# OHDSI

□□□□□□□□□□□□□□□□□□

2025-01-29

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| Thomas Falconer | George Hripcsak | Vojtech Huser |
| Mark Khayter | Greg Klebanov | Kristin Kostka |
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| Akihiko Nishimura | Ellen Palmer | Nirav Patil |
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| Patrick Ryan | Craig Sachson | Izzy Saridakis |
| Paola Saroufim | Martijn Schuemie | Sarah Seager |
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| Erica Voss | Kristin Waite | Mike Warfe |
| Jamie Weaver | James Wiggins | Andrew Williams |
| Seng Chan You | | |

□□□□□□□□OHDSI□□□□□□□□

Table 1: □□□□

# Part I

# OHDSI

# Chapter 1

# OHDSI

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□□□□□□□□□□□□□□□□

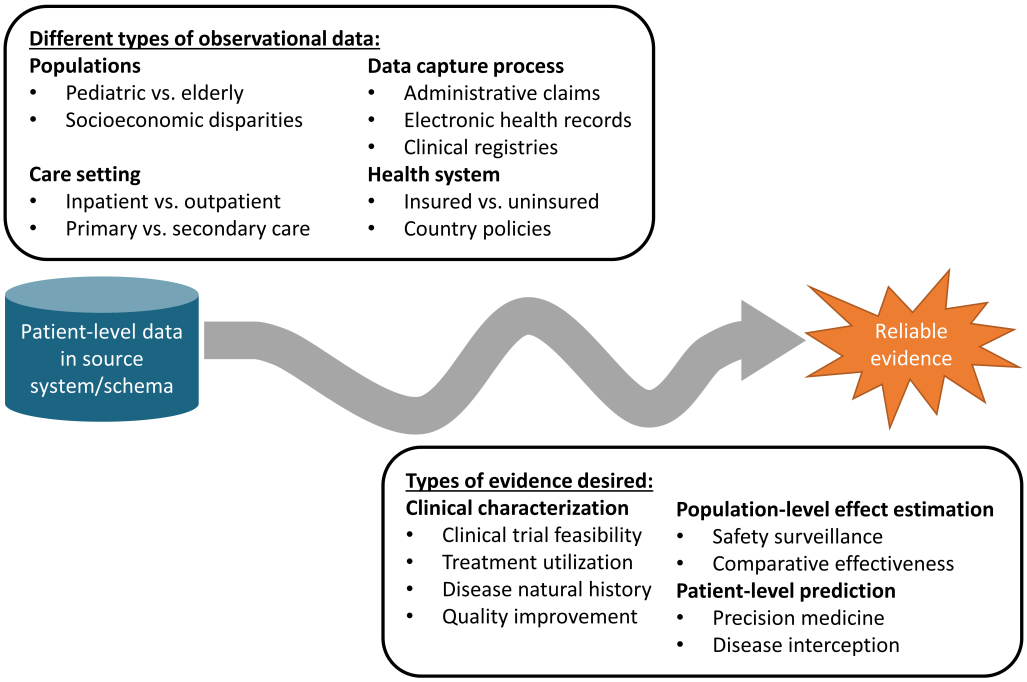


Figure 1.1: □□□□□□□□□□□□□□□

### 1.2.1

□□□□□□□□□□□□□□

## 1.3 OHDSI

OHDSI□2014□□□

## 1.4 OHDSI

OHDSI□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□OHDSI□□□□□□□□□□□□□□□□□□□

# Chapter 2

□□□□□□□□□□□□□□□□□□□□□□□□ & □□□□□□□□□□□□□

□□□□□□□□□□□□□□ - □□

OHDSI□□□□□□□□□□□□□□□□□□□

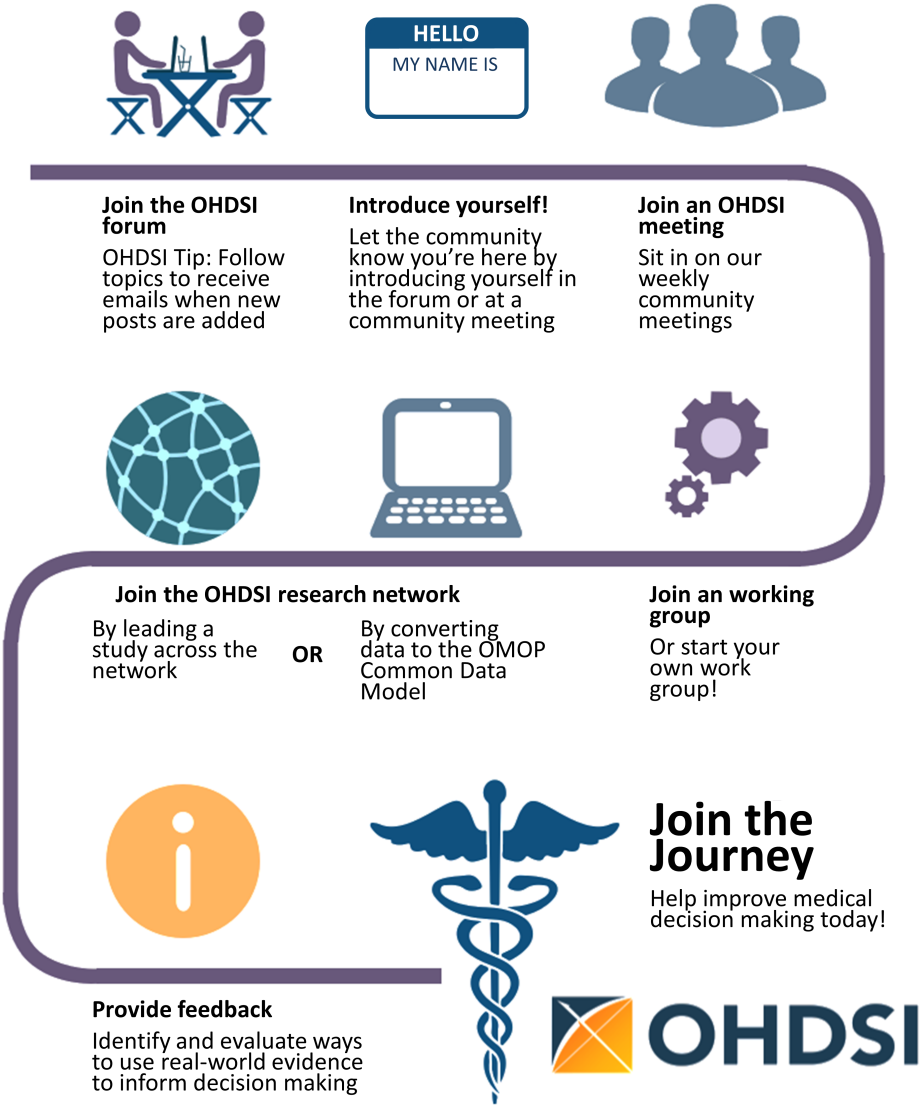


Figure 2.1: □□□□□□□□ - OHDSI□□□□□□□□□□□□□□□□

### 2.0.2 OHDSI

OHDSI□□□

| □□□□□□□ | □□ | □□□□□□□□□ |
|---|---|---|
| GIS | OMOP CD-M□□□□□□□□

## 2.2

- OHDSI□□□

# Chapter 3

□□□□□: □□□□□□□□□□□□

OHDSI□□□□□□□□□□□

## 3.3

OHDSI□□□□□□□□□

### 3.7.4

□□□□□□□□OMOP□□□□□□□□OHDSI□□□□□□□□□□□□□□□□

# Chapter 4

□□□: *Clair Blacketer*

□□□

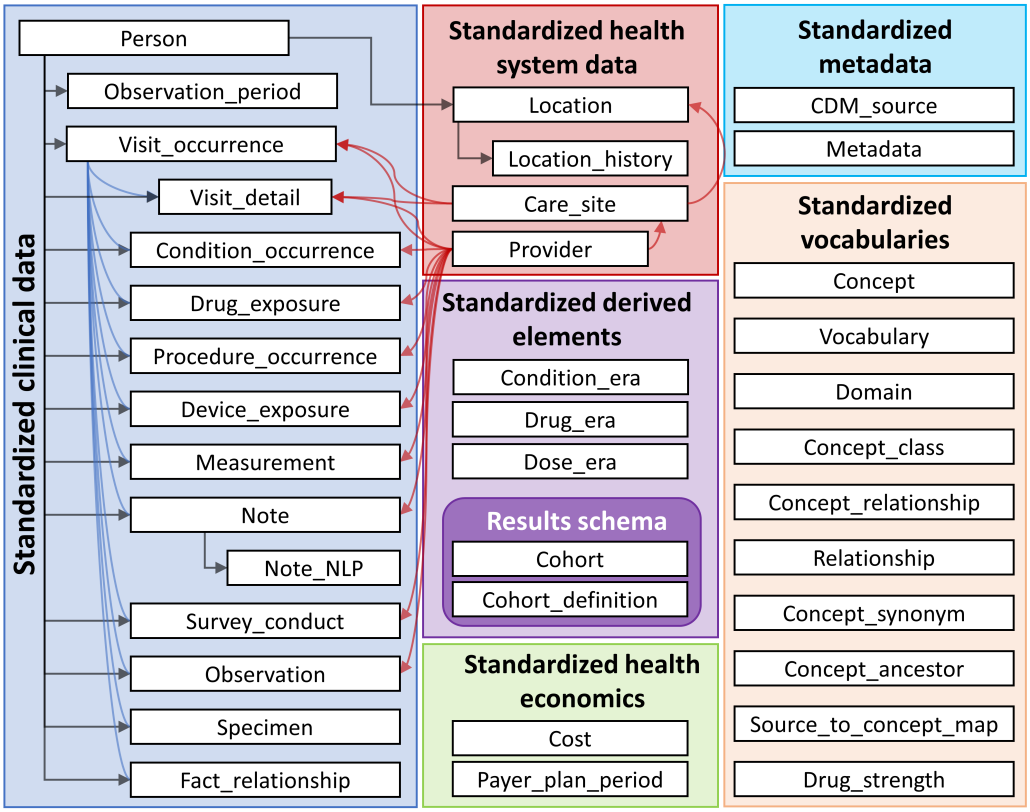


Figure 4.1: CDM□□□□□6.0□□□□□□□□

- □□□□□□□: □□□□□□□

| □□□□□□ | □□□□ID | □□□□□□ | □□□□ID |
|---|---|---|---|
| 17302 | Meas Value | 11 | Plan |
| 1799 | Specimen | 6 | Episode |
| 1215 | Provider Specialty | 6 | Sponsor |
| 1046 | Unit | 5 | Meas Value Operator |
| 944 | Metadata | 3 | Spec Disease Status |
| 538 | Revenue Code | 2 | Gender |
| 336 | Type Concept | 2 | Ethnicity |
| 194 | Relationship | 1 | Observation Type |

### 4.1.5

CDM□□□□□□□

□□□□□□□□□□□□□□□QA□□□□□□□□□□□□□□□

TERM CONNECTIONS (82)

| RELATIONSHIP | RELATES TO | CONCEPT ID | VOCABULARY |
|---|---|---|---|
| ICD-9-CM to MedDRA (MSSO) | Pulmonary tuberculosis | 36110777 | MedDRA |
| Non-standard to Standard map (OMOP) | Pulmonary tuberculosis | 253954 | SNOMED |
| Subsumes | Other specified pulmonary tuberculosis | 44830894 | ICD9CM |
| | Other specified pulmonary tuberculosis, bacteriological or histological examination not done | 44836741 | ICD9CM |
| | Other specified pulmonary tuberculosis, bacteriological or histological examination unknown (at present) | 44836742 | ICD9CM |
| | Other specified pulmonary tuberculosis, tubercle bacilli found (in sputum) by microscopy | 44821641 | ICD9CM |
| | Other specified pulmonary tuberculosis, tubercle bacilli not found (in sputum) by microscopy, but found by bacterial culture | 44833188 | ICD9CM |

Figure 4.3: □□□□SNOMED□□□

### 4.1.8 Running Example:

□□□□□□□

Table 4.3: PERSON□□□□□

| □□ | □ | □□ |
|---|---|---|
| PERSON_ID | 1 | PERSON_ID□□□□□

| □□□□□□□ID | □□□ | □□□ | □□□ |
|---|---|---|---|
| 80 | 2011-01-06 | 2011-01-06 | □□□□ |
| 90 | 2012-01-06 | 2012-01-06 | □□□□ |
| 100 | 2013-01-07 | 2013-01-07 | □□□□ |
| 101 | 2013-01-14 | 2013-01-14 | □□□□ |
| 102 | 2013-01-17 | 2013-01-24 | □□□□ |

□□□□□□□□□□□□□□□□□□□□□OBSERVATION_PERIOD□□□□□□□□□□□□□□□□□□□□□□

Table 4.5: OBSERVATION_PERIOD□□□□□

| □□ | □ | □□ |
|---|---|---|
| OBSERVATION_ PERIOD_ID | 1 | □□□□□□□□□□□□□□□□□□□□

| □□ | □ | □□ |
|---|---|---|
| VISIT_TYPE_CONCEPT_ID | 32034 | □□□□□□□□□□□□□□□□□□□□□□□□□□□EHR□ |
| PROVIDER_ID | NULL | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| CARE_SITE_ID | NULL | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| VISIT_SOURCE_VALUE | □□ | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| VISIT_SOURCE_CONCEPT_ID | NULL | □□□□□□□□□□OHDSI□□□□□□□□□□□□□□□□□□□ |
| ADMITTED_FROM_CONCEPT_ID | NULL | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ 8536□□□□□□□□□□□□ |
| ADMITTED_FROM_SOURCE_CONCEPT_ID | NULL | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| DISCHARGE_TO_CONCEPT_ID | NULL | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ 8615□□□□□□□□□□□□□□□□ |
| DISCHARGE_TO_SOURCE_VALUE | NULL | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ living facility□□□□ |
| PRECEDING_VIS | | |

IT_OCCURRENCE_ID|NULL|□□□□□□□□□□□□□□□□□□□ADMITTED_FROM_CONCEPT

- □□□1□□□□□□□□□□□□□□□□□□□

| □□ | □ | □□ |
|---|---|---|
| CONDITION_START_DATE | 2010-01-06 | □□□□□□□□□□□□□□ |
| CONDITION_START_DATETIME | 2010-01-06 00:00:00 | □□□□□□□□□□□□□□

□□□□

□□□3□□□□□□□□□□□□□□@ref□installR□□□□□□□□□□□□□□R□R-Studio□□□□Java□□□

```
install.packages(c("SqlRender", "DatabaseConnector", "remotes"))
remotes::install_github("ohdsi/Eunomia", ref = "v1.0.0")
```

Eunomia□□□□□□□□□□□□□□R□□□□□□□□□□□□□□CDM□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

```
connectionDetails <- Eunomia::getEunomiaConnectionDetails()
```

CDM□□□□□□□□□□□□□□main□□□□□□□□CONDITION_OCCURRENCE□□□□□□□□□□□□□□□□□□□

# Chapter 5

□□□□□: *Christian Reich & Anna Ostropolets*

OMOP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□OHDSI□□□□□□□□□□□□□□□□□□□

# 1660.

## A General BILL for this present Year,

Ending the 11th Day of December 1660.

According to the Report made to the King's most excellent Majesty,

By the Company of Parish Clerks of LONDON, &c.

### DISEASES and CASUALTIES.

| | | | | | |
|---|---|---|---|---|---|
| Abortive and Stillborn | 421 | Flox and Small Pox | 1523 | Palsy | 17 |
| Aged | 909 | Found dead in the Streets, Fields, &c. | 2 | Plague | 36 |
| Ague and Fever | 2303 | French Pox | 51 | Plurisy | 12 |
| Apoplexy and Suddenly | 91 | Gout | 4 | Quinsy and sore Throat | 21 |
| Blasted and Planet | 3 | Grief | 13 | Rickets | 441 |
| Bleeding and bloody Issue | 7 | Griping in the Guts | 253 | Rising of the Lights | 210 |
| Bloody Flux, Scowring, and Flux | 346 | Hanged and made away themselves | 11 | Rupture | 12 |
| Burnt and Scalded | 6 | Head-ach and Headmouldshot | 35 | Scurvy | 82 |
| Cancer, Gangrene and Fistula | 63 | Jaundies | 102 | Shot | 7 |
| Canker, sore Mouth and Thrush | 73 | Imposthume | 105 | Shingles | 1 |
| Childbed | 226 | Killed by several Accidents | 55 | Sores, Ulcers, broken and bruised Limbs | 61 |
| Chrisomes and Infants | 858 | King's Evil | 28 | Spleen | 7 |
| Cold, Cough and Hiccough | 33 | Lethargy | 6 | Spotted Fever and Purples | 368 |
| Colick and Wind | 116 | Livergrown | 8 | Starved | 7 |
| Consumption and Tissick | 2982 | Lunatick and Frenzy | 14 | Strangury | 22 |
| Convulsion | 742 | Megrims | 5 | Stopping of the Stomach | 186 |
| Cut of the Stone and Stone | 46 | Measles | 6 | Surfeit | 202 |
| Dropsy and Tympany | 646 | Mother | 1 | Swine Pox | 2 |
| Drowned | 57 | Murthered | 7 | Teeth and Worms | 839 |
| Executed | 7 | Overlaid and Starved at Nurse | 46 | Vomiting | 8 |
| Falling Sickness | 4 | | | Wen | 1 |

Figure 5.1: 1660□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□62□□□□□□□□□□□□□□□□□□□

### 5.1.2

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OMOP CDM□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□zip□□□□□□□□□□□□□□□□□□

### 5.1.3 :

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Extension□□□□□□□□□□□5.3.9□□□□ ## □□

OMOP CDM□□□□□□□□□□□□□□□□□□□

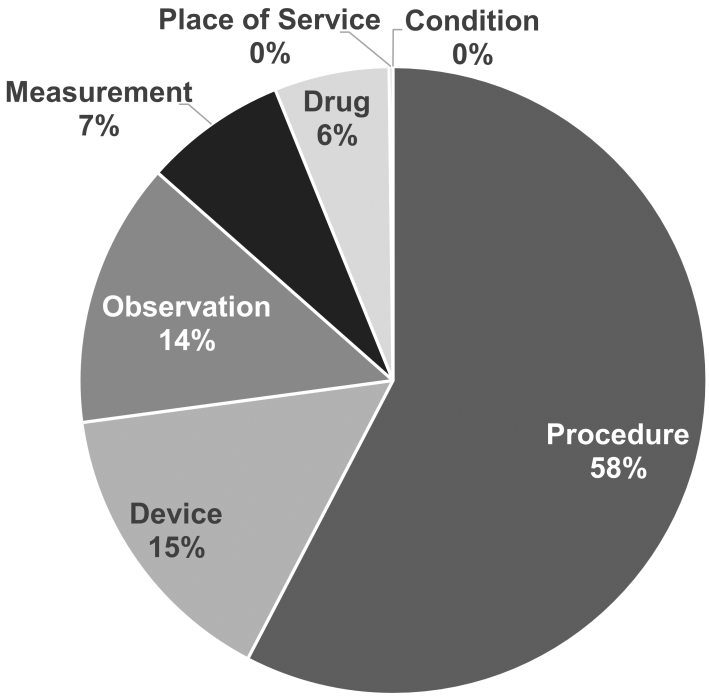


Figure 5.3: □□□□□CPT4□□□HCPCS□□□□

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|---|---|---|---|
| □□ | RxNorm, RxNorm Extension, CVX | HCPCS, CPT4, HemOnc, NAACCR | ATC |
| □□ | SNOMED | □□□□□□□□□□□□□□□□□□□□□□□□ | □□□□ |
| □□ | SNOMED | □□□□ | □□□□□□□ |
| □□ | CMS Place of Service, ABMT, NUCC | SNOMED, HCPCS, CPT4, UB04 | □□□□□□□ |

### 5.1.12

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Table 5.5: □□□□Finding site of□□□□□□□□□□□□□□□□□□□

## 5.2

DOMAIN_ID□VOCABULARY_ID□CONCEPT_CLASS_ID□□□□CONCEPT□□□□□□□□□□CON
VOCABULARY□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□VOCABULARY_REFERENC

## 5.3

### 5.3.1

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## 5.4

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# Chapter 6

□□□□□□□□□: *Clair Blacketer & Erica Voss*

## 6.1

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ETL□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□4□□□□□□□□□□□□□□□

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## □□□□ 1: ETL□□□

ETL□□□□□□□□□□□□□□□□□□□

## □□□□□

White Rabbit□□□□□□□□□

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White Rabbit□□□□□□□□□□□

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | Table | Field | Type | Max length | N rows | N rows checked | Fraction empty |
| 2 | dbo.allergies | start | date | 10 | 3184 | 3184 | 0 |
| 3 | dbo.allergies | stop | date | 10 | 3184 | 3184 | 0.725188442 |
| 4 | dbo.allergies | patient | varchar | 36 | 3184 | 3184 | 0 |
| 5 | dbo.allergies | encounter | varchar | 36 | 3184 | 3184 | 0 |
| 6 | dbo.allergies | code | varchar | 9 | 3184 | 3184 | 0 |
| 7 | dbo.allergies | description | varchar | 24 | 3184 | 3184 | 0 |
| 8 | | | | | | | |
| 9 | dbo.careplans | id | varchar | 36 | 30199 | 30199 | 0 |
| 10 | dbo.careplans | start | date | 10 | 30199 | 30199 | 0 |
| 11 | dbo.careplans | stop | date | 10 | 30199 | 30199 | 0.057849598 |
| 12 | dbo.careplans | patient | varchar | 36 | 30199 | 30199 | 0 |
| 13 | dbo.careplans | encounter | varchar | 36 | 30199 | 30199 | 0 |
| 14 | dbo.careplans | code | varchar | 15 | 30199 | 30199 | 0 |
| 15 | dbo.careplans | description | varchar | 62 | 30199 | 30199 | 0 |
| 16 | dbo.careplans | reasoncode | varchar | 9 | 30199 | 30199 | 0.050796384 |
| 17 | dbo.careplans | reasondescription | varchar | 56 | 30199 | 30199 | 0.050796384 |
| 18 | | | | | | | |

Overview | dbo.allergies | dbo.carepla ...

