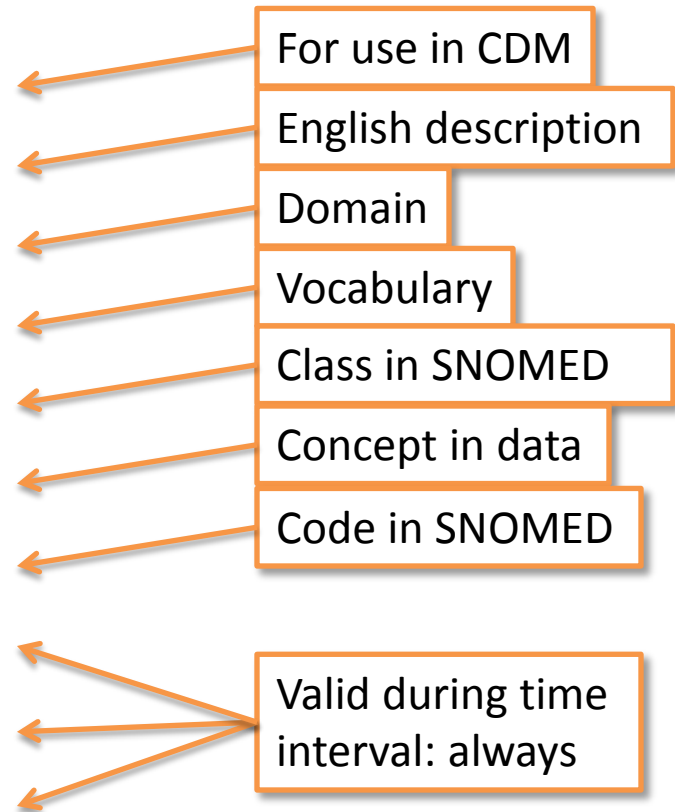
Disease Concepts
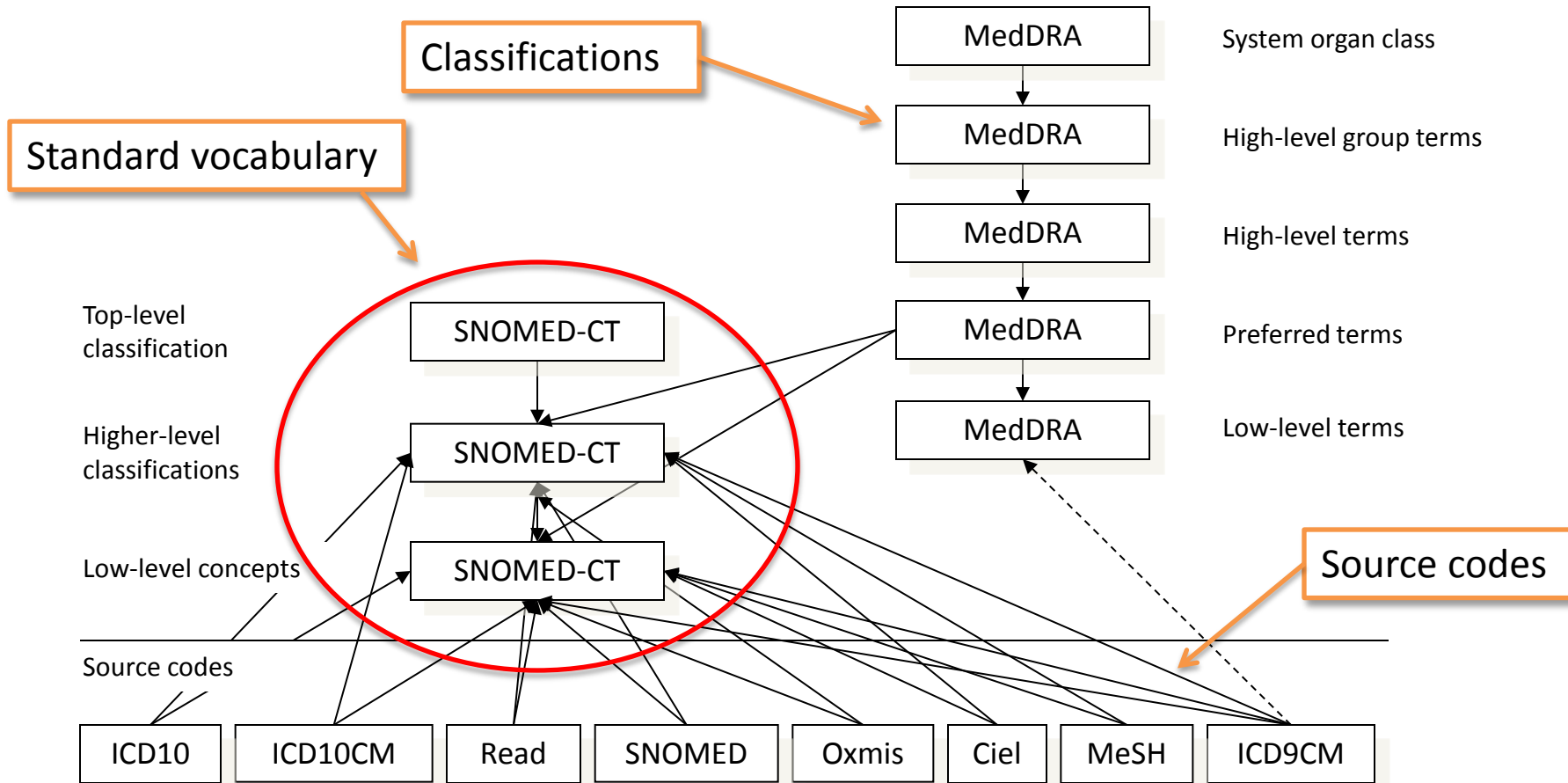
Finding the Right Concept: #1

1. ..if I know the ID

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

CONCEPT _ID	CONCEPT_ NAME	DOMAIN _ID	VOCABULA RY _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	

SNOMED code

2. ..if I know the code

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

CONCEPT _ID	CONCEPT_ NAME	DOMAIN _ID	VOCABULA RY _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	

Concept code 49436004 in SNOMED Browser

Concept ID versus Concept Code

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

SNOMED-CT
399,109

LOINC
72,625

RxNorm
218,011

MedDRA
94,176

Multilex
77,177

VA Product
52,297

Same code

CONCEPT_NAME	CONCEPT_CLASS	VOCAB_ID	CONCEPT_CODE
Antipyrine	Ingredient	8	1001
Drug Dependence	Indication	19	1001
Wound Care - Cleansers	ETC	20	1001
methixene hydrochloride	Ingredient	22	1001
Residential Treatment - Psychiatric	Revenue Code	43	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

	CONCEPT ID_2	RELATIONSHIP _ID	VALID_START _DATE	VALID_END _DATE	INVALID _REASON
44821957	21001551	ICD9CM - FDB Ind	01-Oct-13	31-Dec-99	
44821957	35204953	ICD9CM - MedDRA	01-Jan-70	31-Dec-99	
44821957	44824248	Is a	01-Oct-14	31-Dec-99	
44821957	44834731	Is a	01-Oct-14	31-Dec-99	
44821957	313217	Maps to	01-Jan-70	31-Dec-99	

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?

