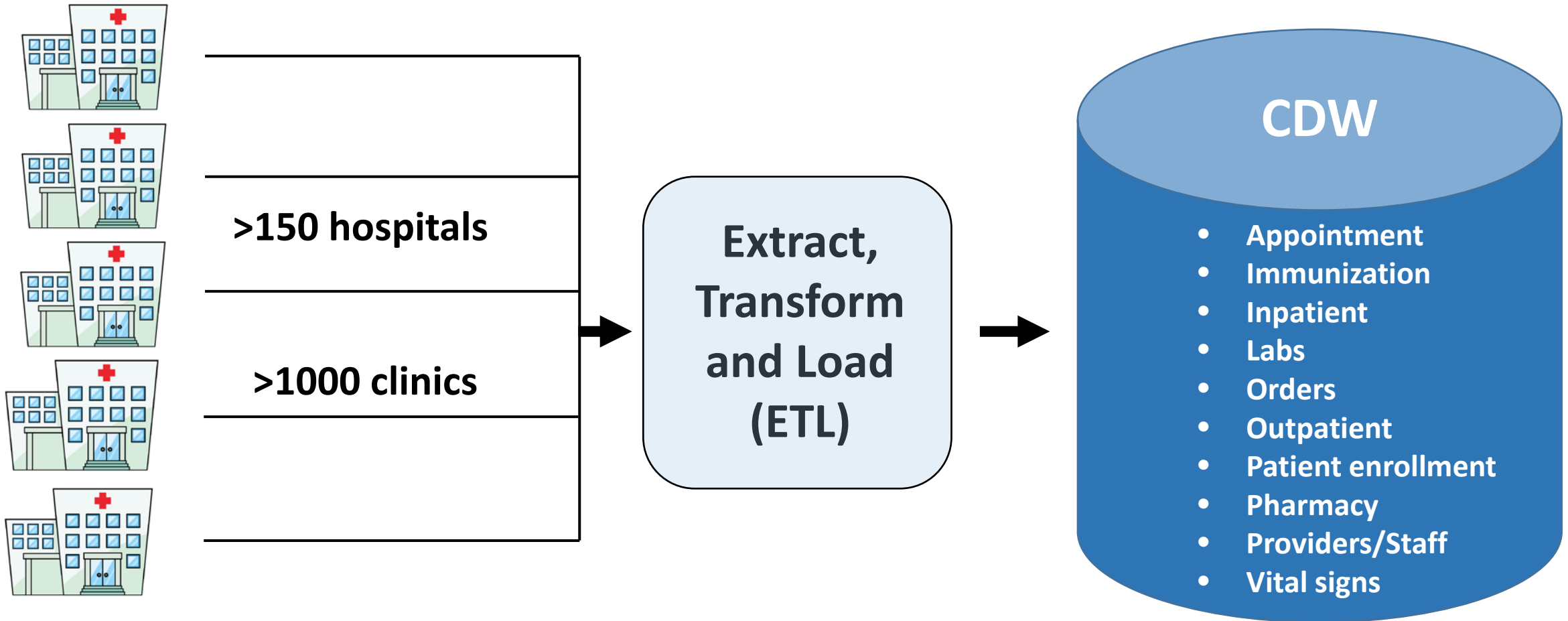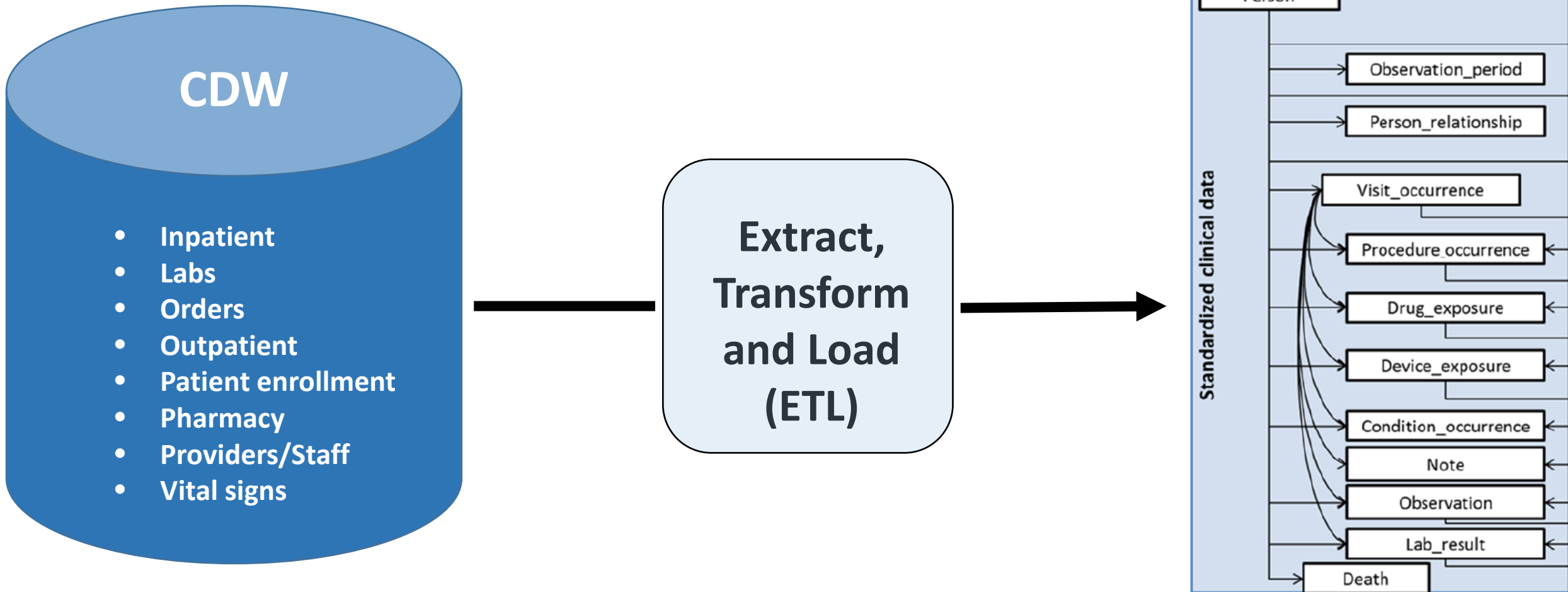# Conducting a research study using OMOP data