Figure 6.3: □□□□□□□□□□□□□□□□□□□□

| | A | B |
|---|---|---|
| 1 | Sex | Frequency |
| 2 | 2 | 61491 |
| 3 | 1 | 35401 |
| 4 | List truncated... | |

Figure 6.4: □□□□□□□□□□□

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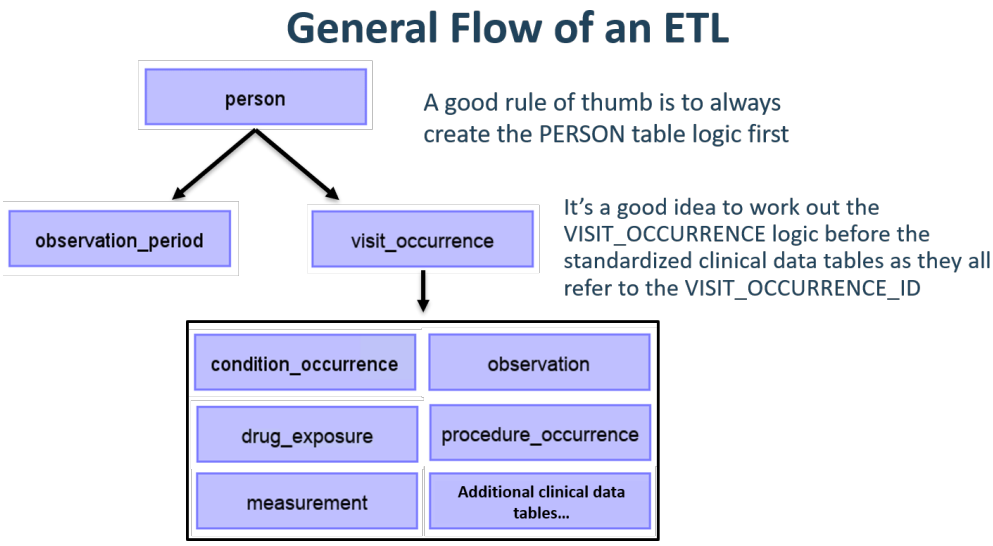


Figure 6.5: ETL□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

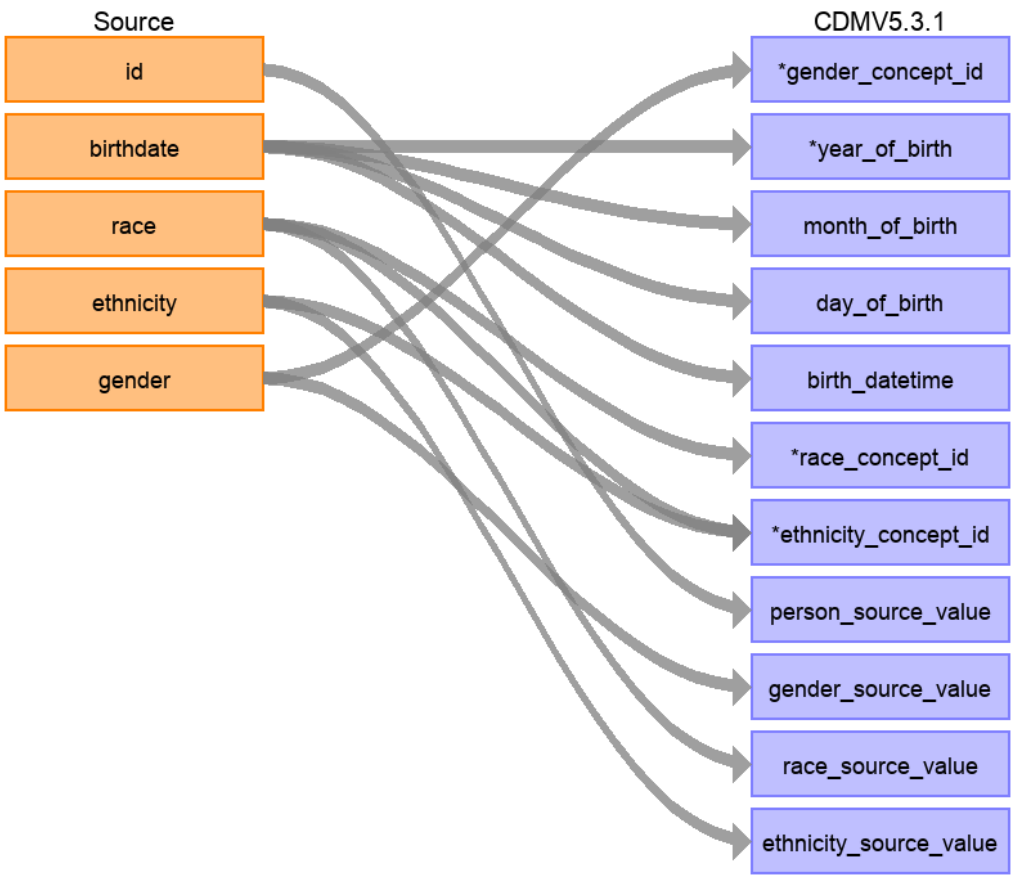


Figure 6.6: Synthea Patients□□□□□□□CDM PERSON□□□□□□□□□□□□□□

□□(□tab:syntheaEtlPerson) Synthea Patients□□□□□CDM PERSON□□□□□□□□□□□□□ETL

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|---|---|
| PERSON_ID | □□□□□ PERSON_ID□□□□□□□□□□□□□□□□□□□□□□□id□□var □□□□id□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| GENDER_CONCEPT_ID gender | □□□□M□□□□□GENDER_CONCEPT_ID□8507□□ |
| YEAR_OF_BIRTH birthdate | □□□□□□ |

## 6.2 2:

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D) □□□□□□□□□□□□□□□□

□□ **6.2.** □□□□OHDSI□□□□□□□□□□□□6.2□□□PERSON□□□□□□□□□4□□□□□□□□□□

□: PERSON□□□□□

| □ | □ |
|---|---|
| PERSON_ID | A123B456 |
| GENDER_CONCEPT_ID | 8532 |
| YEAR_OF_BIRTH | NULL |
| MONTH_OF_BIRTH | NULL |
| DAY_OF_BIRTH | NULL |
| RACE_CONCEPT_ID | 0 |
| ETHNICITY_CONCEPT_ID | 8527 |
| PERSON_SOURCE_VALUE | A123B456 |
| GENDER_SOURCE_VALUE | F |
| RACE_SOURCE_VALUE | WHITE |
| ETHNICITY_SOURCE_VALUE | □□□□□□□□□ |

□□ **6.3.** VISIT_OCCURRENCE□□□□□□□□□□□□□□□□□□□□□Synthea□□□□□□□□□□□□□□
PATIENT□START□END□□□□□□□□□□□□□□□□□□PERSON_ID□□□□□□□□□END□□□□□

- MIN(START)□VISIT_START_DATE□□□□□
- MAX(END)□VISIT_END_DATE□□□□□
- “IP”□PLACE_OF_SERVICE_SOURCE_VALUE□□□□□

□□□□□□□□□6.8□□□□□□□□□□□□□□□□□□□□□□CDM□□□□□□VISIT_OCCURRENCE□

Data Output Explain Messages Notifications Query History

| | id character varying (1000) | start date | stop date | patient character varying (1000) | encounterclass character varying (1000) |
|---|---|---|---|---|---|
| 1 | 12 | 2004-09-26 | 2004-09-27 | 11 | inpatient |
| 2 | 13 | 2004-09-27 | 2004-09-30 | 11 | inpatient |

Figure 6.8: □□□□□□□□□

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# Chapter 7

□□□□□□□□: *David Madigan*

OHDSI□□□□□□□□

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## 7.3

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### 7.4.2

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**□□ 7.2.** □□□□□□□□□□□□□□□□□□□□□□□□□GI□□□□□□□□□□□□□□□□□□□

# Chapter 8

# OHDSI

□□□□□□□□: *Martijn Schuemie & Frank DeFalco*

OHDSI□□□□□□□□

Library□□□□□

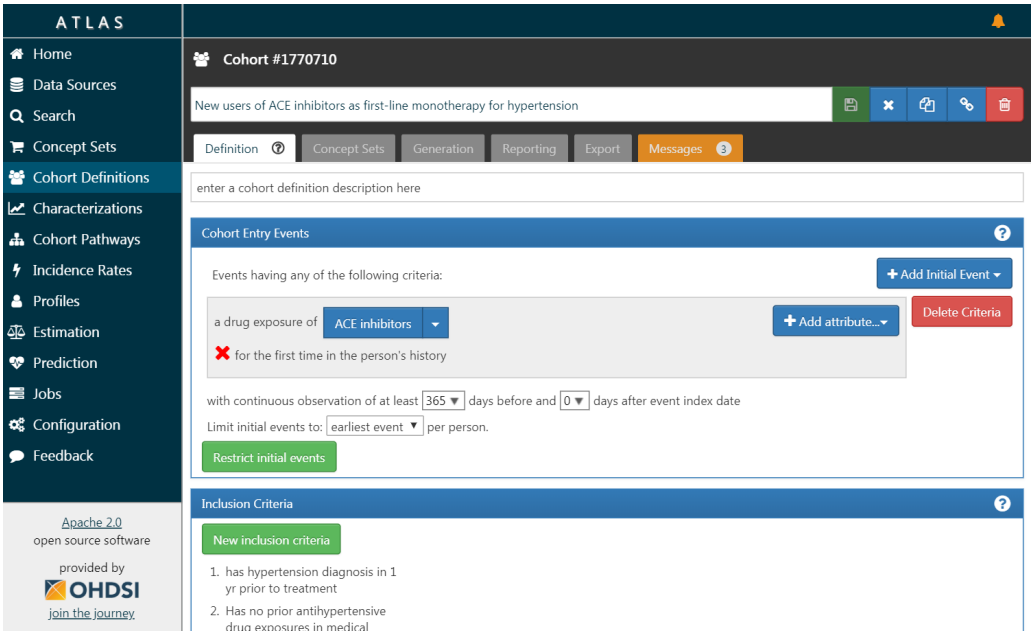


Figure 8.3: ATLAS□□□□□□□□□□□

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### 8.2.3

ATLAS□□□□□□□□□□OHDSI WebAPI□□□□□□□□□□

Figure 8.4: Packages in the OHDSI Methods Library.

### 8.3.4

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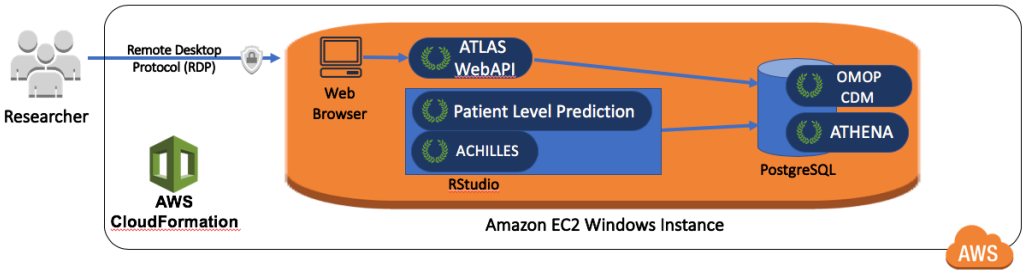


Figure 8.5: OHDSI-in-a-Box□Amazon Web Services□□□□□□□□

OHDSIonAWS□□□□□□□□

- □□□□□OHDSI□□□□□□□□□□□□□□□□□□□□□□□□□□□
  - □□□□□□□□□□□□□□□□□□□□□ATLAS
  - OHDSI Methods Library□R□□□□□
- OHDSI□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

# Chapter 9

# SQL R

□□□□□□□□: *Martijn Schuemie & Peter Rijnbeek*

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```
install.packages("SqlRender")
```

SqlRender□□□□□□□□□□□□□□□□□□□PostgreSQL□Microsoft SQL Server□SQLite□Oracle□□□□□
APS□IBM Netezza□Amazon Redshift□□□□□□□□□□□□□□□□□□□□□□□Impala□□□Hadoop□Goo
BigQuery□□□□□□□□□□□□□□□□R□□□□□□□□□□□□□□□□□□□

```
## [1] "SELECT * FROM cohort "
```

```
render(sql, x = TRUE)
```

```
## [1] "SELECT * FROM cohort WHERE subject_id = 1"
```

□□□□□□□□□□□□□□□□□□

```
sql <- "SELECT * FROM cohort {@x == 1} ? {WHERE subject_id = 1};"
render(sql, x = 1)
```

```
## [1] "SELECT * FROM cohort WHERE subject_id = 1;"
```

```
render(sql, x = 2)
```

```
## [1] "SELECT * FROM cohort ;"
```

IN □□□□□□□□□□□□□□□□□

```
sql <- "SELECT * FROM cohort {@x IN (1,2,3)} ? {WHERE subject_id = 1};"
render(sql, x = 2)
```

```
## [1] "SELECT * FROM cohort WHERE subject_id = 1;"
```

### 9.0.2 SQL

SqlRender □□□□□□□□□□□□□□□□□□OHDSI SQL□□□□□SQL□□□□□□□□□□□□□□□□□□□

```
sql <- "SELECT TOP 10 * FROM person;"
translate(sql, targetDialect = "postgresql")
```

```
## [1] "SELECT  * FROM person LIMIT 10;"
## attr(,"sqlDialect")
## [1] "postgresql"
```

`targetDialect` □□□□□□□□□□□□□□□□□□□□□“oracle”, “postgresql”, “pdw”, “redshift”, “impala”, “netezza”, “bigquery”, “sqlite”, “sql server”□

> □□□□SQL□□□□□□□□□□□□□□□□□□□

**Translate□□□□□□□□□□□□**

□□□□SQL Server□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□: supported by translate

| □□ | □□ | □□ |
|---|---|---|
| ABS | EXP | RAND |
| ACOS | FLOOR | RANK |
| ASIN | GETDATE | RIGHT |
| ATAN | HASHBYTES* | ROUND |
| AVG | ISNULL | ROW_NUMBER |
| CAST | ISNUMERIC | RTRIM |
| CEILING | LEFT | SIN |
| CHARINDEX | LEN | SQRT |
| CONCAT | LOG | SQUARE |
| COS | LOG10 | STDEV |
| COUNT | LOWER | SUM |
| COUNT_BIG | LTRIM | TAN |
| DATEADD | MAX | UPPER |
| DATEDIFF | MIN | VAR |
| DATEFROMPARTS | MONTH | YEAR |
| DATETIMEFROMPARTS | NEWID | |
| DAY | PI | |
| EOMONTH | POWER | |

* Oracle□□□□□□□□□□□□□□□SQLite□□□□□□□□□□□□□□□

□□□□□□□□SQL□□□□□□□□□□□□□□□□□□□

```sql
CREATE TABLE table (field INT);

-- Inserting verbatim values:
INSERT INTO other_table (field_1) VALUES (1);

-- Inserting from SELECT:
INSERT INTO other_table (field_1) SELECT value FROM table;

-- Simple drop commands:
DROP TABLE table;

-- Drop table if it exists:
IF OBJECT_ID('ACHILLES_analysis', 'U') IS NOT NULL
  DROP TABLE ACHILLES_analysis;

-- Drop temp table if it exists:
IF OBJECT_ID('tempdb..#cohorts', 'U') IS NOT NULL
  DROP TABLE #cohorts;

-- Common table expressions:
WITH cte AS (SELECT * FROM table) SELECT * FROM cte;

-- OVER clauses:
SELECT ROW_NUMBER() OVER (PARTITION BY a ORDER BY b)
  AS "Row Number" FROM table;

-- CASE WHEN clauses:
SELECT CASE WHEN a=1 THEN a ELSE 0 END AS value FROM table;

-- UNIONs:
SELECT * FROM a UNION SELECT * FROM b;

-- INTERSECTIONs:
SELECT * FROM a INTERSECT SELECT * FROM b;

-- EXCEPT:
SELECT * FROM a EXCEPT SELECT * FROM b;
```

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□□□□□□□□SQL Server□□□□□□□□□□□□□□□□□□□□1□□□□□SQL Server□□□SELECT `first_name + ' ' + last_name AS full_name FROM table` □□□□□□□□□□□ PostgreSQL □ Oracle □□ `SELECT first_name || ' ' || last_name AS full_name FROM table` □□□□□□□□□□□□□SqlRender□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ `SELECT first_name + last_name AS full_name FROM table` □□□□□□□□SqlRender□2□ `last_name + CAST(age AS VARCHAR(3)) AS full_name FROM table` □□□□□□□□□□□□□□□□□□□□

### □□□□□□□□□□□AS□□□□□□

□□□SQL□□□□□□□□□□□□□□□□□□□□□□□□□□ AS □□□□□□□□□□□□□□□□□□□□

□□□□Oracle□□□□

```
SELECT * FROM @databaseSchema.person
```

SQL Server□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□databaseSchema = "cdm_data.dbo"□□□□□□□□□□□□□□□□□□□

```
## Connecting using PostgreSQL driver
```

□□□□□□□□□□□□□□□□□□□□□□□□□?connect□□□□□□□□□□□□□□□□□□□

### 9.0.5 ffdf

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| NUM_YEARS |
|---|
| 1.980803 |

□□□

```
                THEN 9999
            ELSE age
            END) AS q75_age,
    MAX(age) AS max_age
FROM ages
CROSS JOIN (
    SELECT COUNT(*) AS n
    FROM ages
    ) population_size;
```

| MIN_AGE | Q25_AGE | MEDIAN_AGE | Q75_AGE | MAX_AGE |
|---|---|---|---|---|
| 0 | 6 | 17 | 34 | 90 |

□□□□□□□□□□SQL□□□□□□R□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□R□□□□□

```
sql <- "SELECT YEAR(observation_period_start_date) -
               year_of_birth AS age
FROM @cdm.person
INNER JOIN @cdm.observation_period
  ON person.person_id = observation_period.person_id;"
age <- renderTranslateQuerySql(conn, sql, cdm = "cdm")
quantile(age[, 1], c(0, 0.25, 0.5, 0.75, 1))
```

```
##   0%  25%  50%  75% 100%
##    0    6   17   34   90
```

□□□□□□□□□□□□□□□□□□□

| CONDITION_SOURCE_VALUE | CODE_COUNT |
|---|---|
| 496 | 19570098 |
| I10 | 19453451 |
| 3180 | 18973883 |

□□□□□CONDITION_OCCURRENCE□□□□□□□CONDITION_SOURCE_VALUE□□□□□□□

## 9.1

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```
SELECT COUNT(*) AS subject_count,
  concept_name
FROM @cdm.person
INNER JOIN @cdm.concept
  ON person.gender_concept_id = concept.concept_id
GROUP BY concept_name;
```

| SUBJECT_COUNT | CONCEPT_NAME |
|---|---|
| 14927548 | FEMALE |
| 11371453 | MALE |

□□□□□□□□□□□□□□□□□□□

## 9.2 QueryLibrary

QueryLibrary□□CDM□□□□□□SQL□□□□□□

### 9.3.3

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### 9.3.4

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## SQL□R□□□□□□□□□□□

OHDSI□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□OHDSI□□□□

```
library(DatabaseConnector)
conn <- connect(dbms = "postgresql",
                server = "localhost/postgres",
                user = "joe",
                password = "secret")
cdmDbSchema <- "cdm"
cohortDbSchema <- "scratch"
cohortTable <- "my_cohorts"

sql <- "
CREATE TABLE @cohort_db_schema.@cohort_table (
  cohort_definition_id INT,
  cohort_start_date DATE,
  cohort_end_date DATE,
  subject_id BIGINT
);
"
renderTranslateExecuteSql(conn, sql,
                          cohort_db_schema = cohortDbSchema,
                          cohort_table = cohortTable)
```

□□□□□□□□□□□□□□□□□□□

```
  subject_id
FROM (
  SELECT drug_era_start_date AS cohort_start_date,
    drug_era_end_date AS cohort_end_date,
    person_id AS subject_id
  FROM (
    SELECT drug_era_start_date,
      drug_era_end_date,
      person_id,
      ROW_NUMBER() OVER (
        PARTITION BY person_id
            ORDER BY drug_era_start_date
      ) order_nr
    FROM @cdm_db_schema.drug_era
    WHERE drug_concept_id = 1308216 --
  ) ordered_exposures
  WHERE order_nr = 1
) first_era
INNER JOIN @cdm_db_schema.observation_period
  ON subject_id = person_id
    AND observation_period_start_date < cohort_start_date
    AND observation_period_end_date > cohort_start_date
WHERE DATEDIFF(DAY,
               observation_period_start_date,
               cohort_start_date) >= 365;
"

renderTranslateExecuteSql(conn, sql,
                          cohort_db_schema = cohortDbSchema,
                          cohort_table = cohortTable,
                          cdm_db_schema = cdmDbSchema)
```

□□□□□CDM□□□□□□□□□□□DRUG_ERA□□□□□□□□□□□□□□□□□□□□DRUG_EXPOSURE

### 9.3.6

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```
sql <- "
INSERT INTO @cohort_db_schema.@cohort_table (
 cohort_definition_id,
 cohort_start_date,
 cohort_end_date,
subject_id
)
SELECT 2 AS cohort_definition_id,
  cohort_start_date,
  cohort_end_date,
```

```
  subject_id
FROM (
  SELECT DISTINCT person_id AS subject_id,
    condition_start_date AS cohort_start_date,
    condition_end_date AS cohort_end_date
  FROM @cdm_db_schema.condition_occurrence
  INNER JOIN @cdm_db_schema.concept_ancestor
    ON condition_concept_id = descendant_concept_id
  WHERE ancestor_concept_id = 432791 --
) distinct_occurrence
INNER JOIN @cdm_db_schema.visit_occurrence
  ON subject_id = person_id
  AND visit_start_date <= cohort_start_date
  AND visit_end_date >= cohort_start_date
WHERE visit_concept_id IN (262, 9203,
    9201) --    ER;
"

renderTranslateExecuteSql(conn, sql,
                          cohort_db_schema = cohortDbSchema,
                          cohort_table = cohortTable,
                          cdm_db_schema = cdmDbSchema)
```

□□□□□CONDITION_OCCURRENCE□□□□□CONCEPT_ANCESTOR□□□□□□□□□□□□□

### 9.3.7

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```
sql <- "
WITH tar AS (
  SELECT concept_name AS gender,
    FLOOR((YEAR(cohort_start_date) -
          year_of_birth) / 10) AS age,
    subject_id,
    cohort_start_date,
    CASE WHEN DATEADD(DAY, 7, cohort_start_date) >
      observation_period_end_date
    THEN observation_period_end_date
    ELSE DATEADD(DAY, 7, cohort_start_date)
    END AS cohort_end_date
  FROM @cohort_db_schema.@cohort_table
  INNER JOIN @cdm_db_schema.observation_period
    ON subject_id = observation_period.person_id
      AND observation_period_start_date < cohort_start_date
      AND observation_period_end_date > cohort_start_date
  INNER JOIN @cdm_db_schema.person
    ON subject_id = person.person_id
```

```
  INNER JOIN @cdm_db_schema.concept
    ON gender_concept_id = concept_id
  WHERE cohort_definition_id = 1 --
)
SELECT days.gender,
    days.age,
    days,
    CASE WHEN events IS NULL THEN 0 ELSE events END AS events
FROM (
  SELECT gender,
    age,
    SUM(DATEDIFF(DAY, cohort_start_date,
      cohort_end_date)) AS days
  FROM tar
  GROUP BY gender,
    age
) days
LEFT JOIN (
  SELECT gender,
      age,
      COUNT(*) AS events
  FROM tar
  INNER JOIN @cohort_db_schema.@cohort_table angioedema
    ON tar.subject_id = angioedema.subject_id
      AND tar.cohort_start_date <= angioedema.cohort_start_date
      AND tar.cohort_end_date >= angioedema.cohort_start_date
  WHERE cohort_definition_id = 2 --
  GROUP BY gender,
    age
) events
ON days.gender = events.gender
  AND days.age = events.age;
"

results <- renderTranslateQuerySql(conn, sql,
                                   cohort_db_schema = cohortDbSchema,
                                   cohort_table = cohortTable,
                                   cdm_db_schema = cdmDbSchema,
                                   snakeCaseToCamelCase = TRUE)
```