Gëzuar

Наздраве

Salut

Na zdravi

Skål

Živjeli

Proost

Terviseks

Skál

Santé

Salud

На здравје

Kippis

Υγεια

Zum Wohl

Fenékig

Sláinte

Noroc

Salute

į sveikatą

Saúde

Priekā

Na zdrowie

На здоровье

Cheers

Mapping = Translating

Step 1. Find the Source Concept

```sql
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

```sql
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-70	31-Dec-99	

Step 3. Check out the translated Concept

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

Exercice:
Find Standard Concept from Source Concept

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

Concept

Source codes

| ICD-9-CM 427.31 Atrial Fibrillation | Read G573000 Atrial Fibrillation | ICD-10-CM I48.0 Atrial Fibrillation |
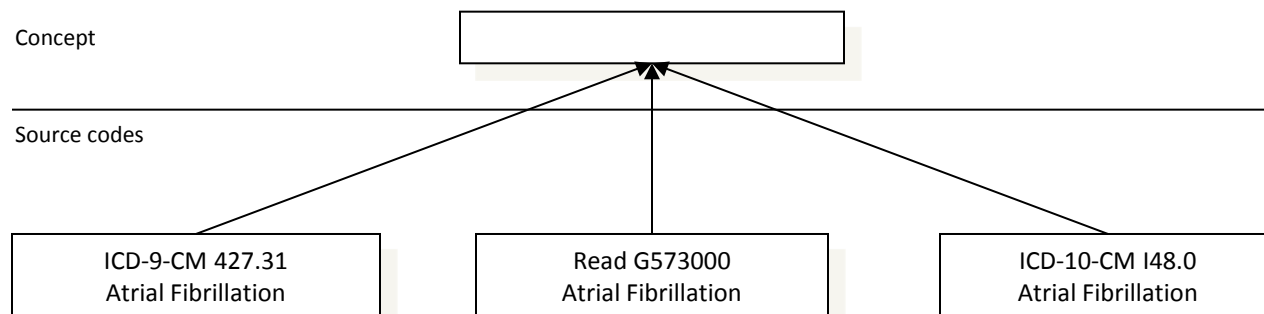
Codes Used in the World

- Conditions
  - READ, OXMIS, ICD-9-CM, ICD-10-CM, ICPC, MedDRA, freetext in different languages

- Drugs
  - Multilex, dm+d, BDPM, AMIS, AMT, ATC, NPI, NDC, freetext in different languages

Reason #2: Disease Hierarchy
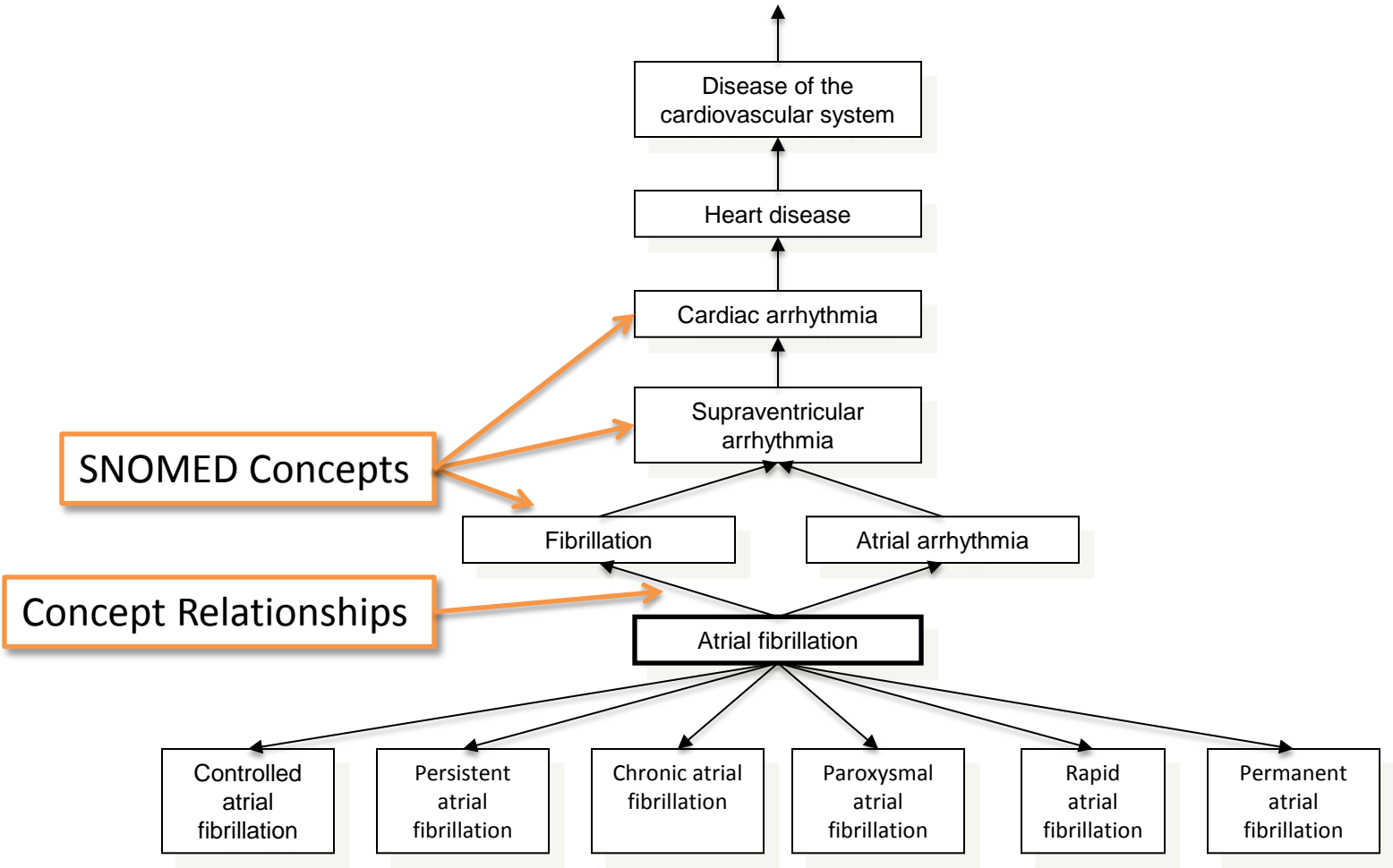
Exploring Relationships