- Brief background
- Implementing traditional research approach using OMOP and the role of the CONCEPT and the CONCEPT table
- Q & A

VA Corporate Data Warehouse (CDW)

>150 hospitals

>1000 clinics

Extract, Transform and Load (ETL)

CDW
- Appointment
- Immunization
- Inpatient
- Labs
- Orders
- Outpatient
- Patient enrollment
- Pharmacy
- Providers/Staff
- Vital signs

CDW to OMOP Common Data Model

CDW Domains Transformed

- Physical Care Site (Location, Institution)
- Patient
- Staff/Provider
- Inpatient Domain (Encounters, Admin Codes)
- Outpatient Domain (Encounters, Admin Codes)
- Inpatient BCMA
- Outpatient Pharmacy Fill
- Patient Chemistry Laboratory
- Vital Signs
- Tobacco Use (Dental)
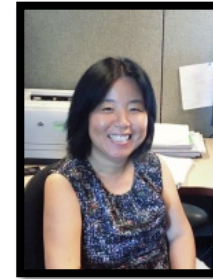- Inpatient Fee Basis Records

Who are we?

ETL

QA

Help Desk/
Documentation

Fern
FitzHenry

Michael
Matheny

Scott
DuVall

Kristine
Lynch

Aize
Cao

Steve
Deppen

Bobbie
Schofield

Kushan
Hewa

Jason
Denton

Daniel
Park

Karuna
Gujar

Ben
Viernes

Liz
Hanchrow

Abby
Hillard

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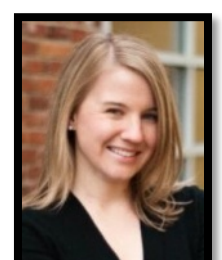
Bobbie Schofield