□□□CTE□tar□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□OBSERVATION_PERIOD_END

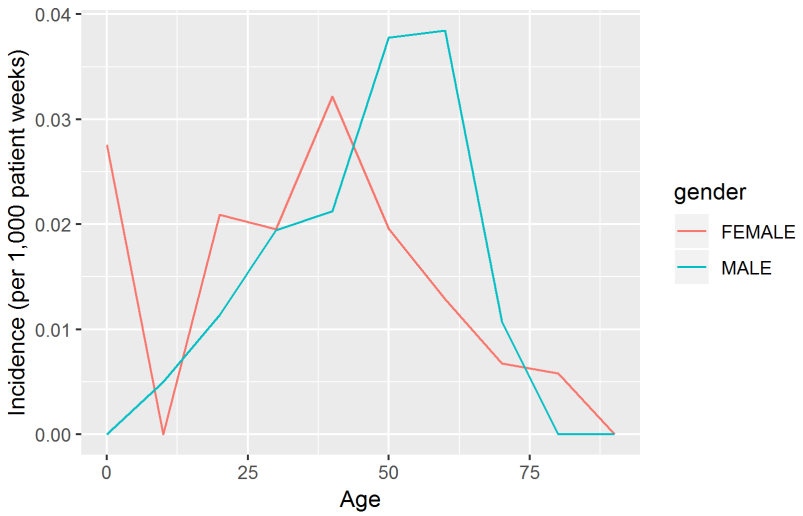
SQL□□□□□□□□□□□□□□□□□□□□□□□□□□□□SQL□□□□□□□□□□□□□□□□□□□□□R□□□□□□□□

ggplot2□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

```
#   IR
results$ir <- 1000 * results$events / results$days / 7
```

```
#
results$age <- results$age * 10

library(ggplot2)
ggplot(results, aes(x = age, y = ir, group = gender, color = gender)) +
  geom_line() +
  xlab(" ") +
  ylab("  1,000     ")
```




### 9.3.8

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## 9.4

- **SQL**□Structured Query Language□□□Common Data Model□CDM□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□□SQL□□□□□□□□□□□□□□□□□□□

# Chapter 10

□□□□□: *Kristin Kostka*

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## 10.2

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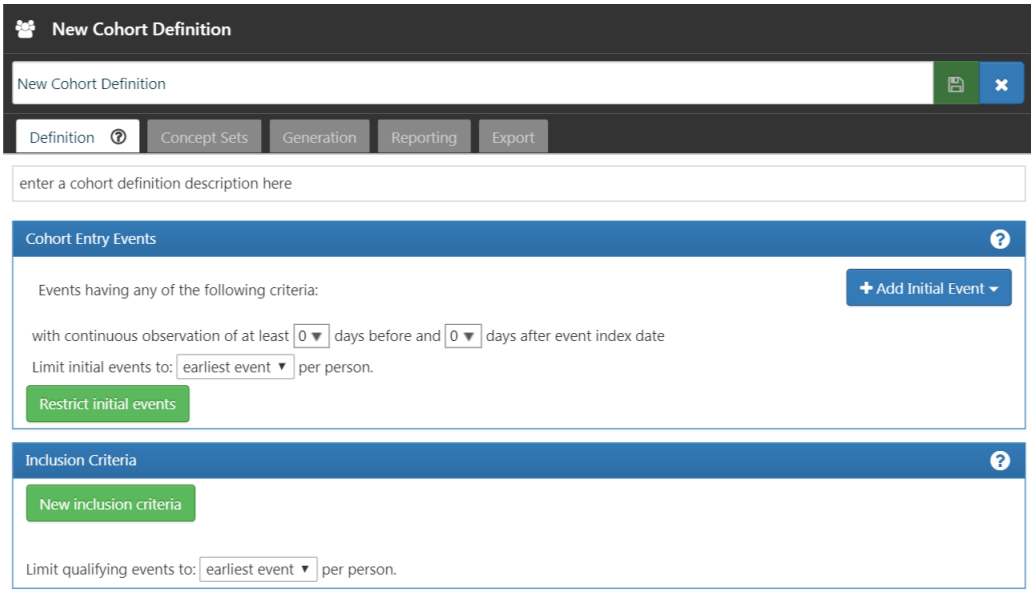


Figure 10.4: □□□□□□□□□□

□□□□□□□New Cohort Definition□□□□□□□□□□□

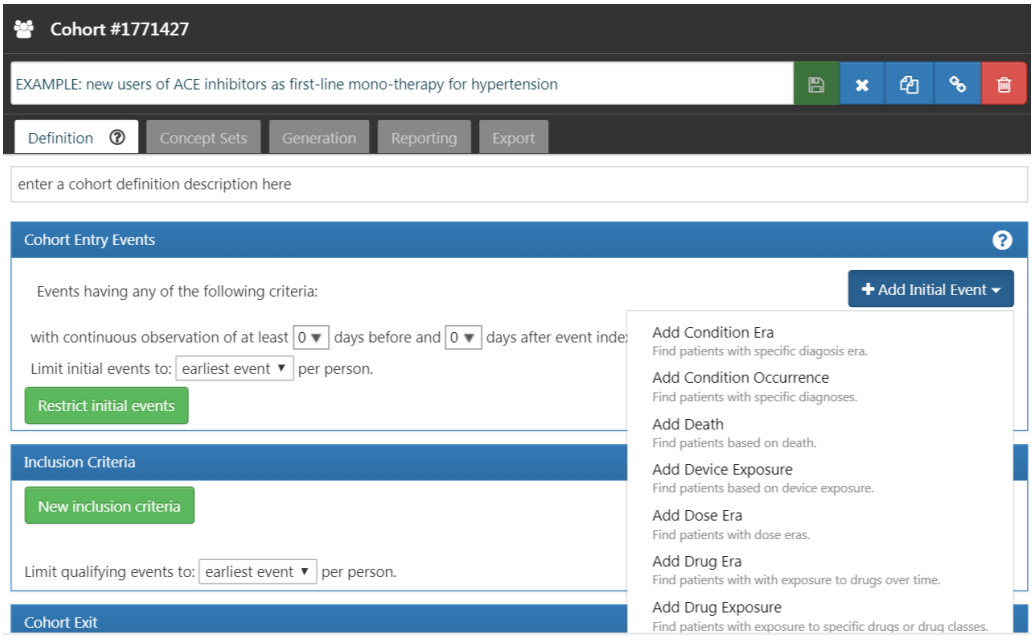


Figure 10.5: □□□□□□□□□

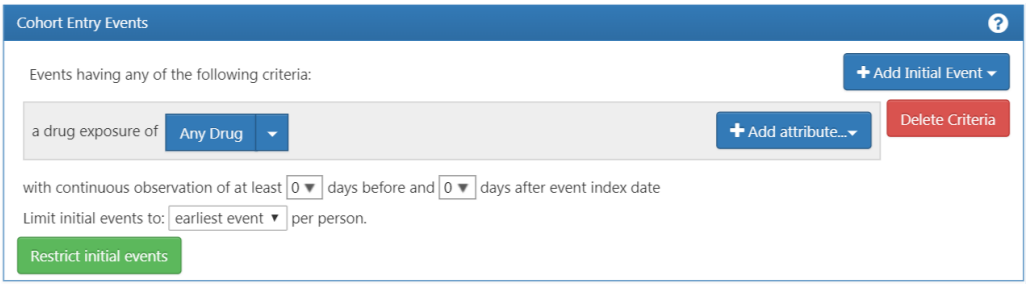


Figure 10.6: □□□□□□□

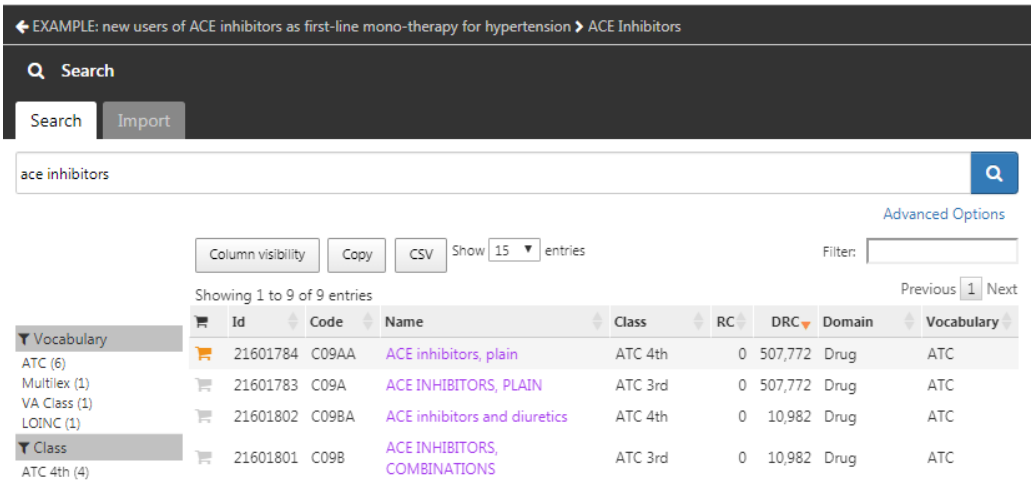


Figure 10.7: □□□□□ - ACE□□□

□□□□□□□□□□□□□□□□ □□□□□□□□□□□□□□□□□□□□□□□□10.7□□□□□□□□□□□□□□□

□10.8□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ACE□□□□□□□□□□□□□□□

□□□□**2:** □□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□ATLAS□□□□□□□□□□□□Import Concept Set□□□□□□□□□□□□
inhibitors□□□□□□□□□□□□□□□□□□□

Concept Set Expression | Included Concepts 21536 | Included Source Codes | Export | Import

Name:

ACE Inhibitors

Show 25 entries Search:

Showing 1 to 15 of 15 entries Previous 1 Next

| Concept Id | Concept Code | Concept Name | Domain | Standard Concept Caption | Exclude | Descendants | Mapped |
|---|---|---|---|---|---|---|---|
| 1335471 | 18867 | benazepril | Drug | Standard | | ✓ | |
| 1340128 | 1998 | Captopril | Drug | Standard | | ✓ | |
| 19050216 | 21102 | Cilazapril | Drug | Standard | | ✓ | |
| 1341927 | 3827 | Enalapril | Drug | Standard | | ✓ | |
| 1342001 | 3829 | Enalaprilat | Drug | Standard | | ✓ | |
| 1363749 | 50166 | Fosinopril | Drug | Standard | | ✓ | |
| 19122327 | 60245 | imidapril | Drug | Standard | | ✓ | |
| 1308216 | 29046 | Lisinopril | Drug | Standard | | ✓ | |
| 1310756 | 30131 | moexipril | Drug | Standard | | ✓ | |
| 1373225 | 54552 | Perindopril | Drug | Standard | | ✓ | |
| 1331235 | 35208 | quinapril | Drug | Standard | | ✓ | |
| 1334456 | 35296 | Ramipril | Drug | Standard | | ✓ | |
| 19040051 | 36908 | spirapril | Drug | Standard | | ✓ | |
| 1342439 | 38454 | trandolapril | Drug | Standard | | ✓ | |
| 19102107 | 39990 | zofenopril | Drug | Standard | | ✓ | |

Classification Non-Standard Standard

Figure 10.8: ACE□□□□□□□□□□□□□□□□□□

Import Concept Set From Repository...

New Concept Set

Show 10 entries Filter Repository Concept Sets: ace inhibitors

| Id | Title | Created | Modified | Author |
|---|---|---|---|---|
| 1794480 | [OHDSI EU 2019] Excluded concepts of ACE inhibitors or Thiazide diuretics | 03/28/2019 11:04 AM | 03/28/2019 11:04 AM | anonymous |
| 963 | ACE Inhibitors | | | anonymous |
| 3268 | COPY OF: ACE Inhibitors | | | anonymous |
| 99283 | Ace Inhibitors | | | anonymous |
| 142965 | PheKB ACE-I ACE inhibitors | | | anonymous |

Showing 1 to 5 of 5 entries (filtered from 11,667 total entries) Previous 1 Next

Figure 10.9: ATLAS□□□□□□□□□□□□□□□□□□□□□□□□□□

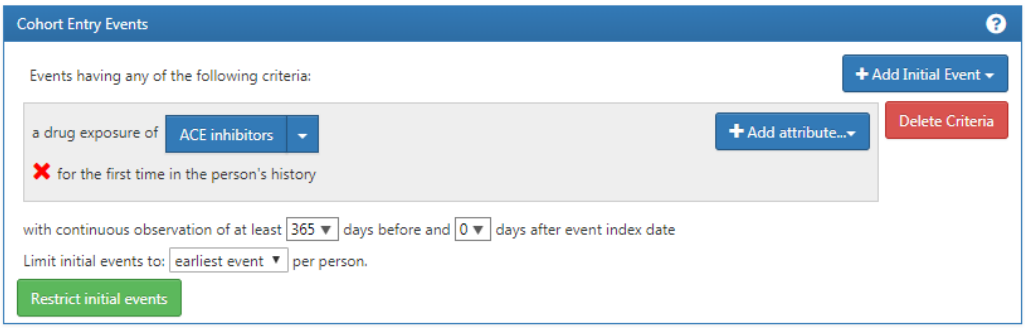


Figure 10.10: □□□□□□□□□□□□□□□□□□□□□□□□□□

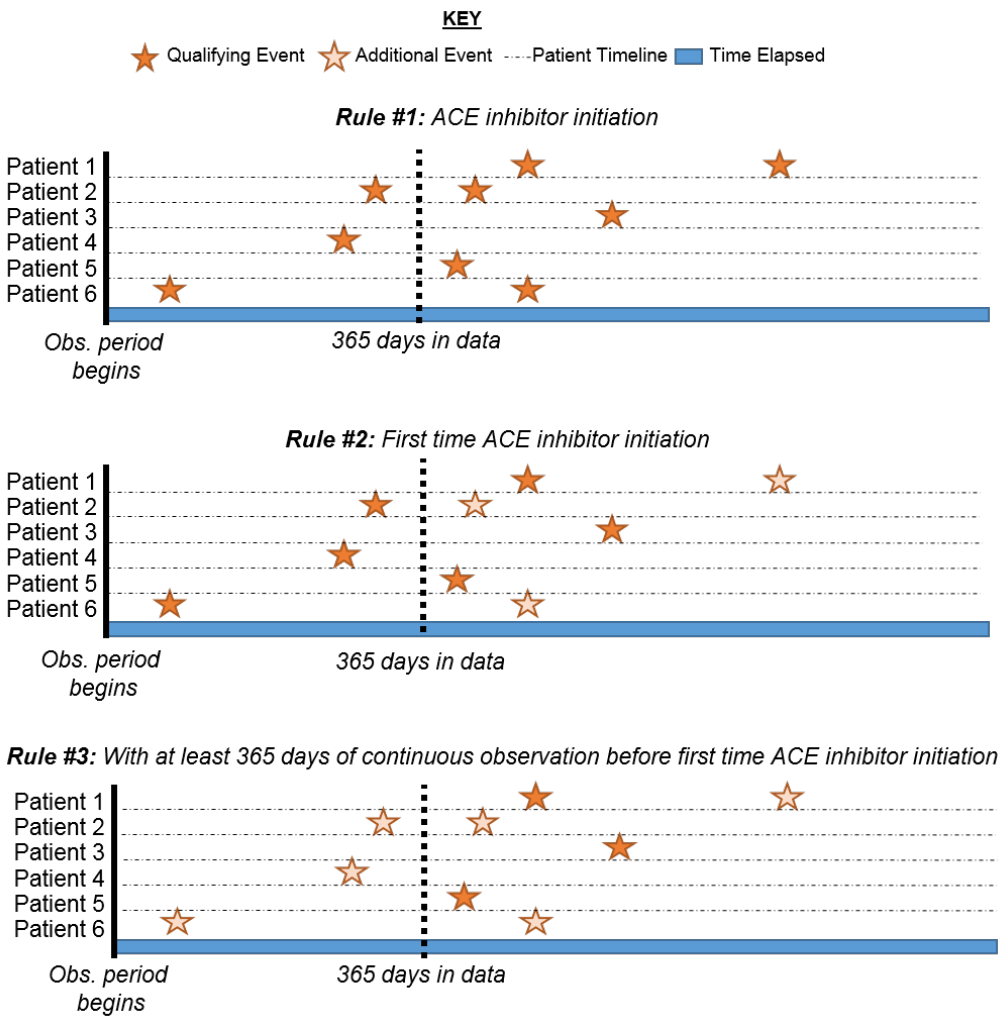


Figure 10.11: □□□□□□□□□□□□□□□□□□□

### 10.4.4

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```
                    978555, 991382, 1305447, 1307046, 1307863, 1308216,
                    1308842, 1309068, 1309799, 1310756, 1313200, 1314002,
                    1314577, 1317640, 1317967, 1318137, 1318853, 1319880,
                    1319998, 1322081, 1326012, 1327978, 1328165, 1331235,
                    1332418, 1334456, 1335471, 1338005, 1340128, 1341238,
                    1341927, 1342439, 1344965, 1345858, 1346686, 1346823,
                    1347384, 1350489, 1351557, 1353766, 1353776, 1363053,
                    1363749, 1367500, 1373225, 1373928, 1386957, 1395058,
                    1398937, 40226742, 40235485)
```

### 10.4.7

□□□□□□□ACE□□□□□□□□□□□□□□□□

```
conn <- connect(connDetails)

sql <- "SELECT person_id AS subject_id,
  MIN(drug_exposure_start_date) AS cohort_start_date
INTO #first_use
FROM @cdm_db_schema.drug_exposure
INNER JOIN @cdm_db_schema.concept_ancestor
  ON descendant_concept_id = drug_concept_id
WHERE ancestor_concept_id IN (@ace_i)
GROUP BY person_id;"

renderTranslateExecuteSql(conn,
                          sql,
                          cdm_db_schema = cdmDbSchema,
                          ace_i = aceI)
```

DRUG_EXPOSURE□□□□□CONCEPT_ANCESTOR□□□□□□□□□□□□□□ACE□□□□□□

### 10.4.8 365

□□□OBSERVATION_PERIOD□□□□□□□□□□365□□□□□□□□□□□□□□□□□

```
sql <- "SELECT subject_id,
  cohort_start_date
INTO #has_prior_obs
FROM #first_use
INNER JOIN @cdm_db_schema.observation_period
  ON subject_id = person_id
    AND observation_period_start_date <= cohort_start_date
    AND observation_period_end_date >= cohort_start_date
WHERE DATEADD(DAY, 365, observation_period_start_date) < cohort_start_date;"
```

```
renderTranslateExecuteSql(conn, sql, cdm_db_schema = cdmDbSchema)
```

### 10.4.9

365□□□□□□□□□□□□□□□□

```
sql <- "SELECT DISTINCT subject_id,
  cohort_start_date
INTO #has_ht
FROM #has_prior_obs
INNER JOIN @cdm_db_schema.condition_occurrence
  ON subject_id = person_id
    AND condition_start_date <= cohort_start_date
    AND condition_start_date >= DATEADD(DAY, -365, cohort_start_date)
INNER JOIN @cdm_db_schema.concept_ancestor
  ON descendant_concept_id = condition_concept_id
WHERE ancestor_concept_id = @hypertension;"

renderTranslateExecuteSql(conn,
                          sql,
                          cdm_db_schema = cdmDbSchema,
                          hypertension = hypertension)
```

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### 10.4.10

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```
sql <- "SELECT subject_id,
  cohort_start_date
INTO #no_prior_ht_drugs
FROM #has_ht
LEFT JOIN (
  SELECT *
  FROM @cdm_db_schema.drug_exposure
  INNER JOIN @cdm_db_schema.concept_ancestor
    ON descendant_concept_id = drug_concept_id
  WHERE ancestor_concept_id IN (@all_ht_drugs)
) ht_drugs
  ON subject_id = person_id
    AND drug_exposure_start_date < cohort_start_date
WHERE person_id IS NULL;"

renderTranslateExecuteSql(conn,
```

```
                          sql,
                          cdm_db_schema = cdmDbSchema,
                          all_ht_drugs = allHtDrugs)
```

LEFT JOIN□□□□□□□□□DRUG_EXPOSURE□□□□□□□□person_id□NULL□□□□□□□□□□□

### 10.4.11

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```
sql <- "SELECT subject_id,
  cohort_start_date
INTO #monotherapy
FROM #no_prior_ht_drugs
INNER JOIN @cdm_db_schema.drug_exposure
  ON subject_id = person_id
    AND drug_exposure_start_date >= cohort_start_date
    AND drug_exposure_start_date <= DATEADD(DAY, 7, cohort_start_date)
INNER JOIN @cdm_db_schema.concept_ancestor
  ON descendant_concept_id = drug_concept_id
WHERE ancestor_concept_id IN (@all_ht_drugs)
GROUP BY subject_id,
  cohort_start_date
HAVING COUNT(*) = 1;"

renderTranslateExecuteSql(conn,
                          sql,
                          cdm_db_schema = cdmDbSchema,
                          all_ht_drugs = allHtDrugs)
```

### 10.4.12

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```
                                cdm_db_schema = cdmDbSchema,
                                ace_i = aceI)
```

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```
sql <- "
SELECT ends.person_id AS subject_id,
    ends.concept_id AS cohort_definition_id,
  MIN(exposure_start_date) AS cohort_start_date,
  ends.era_end_date AS cohort_end_date
INTO #exposure_era
FROM (
  SELECT exposure.person_id,
    exposure.concept_id,
    exposure.exposure_start_date,
    MIN(events.end_date) AS era_end_date
  FROM #exposure exposure
  JOIN (
--cteEndDates
    SELECT person_id,
      concept_id,
      DATEADD(DAY, - 1 * @max_gap, event_date) AS end_date
    FROM (
      SELECT person_id,
        concept_id,
        event_date,
        event_type,
        MAX(start_ordinal) OVER (
          PARTITION BY person_id ,concept_id ORDER BY event_date,
              event_type ROWS UNBOUNDED PRECEDING
          ) AS start_ordinal,
        ROW_NUMBER() OVER (
          PARTITION BY person_id, concept_id ORDER BY event_date,
            event_type
          ) AS overall_ord
      FROM (
-- select the start dates, assigning a row number to each
        SELECT person_id,
          concept_id,
          exposure_start_date AS event_date,
          0 AS event_type,
          ROW_NUMBER() OVER (
            PARTITION BY person_id, concept_id ORDER BY exposure_start_date
            ) AS start_ordinal
        FROM #exposure exposure

        UNION ALL
-- add the end dates with NULL as the row number, padding the end dates by
```

```
-- @max_gap to allow a grace period for overlapping ranges.