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

Related Concepts

Relationship ID

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

Exploring Relationships #2

```sql
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

Parent concepts

Child 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: atria...	Observation	SNOMED	Context-dependent	S	312442005	1-Jan-1970	31-Dec-2099	
Due to of	4139517	Transient cerebral ischaemia 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		... r	Condition	SNOMED	Clinical Finding	S	195080001	1-Jan-1970	31-Dec-2099	
Subsumes		... ventricular response	Condition	SNOMED	Clinical Finding	S	1.20041E+14	31-Jan-2014	31-Dec-2099	
Subsumes			Condition	SNOMED	Clinical Finding	S	426749004	1-Jan-1970	31-Dec-2099	

Ancestry Relationships: Higher-Level Relationships
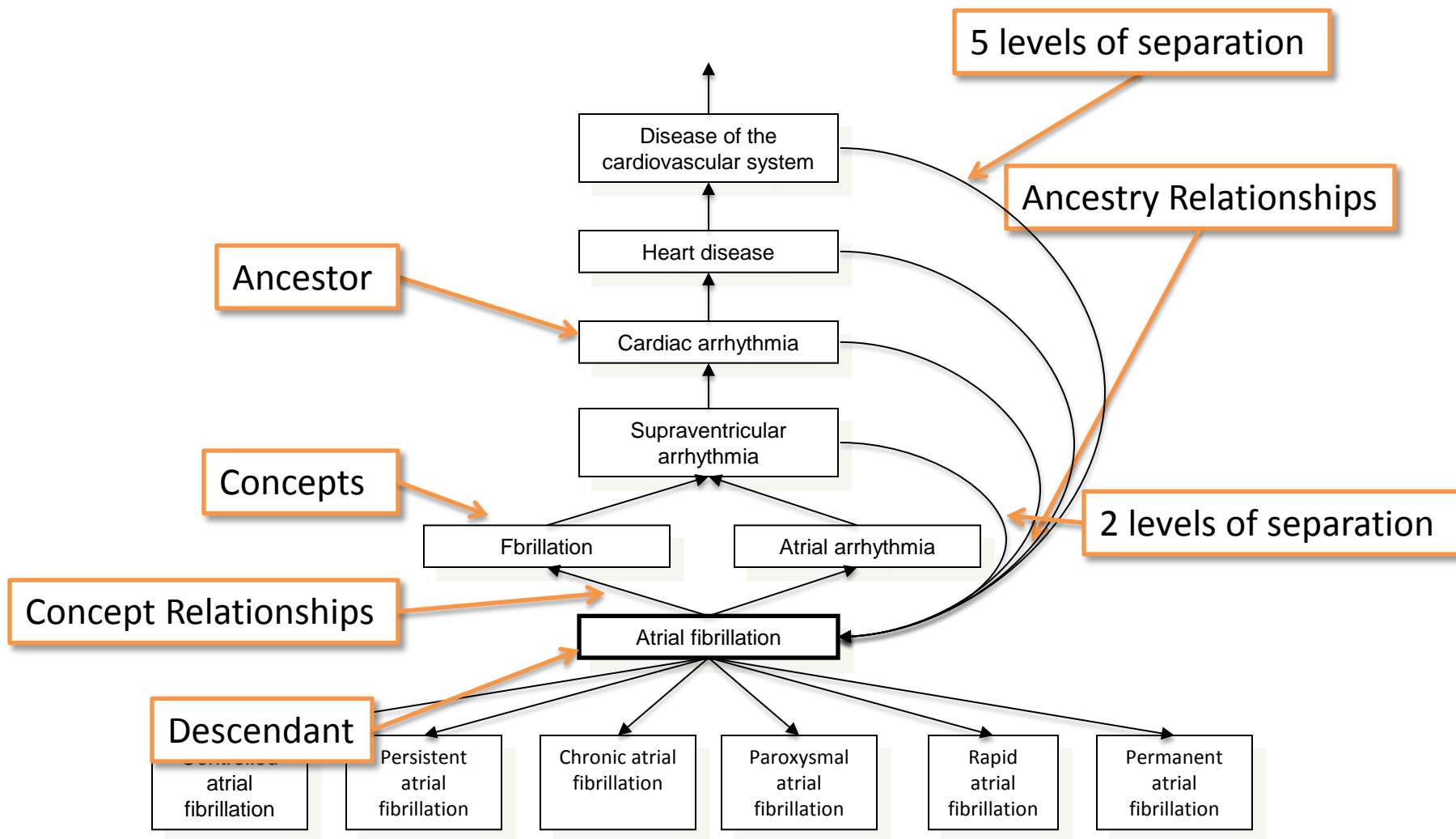
Exploring Ancestors of a Concept

```sql
SELECT max_levels_of_separation, ancestor.*
FROM concept_ancestor a, concept ancestor
WHERE a.descendant_concept_id = 313217 /* Atrial fibrillation */
    AND a.ancestor_concept_id = ancestor.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		
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

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

Hold the ancestor

MAX_LEVELS_ OF_SEPARATION	CONCEPT _ID	CONCEPT_NAME	DOMAIN _ID	VOCABULAR Y _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
1	4248028	Supraventricular arrhythmia	Condition	SNOMED	Clinical Finding	S
1	4262389	Tic-tac rhythm	Condition	SNOMED	Clinical Finding	S

Let's find Upper Gastrointestinal Bleeding

1. Find some initiation concept

```sql
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

```sql
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

```sql
SELECT max_levels_of_separation, ancestor.*
FROM concept_ancestor a, concept ancestor
WHERE a.descendant_concept_id = 4308202 /* Upper gastrointestinal hemorrhage associated...*/
    AND a.ancestor_concept_id = ancestor.concept_id
ORDER BY max_levels_of_separation;
```