Kushan Hewa

Jason Denton

Daniel Park

Karuna Gujar

Ben Viernes

Liz Hanchrow

Abby Hillard

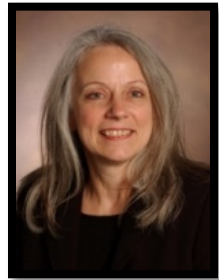# Poll questions:
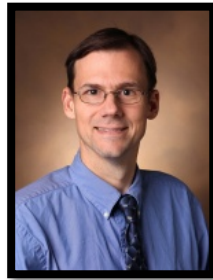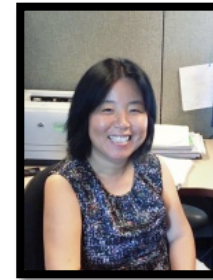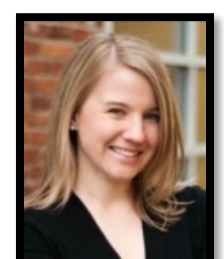
1.) What is your position title?

   a)   Physician PI
   b)   Non-physician PI
   c)   Data analyst/manager
   d)   Project manager
   e)   Other

Poll questions:

2.) What is your <u>CDW</u> experience level?

    a) High
    b) Moderate
    c) Low
    d) None

Poll questions:

3.) What is your <u>OMOP</u> experience level?

    a)   High
    b)   Moderate
    c)   Low
    d)   None

Conducting a research study using OMOP data

- Brief background

- Implementing traditional research approach using OMOP and the role of the CONCEPT and the CONCEPT table
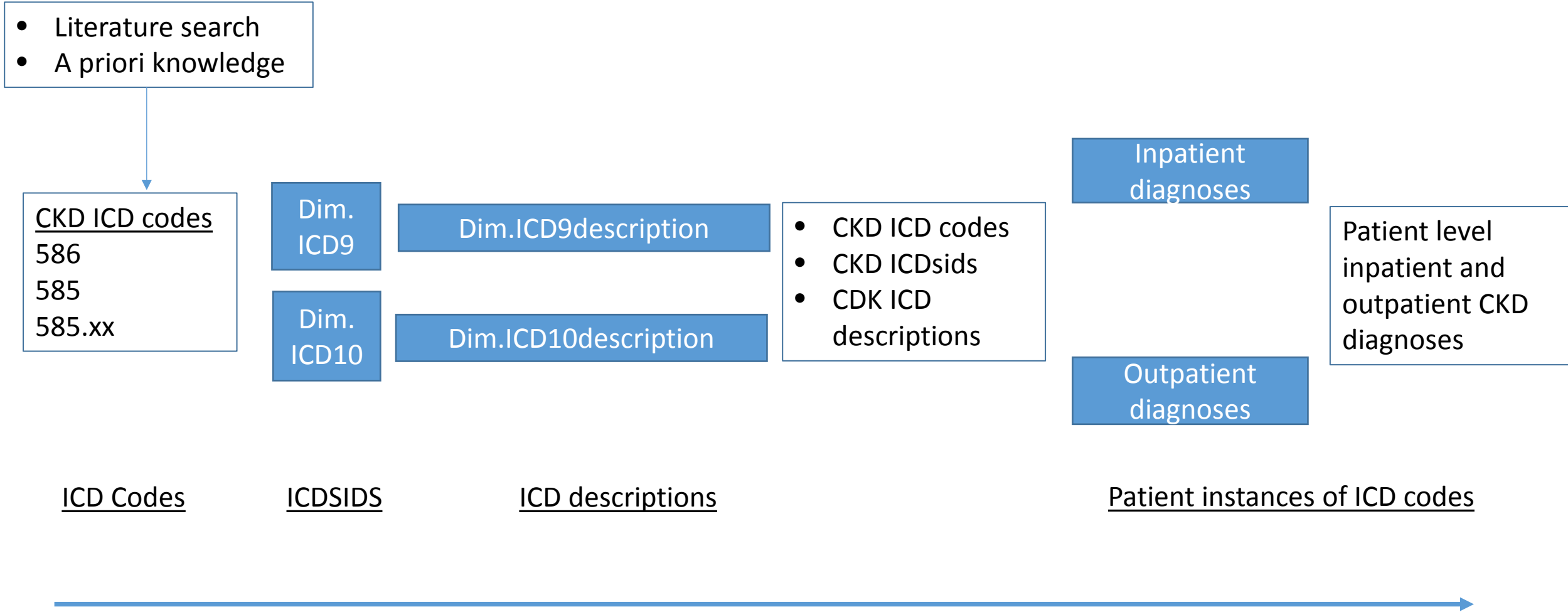
- Q & A