        SELECT person_id,
          concept_id,
          DATEADD(day, @max_gap, exposure_end_date),
          1 AS event_type,
          NULL
        FROM #exposure exposure
        ) rawdata
    ) events
  WHERE 2 * events.start_ordinal - events.overall_ord = 0
  ) events
  ON exposure.person_id = events.person_id
      AND exposure.concept_id = events.concept_id
      AND events.end_date >= exposure.exposure_end_date
  GROUP BY exposure.person_id,
      exposure.concept_id,
      exposure.exposure_start_date
  ) ends
GROUP BY ends.person_id,
  concept_id,
  ends.era_end_date;"

renderTranslateExecuteSql(conn,
                          sql,
                          cdm_db_schema = cdmDbSchema,
                          max_gap = 30)
```

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### 10.4.13

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### □□ 10.1. □□□□□□□□□□ATLAS□□□□□□□□□□□□□□

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- □□□NSAID□□□□□□□□□□□□□□□□□□□□□□□□□□□
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# Chapter 11

□□□□□□□□: *Anthony Sena & Daniel Prieto-Alhambra*

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Elm et al., 2008)

## 11.3

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Prevalence

Treemap | Table

Column visibility | Copy | CSV | Show 15 entries | Filter: hypertension

Showing 1 to 15 of 47 entries
(filtered from 15,907 total entries)

Previous 1 2 3 4 Next

| Concept Id | Name | Person Count | Prevalence | Records per person |
|---|---|---|---|---|
| 320128 | Essential hypertension | 17,814,076 | 12.30% | 5.80 |
| 312648 | Benign essential hypertension | 11,014,877 | 7.61% | 4.35 |
| 317898 | Malignant essential hypertension | 1,021,441 | 0.70% | 2.22 |
| 381290 | Ocular hypertension | 521,264 | 0.36% | 2.40 |
| 441922 | Transient hypertension of pregnancy | 209,317 | 0.14% | 2.45 |
| 44782429 | Chronic kidney disease due to hypertension | 170,534 | 0.12% | 3.60 |
| 137940 | Transient hypertension of pregnancy - delivered | 153,806 | 0.11% | 1.07 |
| 321080 | Hypertension complicating pregnancy, childbirth and the puerperium | 148,728 | 0.10% | 2.15 |
| 314423 | Benign essential hypertension complicating pregnancy, childbirth and the puerperium - not delivered | 132,245 | 0.09% | 3.94 |
| 44782690 | Chronic kidney disease stage 5 due to hypertension | 119,375 | 0.08% | 5.20 |
| 44783618 | Heritable pulmonary arterial hypertension | 104,737 | 0.07% | 3.61 |
| 319826 | Secondary hypertension | 96,356 | 0.07% | 2.14 |
| 4167493 | Pregnancy-induced hypertension | 91,675 | 0.06% | 2.60 |
| 321074 | Pre-existing hypertension complicating pregnancy, childbirth and puerperium | 74,311 | 0.05% | 2.99 |
| 192680 | Portal hypertension | 71,240 | 0.05% | 3.11 |

Showing 1 to 15 of 47 entries
(filtered from 15,907 total entries)

Previous 1 2 3 4 Next

Figure 11.4: Atlas Data Sources: Conditions with ”hypertension” found in the concept name

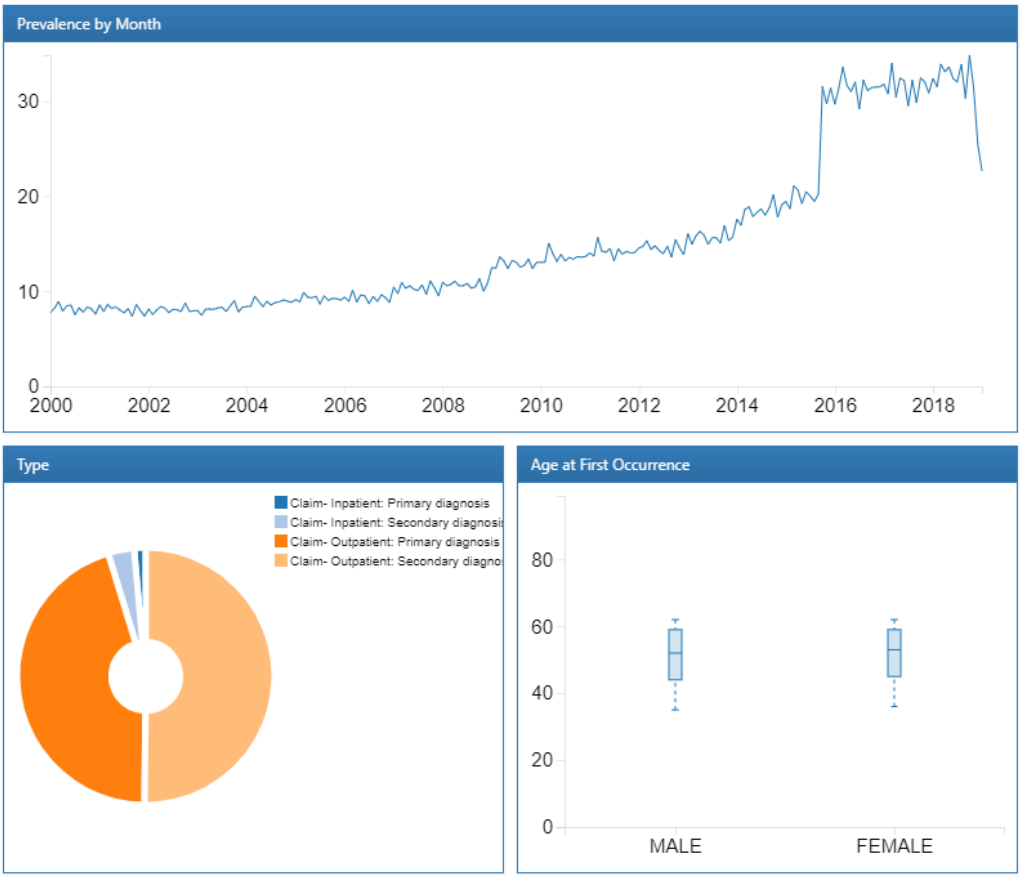


Figure 11.5: Atlas Data Sources: Essential hypertension drill down report

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Feature analyses

Import

Show 25 entries Search:

| ID | Name | Description | Actions |
|---|---|---|---|
| 43 | Drug Era Short Term | One covariate per drug in the drug_era table overlapping with any part of the short window. | Remove |
| 49 | Charlson Index | The Charlson comorbidity index (Romano adaptation) using all conditions prior to the window end. | Remove |
| 67 | Condition Occurrence Long Term | One covariate per condition in the condition_occurrence table starting in the long term window. | Remove |
| 71 | Demographics Age Group | Age of the subject on the index date (in 5 year age groups) | Remove |
| 72 | Demographics Race | Race of the subject. | Remove |
| 73 | Demographics Prior Observation Time | Number of continuous days of observation time preceding the index date. | Remove |
| 74 | Demographics Gender | Gender of the subject. | Remove |
| 76 | Condition Occurrence Medium Term | One covariate per condition in the condition_occurrence table starting in the medium term window. | Remove |
| 77 | Demographics Age | Age of the subject on the index date (in years). | Remove |
| 79 | Demographics Time In Cohort | Number of days of observation time during cohort period. | Remove |
| 80 | Demographics Index Year | Year of the index date. | Remove |
| 81 | Demographics Post Observation Time | Number of continuous days of observation time following the index date. | Remove |
| 87 | Procedure Occurrence Any Time Prior | One covariate per procedure in the procedure_occurrence table any time prior to index. | Remove |
| 103 | Visit Count Long Term | The number of visits observed in the long term window. | Remove |

Figure 11.7: □□□□□□ - □□□□

- **Medium term**: □□□□□□□□□□□180□□
- **Short term**: □□□□□□□□□□□30□□

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### 11.5.3

CONDITION / Condition Occurrence Long Term / stratified by Female

Export | Export comparison | Show 10 entries | Search: cardi

| Covariate | Explore | Concept ID | Patients initiating first-line therapy for hypertension with >1 yr follow-up | | | | Patients initiating first-line therapy for hypertension with >3 yr follow-up | | | | Std diff |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Count | Pct | Female | | Count | Pct | Female | | |
| | | | | | Count | Pct | | | Count | Pct | |
| Tachycardia | Explore | 444070 | 17,322 | 1.04% | 9,042 | 1.18% | 6,547 | 0.78% | 3,530 | 0.90% | -0.0193 |
| Cardiomegaly | Explore | 314658 | 20,958 | 1.26% | 8,007 | 1.04% | 9,016 | 1.08% | 3,465 | 0.89% | -0.0121 |
| Cardiac arrhythmia | Explore | 44784217 | 30,474 | 1.83% | 13,221 | 1.72% | 14,540 | 1.74% | 6,318 | 1.62% | -0.0052 |

Showing 1 to 3 of 3 entries (filtered from 206 total entries) Previous 1 Next

Figure 11.10: □□□□ - □□1□□□□□□□

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Exploring condition_occurrence during day -365 through 0 days relative to index: Cardiac arrhythmia ×

Cohort: Patients initiating first-line therapy for hypertension with >1 yr follow-up

Export Show 10 entries Search:

| Relationship type | | Distance | Concept name | All stratas | | Female | |
|---|---|---|---|---|---|---|---|
| | | | | Count | Pct | Count | Pct |
| Explore | Ancestor | 4 | Disorder by body site | 32 | 0.00% | 17 | 0.00% |
| Explore | Ancestor | 4 | Finding of trunk structure | 991 | 0.06% | 605 | 0.08% |
| Explore | Ancestor | 3 | Disorder of trunk | 23 | 0.00% | 14 | 0.00% |
| Explore | Ancestor | 3 | Disorder of thorax | 241 | 0.01% | 104 | 0.01% |
| Explore | Ancestor | 3 | Disorder of body system | 4,135 | 0.25% | 1,992 | 0.26% |
| Explore | Ancestor | 2 | Disorder of cardiovascular system | 12,979 | 0.78% | 6,073 | 0.79% |
| Explore | Ancestor | 2 | Disorder of mediastinum | 138 | 0.01% | 62 | 0.01% |
| Explore | Ancestor | 2 | Disorder of body cavity | 24 | 0.00% | 10 | 0.00% |
| Explore | Ancestor | 1 | Heart disease | 4,691 | 0.28% | 1,869 | 0.24% |
| Explore | Selected | 0 | Cardiac arrhythmia | 30,474 | 1.83% | 13,221 | 1.72% |

Showing 1 to 10 of 62 entries Previous 1 2 3 4 5 6 7 Next

Figure 11.11: □□□□ - □□□□□□□

CONDITION / Condition Occurrence Long Term / stratified by Female

Export Export comparison Show 10 entries Search: edema

| Covariate | Explore | Concept ID | Patients initiating first-line therapy for hypertension with >1 yr follow-up | | | | Patients initiating first-line therapy for hypertension with >3 yr follow-up | | | | Std diff |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Count | Pct | Female | | Count | Pct | Female | | |
| | | | | | Count | Pct | | | Count | Pct | |
| Edema | Explore | 433595 | 32,243 | 1.94% | 20,200 | 2.63% | 15,173 | 1.81% | 9,684 | 2.48% | -0.0066 |

Showing 1 to 1 of 1 entries (filtered from 206 total entries) Previous 1 Next

Figure 11.12: □□□□ - □□□□□□□

Exploring condition_occurrence during day -365 through 0 days relative to index: Edema

Cohort: Patients initiating first-line therapy for hypertension with >1 yr follow-up

Export Show 10 entries Search: ang

| Relationship type | Distance | Concept name | All stratas | | Female | |
|---|---|---|---|---|---|---|
| | | | Count | Pct | Count | Pct |
| Explore Descendant | -2 | Angioedema | 2,605 | 0.16% | 1,506 | 0.20% |

Showing 1 to 1 of 1 entries (filtered from 56 total entries) Previous 1 Next

Figure 11.13: □□□□ - □□□□□□□□□□□

DEMOGRAPHICS / Demographics Age

Export Export comparison Show 10 entries Search:

| Strata | Patients initiating first-line therapy for hypertension with >1 yr follow-up | | | | Patients initiating first-line therapy for hypertension with >3 yr follow-up | | | | Std diff |
|---|---|---|---|---|---|---|---|---|---|
| | Count | Avg | Std Dev | Median | Count | Avg | Std Dev | Median | |
| Female | 768,180 | 49.39 | 9.78 | 51.00 | 390,693 | 49.01 | 9.03 | 51.00 | -0.0291 |
| All stratas | 1,661,604 | 48.96 | 10.00 | 50.00 | 837,459 | 48.64 | 9.26 | 50.00 | -0.0232 |

Showing 1 to 2 of 2 entries Previous 1 Next

Figure 11.14: □□□□□□□□□□□□□□□□□□□□□□

Design

Criteria Custom

Analysis type:

Prevalence

Add Criteria feature

Ace inhibitor exposure after index

having all of the following criteria: Add criteria to group...

with at least 1 using all occurrences of:

a drug era of ACE inhibitors Add attribute...

where event starts between 1 days After and All days After index start date add additional constraint

allow events from outside observation period

Delete Criteria

Figure 11.15: ATLAS□□□□□□□□□□□

DRUG / Ace inhibitor exposure after index / stratified by Female

Export | Export comparison | Show 10 entries | Search:

| Covariate | Explore | Concept ID | Patients initiating first-line therapy for hypertension with >1 yr follow-up | | | | Patients initiating first-line therapy for hypertension with >3 yr follow-up | | | | Std diff |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Count | Pct | Female | | Count | Pct | Female | | |
| | | | | | Count | Pct | | | Count | Pct | |
| Ace inhibitor exposure after index | Explore | 0 | 686,034 | 41.29% | 289,215 | 17.41% | 426,280 | 50.90% | 182,219 | 21.76% | 0.1001 |

Showing 1 to 1 of 1 entries | Previous 1 Ne

Figure 11.16: □□□□□□□□□□□

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FeatureExtraction□□□□□□□□□□□□□□□□□□□□□□□2□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

## 11.6.1

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```
settings <- createCovariateSettings(
  useDemographicsGender = TRUE,
  useDemographicsAgeGroup = TRUE,
  useConditionOccurrenceAnyTimePrior = TRUE)
```

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```
covariateSettings <- createDefaultCovariateSettings()

covariateData2 <- getDbCovariateData(
  connectionDetails = connectionDetails,
  cdmDatabaseSchema = cdmDatabaseSchema,
  cohortDatabaseSchema = resultsDatabaseSchema,
  cohortTable = "cohorts_of_interest",
  cohortId = 1,
  covariateSettings = covariateSettings,
  aggregated = TRUE)

summary(covariateData2)
```

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```
## CovariateData Object Summary
##

## Number of Covariates: 41330

## Number of Non-Zero Covariate Values: 41330
```

### 11.6.5

□□□□□covariateData□□□□□□□□□□□□□□□

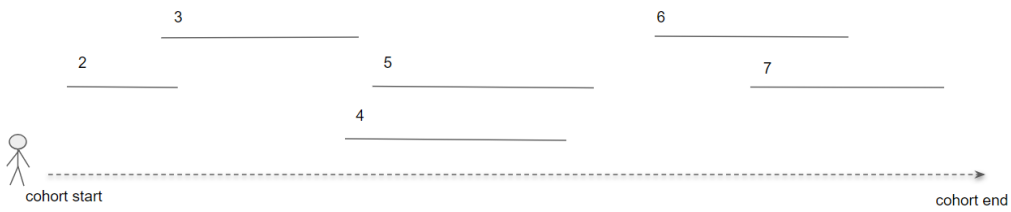


Figure 11.17: □□□□□□□□□□□□□□□□□□□□□□

## 11.6.7

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22.6, 22.7□□□□□□□□□□□□2□□□□□□□□□□□□□□□□□□□□

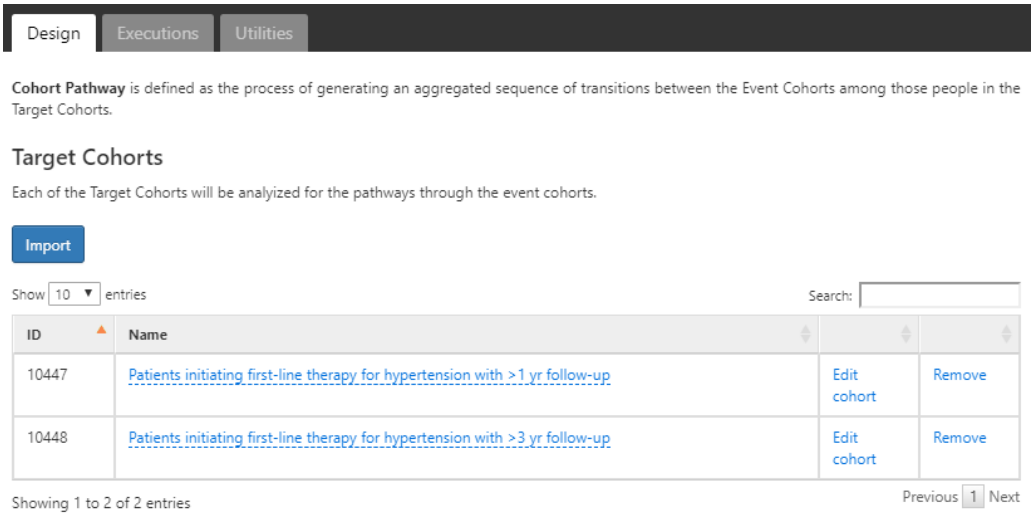


Figure 11.18: □□□□□□□□□□□□□□□□□□□□□□□□

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## Event Cohorts

Each Event Cohort defines the step in a pathway that may occur for a person in the Target Cohort.

Import

Show 10 entries Search:

| ID | Name | | |
|---|---|---|---|
| 9174 | ACE inhibitor use | Edit cohort | Remove |
| 9175 | Angiotensin receptor blocker (ARB) use | Edit cohort | Remove |
| 9176 | Thiazide or thiazide-like diuretic use | Edit cohort | Remove |
| 9177 | dihydropyridine Calcium Channel Blocker (dCCB) use | Edit cohort | Remove |
| 9178 | non-dihydropyridine Calcium Channel Blocker (ndCCB) use | Edit cohort | Remove |
| 9179 | beta blocker use | Edit cohort | Remove |
| 9180 | Diuretic-loop use | Edit cohort | Remove |
| 9181 | Diuretic-potassium sparing use | Edit cohort | Remove |
| 9182 | alpha-1 blocker use | Edit cohort | Remove |

Showing 1 to 9 of 9 entries Previous 1 Next

Figure 11.19: □□□□

### 11.6.9

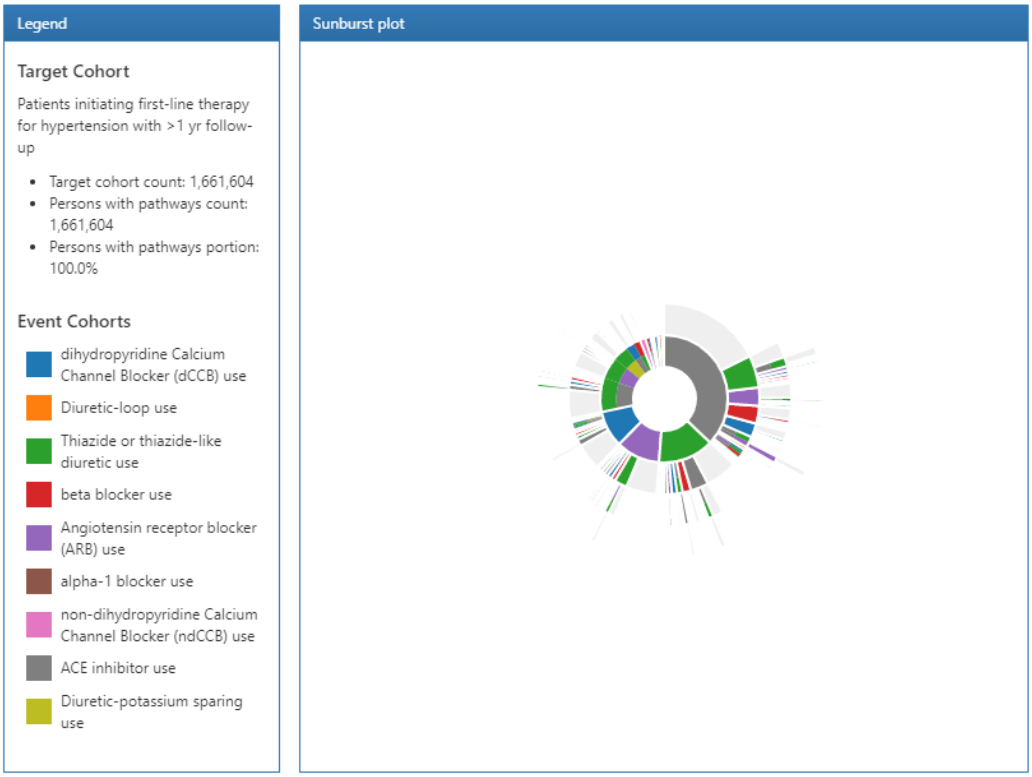


Figure 11.20: □□□□□□□□□□□□□

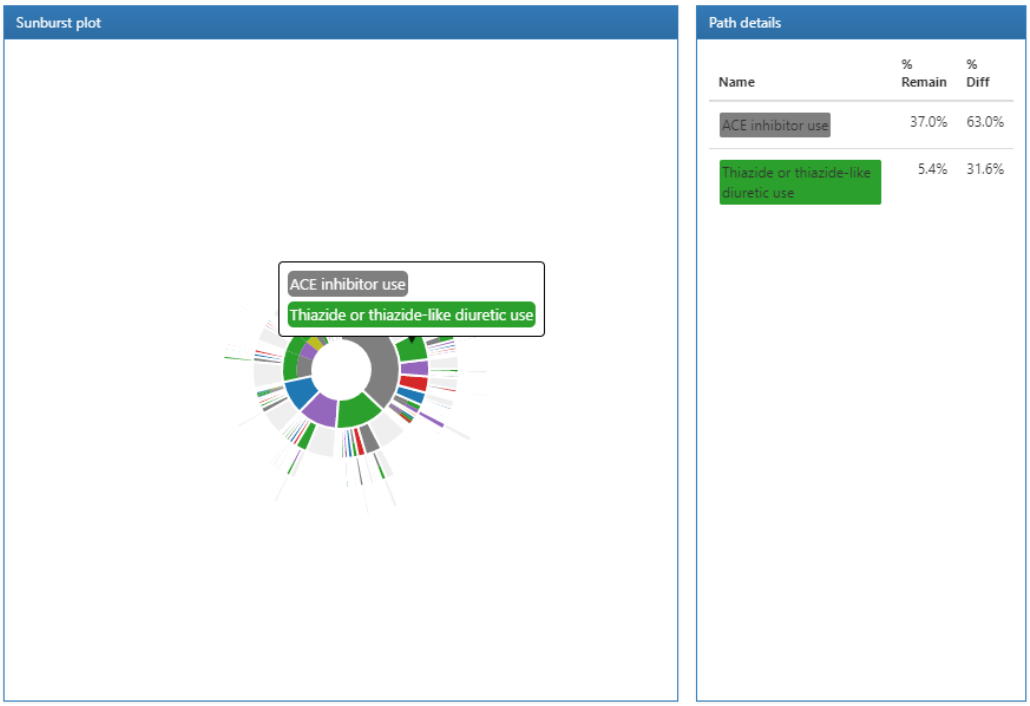


Figure 11.21: □□□□□□□□□□□□□□□□□□□

azidesMono)) □□□□□□□□□□□□□ (Appendix **?**(Angioedema), **?**(Ami), **?**(ARBUse)) □□□□□□□□□□□□□□□□□