Hold the descendant

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

Going down: Checking the right content

```sql
SELECT max_levels_of_separation, descendant.*
FROM concept_ancestor a, concept descendant
WHERE a.ancestor_concept_id = 4291649 /* Upper gastrointestinal hemorrhage */
    AND a.descendant_concept_id = descendant.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					
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 children comprise Upper GI Bleeding

Exercice:
Find Conditions

- Asthma   317009

- Plague   434271

- Ingrown toenail   139099
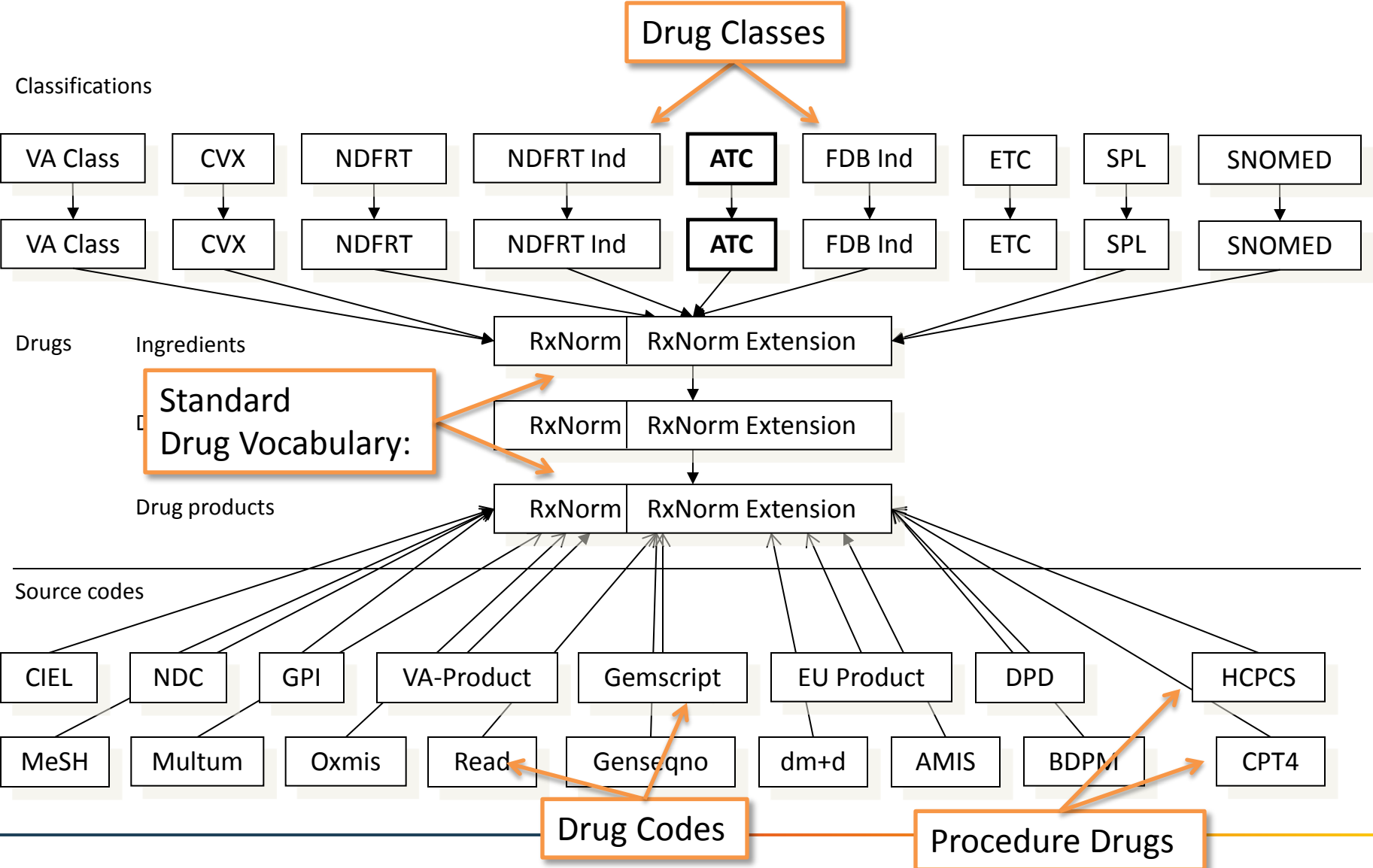
- Your favorite condition here

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

```sql
SELECT * FROM concept WHERE concept_name = 'Warfarin';
```

concetp_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
1310149	Warfarin	Drug	RxNorm	Ingredient	S	11289
4174989	Warfarin	Drug	SNOMED	Pharma/Biol Product		48603004
4187015	Warfarin	Drug	SNOMED	Substance		372756006
4325514	Warfarin	Drug	NDFRT	Chemical Structure	C	N0000006403
40772658	Warfarin	Measurement	LOINC	LOINC Hierarchy	C	LP16309-4
45618204	Warfarin	Drug	MeSH	Main Heading		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';
SELECT * FROM concept_relationship WHERE concept_id_1=45867731 and relationship_id='Maps to';
SELECT * FROM concept WHERE concept_id=1322185;
```

concetp_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code
1322185	clopidogrel 75 MG Oral Tablet [Plavix]	Drug	RxNorm	Branded Drug	S	213169

Let's find Clopidogrel ingredient

2. Find ingredient Clopidogrel as Ancestor of drug product

```sql
SELECT a.max_levels_of_separation, ancestor.*
FROM concept_ancestor a, concept ancestor
WHERE a.descendant_concept_id = 1322185 /* clopidogrel 75 MG Oral Tablet [Plavix] */
    AND a.ancestor_concept_id = ancestor.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	RxNorm	Clinical Drug Comp	S	329449
1	40095878	clopidogrel Oral Tablet	Drug	RxNorm		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 t	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	ATC 4th	C	B01AC

Clopidogrel

Drug classes

Check out Ingredients

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

```
SELECT max_levels_of_separation, descendant.*
FROM concept_ancestor a, concept descendant
WHERE a.ancestor_concept_id = 1310149 /* Warfarin or 1322185 Clopidogrel*/
    AND a.descendant_concept_id = descendant.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 out Drug Classes

Check Ingredient Descendants of Drug Class Anticoagulants

```sql
SELECT max_levels_of_separation, descendant.*
FROM concept_ancestor a, concept descendant
WHERE a.ancestor_concept_id = 21600961 /* ATC Antithromboic Agent */
    AND a.descendant_
    AND descendant.co
ORDER BY max_levels_o
```

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
1347450	alteplase	Drug	RxNorm	Ingredient
19069107	indobufen	Drug	RxNorm	Ingredient
1325124	Dicumarol	Drug	RxNorm	Ingredient
19018364	tioclomarol	Drug	RxNorm	Ingredient
19018432	aloxiprin	Drug	RxNorm	Ingredient
40228152	dabigatran etexilate	Drug	RxNorm	Ingredient

Using Classes for Querying the Data

OBSERVATIONAL
MEDICAL
OUTCOMES
PARTNERSHIP

Example queries for the Drug Era table

```
/*
Find all periods of exposure for patients exposed to warfarin
*/

CREATE TEMPORARY TABLE warfarin_all_exposures AS
SELECT
    person_id,
    drug_concept_id,
    drug_era_start_date,
    drug_era_end_date
FROM
    drug_era
WHERE
    drug_concept_id IN (1310149 /* warfarin */)
```

28

```
WHERE
    drug_concept_id IN (1310149 /* warfarin */)
```

```
WHERE
    drug_concept_id IN (
        SELECT descendant.concept_id
        FROM concept_ancestor a, concept descendant
        WHERE a.ancestor_concept_id = 21500803 /* ETC Anticoagulants */
            AND a.descendant_concept_id = descendant.concept_id
    )
```

Example queries for many use cases

OMOP Vocabulary Queries

Search this site

- Introduction
- Glossary
- General Queries
- Condition Queries
- **Drug Queries**
- Procedure Queries
- Observation Queries