Research study: general approach

1. Define study question and approach

2. Define study variables/study cohort

3. Construct analytic file

4. Complete analysis

5. Assess results
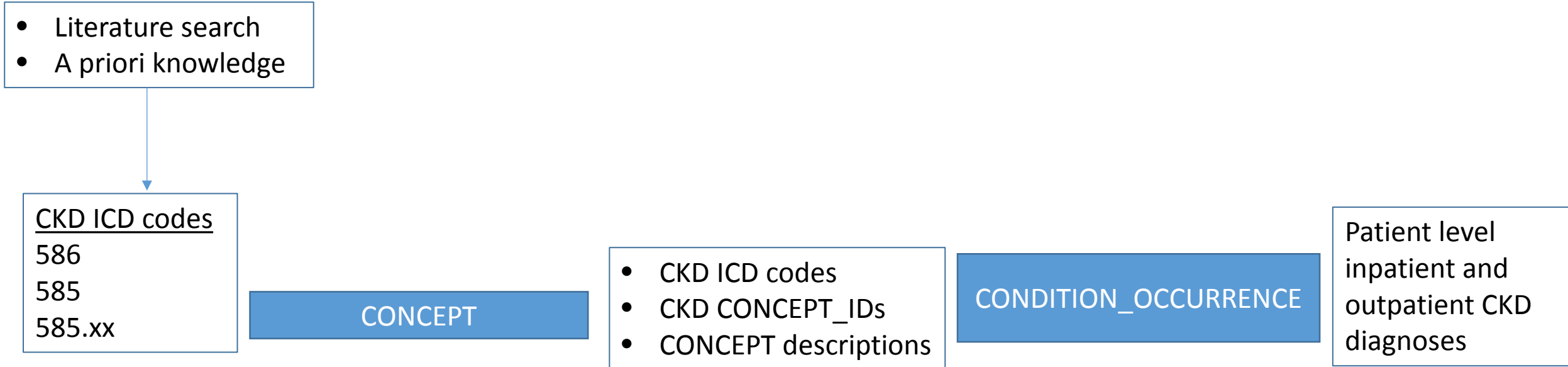
6. Dissemination of results

Research study: general approach

1. Define study question and approach
2. **Define study variables/study cohort**
3. Construct analytic file
4. Complete analysis
5. Assess results
6. Dissemination of results