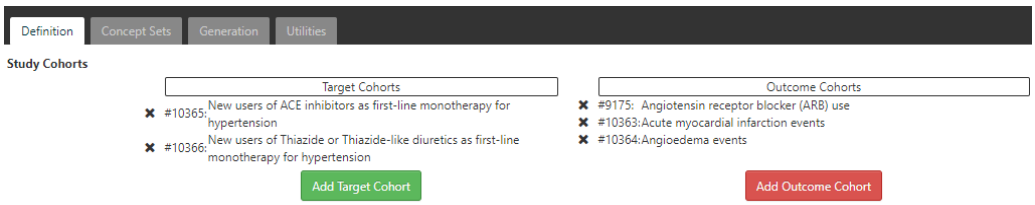


Figure 11.22: □□□□□□□□□□□□□□□□□□□□□□

□□□□□□ *New users of ACE inhibitors* □□□□□ *New users of Thiazide or Thiazide-like diuretics* □□□□□□□□□□□□□□□□□□□□

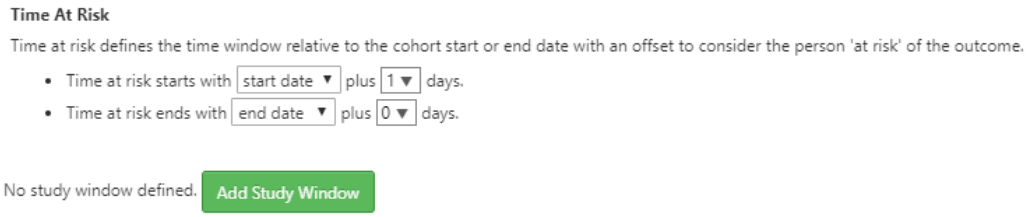


Figure 11.23: □□□□□□□□□□□□□□□□□□□□□□□□

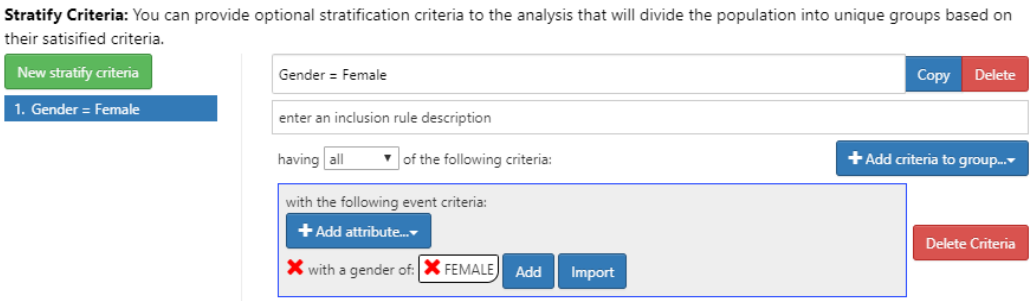


Figure 11.24: □□□□□□□□□□□□□□

## 11.6.11

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| | Persons | Cases | Proportion [+\|-] per 1k persons | Time At Risk (years) | Rate [+\|-] per 1k years |
|---|---|---|---|---|---|
| Summary Statistics: | 816,867 | 1,703 | 2.08 | 623,402 | 2.73 |

| Stratify Rule | N | Cases | Proportion [+\|-] per 1k persons | Time At Risk (years) | Rate [+\|-] per 1k years |
|---|---|---|---|---|---|
| 1. Gender = Female | 313,518 | 416 | 1.33 | 230,157 | 1.81 |

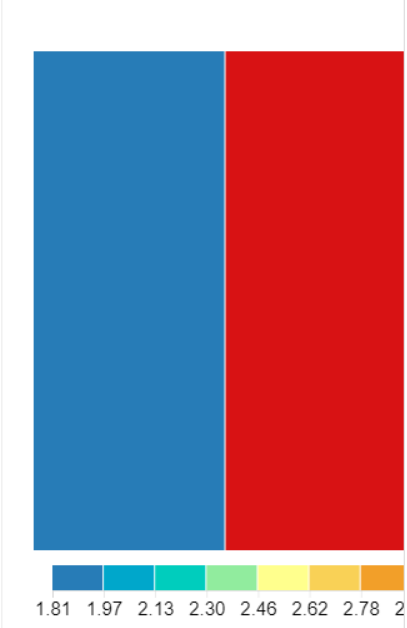


Figure 11.26: □□□□□□□□□ - AMI □□□□□□□□□□□□ ACEi □□□□

□□□□□□□□□□□□□□TAR □□□□□□□□□□□□□□□□□□□□

| | Persons | Cases | Proportion [+\|-] per 1k persons | Time At Risk (years) | Rate [+\|-] per 1k years |
|---|---|---|---|---|---|
| Summary Statistics: | 818,520 | 43,868 | 53.59 | 621,094 | 70.63 |

| Stratify Rule | N | Cases | Proportion [+\|-] per 1k persons | Time At Risk (years) | Rate [+\|-] per 1k years |
|---|---|---|---|---|---|
| 1. Gender = Female | 313,832 | 21,049 | 67.07 | 228,369 | 92.17 |

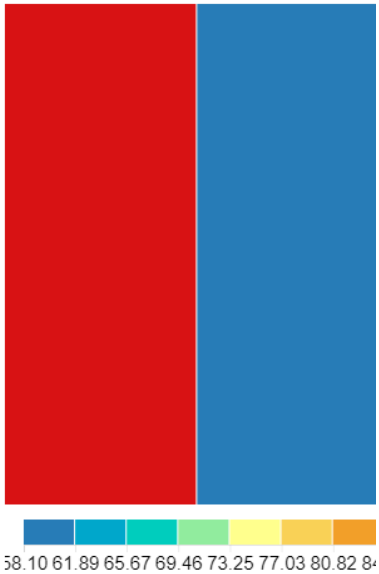


Figure 11.27: □□□ - ACEi □□□□ ARB □□□□□□□□□□□ ACEi □□□□

## 11.8

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□□□□□□□□□□ATLAS □□□□□□□□□□□□□□□□□□□□□http://atlas-demo.ohdsi.org □□□□□□□□□□□□□□□□□□□□

# Chapter 12

□□□□□□□□□: *Martijn Schuemie, David Madigan, Marc Suchard & Patrick Ryan*

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Table 12.2: □□□□□□□□□□□□□□□□□□□□□□□□□

| Choice | Description |
|---|---|
| Target cohort | □□□□□□□□□□ |
| Outcome cohort | □□□□□□□□□□□□□□□ |
| Time-at-risk | □□□□□□□□□□□□□□□□□□□□

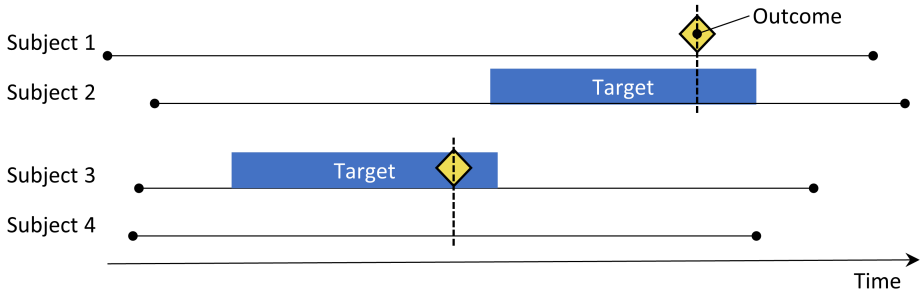
Outcome
Subject 1
Subject 2
Target
Subject 3
Target
Subject 4
Time

Figure 12.3: □□□□□□□□

Table 12.4: □□□□□□□□□□□□□□□□□□□□

| Choice | Description |
|---|---|
| Outcome cohort | □□□□□□□□□□□□□□□□□□□□ |
| Target cohort | □□□□□□□□□□ |
| Time-at-risk | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| Control time | □□□□□□□□□□□□□□□□□□□□ |

Table 12.5: □□□□□□□□□□□□□□□□□□□□□□□□

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| □□□□□ | □□□□□□□□□□□□□□□□□□□□

et al., 2012)□□□□□□□□□□□□ACEi□β□□□□□□□□□□□□

### 12.3.8

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Negative controls for ACEi and THZ

Optimize

Concept Set Expression | Included Concepts 75 | Included Source Codes | Explore Evidence | Export | Compare

Show 25 entries

Search:

Showing 1 to 25 of 75 entries

Previous 1 2 3 Next

| Concept Id | Concept Code | Concept Name | Domain | Standard Concept Caption | Exclude | Descendants | Mapped |
|---|---|---|---|---|---|---|---|
| 72748 | 74779009 | Strain of rotator cuff capsule | Condition | Standard | | | |
| 73241 | 197210001 | Anal and rectal polyp | Condition | Standard | | | |
| 73560 | 55260003 | Calcaneal spur | Condition | Standard | | | |
| 75911 | 65358001 | Acquired hallux valgus | Condition | Standard | | | |
| 76786 | 63643000 | Derangement of knee | Condition | Standard | | | |

Figure 12.7: □□□□□□□□□□□□□□□□□□□□

Concept Set #1798551

Concepts to exclude for ACEi and THZ

Optimize

Concept Set Expression | Included Concepts 38225 | Included Source Codes | Explore Evidence | Export | Compare

Show 25 entries

Search:

Showing 1 to 14 of 14 entries

Previous 1 Next

| Concept Id | Concept Code | Concept Name | Domain | Standard Concept Caption | Exclude | Descendants | Mapped |
|---|---|---|---|---|---|---|---|
| 1342439 | 38454 | trandolapril | Drug | Standard | | ✓ | |
| 1334456 | 35296 | Ramipril | Drug | Standard | | ✓ | |
| 1331235 | 35208 | quinapril | Drug | Standard | | ✓ | |
| 1373225 | 54552 | Perindopril | Drug | Standard | | ✓ | |
| 1310756 | 30131 | moexipril | Drug | Standard | | ✓ | |

Figure 12.8: □□□□□□□□□□□□□□□□□□□□

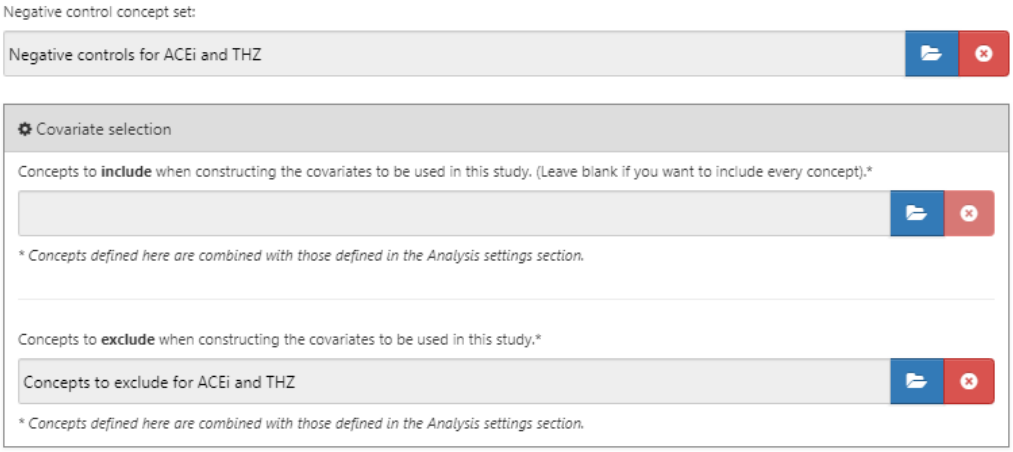
Negative control concept set:
Negative controls for ACEi and THZ
Covariate selection
Concepts to **include** when constructing the covariates to be used in this study. (Leave blank if you want to include every concept).*
* Concepts defined here are combined with those defined in the Analysis settings section.
Concepts to **exclude** when constructing the covariates to be used in this study.*
Concepts to exclude for ACEi and THZ
* Concepts defined here are combined with those defined in the Analysis settings section.

Figure 12.9: □□□□□□□□□□□□

```
library(CohortMethod)
connDetails <- createConnectionDetails(dbms = "postgresql",
                                       server = "localhost/ohdsi",
                                       user = "joe",
                                       password = "supersecret")

cdmDbSchema <- "my_cdm_data"
cohortDbSchema <- "scratch"
cohortTable <- "my_cohorts"
cdmVersion <- "5"
```

□□□4□□cdmDbSchema□cohortDbSchema□□□□cohortTable□□□□CDM□□□□□□□□□□□□□
SQL Server□□□□□□□□□□□□□

```
## CohortMethodData
##
##     ID 1
##       ID 2
##      ID(s) 3
```

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(?(CohortMethod))□□□□□□□□□□□□□□□□□□□

□□□□□1□□□□□□□□□□□□□□□□CohortMethod□□□□□□□□□□□□□□□□

### 12.3.14

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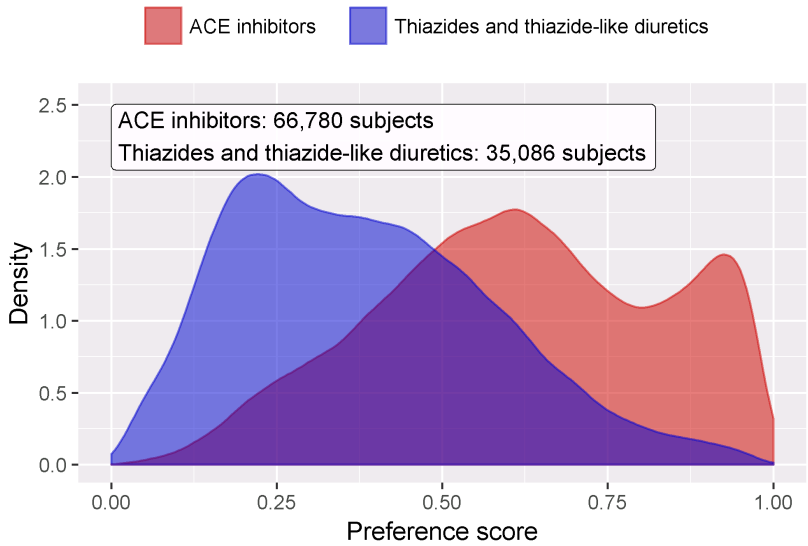


Figure 12.10: □□□□□□□□

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| -1.42 | □□□□□-30□□□0□□□□□□□□□□□□: □□ |
| -1.11 | □□□□□0□□□0□□□□□□□□□□□□: □□□□□□ |
| 0.68 | □□□□□□: 05-09 |
| 0.64 | □□□□□-365□□□0□□□□□□□□□□: □□□ |
| 0.63 | □□□□□-30□□□0□□□□□□□□□□□□: □□□ |
| 0.57 | □□□□□-30□□□0□□□□□□□□□□□□: □□□□□ |
| 0.55 | □□□□□-365□□□0□□□□□□□□□□□□: □□□□□□□□□□ |
| -0.54 | □□: □□□□□□□□□□□□□□□□ |
| 0.52 | (□□) |
| 0.50 | □□: □□ |

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### 12.3.17

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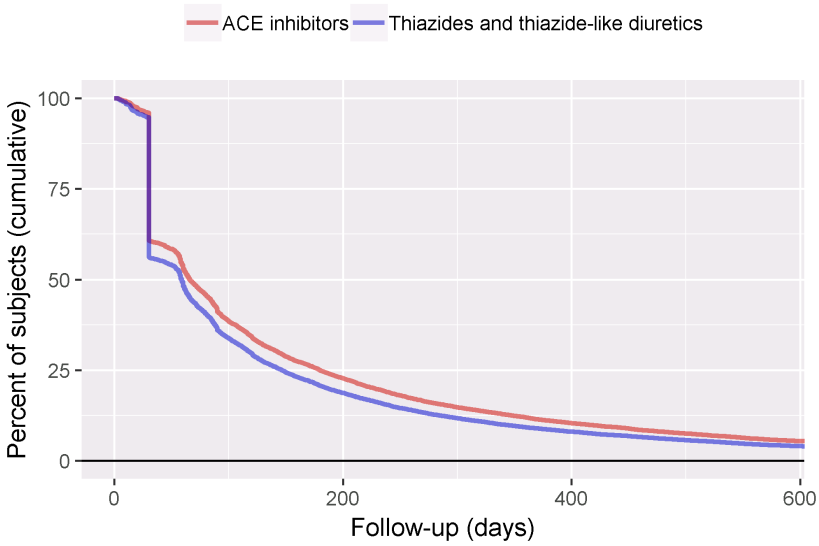
ACE inhibitors
Thiazides and thiazide-like diuretics
Percent of subjects (cumulative)
100
75
50
25
0
0
200
400
600
Follow-up (days)

Figure 12.13: □□□□□□□□

## 12.4

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□□ **12.6.** PS□□□□□□□□

# Chapter 13

□□□□□: *Peter Rijnbeek & Jenna Reps*

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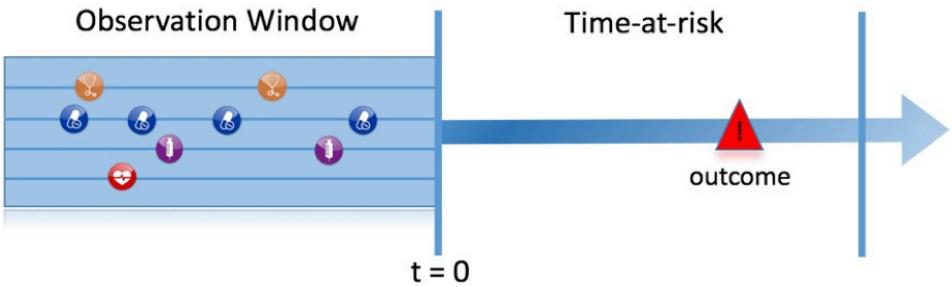


Figure 13.1: □□□□□

□□ □□□□CONDITION_OCCURRENCE□□□□□□□□□□□□□3□□□□□□□□□□□□□□□

| PERSON_ID | CONDITION_CONCEPT_ID | CONDITION_START_DATE |
|---|---|---|
| 1 | 320128 | 2000-10-01 |
| 2 | 320128 | 2001-05-01 |

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|---|---|---|

### 13.1.6 K-

K-nearest neighbors (KNN) □□□□□

### 13.1.10

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### 13.1.14

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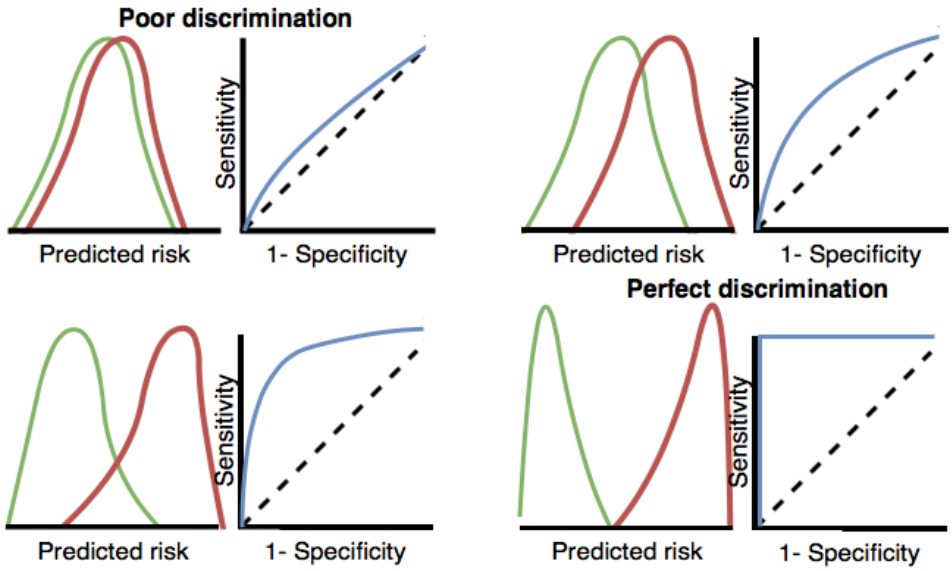


Figure 13.3: □□□□□□□□□ROC□□□□□□2□□□□□□□□

### 13.1.16

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### 13.2.1

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**Gradient Boosting Machine Model Settings**
Use the options below to edit the model settings

The boosting learn rate (default = 0.01,0.1):

| Boosting learn rate | Action |
|---|---|
| 0.001 | Remove |
| 0.01 | Remove |
| 0.1 | Remove |
| 0.9 | Remove |
| | Add / Reset to default |

Maximum number of interactions - a large value will lead to slow model training (default = 4,6,17):

| Maximum number of interactions | Action |
|---|---|
| 4 | Remove |
| 7 | Remove |
| 10 | Remove |
| | Add / Reset to default |

The minimum number of rows required at each end node of the tree (default = 20):

| Minimum number of rows | Action |
|---|---|
| 20 | Remove |
| | Add / Using default |

The number of trees to build (default = 10,100):

| Trees to build | Action |
|---|---|
| 5000 | Remove |
| | Add / Reset to default |

The number of computer threads to use (how many cores do you have?) (default = 20):

20 Using default

Figure 13.5: □□□□□□□□□□□□□□□□

**model? (Leave blank if you want to include everything)□□□□□□

- □□ [□□□□□□-365□□□□□□□□□□□□□□]
- □□ [□□□□□□-180□□□□□□□□□□□□□□]
- □□ [□□□□□□-30□□□□□□□□□□□□□□]

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Time bound covariates

Set the time windows for the time bound covariates in days relative to the cohort index

| | Any Time Prior | Long Term | Medium Term | Short Term | End Days |
|---|---|---|---|---|---|
| Time Windows | All Time | -365 | -180 | -30 | 0 |

Figure 13.8: □□□□□□□□□□□.