Drug Queries

The following drug domain queries are available:

- D01: Find drug concept by concept ID
- D02: Find drug or class by keyword
- D03: Find ingredients of a drug
- D04: Find drugs by ingredient
- D05: Find generic drugs by ingredient
- D06: Find branded drugs by ingredient
- D07: Find single ingredient drugs by ingredient
- D08: Find drug classes for a drug or ingredient
- D09: Find drugs by drug class
- D10: Find ingredient by drug class
- D11: Find source codes by drug class
- D12: Find indications for a drug
- D13: Find indications as condition concepts for a drug
- D14: Find drugs for an indication
- D15: Find drugs for an indication provided as condition concepts
- D16: Find drugs for an indication by indication type
- D17: Find ingredients for an indication

http://vocabqueries.omop.org/

Resources

1. Download

http://athena.ohdsi.org

2. Rebuild (not for the faint of heart)

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

3. Documentation (incomplete still)

http://www.ohdsi.org/web/wiki/doku.php?id=documentation:vocabulary

Vocabulary Exploration

with

ATLAS

watch and learn

ask questions

try it yourself

ask questions

Vocabulary
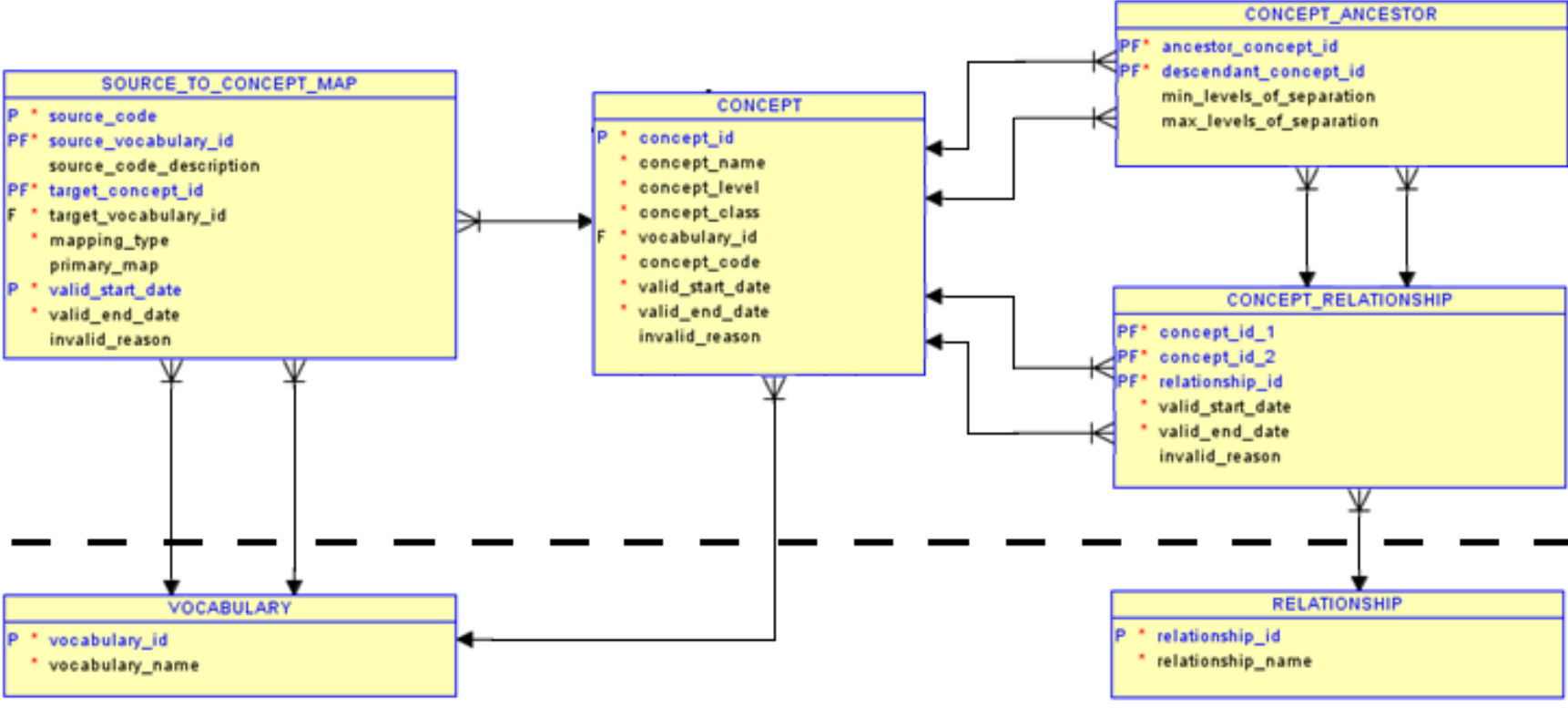
ATLAS

ATLAS is a free, publicly available, web based, open source software tool for researchers to conduct scientific analyses on standardized observational data.

ATLAS is packed with features.
Today we will focus on the Vocabulary.

Q Vocabulary

Domains
Counts
Search Hierarchies Identifiers
Concepts Relationships
Classes Vocabularies
Import Records
Codes Results
Filters

As a computational epidemiologist, I use large scale, observational data in order to perform new research or replicate and confirm research performed by others.

Cardiovascular, Bleeding, and Mortality Risks in Elderly Medicare Patients Treated With Dabigatran or Warfarin for Nonvalvular Atrial Fibrillation

David J. Graham, MD, MPH; Marsha E. Reichman, PhD; Michael Wernecke, BA;
Rongmei Zhang, PhD; Mary Ross Southworth, PharmD; Mark Levenson, PhD;
Ting-Chang Sheu, MPH; Katrina Mott, MHS; Margie R. Goulding, PhD;
Monika Houstoun, PharmD, MPH; Thomas E. MaCurdy, PhD; Chris Worrall, BS;
Jeffrey A. Kelman, MD, MMSc

Background — The comparative safety of dabigatran versus warfarin for treatment of nonvalvular atrial fibrillation in general practice settings has not been established.

Methods and Results — We formed new-user cohorts of propensity score–matched elderly patients enrolled in Medicare who initiated dabigatran or warfarin for treatment of nonvalvular atrial fibrillation between October 2010 and December 2012. Among 134 414 patients with 37 587 person-years of follow-up, there were 2715 primary outcome events. The hazard ratios (95% confidence intervals) comparing dabigatran with warfarin (reference) were as follows: ischemic stroke, 0.80 (0.67–0.96); intracranial hemorrhage, 0.34 (0.26–0.46); major gastrointestinal bleeding, 1.28 (1.14–1.44); acute myocardial infarction, 0.92 (0.78–1.08); and death, 0.86 (0.77–0.96). In the subgroup treated with dabigatran 75 mg twice daily, there was no difference in risk compared with warfarin for any outcome except intracranial hemorrhage, in which case dabigatran risk was reduced. Most patients treated with dabigatran 75 mg twice daily appeared not to have severe renal impairment, the intended population for this dose. In the dabigatran 150-mg twice daily subgroup, the magnitude of effect for each outcome was greater than in the combined-dose analysis.