General approach in CDW

- Literature search
- A priori knowledge

CKD ICD codes
586
585
585.xx

Dim. ICD9

Dim.ICD9description

Dim. ICD10

Dim.ICD10description

- CKD ICD codes
- CKD ICDsids
- CDK ICD descriptions

Inpatient diagnoses

Outpatient diagnoses

Patient level inpatient and outpatient CKD diagnoses

ICD Codes

ICDSIDS

ICD descriptions

Patient instances of ICD codes

General approach in OMOP

Literature search
A priori knowledge

CKD ICD codes
586
585
585.xx

CONCEPT

- CKD ICD codes
- CKD CONCEPT_IDs
- CONCEPT descriptions

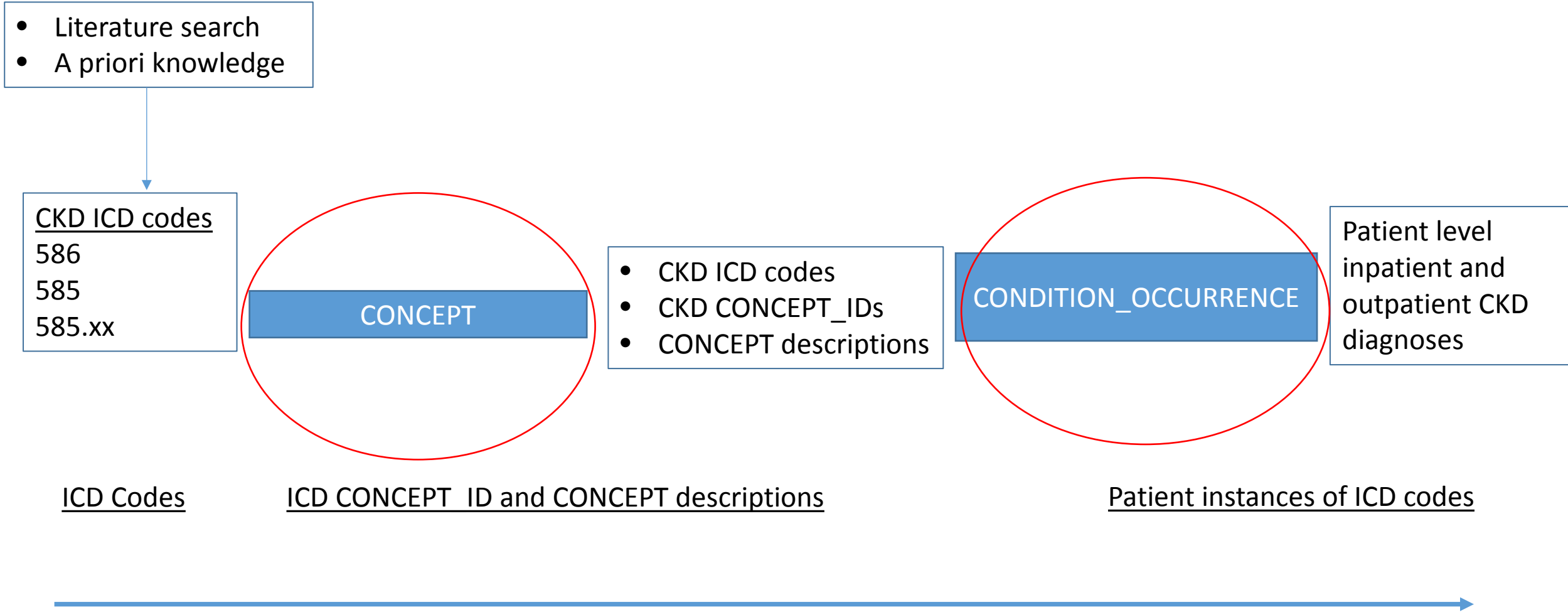CONDITION_OCCURRENCE

Patient level inpatient and outpatient CKD diagnoses

ICD Codes

ICD CONCEPT_ID and CONCEPT descriptions

Patient instances of ICD codes

General approach in OMOP

- Literature search
- A priori knowledge

CKD ICD codes
586
585
585.xx

CONCEPT

- CKD ICD codes
- CKD CONCEPT_IDs
- CONCEPT descriptions

CONDITION_OCCURRENCE

Patient level inpatient and outpatient CKD diagnoses

ICD Codes

ICD CONCEPT_ID and CONCEPT descriptions

Patient instances of ICD codes

The CONCEPT and the CONCEPT Table

Src.OMOPV5_CARE_SITE
Src.OMOPV5_CDM_SOURCE
Src.OMOPV5_CONCEPT
Src.OMOPV5_CONCEPT_ANCESTOR
Src.OMOPV5_CONCEPT_CLASS
Src.OMOPV5_CONCEPT_RELATIONSHIP
Src.OMOPV5_CONCEPT_SYNONYM
Src.OMOPV5_CONDITION_ERA
Src.OMOPV5_CONDITION_OCCURRENCE
Src.OMOPV5_DEATH
Src.OMOPV5_DEVICE_COST
Src.OMOPV5_DEVICE_EXPOSURE
Src.OMOPV5_DOMAIN
Src.OMOPV5_DOSE_ERA
Src.OMOPV5_DRUG_COST
Src.OMOPV5_DRUG_ERA
Src.OMOPV5_DRUG_EXPOSURE
Src.OMOPV5_DRUG_STRENGTH
Src.OMOPV5_FACT_RELATIONSHIP
Src.OMOPV5_LOCATION
Src.OMOPV5_MEASUREMENT
Src.OMOPV5_NOTE
Src.OMOPV5_OBSERVATION
Src.OMOPV5_OBSERVATION_PERIOD
Src.OMOPV5_PAYER_PLAN_PERIOD
Src.OMOPV5_PERSON
Src.OMOPV5_PROCEDURE_COST
Src.OMOPV5_PROCEDURE_OCCURRENCE
Src.OMOPV5_PROVIDER
Src.OMOPV5_RELATIONSHIP
Src.OMOPV5_SPECIMEN
Src.OMOPV5_VISIT_COST
Src.OMOPV5_VISIT_OCCURRENCE
Src.OMOPV5_VOCABULARY