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- Condition: □□□□□□□□□□□□□□□□□□□□ID□□□□□□□□□□□□□□□□□□□

### 13.2.3

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```
  useDrugGroupEraLongTerm = TRUE,
  useDrugGroupEraAnyTimePrior = TRUE,
  useVisitConceptCountLongTerm = TRUE,
  longTermStartDays = -365,
  endDays = -1)
```

□□□□□□□□□□□□□□□getPlpData□□□□□□□□□□□□□□□

```
                                    minTimeAtRisk = 364,
                                    requireTimeAtRisk = TRUE,
                                    includeAllOutcomes = TRUE,
                                    verbosity = "DEBUG"
)
```

### 13.2.6

□□□□□□□

```
savePlpResult(gbmResults, location = "gbmResults")
```

□□□□□□□□□□□□□□□□□□

```
gbmResults <- loadPlpResult("gbmResults")
```

### 13.2.7

□□□□□□□□□□runPlp□□□□□□□□□□□□□□□□□□□□□□□/□□□□□□□□□□□□□□□□□□□

```
plpResult <- loadPlpResult(file.path(outputFolder,
                                     'Analysis_1',
                                     'plpResult'))
```

□□□□Analysis_1□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□Shiny□□□□□□□□□□□□□□□□□□

```
viewPlp(plpResult)
```

Shiny□□□□□□□□□□□□□□□□□□□

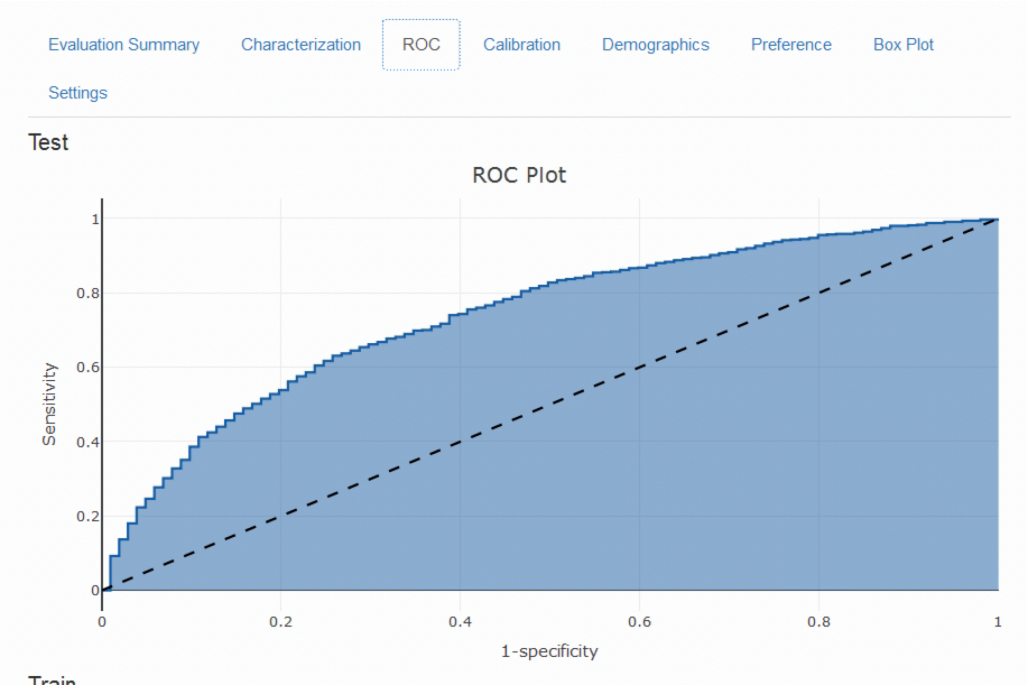


Figure 13.11: ROC□□□□□

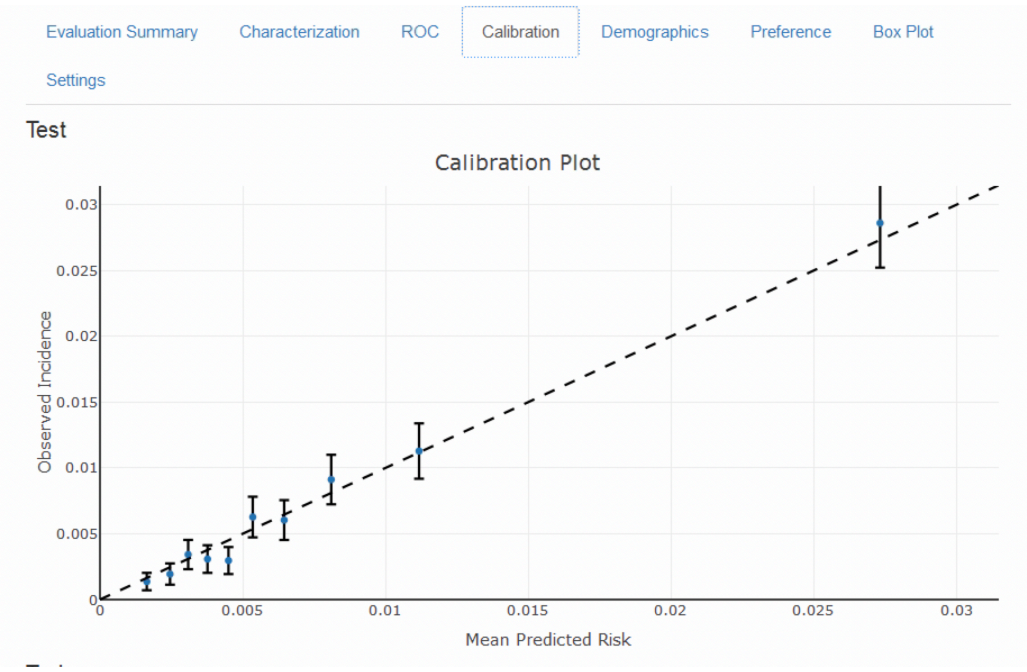


Figure 13.12: □□□□□□□□□□□□□□

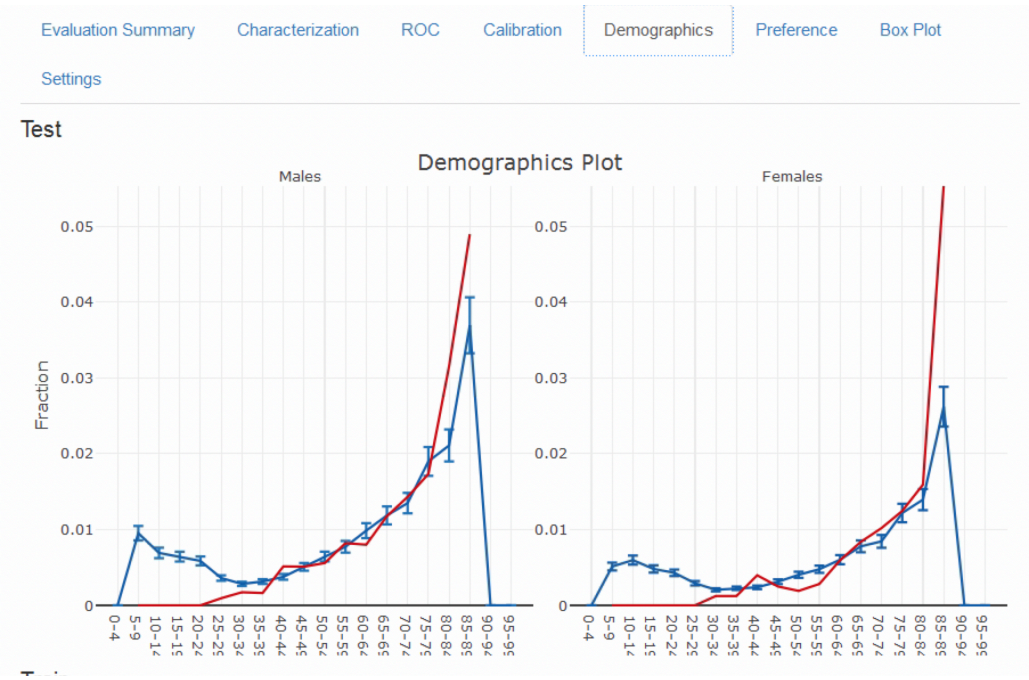


Figure 13.13: □□□□□□□□□□□□□□□□□□□□□

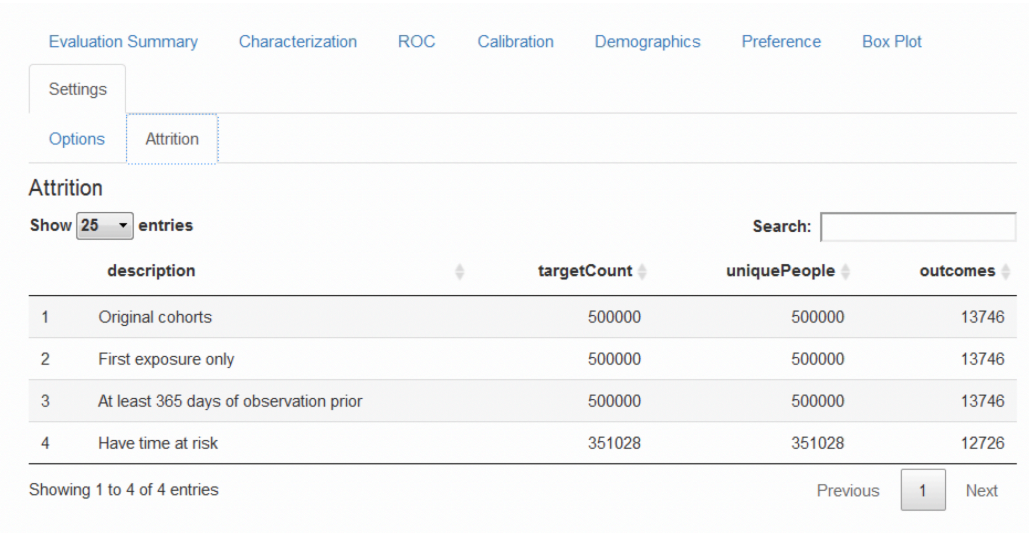


Figure 13.14: □□□□□□□□attrition□□□□

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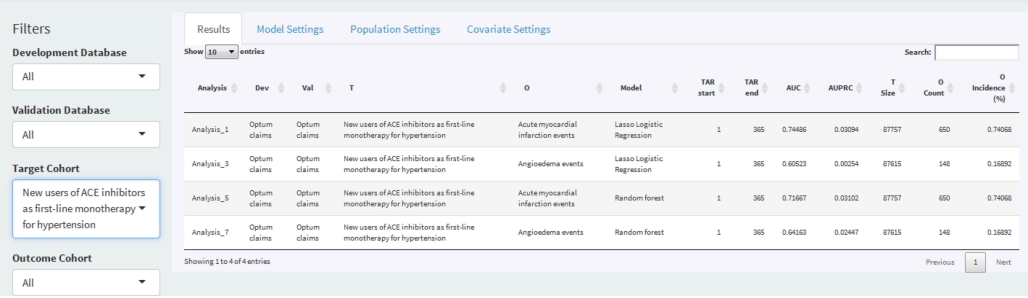


Figure 13.15: □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□Shiny□□□□□□□

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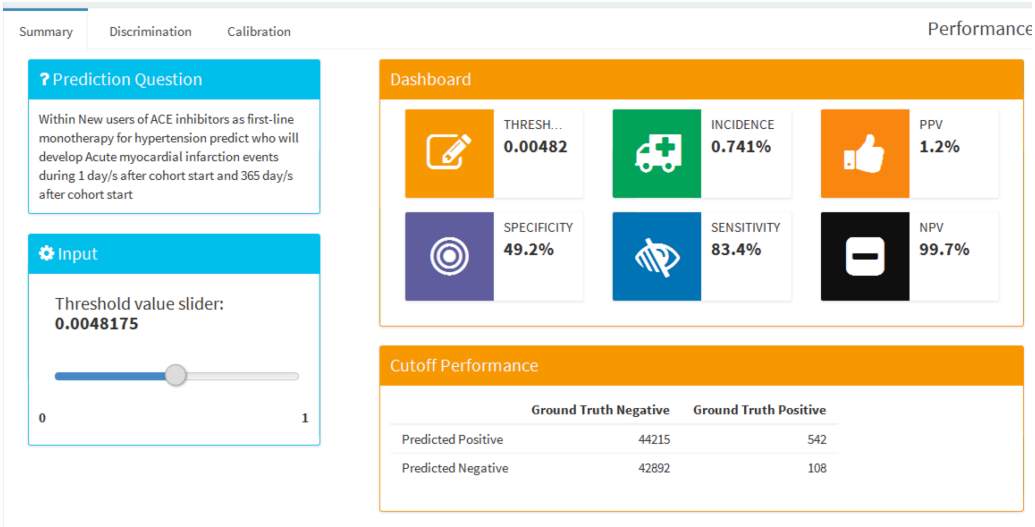


Figure 13.17: □□□□□□□□□□□□□□□□□□□□□□□□□□□□

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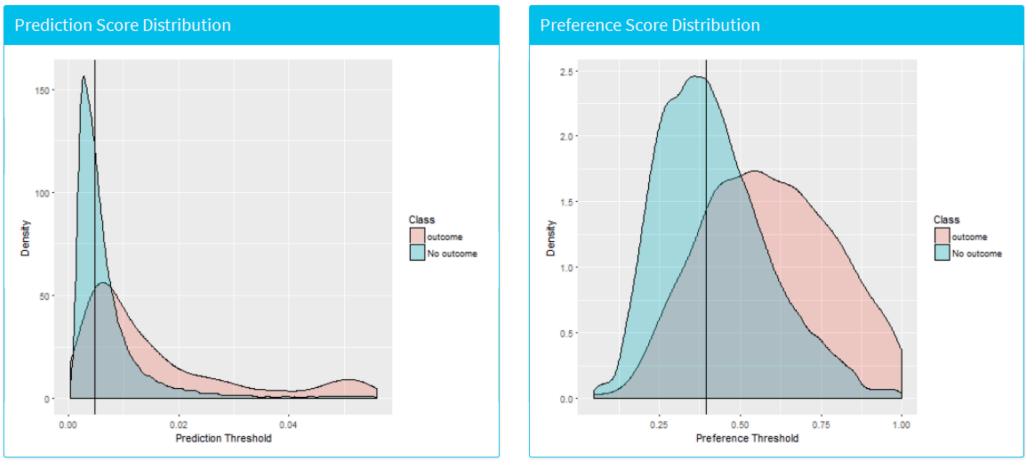


Figure 13.19: □□□□□□□□□□□□outing□□□□□□□□□□□

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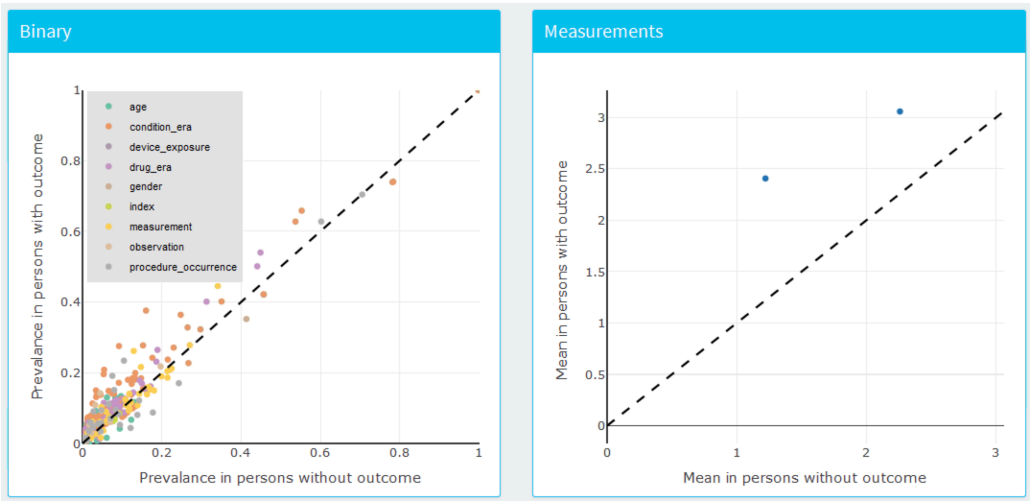


Figure 13.21: □□□□□□□□□□□□□□□□□□□□

Model Table

Download Model

Show 10 entries

Search:

| | Covariate Name | Value | Outcome Mean | Non-outcome Mean |
|---|---|---|---|---|
| 1 | age group: 00-04 | 0 | 0.0004 | 0.0001 |
| 2 | age group: 05-09 | 0 | 0 | 0.0003 |
| 3 | index month: 1 | 0 | 0.1307 | 0.1096 |
| 4 | observation during day -365 through 0 days relative to index: Domain | 0 | 0.1188 | 0.0514 |
| 5 | Charlson index - Romano adaptation | 0 | 2.4783 | 1.3817 |
| 6 | Diabetes Comorbidity Severity Index (DCSI) | 0.1478 | 2.4056 | 1.2207 |
| 7 | CHADS2VASc | 0.9279 | 3.0573 | 2.2576 |
| 8 | visit_occurrence concept count during day -365 through 0 concept_count relative to index | 0 | 19.5263 | 13.8837 |
| 9 | age group: 10-14 | 0 | 0 | 0.001 |
| 10 | index month: 2 | 0 | 0.0934 | 0.0909 |

Showing 1 to 10 of 67,897 entries Previous 1 2 3 4 5 ... 6790 Next

Figure 13.22: □□□□□□□□□□□

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## 13.4

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# Chapter 14

□□□□□□□□: *Patrick Ryan & Jon Duke*

## 14.1

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## 14.2

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# Chapter 15

□□□□□: *Martijn Schuemie, Vojtech Huser & Clair Blacketer*

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16□Chapter 17□Chapter 18 □□□□□□□□□□□□□ ## □□□□□□□□□□

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(2016) □□□□□□□□□□□□□□□□□□□□DQ□□□□3□□□□□□□□□□□□□□□□□□□□□□

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|---|---|---|---|
| 0.99 | MEASUREMENT □□□□□ measurement_source_value □□□□□□□□□□□□□□□□□□□□□□□□□□□□ 0 □□□□□□□□□□□□□ | 0.30 | FAIL |
| 0.09 | DRUG_ERA □□□□□ drug_concept_id □□□□□□□□□□□□□□□□□□□□

□□□□□□Rabbit-in-a-Hat □□□□□□□

## 15.2

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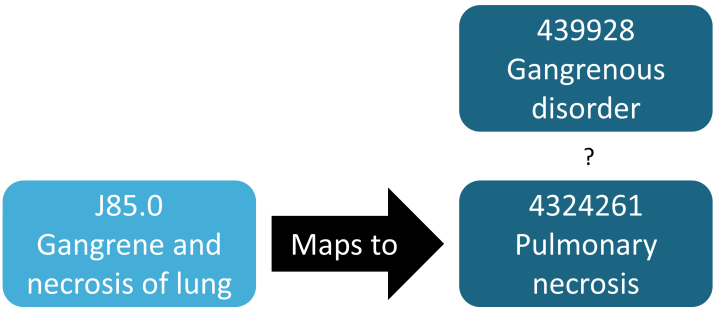


Figure 15.3: □□□□□□□□□□□□□□□□□□

## 15.3 ACHILLES

□□□□□CDM□□□□□□□□□□□□□□□ACHILLES□□□□□□□□□□□□□□□

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```
library(Achilles)
connDetails <- createConnectionDetails(dbms = "postgresql",
                                       server = "localhost/ohdsi",
                                       user = "joe",
                                       password = "supersecret")

cdmDbSchema <- "my_cdm_data"
cdmVersion <- "5.3.0"
```

□□□2□□ `cdmDbSchema` □□□CDM□□□□□□□□□□□□□□□□□□□□□□□CDM□□□□□□□□□□□□□□□□□□□

```
DataQualityDashboard::executeDqChecks(connectionDetails = connectionDetails,
                                      cdmDatabaseSchema = cdmDbSchema,
                                      resultsDatabaseSchema = cdmDbSchema,
                                      cdmSourceName = "My database",
                                      outputFolder = "My output")
```

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# RESULTS

## SYNTHEA SYNTHETIC HEALTH DATABASE

Results generated at 2019-08-22 14:15:06 in 29 mins

Column visibility CSV

Show 5 entries Search:

| STATUS | CONTEXT | CATEGORY | SUBCATEGORY | LEVEL | DESCRIPTION | % RECORDS |
|---|---|---|---|---|---|---|
| FAIL | Verification | Plausibility | Atemporal | FIELD | The number and percent of records with a value in the gap_days field of the DRUG_ERA table less than 0. (Threshold=0%). | 24.07% |
| FAIL | Verification | Completeness | None | FIELD | The number and percent of records with a value of 0 in the standard concept field race_concept_id in the PERSON table. (Threshold=0%). | 16.74% |
| FAIL | Verification | Conformance | Relational | FIELD | The number and percent of records that have a value in the ethnicity_concept_id field in the PERSON table that does not exist in the CONCEPT table. (Threshold=0%). | 16.15% |
| PASS | Verification | Completeness | None | FIELD | The number and percent of records with a NULL value in the condition_end_date of the CONDITION_OCCURRENCE. (Threshold=100%). | 13.24% |
| PASS | Verification | Completeness | None | FIELD | The number and percent of records with a NULL value in the condition_end_datetime of the CONDITION_OCCURRENCE. (Threshold=100%). | 13.24% |

Showing 71 to 75 of 1,327 entries (filtered from 1,639 total entries) Previous 1 ... 14 15 16 ... 266 Next

Figure 15.5: Data Quality Dashboard□□□□□□□□□□□□□□□□□□□

```
                    cdmDatabaseSchema = cdmDbSchema,
                    cohortJson = json,
                    cohortSql = sql,
                    outputFile = "output.html")
```

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9□□□□□□□□ICD-10□□□□□□□□□□□□□□□□□□□

| □□□ | □□ | □□ID | □□□□□□□ |
|---|---|---|---|
| 148774 | Angioneurotic Edema of Larynx | CIEL | 0 |
| 402383003 | Idiopathic urticaria and/or angioedema | SNOMED | 0 |
| 232437009 | Angioneurotic edema of larynx | SNOMED | 0 |
| 10002472 | Angioneurotic edema, not elsewhere classified | MedDRA | 0 |

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□”Angioneurotic edema, sequela”□□□□□□□□□□□□□□□□□□□

| ‰ per month | Max monthly ‰ | Person count | Description |
|---|---|---|---|
| | 60.60 | 24,189,656 | **Inpatient or ER visit** |
| | 39.50 | 15,003,249 | **Emergency Room Visit** 9203 |
| | 39.50 | 15,003,249 | ER (None) No matching concept |
| | 23.90 | 9,186,407 | **Inpatient Visit** 9201 |
| | 23.90 | 9,186,407 | IP (None) No matching concept |
| | 0.27 | 76,711 | **Angioedema** |
| | 0.27 | 76,711 | **Angioedema** 432791 |
| | 0.26 | 64,726 | 9951 (ICD9CM) Angioneurotic edema, not elsewhere classified |
| | 0.20 | 8,822 | T783XXA (ICD10CM) Angioneurotic edema, initial encounter |
| | 0.09 | 3,163 | T783XXD (ICD10CM) Angioneurotic edema, subsequent encounter |

Figure 15.6: □□□□□

# Chapter 16

□□□□□: *Joel Swerdel, Seng Chan You, Ray Chen & Patrick Ryan*

> □□□□□□

| | | Gold Standard | |
|---|---|---|---|
| | | True | False |
| Cohort Definition | True | True Positive | False Positive |
| | False | False Negative | True Negative |

Figure 16.1: □□□□□□□□□□□□□□□

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### 16.1.2

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### □□□□ 1: xSpec □□□□□□□□

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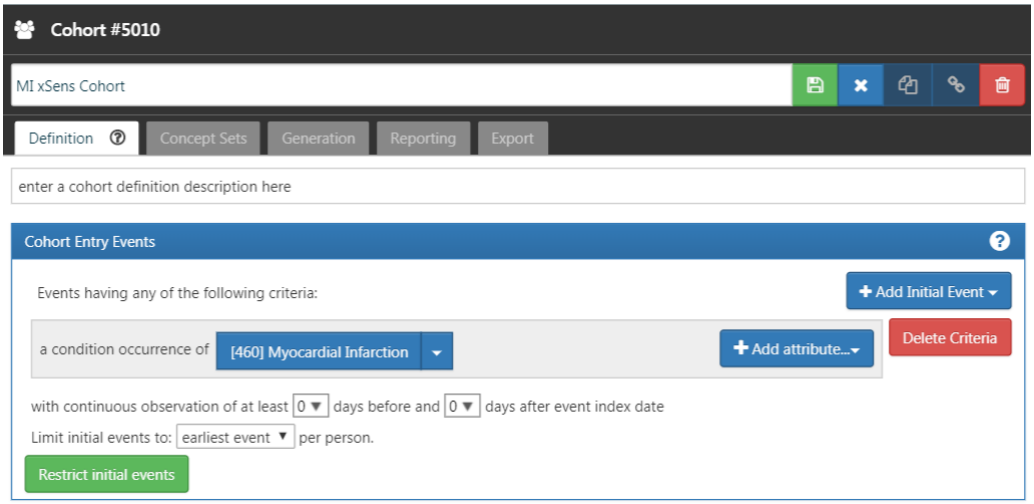