Conclusions — In general practice settings, dabigatran was associated with reduced risk of ischemic stroke, intracranial hemorrhage, and death and increased risk of major gastrointestinal hemorrhage compared with warfarin in elderly patients with nonvalvular atrial fibrillation. These associations were most pronounced in patients treated with dabigatran 150 mg twice daily, whereas the association of 75 mg twice daily with study outcomes was indistinguishable from warfarin except for a lower risk of intracranial hemorrhage with dabigatran. (*Circulation*. 2015;131:157-164. DOI: 10.1161/CIRCULATIONAHA.114.012061.)
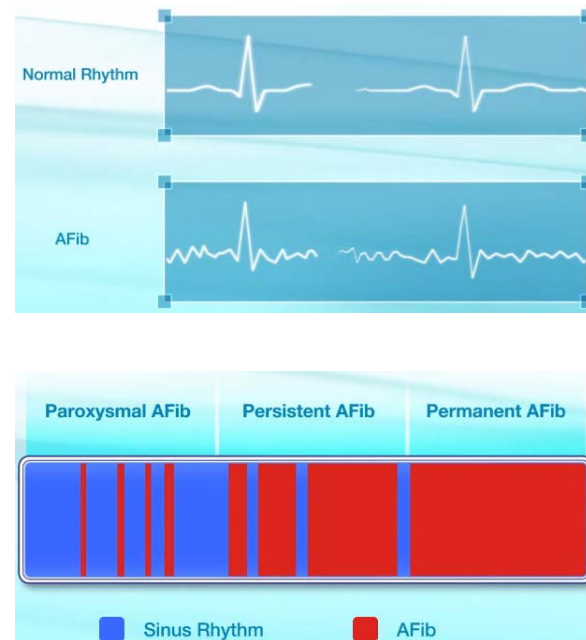
How can we identify atrial fibrillation in our observational data when the authors have not provided any specific codes?

A new-user retrospective cohort design was used to compare patients initiating dabigatran or warfarin for the treatment of nonvalvular AF.[10] We identified all patients with any inpatient or outpatient diagnoses of AF or atrial flutter based on *International Classification of Diseases, Ninth Revision* coding who also filled at least 1 prescription for either drug from October 19, 2010 (US dabigatran approval date) through December 31, 2012, the study end date.

We can start by searching the vocabulary.

When searching you can enter just about anything you like including not only clinical concepts, conditions and drug names but also medical codes like ICD9, CPT and NDC and even OMOP CDM concept identifiers.

Search

type your search here

let's break down the search results

Search Results for atrial fibrillation

Vocabulary
- SNOMED (44)
- ICD10CM (0)
- Read (0)
- Indication (0)
- LOINC (0)
- HCPCS (0)
- OXMIS (0)
- Cohort (0)

Class
- Clinical Finding (21)
- Procedure (16)
- Context-dependent (6)
- Record Artifact (1)
- LLT (0)
- Diagnosis (0)
- 4-char billing code (0)
- 4-char nonbill code (0)

Domain
- Observation (19)
- Condition (17)
- Procedure (6)
- Measurement (1)
- Type Concept (1)
- Drug (0)
- Meas Value (0)

Standard Concept
- Standard (36)
- Non-Standard (8)
- Classification (0)

Show 15 ▼ entries

Showing 1 to 15 of 44 entries

Filter:

Previous 1 2 3 Next

	Id	Code	Name	Class	RC	DRC	Domain	Vocabulary
🛒	313217	49436004	Atrial fibrillation	Clinical Finding	4,640,825	4,644,974	Condition	SNOMED
🛒	4108832	195080001	Atrial fibrillation and flutter	Clinical Finding	4,149	4,149	Condition	SNOMED
🛒	4181800	429211003	Maze procedure for atrial fibrillation	Procedure	0	3,085	Procedure	SNOMED
🛒	4108242	195082009	Atrial fibrillation and flutter NOS	Clinical Finding	0	0	Condition	SNOMED
🛒	44790918	248411000000105	Atrial fibrillation annual review	Procedure	0	0	Observation	SNOMED
🛒	44808026	847611000000104	Atrial fibrillation care pathway	Procedure	0	0	Observation	SNOMED
🛒	44807374	816401000000105	Atrial fibrillation excluded	Context-dependent	0	0	Observation	SNOMED
🛒	40547142	367266005	Atrial fibrillation monitoring	Procedure	0	0	Procedure	SNOMED
🛒	40546153	367037002	Atrial fibrillation monitoring	Procedure	0	0	Procedure	SNOMED
🛒	4047554	134377004	Atrial fibrillation monitoring	Procedure	0	0	Observation	SNOMED
🛒	44803386	713801000000102	Atrial fibrillation monitoring administration	Record Artifact	0	0	Type Concept	SNOMED
🛒	44803863	717221000000101	Atrial fibrillation monitoring first letter	Procedure	0	0	Observation	SNOMED
🛒	44804336	711411000000101	Atrial fibrillation monitoring invitation	Procedure	0	0	Observation	SNOMED
🛒	44803842	716981000000106	Atrial fibrillation monitoring second letter	Procedure	0	0	Observation	SNOMED
🛒	44803786	716721000000107	Atrial fibrillation monitoring telephone invitation	Procedure	0	0	Observation	SNOMED

Search Results for atrial fibrillation

FILTERING AND PAGING
SORTING
FACETS
SEARCH RESULTS

Vocabulary
SNOMED (44)
ICD10CM (0)
Read (0)
Indication (0)
LOINC (0)
HCPCS (0)
OXMIS (0)
Cohort (0)

Class
Clinical Finding (21)
Procedure (16)
Context-dependent (6)
Record Artifact (1)
LLT (0)
Diagnosis (0)
4-char billing code (0)
4-char nonbill code (0)

Domain
Observation (19)
Condition (17)
Procedure (6)
Measurement (1)
Type Concept (1)
Drug (0)
Meas Value (0)

Standard Concept
Standard (36)
Non-Standard (8)
Classification (0)

Show 15 entries
Showing 1 to 15 of 44 entries

Filter:
Previous 1 2 3 Next

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4108832	195080001	Atrial fibrillation and flutter	Clinical Finding	4,149	4,149	Condition	SNOMED
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44807374	816401000000105	Atrial fibrillation excluded	Context-dependent	0	0	Observation	SNOMED
40547142	367266005	Atrial fibrillation m...	Procedure	0	0	Procedure	SNOMED
40546153	367037002	Atrial fibrillation monitoring	Procedure	0	0	Procedure	SNOMED
4047554	134377004	Atrial fibrillation monitoring	Procedure	0	0	Observation	SNOMED
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44803842	716981000000106	Atrial fibrillation monitoring second letter	Procedure	0	0	Observation	SNOMED
44803786	716721000000107	Atrial fibrillation monitoring telephone invitation	Procedure	0	0	Observation	SNOMED