Dim.ICD10Procedure
Dim.ICD10ProcedureDescriptionVersion
Dim.ICD10ProcedureDRGIDCode
Dim.ICD10ProcedureMDC
Dim.ICD10ProcedureOperationVersion
Dim.ICD10ProcedureSexVersion
Dim.ICD10ProcedureStatusVersion
Dim.ICD10SexVersion
Dim.ICD10StatusVersion
Dim.ICD9
Dim.ICD9AgeHighVersion
Dim.ICD9AgeLowVersion
Dim.ICD9DescriptionVersion
Dim.ICD9DiagnosisVersion
Dim.ICD9MDCMap
Dim.ICD9Procedure
Dim.ICD9ProcedureDescriptionVersion
Dim.ICD9ProcedureDRGIDCode
Dim.ICD9ProcedureMDC

The CONCEPT and the CONCEPT Table

- Everything in the OMOP CDM revolves around the idea of a **CONCEPT**

- The **CONCEPT_ID** is a unique identifier that is generated for each **CONCEPT** across all domains

- The content of each clinical record is represented by one or more **CONCEPT_IDs** in the fact tables

- The description of those **CONCEPT_IDs** are stored in the CONCEPT Table

The CONCEPT Table

```
select count(*), count(distinct concept_id)
from OMOP_V5.OMOPV5.CONCEPT
```

rows_in_concept_table	concepts_in_concept_table
4623677	4623677

CONCEPT_ID	44830172
CONCEPT_NAME	Chronic kidney disease
DOMAIN_ID	Condition
VOCABULARY_ID	ICD9CM
CONCEPT_CLASS_ID	3-dig nonbill code
STANDARD_CONCEPT	
CONCEPT_CODE	585

The CONCEPT Table

CONCEPT_ID	1112840
CONCEPT_NAME	Aspirin 324 MG Oral tablet
DOMAIN_ID	Drug
VOCABULARY_ID	RxNorm
CONCEPT_CLASS_ID	Clinical Drug
STANDARD_CONCEPT	S
CONCEPT_CODE	198465

CONCEPT_ID	8748
CONCEPT_NAME	Microgram per liter
DOMAIN_ID	Unit
VOCABULARY_ID	UCUM
CONCEPT_CLASS_ID	Unit
STANDARD_CONCEPT	S
CONCEPT_CODE	Ug/L

Example:

1. Define study question and approach
2. **Define study variables/study cohort**
3. Construct analytic file
4. Complete analysis
5. Assess results
6. Dissemination of results

Cohort definition:

- Cohort of patients with a CKD diagnosis according to ICD9 code 585.

Getting your CONCEPT_IDs

```sql
-- Option 1: you know the ICD code

SELECT *
FROM OMOP_V5.OMOPV5.CONCEPT
WHERE CONCEPT_CODE like '585'
```

CONCEPT_ID	CONCEPT_NAME	DOMAIN_ID	VOCABULARY_ID	CONCEPT_CLASS_ID	STANDARD_CONCEPT	CONCEPT_CODE
45906108	MASS TENDER	Condition	CIEL	Finding		585
38001353	Breast biopsy, local excision & other breast proce...	Observation	DRG	MS-DRG	S	585
44830172	Chronic kidney disease (CKD)	Condition	ICD9CM	3-dig nonbill code		585
45410776	Atropine Sulfate, Ophthalmic, 1% ophthalmic oint...	Drug	Multum	Multum		585