Figure 16.3: □□□□□□□□□□□□□□□□□□□□□□□□xSens□□

xSpec□□□□□□□□□□□□□□□□□□□

```
  upperAgeLimit = 90,
  gender = c(8507, 8532),
  startDate = "20100101",
  endDate = "20171231")
```

□□□□□□“my_results” □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□cohortDatabase
- “my_results.cohort”□□□□□□□□□□□□□□□□□□□

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# Chapter 17

□□□□□□□□: *Martijn Schuemie*

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### 17.1.6

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## 17.3

- □□□□□□□CDM□□□□□□□□□□

# Chapter 18

□□□□□: *Martijn Schuemie*

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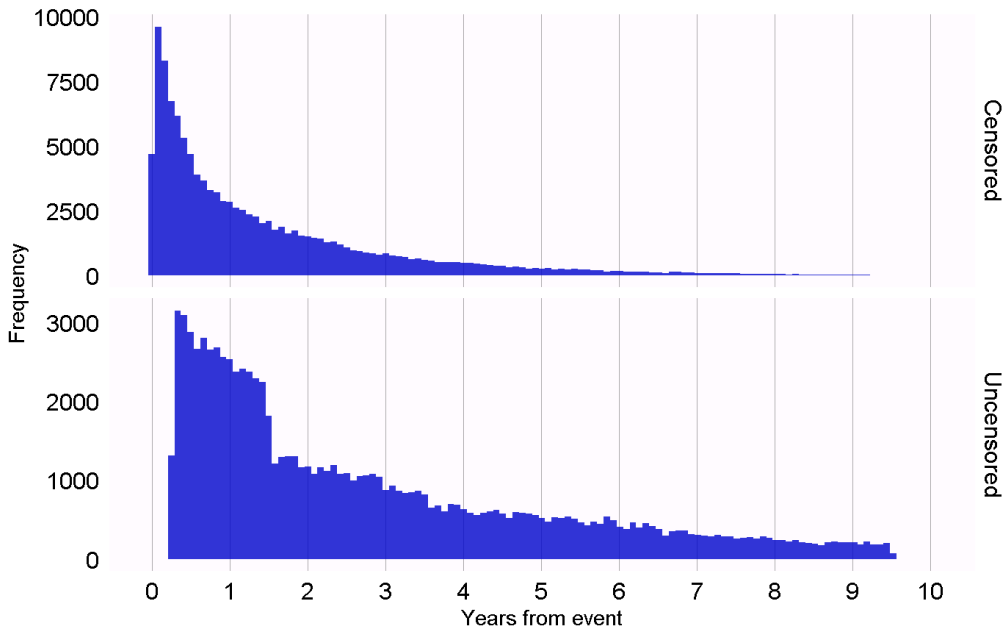
10000
7500
5000
2500
0
Frequency
3000
2000
1000
0
Censored
Uncensored
0
1
2
3
4
5
6
7
8
9
10
Years from event

Figure 18.1: □□□□□□

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$$\beta_i \sim N(\mu, \sigma^2) \text{ □□□ } \hat{\theta}_i \sim N(\theta_i + \beta_i, \tau_i^2)$$

□□□ $N(a, b)$ □□□□ $a$ □□□ $b$ □□□□□□□□□□□□□□□□:

$$L(\mu, \sigma|\theta, \tau) \propto \prod_{i=1}^{n} \int p(\hat{\theta}_i|\beta_i, \theta_i, \hat{\tau}_i) p(\beta_i|\mu, \sigma) \mathrm{d}\beta_i$$

□□□□□□□□□□□ $\hat{\mu}$ □ $\hat{\sigma}$ □□□□□□□□□□□□□□□□□□□p□□□□□□□□□□□□□□□□□□

Evidence for all conditions for ACEi and THZ combined

Save New Concept Set From Selection Below | View database record counts (RC) and descendant record counts (DRC) for: SYNPUF 5%

Column visibility | Copy | CSV | Show 15 entries | Filter:

Showing 1 to 15 of 13,787 entries | Previous 1 2 3 4 5 ... 920 Next

Suggested Negative Control
No (12777)
Yes (1010)

Found in Publications
No (12398)
Yes (Parent) (1160)
Yes (Exact) (229)

Found on Product Label
No (12667)
Yes (Parent) (878)
Yes (Exact) (242)

Found in Product Label Or Publications
Yes (10576)
No (3211)

Signal in FAERS
No (10951)
Yes (Parent) (1949)

| Name | Suggested Negative Control | Sort Order | Publication Count (Descendant Concept Match) | Publication Count (Exact Concept Match) | Publication Count (Parent Concept Match) | Product Label Count (Descendant Concept Match) | Product Label (Exact Concept Match) | Product Label (Parent Concept Match) |
|---|---|---|---|---|---|---|---|---|
| Rift valley fever | Y | 13,781 | 0 | 0 | 0 | 0 | 0 | 0 |
| Obstruction due to foreign body accidentally left in operative wound AND/OR body cavity during a procedure | Y | 13,780 | 0 | 0 | 0 | 0 | 0 | 0 |
| Infection by Shigella | Y | 13,766 | 0 | 0 | 0 | 0 | 0 | 0 |

Figure 18.4: □□□□□□□□□

```
  removePeopleWithPriorOutcomes = TRUE,
  washoutPeriod = 365,
  riskWindowStart = 1,
  riskWindowEnd = 0,
  endAnchor = "cohort end",
  exposureOutcomePairs = eoPairs,
  effectSizes = c(1.5, 2, 4),
  cdmVersion = cdmVersion,
  workFolder = file.path(outputFolder, "pcSynthesis"))
```

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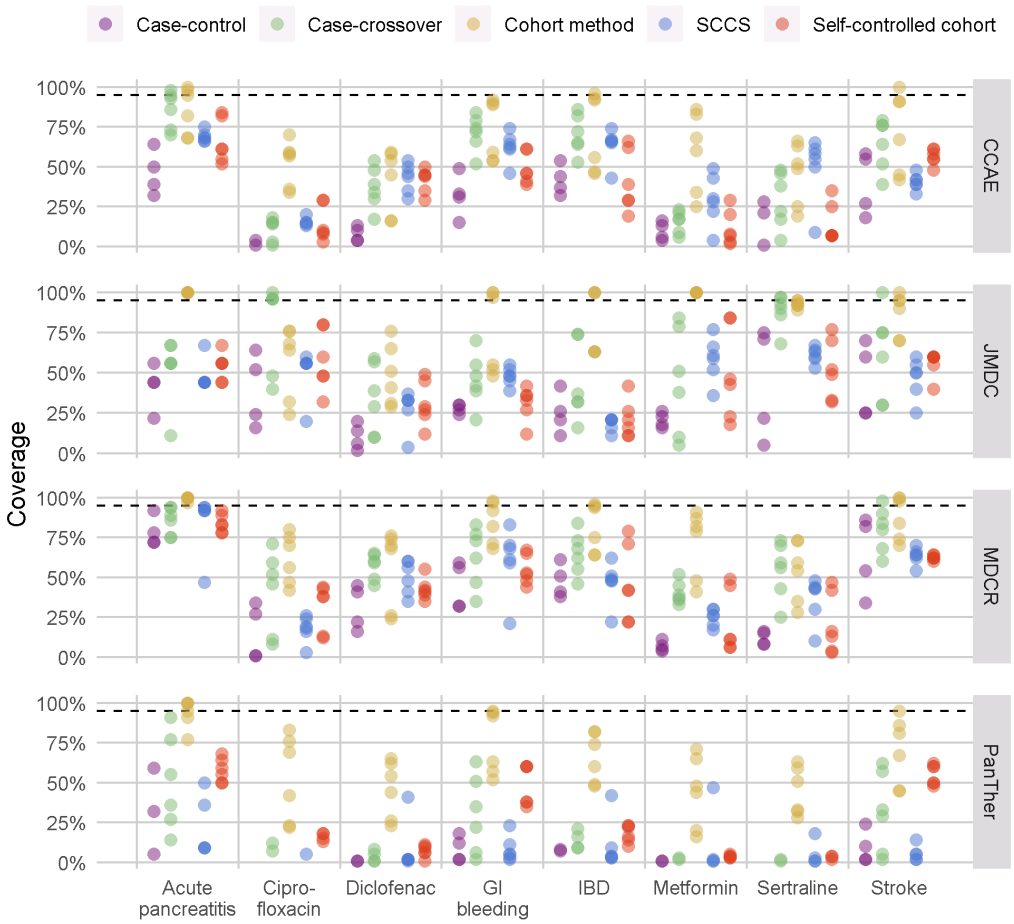


Figure 18.6: □□□□□□□□□□□□□□□□□□□□□95%□□□□□□□□□□□□□□□□□□□

# Part II

# OHDSI

# Chapter 19

□□□□□□□□: *Sara Dempster & Martijn Schuemie*

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# Chapter 20

# OHDSI

□□□□: *Kristin Kostka, Greg Klebanov & Sara Dempster*

OHDSI□□□□

### 20.2.2 OHDSI

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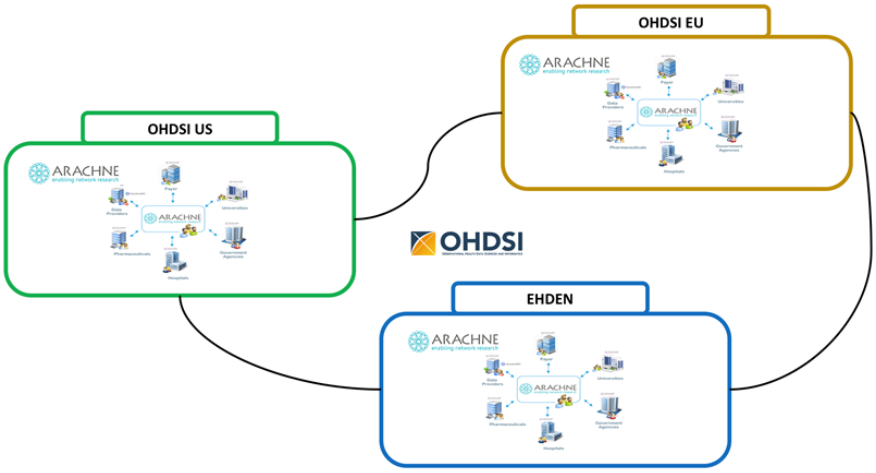


Figure 20.2: ARACHNE□□□□□□□□□□□□□□□□□□□

## 20.4

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# Chapter 21

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# Chapter 22

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## 22.2 ACE

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| 1314002 | □□□□□□ | □□□ | □□ | □□□ |
| 1314577 | □□□□□□ | □□□ | □□ | □□□ |
| 1317640 | □□□□□□□ | □□□ | □□ | □□□ |
| 1317967 | □□□□□□ | □□□ | □□ | □□□ |
| 1318137 | □□□□□□□ | □□□ | □□ | □□□ |
| 1318853 | □□□□□□ | □□□ | □□ | □□□ |
| 1319880 | □□□□□□ | □□□ | □□ | □□□ |
| 1319998 | □□□□□□□ | □□□ | □□ | □□□ |
| 1322081 | □□□□□□ | □□□ | □□ | □□□ |
| 1326012 | □□□□□□ | □□□ | □□ | □□□ |
| 1327978 | □□□□□□□ | □□□ | □□ | □□□ |
| 1328165 | □□□□□□ | □□□ | □□ | □□□ |
| 1331235 | □□□□□ | □□□ | □□ | □□□ |
| 1332418 | □□□□□□ | □□□ | □□ | □□□ |
| 1334456 | □□□□□ | □□□ | □□ | □□□ |
| 1335471 | □□□□□□ | □□□ | □□ | □□□ |
| 1338005 | □□□□□□□ | □□□ | □□ | □□□ |
| 1340128 | □□□□□□ | □□□ | □□ | □□□ |
| 1341238 | □□□□□ | □□□ | □□ | □□□ |
| 1341927 | □□□□□□ | □□□ | □□ | □□□ |
| 1342439 | □□□□□□□□ | □□□ | □□ | □□□ |
| 1344965 | □□□□□□□ | □□□ | □□ | □□□ |
| 1345858 | □□□□□□ | □□□ | □□ | □□□ |

| □□ID | □□□ | □□ | □ | □□□□□ |
|---|---|---|---|---|
| 1346686 | □□□□□□□ | □□□ | □□ | □□□ |
| 1346823 | □□□□□□□ | □□□ | □□ | □□□ |
| 1347384 | □□□□□□□ | □□□ | □□ | □□□ |
| 1350489 | □□□□□ | □□□ | □□ | □□□ |
| 1351557 | □□□□□□□ | □□□ | □□ | □□□ |
| 1353766 | □□□□□□□□ | □□□ | □□ | □□□ |
| 1353776 | □□□□□□ | □□□ | □□ | □□□ |
| 1363053 | □□□□□□ | □□□ | □□ | □□□ |
| 1363749 | □□□□□□□ | □□□ | □□ | □□□ |
| 1367500 | □□□□□ | □□□ | □□ | □□□ |
| 1373225 | □□□□□□□ | □□□ | □□ | □□□ |
| 1373928 | □□□□□□ | □□□ | □□ | □□□ |
| 1386957 | □□□□□□ | □□□ | □□ | □□□ |
| 1395058 | □□□□□□□ | □□□ | □□ | □□□ |
| 1398937 | □□□□□ | □□□ | □□ | □□□ |
| 40226742 | □□□□□□□ | □□□ | □□ | □□□ |
| 40235485 | □□□□□□□ | □□□ | □□ | □□□ |

## 22.6

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| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 907013 | □□□□□ | NO | YES | NO |
| 974166 | □□□□□□□□□□□ | NO | YES | NO |
| 978555 | □□□□□□ | NO | YES | NO |
| 1307863 | □□□□□ | NO | YES | NO |
| 1308216 | □□□□□□ | NO | YES | NO |
| 1308842 | □□□□□□ | NO | YES | NO |
| 1310756 | □□□□□□□ | NO | YES | NO |
| 1317640 | □□□□□□□ | NO | YES | NO |
| 1318137 | □□□□□□ | NO | YES | NO |
| 1318853 | □□□□□□ | NO | YES | NO |
| 1319880 | □□□□□□ | NO | YES | NO |
| 1326012 | □□□□□□ | NO | YES | NO |
| 1328165 | □□□□□□ | NO | YES | NO |
| 1331235 | □□□□□ | NO | YES | NO |
| 1332418 | □□□□□□ | NO | YES | NO |
| 1334456 | □□□□□ | NO | YES | NO |
| 1335471 | □□□□□□ | NO | YES | NO |
| 1340128 | □□□□□□ | NO | YES | NO |
| 1341927 | □□□□□□ | NO | YES | NO |
| 1342439 | □□□□□□□□ | NO | YES | NO |
| 1346686 | □□□□□□□ | NO | YES | NO |
| 1347384 | □□□□□□□ | NO | YES | NO |
| 1351557 | □□□□□□□ | NO | YES | NO |
| 1353776 | □□□□□□ | NO | YES | NO |
| 1363749 | □□□□□□ | NO | YES | NO |
| 1367500 | □□□□□ | NO | YES | NO |
| 1373225 | □□□□□□□ | NO | YES | NO |
| 1395058 | □□□□□□□ | NO | YES | NO |
| 40226742 | □□□□□□□ | NO | YES | NO |
| 40235485 | □□□□□□□ | NO | YES | NO |

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| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 904542 | □□□□□□□ | NO | YES | NO |
| 907013 | □□□□□ | NO | YES | NO |
| 932745 | □□□□□ | NO | YES | NO |
| 942350 | □□□□□ | NO | YES | NO |
| 956874 | □□□□□ | NO | YES | NO |

| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 970250 | □□□□□□□□ | NO | YES | NO |
| 974166 | □□□□□□□□□□ | NO | YES | NO |
| 978555 | □□□□□□ | NO | YES | NO |
| 991382 | □□□□□ | NO | YES | NO |
| 1305447 | □□□□□ | NO | YES | NO |
| 1307046 | □□□□□□□ | NO | YES | NO |
| 1307863 | □□□□□ | NO | YES | NO |
| 1308216 | □□□□□□ | NO | YES | NO |
| 1308842 | □□□□□□ | NO | YES | NO |
| 1309068 | □□□□□□ | NO | YES | NO |
| 1309799 | □□□□□□ | NO | YES | NO |
| 1310756 | □□□□□□□ | NO | YES | NO |
| 1313200 | □□□□□ | NO | YES | NO |
| 1314002 | □□□□□□ | NO | YES | NO |
| 1314577 | □□□□□□ | NO | YES | NO |
| 1317640 | □□□□□□□ | NO | YES | NO |
| 1317967 | □□□□□□ | NO | YES | NO |
| 1318137 | □□□□□□ | NO | YES | NO |
| 1318853 | □□□□□□ | NO | YES | NO |
| 1319880 | □□□□□□ | NO | YES | NO |
| 1319998 | □□□□□□□ | NO | YES | NO |
| 1322081 | □□□□□□□ | NO | YES | NO |
| 1326012 | □□□□□□ | NO | YES | NO |
| 1327978 | □□□□□□□ | NO | YES | NO |
| 1328165 | □□□□□□ | NO | YES | NO |
| 1331235 | □□□□□ | NO | YES | NO |
| 1332418 | □□□□□□ | NO | YES | NO |
| 1334456 | □□□□□ | NO | YES | NO |
| 1335471 | □□□□□□ | NO | YES | NO |
| 1338005 | □□□□□□□ | NO | YES | NO |
| 1340128 | □□□□□□ | NO | YES | NO |
| 1341238 | □□□□□ | NO | YES | NO |
| 1341927 | □□□□□□ | NO | YES | NO |
| 1342439 | □□□□□□□□ | NO | YES | NO |
| 1344965 | □□□□□□□ | NO | YES | NO |
| 1345858 | □□□□□□ | NO | YES | NO |
| 1346686 | □□□□□□□ | NO | YES | NO |
| 1346823 | □□□□□□□ | NO | YES | NO |
| 1347384 | □□□□□□□ | NO | YES | NO |
| 1350489 | □□□□□ | NO | YES | NO |
| 1351557 | □□□□□□□ | NO | YES | NO |
| 1353766 | □□□□□□□□ | NO | YES | NO |
| 1353776 | □□□□□□ | NO | YES | NO |

| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 1363053 | □□□□□□ | NO | YES | NO |
| 1363749 | □□□□□□ | NO | YES | NO |
| 1367500 | □□□□□ | NO | YES | NO |
| 1373225 | □□□□□□□ | NO | YES | NO |
| 1373928 | □□□□□□ | NO | YES | NO |
| 1386957 | □□□□□□ | NO | YES | NO |
| 1395058 | □□□□□□□ | NO | YES | NO |
| 1398937 | □□□□□ | NO | YES | NO |
| 40226742 | □□□□□□□ | NO | YES | NO |
| 40235485 | □□□□□□□ | NO | YES | NO |

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| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 316866 | □□□□□□ | NO | YES | NO |

## 22.7 3

□□□□□□ *22.6* □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□365□□□□**1095**□□□□□□□□□□□□

## 22.8 ACE

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- *ACE*□□□□□□ 22.8□□□□□□□

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□: ACE□□□

| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 1308216 | □□□□□□ | NO | YES | NO |
| 1310756 | □□□□□□□ | NO | YES | NO |
| 1331235 | □□□□□ | NO | YES | NO |
| 1334456 | □□□□□ | NO | YES | NO |
| 1335471 | □□□□□□ | NO | YES | NO |
| 1340128 | □□□□□□ | NO | YES | NO |
| 1341927 | □□□□□□ | NO | YES | NO |
| 1342439 | □□□□□□□□ | NO | YES | NO |
| 1363749 | □□□□□□ | NO | YES | NO |
| 1373225 | □□□□□□□ | NO | YES | NO |

## 22.9 ARB

□□□□□□ *22.8* □□□□□□□□□□□□□□□□□□□□□□□□□□□□□*ARB*□□□ 22.9□□*ACE*□□□□□ 22.8□□□□□□□□□□□□□□

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□: □□□□□□□□□□□□□□□□□ARB□

| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 1308842 | □□□□□□ | NO | YES | NO |
| 1317640 | □□□□□□□ | NO | YES | NO |
| 1346686 | □□□□□□□ | NO | YES | NO |
| 1347384 | □□□□□□□ | NO | YES | NO |
| 1351557 | □□□□□□□ | NO | YES | NO |
| 1367500 | □□□□□ | NO | YES | NO |
| 40226742 | □□□□□□□ | NO | YES | NO |
| 40235485 | □□□□□□□ | NO | YES | NO |

## 22.10

□□□□□□ *22.8* □□□□□□□□□□□□□□□□□□□□

| □□□□□ID | □□□□□□ | □□ | □□ | □□□□□ |
|---|---|---|---|---|
| 907013 | □□□□□ | NO | YES | NO |
| 974166 | □□□□□□□□□□ | NO | YES | NO |
| 978555 | □□□□□□ | NO | YES | NO |
| 1395058 | □□□□□□□ | NO | YES | NO |

## 22.11 dCCB

□□□□□□ *22.8* □□□□□□□□□□

□□□□□□□□□

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| □□ID | □□□ | □□ | □□ | □□□ |
|---|---|---|---|---|
| 1307046 | □□□□□□□ | NO | YES | NO |
| 1313200 | □□□□□ | NO | YES | NO |
| 1314002 | □□□□□□ | NO | YES | NO |
| 1314577 | □□□□□□ | NO | YES | NO |
| 1319998 | □□□□□□□ | NO | YES | NO |
| 1322081 | □□□□□□□ | NO | YES | NO |
| 1327978 | □□□□□□□ | NO | YES | NO |
| 1338005 | □□□□□□□ | NO | YES | NO |
| 1345858 | □□□□□□ | NO | YES | NO |
| 1346823 | □□□□□□□ | NO | YES | NO |
| 1353766 | □□□□□□□□ | NO | YES | NO |
| 1386957 | □□□□□□ | NO | YES | NO |

## 22.14

*ACE*□□□□□ *22.8* □□□□□□□□□□□□ (□ 22.14) □ *ACE*□□□ (□ 22.8) □□□□□□□□□

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| □□ID | □□□ | □□ | □□ | □□□ |
|---|---|---|---|---|
| 932745 | □□□□□ | NO | YES | NO |
| 942350 | □□□□□ | NO | YES | NO |
| 956874 | □□□□□ | NO | YES | NO |