You will find that this layout is standard and used in many areas in ATLAS

FACETS	FILTERING AND PAGING
	SORTING
	DATA
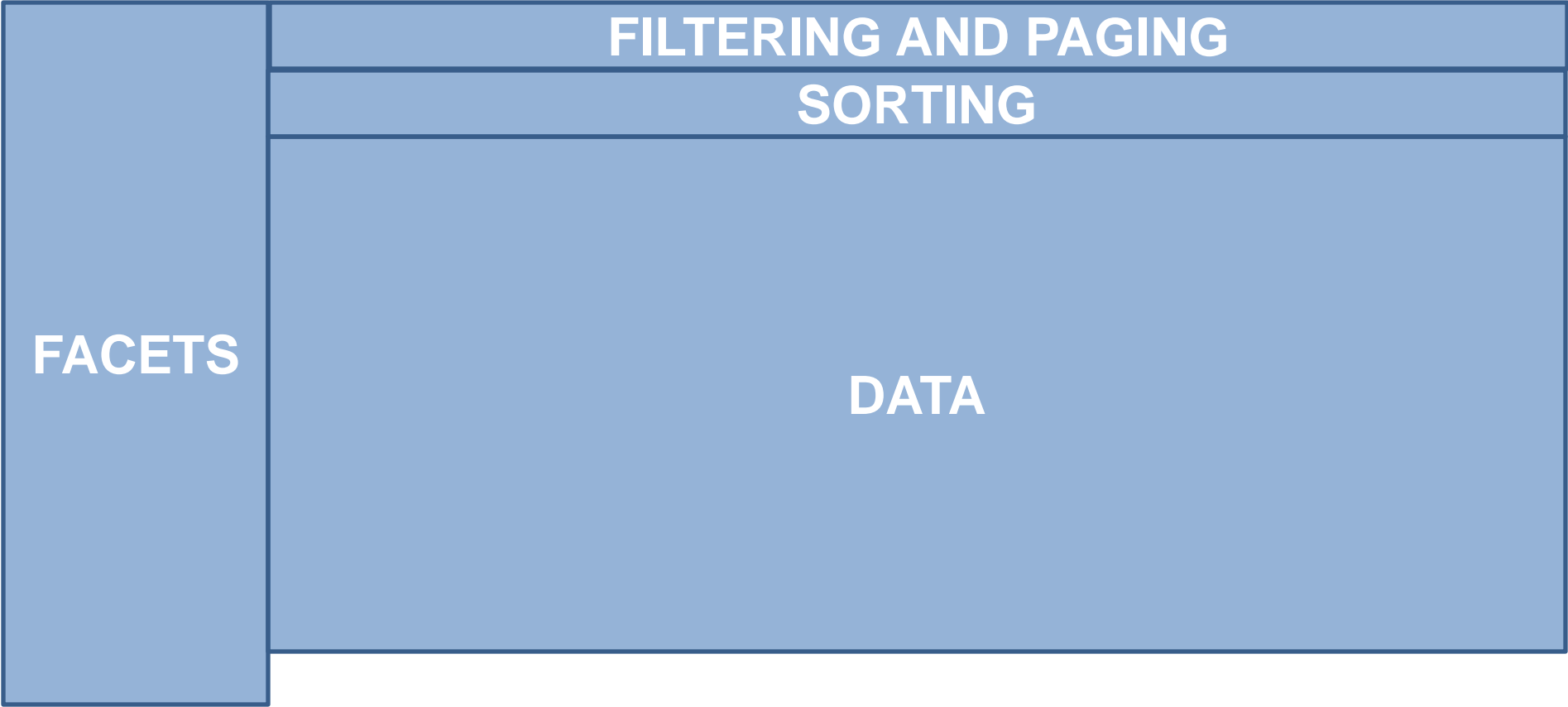
what else can we learn?

Search Results for atrial fibrillation

▼ Vocabulary

SNOMED (44)	
ICD10CM (0)	
Read (0)	
Indication (0)	
LOINC (0)	
HCPCS (0)	
OXMIS (0)	
Cohort (0)	

▼ Class

Clinical Finding (21)
Procedure (16)
Context-dependent (6)
Record Artifact (1)
LLT (0)
Diagnosis (0)
4-char billing code (0)
4-char nonbill code (0)

▼ Domain

Observation (19)
Condition (17)
Procedure (6)
Measurement (1)
Type Concept (1)
Drug (0)
Meas Value (0)

▼ Standard Concept

Standard (36)
Non-Standard (8)
Classification (0)

Show 15 ▼ entries

Showing 1 to 15 of 44 entries

Filter: [ ]

Previous 1 2 3 Next

	Id	Code	Name	Class	RC	DRC▼	Domain	Vocabulary
🛒	313217	49436004	Atrial fibrillation	Clinical Finding	4,640,825	4,644,974	Condition	SNOMED
🛒	4108832	195080001	Atrial fibrillation and flutter	Clinical Finding	4,149	4,149	Condition	SNOMED
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🛒	44803842	716981000000106	Atrial fibrillation monitoring second letter	Procedure	0	0	Observation	SNOMED
🛒	44803786	716721000000107	Atrial fibrillation monitoring telephone invitation	Procedure	0	0	Observation	SNOMED

the color of a concept name is meaningful

classifications

standard

non-standard

standard

why?

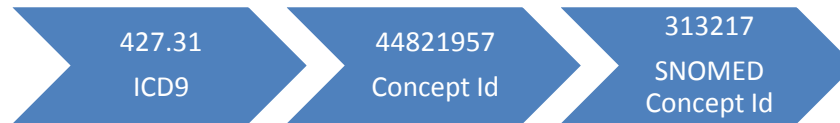| 427.31 ICD9 | 44821957 Concept Id | 313217 SNOMED Concept Id |

Original / Native

Standardized CDM

ICD9, ICD10, READ, SNOMED

ATC, ETC, NDC

record counts (RC,DRC) help us understand how frequently these clinical concepts occur in the observational data

Name	Class	RC	DRC
Atrial fibrillation	Clinical Finding	4,640,825	4,644,974
Atrial fibrillation and flutter	Clinical Finding	4,149	4,149
Maze procedure for atrial fibrillation	Procedure	0	3,085
Atrial fibrillation and flutter NOS	Clinical Finding	0	0
Atrial fibrillation annual review	Procedure	0	0
Atrial fibrillation care pathway	Procedure	0	0
Atrial fibrillation excluded	Context-dependent	0	0
Atrial fibrillation monitoring	Procedure	0	0
Atrial fibrillation monitoring	Procedure	0	0
Atrial fibrillation monitoring	Procedure	0	0
Atrial fibrillation monitoring administration	Record Artifact	0	0
Atrial fibrillation monitoring first letter	Procedure	0	0
Atrial fibrillation monitoring invitation	Procedure	0	0
Atrial fibrillation monitoring second letter	Procedure	0	0
Atrial fibrillation monitoring telephone invitation	Procedure	0	0

What about when we are working with prior research that *does* have codes provided?