Getting your CONCEPT_IDs

```sql
-- Option 1: you know the ICD code

SELECT *
FROM OMOP_V5.OMOPV5.CONCEPT
WHERE CONCEPT_CODE like '585'
and VOCABULARY_ID='icd9cm'
```

CONCEPT_ID	CONCEPT_NAME	DOMAIN_ID	VOCABULARY_ID	CONCEPT_CLASS_ID	STANDARD_CONCEPT	CONCEPT_CODE
44830172	Chronic kidney disease (CKD)	Condition	ICD9CM	3-dig nonbill code		585

Getting your CONCEPT_IDs

```sql
-- Option 2: you know the description

SELECT *
FROM OMOP_V5.OMOPV5.CONCEPT
WHERE CONCEPT_NAME like '%KIDNEY%DISEASE%'
and VOCABULARY_ID='ICD9CM'
```

CONCEPT_ID	CONCEPT_NAME	DOMAIN_ID	VOCABULARY_ID	CONCEPT_CLASS_ID	STAND...	CONCEPT_CODE	
44827780	Hypertensive heart and chronic kidney disease	Condition	ICD9CM	3-dig nonbill code		404	
44827888	Chronic kidney disease, Stage III (moderate)	Condition	ICD9CM	4-dig billing code		585.3	
44828971	Hypertensive chronic kidney disease, unspecified,...	Condition	ICD9CM	5-dig billing code		403.91	
44830172	Chronic kidney disease (CKD)	Condition	ICD9CM	3-dig nonbill code		585	

Concepts in the CONDITION_OCCURRENCE Table

You have the CONCEPT_ID for CKD ICD9 code. Now what??

?

OMOPV5.CONDITION_OCCURRENCE
  Columns
    CONDITION_OCCURRENCE_ID (bigint, not null)
    PERSON_ID (bigint, null)
    CONDITION_CONCEPT_ID (int, not null) → Standard OMOP concept
    CONDITION_START_DATE (date, null)
    CONDITION_START_DATETIME (datetime2(0), null)
    CONDITION_END_DATE (date, null)
    CONDITION_END_DATETIME (datetime2(0), null)
    CONDITION_TYPE_CONCEPT_ID (int, null) → The type of fact presented (different across domains). Here it's the admin code position.
    STOP_REASON (varchar(20), null)
    PROVIDER_ID (bigint, null)
    VISIT_OCCURRENCE_ID (bigint, null)
    CONDITION_SOURCE_VALUE (varchar(50), null)
    CONDITION_SOURCE_CONCEPT_ID (int, null) → Concept of the source clinical data.

OMOP Concept relationships

Concepts in the CONDITION_OCCURRENCE Table

You have the CONCEPT_ID for CKD ICD9 code. Now what??

OMOPV5.CONDITION_OCCURRENCE
  Columns
    CONDITION_OCCURRENCE_ID (bigint, not null)
    PERSON_ID (bigint, null)
    CONDITION_CONCEPT_ID (int, not null) → Standard OMOP concept (SNOMED)
    CONDITION_START_DATE (date, null)
    CONDITION_START_DATETIME (datetime2(0), null)
    CONDITION_END_DATE (date, null)
    CONDITION_END_DATETIME (datetime2(0), null)
    CONDITION_TYPE_CONCEPT_ID (int, null) → The type of fact presented (different across domains). Here it's the admin code position.
    STOP_REASON (varchar(20), null)
    PROVIDER_ID (bigint, null)
    VISIT_OCCURRENCE_ID (bigint, null)
    CONDITION_SOURCE_VALUE (varchar(50), null)
    CONDITION_SOURCE_CONCEPT_ID (int, null) → Concept of the source clinical data. Source=CDW ICD codes

Find instances of CONCEPT_ID(s)

```sql
SELECT TOP 1 CONDITION_CONCEPT_ID, CONDITION_TYPE_CONCEPT_ID, CONDITION_SOURCE_CONCEPT_ID
FROM
    OMOP_V5.OMOPV5.CONDITION_OCCURRENCE
WHERE
    CONDITION_SOURCE_CONCEPT_ID=44830172
```

CONDITION_CONCEPT_ID	CONDITION_TYPE_CONCEPT_ID	CONDITION_SOURCE_CONCEPT_ID
46271022	38000230	44830172

```sql
SELECT *
FROM OMOP_V5.OMOPV5.CONCEPT
where CONCEPT_ID IN
( 46271022
 ,38000230
 ,44830172
)
```

CONCEPT_ID	CONCEPT_NAME	DOMAIN_ID	VOCABULARY_...	CONCEPT_CLASS_...	STANDARD_CONCE...	CONCEPT_CODE
38000230	Outpatient header - 1st position	Type Concept	Condition Type	Condition Type	S	OMOP generated
44830172	Chronic kidney disease (CKD)	Condition	ICD9CM	3-dig nonbill code		585
46271022	Chronic kidney disease	Condition	SNOMED	Clinical Finding	S	709044004

```sql
SELECT
    CONDITION_CONCEPT_ID, CONDITION_TYPE_CONCEPT_ID, CONDITION_SOURCE_CONCEPT_ID
FROM
    OMOP_V5.OMOPV5.CONDITION_OCCURRENCE
WHERE
    CONDITION_CONCEPT_ID = 46271022
```

CONDITION_CONCEPT_ID	CONDITION_TYPE_CONCEPT_ID	CONDITION_SOURCE_CONCEPT_ID
46271022	38000231	44830172

```sql
SELECT *
FROM
    OMOP_V5.OMOPV5.CONCEPT
WHERE
    CONCEPT_ID IN (46271022,38000231,44830172)
```

CONCEPT_ID	CONCEPT_NAME	DOMAIN_ID	VOCABULARY_ID	CONCEPT_CLASS_ID	STANDARD_CONCEPT
38000231	Outpatient header - 2nd position	Type Concept	Condition Type	Condition Type	S
44830172	Chronic kidney disease (CKD)	Condition	ICD9CM	3-dig nonbill code	
46271022	Chronic kidney disease	Condition	SNOMED	Clinical Finding	S

Find instances of a SNOMED

```sql
SELECT *
FROM
    OMOP_V5.OMOPV5.CONCEPT
WHERE
    CONCEPT_NAME LIKE 'Chronic Kidney disease%'
AND
    VOCABULARY_ID = 'SNOMED'
AND
    DOMAIN_ID = 'Condition'
```

CONCEPT_ID	CONCEPT_NAME	DOMAIN_ID	VOCABULARY_ID	CONCEPT_CLASS_ID
46271022	Chronic kidney disease	Condition	SNOMED	Clinical Finding
46270353	Chronic kidney disease due to benign hypertension	Condition	SNOMED	Clinical Finding
44782429	Chronic kidney disease due to hypertension	Condition	SNOMED	Clinical Finding
36717349	Chronic kidney disease due to systemic infection	Condition	SNOMED	Clinical Finding
36716455	Chronic kidney disease due to traumatic loss of kid...	Condition	SNOMED	Clinical Finding
45773688	Chronic kidney disease due to type 1 diabetes mell...	Condition	SNOMED	Clinical Finding
43531578	Chronic kidney disease due to type 2 diabetes mell...	Condition	SNOMED	Clinical Finding
36716184	Chronic kidney disease following donor nephrectomy	Condition	SNOMED	Clinical Finding
36717534	Chronic kidney disease following excision of renal ...	Condition	SNOMED	Clinical Finding
37017104	Chronic kidney disease mineral and bone disorder	Condition	SNOMED	Clinical Finding
46284080	Chronic kidney disease resolved	Condition	SNOMED	Clinical Finding
443614	Chronic kidney disease stage 1	Condition	SNOMED	Clinical Finding

OMOP Support

- VINCI Help Desk– include OMOP in your ticket descriptor or subject line in email to VINCI@VA.gov

- VAPulse.net VINCI OMOP Users Group- Training resources, Documentation, FAQ, Example code

- OHDSI OMOP-CDM Community - Open Source www.ohdsi.org