RESEARCH

Risk of acute kidney injury associated with the use of fluoroquinolones

Steven T. Bird PharmD MS, Mahyar Etminan PharmD MSc, James M. Brophy MD PhD, Abraham G. Hartzema PharmD PhD, Joseph A.C. Delaney PhD

ABSTRACT

Background: Case reports indicate that the use of fluoroquinolones may lead to acute

Results: We identified 1292 cases and 12 651 matched controls. Current fluoroquinolone use

Competing interests: None declared.

We defined acute kidney injury as ICD-9-CM 584.0 (acute renal failure, unspecified), 584.5 (acute tubular necrosis), 584.6 (cortical acute renal failure), 584.7 (medullary acute renal failure), 584.8 (acute renal failure with other specified pathologic lesion) and 584.9 (acute renal failure, not otherwise specified). We further

we can use the import feature to bring a clinical code sets into ATLAS

Search | Advanced | Results | Import

Concept Identifiers | Source Codes | Concept Set

584, 584.5, 584.6, 584.7, 584.8, 584.9

we should always review the results of an import

Imported Concepts

Show 15 ▼ entries   Filter: _____

Showing 1 to 10 of 10 entries   Previous 1 Next

▼ **Vocabulary**
ICD9CM (6)
DRG (1)
Multum (1)
CIEL (1)
OXMIS (1)

▼ **Invalid Reason**
Valid (9)
Invalid (1)

▼ **Class**
4-dig billing code (5)
3-dig nonbill code (1)
MS-DRG (1)
Multum (1)
Finding (1)
OXMIS (1)

▼ **Domain**
Condition (8)
Observation (1)

	Id	Code	Name	Class	Domain	Vocabulary
🛒	45912092	584	MASS PULSATILE	Finding	Condition	CIEL
🛒	45526152	584	SCLEROSIS RENAL	OXMIS	Condition	OXMIS
🛒	45410774	584	Cephalexin Monohydrate, 500 mg oral capsule	Multum	Drug	Multum
🛒	44837190	584.7	Acute kidney failure with lesion of renal medullary [papillary] necrosis	4-dig billing code	Condition	ICD9CM
🛒	44837189	584.6	Acute kidney failure with lesion of renal cortical necrosis	4-dig billing code	Condition	ICD9CM
🛒	44833659	584.5	Acute kidney failure with lesion of tubular necrosis	4-dig billing code	Condition	ICD9CM
🛒	44833658	584	Acute kidney failure	3-dig nonbill code	Condition	ICD9CM
🛒	44826731	584.9	Acute kidney failure, unspecified	4-dig billing code	Condition	ICD9CM
🛒	44820969	584.8	Acute kidney failure with other specified pathological lesion in kidney	4-dig billing code	Condition	ICD9CM
🛒	38001352	584	Breast biopsy, local excision & other breast procedures w CC/MCC	MS-DRG	Observation	DRG

don't let this be you!

The Washington Post

An alarming number of scientific papers contain Excel errors

By **Christopher Ingraham**   August 26

Remember that **searching** for a name like **neoplasm of prostate** would not find **malignant tumor of prostate**.

584 is *NOT* just an **ICD9** code but also a **DRG** and **OXMIS** code

Search is just the first step in **exploring the vocabulary**.

The concept details tab tells us what the vocabulary knows about atrial fibrillation

🛒 Atrial fibrillation

Details | Related Concepts | Hierarchy | Record Counts

Property	Value
Concept Name	Atrial fibrillation
Domain Id	Condition
Concept Class Id	Clinical Finding
Vocabulary Id	SNOMED
Concept Id	313217
Concept Code	49436004
Invalid Reason	Valid
Standard Concept	Standard

The **related concepts tab** allows us to **explore** other **medical concepts** that the **vocabulary** identifies as being related

`concept_relationship, concept_ancestor`

Does our **research** need to apply to a broad or specific form of a disease? The **hierarchy tab** allows us to **explore** more general or more specific **medical concepts**

🛒 Atrial fibrillation

| Details | Related Concepts | Hierarchy | Record Counts |

Parents

	Id	Code	Name	Class	RC	DRC ▾	Domain	Vocabulary
🛒	500001801	500001801	OMOP Qt Prolongation/Torsade De Pointes 1	Cohort	0	44,888,997	Condition	Cohort
🛒	35202455	10042600	Supraventricular arrhythmias	HLT	0	33,386,144	Condition	MedDRA
🛒	4068155	17366009	Atrial arrhythmia	Clinical Finding	0	31,869,056	Condition	SNOMED
🛒	4226399	40593004	Fibrillation	Clinical Finding	0	28,648,534	Condition	SNOMED
🛒	35204969	10061592	Cardiac fibrillation	PT	0	28,648,534	Condition	MedDRA
🛒	35204953	10003658	Atrial fibrillation	PT	0	28,501,652	Condition	MedDRA
🛒	500002401	500002401	OMOP Atrial Fibrillation 1	Cohort	0	28,501,652	Condition	Cohort

49436004 Atrial fibrillation

Children

	Id	Code	Name	Class	RC	DRC ▾	Domain	Vocabulary
🛒	4154290	282825002	Paroxysmal atrial fibrillation	Clinical Finding	475,032	475,032	Condition	SNOMED
🛒	4141360	426749004	Chronic atrial fibrillation	Clinical Finding	343,710	343,710	Condition	SNOMED
🛒	4232697	440059007	Persistent atrial fibrillation	Clinical Finding	84,022	84,022	Condition	SNOMED

Let's try **researching** a topic together using **ATLAS**, how about **asthma**?
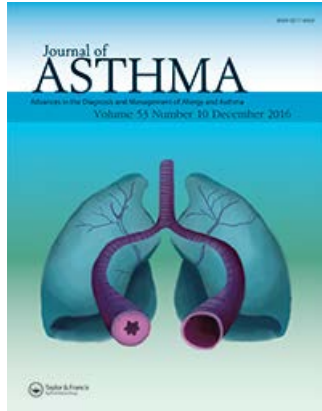
Research article

Factors associated with increased healthcare utilization among adults with asthma

Dr Monideepa Bhattacharya Becerra ✉, DrPH, MPH

Search

Browse Related

View Hierarchy

Try **researching** your **topic** using **ATLAS**

http://localhost:8080/atlas (VM)

http://www.ohdsi.org/web/atlas (Public)