## 22.15

*ACE*□□□□□ *22.8* □□□□□□□□□□□□□□ (□ 22.15) □ *ACE*□□□ (□ 22.8) □□□□□□□□□

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| □□ID | □□□ | □□ | □□ | □□□ |
|---|---|---|---|---|
| 904542 | □□□□□□□ | NO | YES | NO |
| 991382 | □□□□□□ | NO | YES | NO |

## 22.16 1

*ACE*□□□□□ *22.8* □□□□□□□□□□*1*□□□□□ (□ 22.16) □ *ACE*□□□ (□ 22.8)□□□□□□□□□□

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□: □□□□1□□□□□

| □□ID | □□□ | □□ | □□ | □□□ |
|---|---|---|---|---|
| 1341238 | □□□□□ | NO | YES | NO |
| 1350489 | □□□□□ | NO | YES | NO |
| 1363053 | □□□□□□ | NO | YES | NO |

## 22.17

□□□□□□□□□□

| □□□□□ID | □□□□□□□□ |
| --- | --- |
| 46269889 | □□□□□□□□□□□ |
| 134438 | □□□□□□ |
| 78619 | □□□□□ |
| 201606 | □□□□□ |
| 76786 | □□□□ |
| 4115402 | □□□□ |
| 45757370 | □□□□□□□□ |
| 433111 | □□□□□ |
| 433527 | □□□□□ |
| 4170770 | □□□□ |
| 4092896 | □□□□□□□□ |
| 259995 | □□□□□□□ |
| 40481632 | □□□□□□□□ |
| 4166231 | □□□□□ |
| 433577 | □□□□□□ |
| 4231770 | □□□□□□ |
| 440329 | □□□□□□□□□□ |
| 4012570 | □□□□□□□□ |
| 4012934 | □□□□□□□□ |
| 441788 | □□□□□□□□□□□□□ |
| 4201717 | □□□□□□ |
| 374375 | □□□□ |
| 4344500 | □□□□□□□□□□□□□□□□□ |
| 139099 | □□□ |
| 444132 | □□□□ |
| 196168 | □□□□□□ |
| 432593 | □□□□□□□ |
| 434203 | □□□□□□ |
| 438329 | □□□□□□□□□ |
| 195873 | □□□□ |
| 4083487 | □□□ |
| 4103703 | □□□□□□□□ |
| 4209423 | □□□□□□□ |
| 377572 | □□□□□□□□□□□ |
| 40480893 | □□□□□□□□□□□□□□□ |
| 136368 | □□□□□□□□□□□ |
| 140648 | □□□□□□□□□□□ |
| 438130 | □□□□□□□ |
| 4091513 | □□ |
| 4202045 | □□□□□□□□□□□□ |
| 373478 | □□ |
| 46286594 | □□□□□□□□□□□□□□□ |
| 439790 | □□□□ |

| □□□□□ID | □□□□□□□□□ |
|---|---|
| 81634 | □□□□ |
| 380706 | □□□□□□ |
| 141932 | □□□□□□ |
| 36713918 | □□□□□□□□□□ |
| 443172 | □□□□□□□□□□□□□ |
| 81151 | □□□□□□ |
| 72748 | □□□□□□□□□□□□□□□□□□□ |
| 378427 | □□□□□ |
| 437264 | □□□□□□□ |
| 194083 | □□□□□□□□□□ |
| 140641 | □□□□□□ |
| 440193 | □□□□□ |
| 4115367 | □□□□□ |

## 22.19

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16. □□□□

## 22.20 NA

# Chapter 23

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## 23.1

□□□□ **4.1**

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□: PERSON□□□□□□

| □□□□ | □ | □□ |
|---|---|---|
| PERSON_ID | 2 | □□□□□□ |
| GENDER_CONCEPT_ID | 8507 | □□□□□ ID □ 8507□ |
| YEAR_OF_BIRTH | 1974 | |
| MONTH_OF_BIRTH | 8 | |
| DAY_OF_BIRTH | 4 | |
| BIRTH_DATETIME | 1974-08-04 00:00:00 | □□□□□□□□□□□□□□00:00:00□□□□□ |
| DEATH_DATETIME | NULL | |
| RACE_CONCEPT_ID | 8516 | □□□□□□□□□□□□□□ ID □ 8516□ |
| ETHNICITY_ CONCEPT_ID | 38003564 | 38003564 □□□□□□□□□□□□□□□□□□□□ |
| LOCATION_ID | | □□□□□□ |
| PROVIDER_ID | | □□□□□□□ |
| CARE_SITE | | □□□□□□□□□ |
| PERSON_SOURCE_ VALUE | NULL | □□□□□□□□□ |
| GENDER_SOURCE_ VALUE | Man | □□□□□□□□□□□□□□ |

| □□□□ | □ | □□ |
|---|---|---|
| GENDER_SOURCE_CONCEPT_ID | 0 | |
| RACE_SOURCE_VALUE | African American | □□□□□□□□□□□□□□ |
| RACE_SOURCE_CONCEPT_ID | 0 | |
| ETHNICITY_SOURCE_VALUE | NULL | |
| ETHNICITY_SOURCE_CONCEPT_ID | 0 | |

□□□□ **4.2**

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ 23.1 □□□□□□□□□□□□

□: OBSERVATION_PERIOD□□□□□

| □□□□ | □ | □□ |
|---|---|---|
| OBSERVATION_PERIOD_ID | 2 | □□□□□□ |
| PERSON_ID | 2 | □□□PERSON□□□□□□□□□□□□□□□□□□□□□□□□ |
| OBSERVATION_PERIOD_START_DATE | 2015-01-01 | □□□□□□□□ |
| OBSERVATION_PERIOD_END_DATE | 2019-07-01 | □□□□□□□□□□□□□□□□□□□□□□ |
| PERIOD_TYPE_CONCEPT_ID | 44814722 | 44814724 □□□□□□□□□□□□□□ |

□□□□ **4.3**

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ 23.1 □□□□□□□□□□□□

□: DRUG_EXPOSURE□□□□□

| □□□□ | □ | □□ |
|---|---|---|
| DRUG_EXPOSURE_ID | 1001 | □□□□□□ |
| PERSON_ID | 2 | □□□PERSON□□□□□□□□□□□□□□□□□□□□□□□□ |
| DRUG_CONCEPT_ID | 19078461 | □□□□□NDC□□□□□□□□□ 19078461 □□□□□□□□□□□ |
| DRUG_EXPOSURE_START_DATE | 2019-05-01 | □□□□□□□□□□ |
| DRUG_EXPOSURE_START_DATETIME | 2019-05-01 00:00:00 | □□□□□□□□□□□□□□□□□ |

| □□□□ | □ | □□ |
|---|---|---|
| DRUG_EXPOSURE_END_DATE | 2019-05-31 | □□□ + □□□□□□□□□ |
| DRUG_EXPOSURE_END_DATETIME | 2019-05-31 00:00:00 | □□□□□□□□□□□□□□□ |
| VERBATIM_END_DATE | NULL | □□□□□□□□□ |
| DRUG_TYPE_CONCEPT_ID | 38000177 | 38000177 □□□□□□□□□□□□□□□□□ |
| STOP_REASON | NULL | |
| REFILLS | NULL | |
| QUANTITY | NULL | □□□□□□□□□ |
| DAYS_SUPPLY | 30 | □□□□□□□□□□□□□□□ |
| SIG | NULL | □□□□□□□□□ |
| ROUTE_CONCEPT_ID | 4132161 | 4132161 □□□□□□□□□ |
| LOT_NUMBER | NULL | □□□□□□□□□ |
| PROVIDER_ID | NULL | □□□□□□□□□ |
| VISIT_OCCURRENCE_ID | NULL | □□□□□□□□□□□□□□□□□□ |
| VISIT_DETAIL_ID | NULL | |
| DRUG_SOURCE_VALUE | 76168009520 | □□□□□NDC□□□□ |
| DRUG_SOURCE_CONCEPT_ID | 583945 | 583945 □□□□□□□□□ (NDC□□□□76168009520□)□ |
| ROUTE_SOURCE_VALUE | NULL | |

### □□□□ 4.4

□□□□□□□□□□□□□□□□CONDITION_OCCURRENCE□□□□□□□□□□□□□□□□□□□

```
library(DatabaseConnector)
connection <- connect(connectionDetails)
sql <- "SELECT *
FROM @cdm.condition_occurrence
WHERE condition_concept_id = 192671;"

result <- renderTranslateQuerySql(connection, sql, cdm = "main")
head(result)
```

```
##   CONDITION_OCCURRENCE_ID PERSON_ID CONDITION_CONCEPT_ID ...
## 1                    4657       273               192671 ...
## 2                    1021        61               192671 ...
## 3                    5978       351               192671 ...
## 4                    9798       579               192671 ...
```

```
## 5                      9301        549                192671 ...
## 6                      1997        116                192671 ...
```

### □□□□ 4.5

□□□□□□□□□□□□□□□□CONDITION_OCCURRENCE□□□□□□CONDITION_SOURCE_VALUE

```
sql <- "SELECT *
FROM @cdm.condition_occurrence
WHERE condition_source_value = 'K92.2';"

result <- renderTranslateQuerySql(connection, sql, cdm = "main")
head(result)
```

```
##   CONDITION_OCCURRENCE_ID PERSON_ID CONDITION_CONCEPT_ID ...
## 1                    4657       273                192671 ...
## 2                    1021        61                192671 ...
## 3                    5978       351                192671 ...
## 4                    9798       579                192671 ...
## 5                    9301       549                192671 ...
## 6                    1997       116                192671 ...
```

### □□□□ 4.6

□□□□□OBSERVATION_PERIOD□□□□□□□□□□□□□□□

```
library(DatabaseConnector)
connection <- connect(connectionDetails)
sql <- "SELECT *
FROM @cdm.observation_period
WHERE person_id = 61;"

renderTranslateQuerySql(connection, sql, cdm = "main")
```

```
##   OBSERVATION_PERIOD_ID PERSON_ID OBSERVATION_PERIOD_START_DATE ...
## 1                    61        61                     1968-01-21 ...
```

## 23.2

### □□□□ 5.1

□□ ID 192671 (“□□□□”)

### □□□□ 5.2

ICD-10CM□□□□

- K29.91 “□□□□□□□□□□□□□□□□□□□□□”
- K92.2 “□□□□□□□□□□□□□”

ICD-9CM□□□□

- 578 “□□□□”
- 578.9 “□□□□□□□□□□□□□”

#### □□□□ 5.3

MedDRA□□□□□

- “□□□□” (□□ID 35707864)
- “□□□” (□□ID 35707858)

## 23.3

#### □□□□ 6.1

A) □□□□□□□□CDM□□□□□□□□□ETL□□□□□□
B) □□□□□□□□□□□□□□□□□□□□□□□□□
C) □□□□ETL□□□□□
D) □□□□□□□□□□□□□

#### □□□□ 6.2

| □□□ | □ | □□ |
|---|---|---|
| PERSON_ID | A123B456 | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| GENDER_CONCEPT_ID | 8532 | |
| YEAR_OF_BIRTH | NULL | □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ |
| MONTH_OF_BIRTH | NULL | |
| DAY_OF_BIRTH | NULL | |
| RACE_CONCEPT_ID | 0 | □□□WHITE□□□□□□□□8527□□□□□□□□□ |
| ETHNICITY_CONCEPT_ID | 8527 | □□□□□□□□□□□□□□□□□□□□□0□□□□□□□ |
| PERSON_SOURCE_VALUE | A123B456 | |
| GENDER_SOURCE_VALUE | F | |
| RACE_SOURCE_VALUE | WHITE | |
| ETHNICITY_SOURCE_VALUE | NONE PROVIDED | |

#### □□□□ 6.3

| □□□ | □ |
|---|---|
| VISIT_OCCURRENCE_ID | 1 |
| PERSON_ID | 11 |
| VISIT_START_DATE | 2004-09-26 |
| VISIT_END_DATE | 2004-09-30 |
| VISIT_CONCEPT_ID | 9201 |
| VISIT_SOURCE_VALUE | inpatient |

## 23.4

### □□□□ 7.1

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2. □□□□□□□□
3. □□□□□□□□

### □□□□ 7.2

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```
INNER JOIN @cdm.concept_ancestor
  ON drug_concept_id = descendant_concept_id
INNER JOIN @cdm.concept ingredient
  ON ancestor_concept_id = ingredient.concept_id
WHERE LOWER(ingredient.concept_name) = 'celecoxib'
  AND ingredient.concept_class_id = 'Ingredient'
  AND ingredient.standard_concept = 'S';"

renderTranslateQuerySql(connection, sql, cdm = "main")
```

```
##   PERSON_COUNT
## 1         1844
```

COUNT(DISTINCT(person_id))□□□□□□□□□□□□□

```
  ON condition_concept_id =descendant_concept_id
WHERE LOWER(ingredient.concept_name) = 'celecoxib'
  AND ingredient.concept_class_id = 'Ingredient'
  AND ingredient.standard_concept = 'S'
  AND ancestor_concept_id = 192671;"

renderTranslateQuerySql(connection, sql, cdm = "main")
```

```
##   DIAGNOSE_COUNT
## 1             41
```

□□□□□DRUG_EXPOSURE□□□□□□□□□DRUG_ERA□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

## 23.5

**□□ 10.1**

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- 16□□□
- □□□□□□□□□□365□□□□□□□□□□□□□

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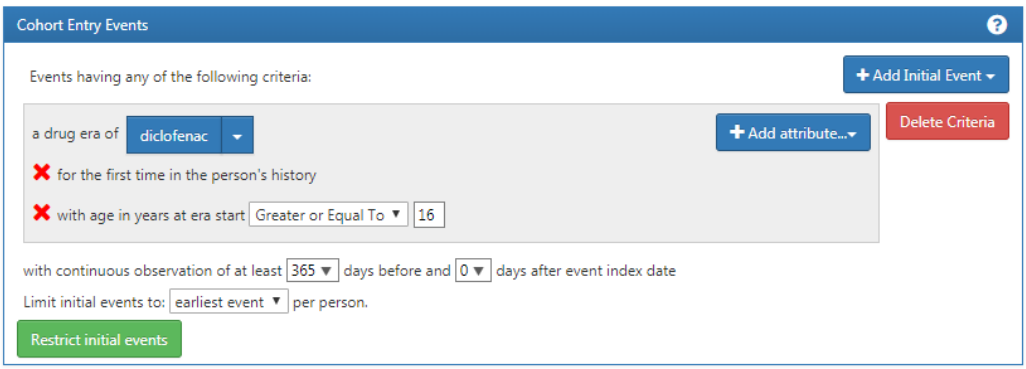


Figure 23.1: □□□□□□□□□□□□□□□□□□□□

Concept Set Expression | Included Concepts 11473 | Included Source Codes | Export | Import

Name:

diclofenac

Show 25 entries Search:

Showing 1 to 1 of 1 entries Previous 1 Next

| Concept Id | Concept Code | Concept Name | Domain | Standard Concept Caption | Exclude | Descendants | Mapped |
|---|---|---|---|---|---|---|---|
| 1124300 | 3355 | Diclofenac | Drug | Standard | ☐ | ☑ | ☐ |

Classification Non-Standard Standard

Figure 23.2: □□□□□□□□□□□□□□□□□□

Inclusion Criteria

New inclusion criteria

1. Without prior exposure to any NSAID
*Excluding subjects with prior exposure to any NSAID*

Without prior exposure to any NSAID | Copy | Delete

Excluding subjects with prior exposure to any NSAID

having all of the following criteria: + Add criteria to group...

with exactly 0 using all occurrences of:
a drug exposure of NSAIDs + Add attribute...
where event starts between All days Before and 1 days Before
index start date *add additional constraint*
☐ restrict to the same visit occurrence
☐ allow events from outside observation period

Delete Criteria

Limit qualifying events to: earliest event per person.

Figure 23.3: NSAID□□□□□□□□□□□□□

Concept Set Expression | Included Concepts 23112 | Included Source Codes | Export | Import

Name:

NSAIDs

Show 25 entries Search:

Showing 1 to 1 of 1 entries Previous 1 Next

| Concept Id | Concept Code | Concept Name | Domain | Standard Concept Caption | Exclude | Descendants | Mapped |
|---|---|---|---|---|---|---|---|
| 21603933 | M01A | ANTIINFLAMMATORY AND ANTIRHEUMATIC PRODUCTS, NON-STEROIDS | Drug | Classification | ☐ | ☑ | ☐ |

Classification Non-Standard Standard

Figure 23.4: NSAIDs□□□□□□□□□

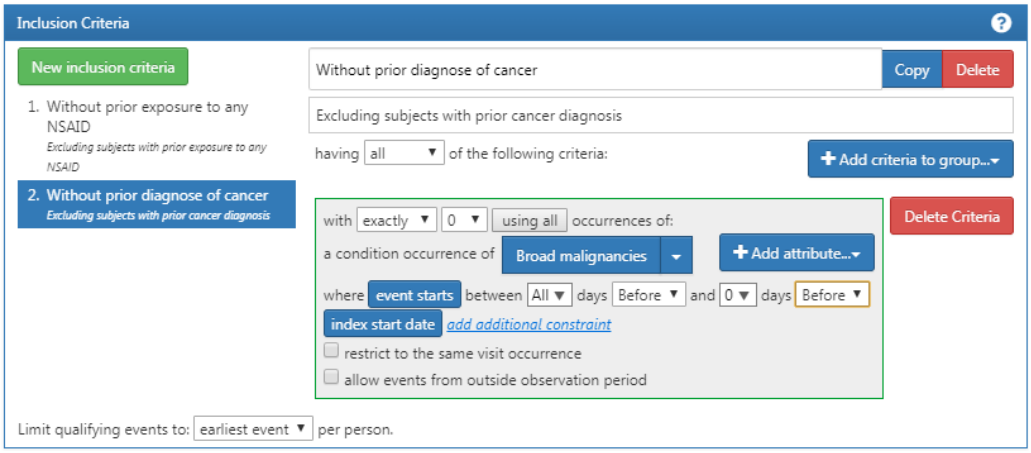


Figure 23.5: □□□□□□□□□□□□□□□□□□□□

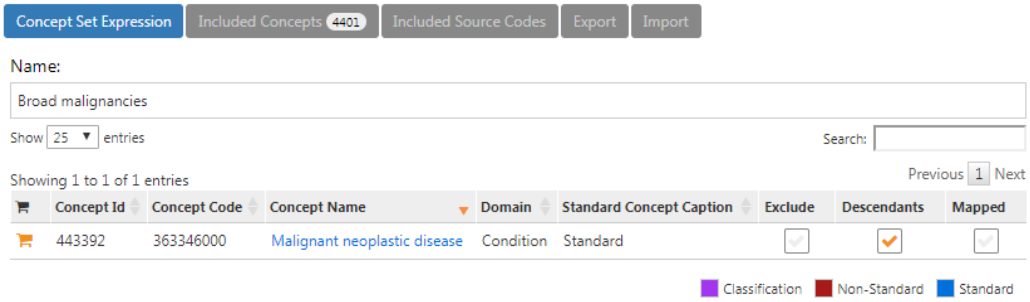


Figure 23.6: □□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□30□□□□□□□□□□□□□□□□□□□□□□□□23.7□□□

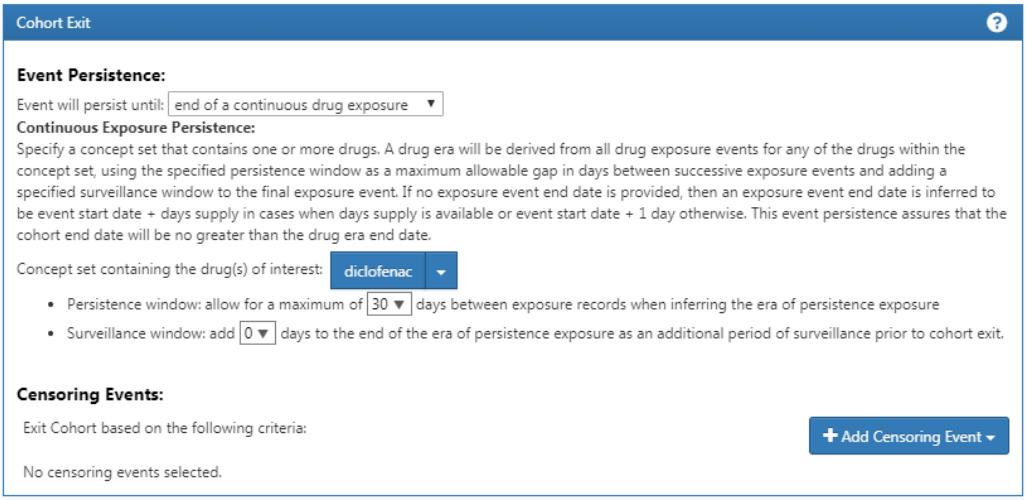


Figure 23.7: □□□□□□□□□□□□

## □□ 10.2

□□□□□□□□□□SQL□2□□□□□□□□□□□□□□□□□□□

```
  cohort_start_date,
  cohort_definition_id
  )
SELECT subject_id,
  cohort_start_date,
  CAST (1 AS INT) AS cohort_definition_id
FROM #diagnoses
INNER JOIN @cdm.visit_occurrence
  ON subject_id = person_id
    AND cohort_start_date >= visit_start_date
    AND cohort_start_date <= visit_end_date
WHERE visit_concept_id IN (9201, 9203, 262); --    ER;"

renderTranslateExecuteSql(connection, sql, cdm = "main")
```

□□□□□□VISIT_OCCURRENCE_ID□□□□□□

Data Sources

SYNPUF 5%

Drug Exposure

SYNPUF 5% Drug Exposure Report

Prevalence

Treemap | Table

Column visibility | Copy | CSV | Show 15 entries | Filter: celecoxib

Showing 1 to 8 of 8 entries
(filtered from 18,541 total entries)

Previous 1 Next

| Concept Id | Ingredient | Name | Person Count | Prevalence | Records per person |
|---|---|---|---|---|---|
| 1118116 | celecoxib | celecoxib 50 MG Oral Capsule [Celebrex] | 3 | 0.00% | 1.00 |
| 1118115 | celecoxib | celecoxib 50 MG Oral Capsule | 8 | 0.01% | 1.00 |
| 1118113 | celecoxib | celecoxib 400 MG Oral Capsule [Celebrex] | 35 | 0.03% | 1.03 |
| 1118091 | celecoxib | celecoxib 400 MG Oral Capsule | 440 | 0.38% | 1.00 |
| 1118088 | celecoxib | celecoxib 200 MG Oral Capsule [Celebrex] | 845 | 0.73% | 1.02 |
| 19029025 | celecoxib | celecoxib 200 MG Oral Capsule | 510 | 0.44% | 1.01 |
| 1118087 | celecoxib | celecoxib 100 MG Oral Capsule [Celebrex] | 475 | 0.41% | 1.02 |
| 19029024 | celecoxib | celecoxib 100 MG Oral Capsule | 253 | 0.22% | 1.01 |

Showing 1 to 8 of 8 entries
(filtered from 18,541 total entries)

Previous 1 Next

Figure 23.8: □□□□□□□□□□□□□

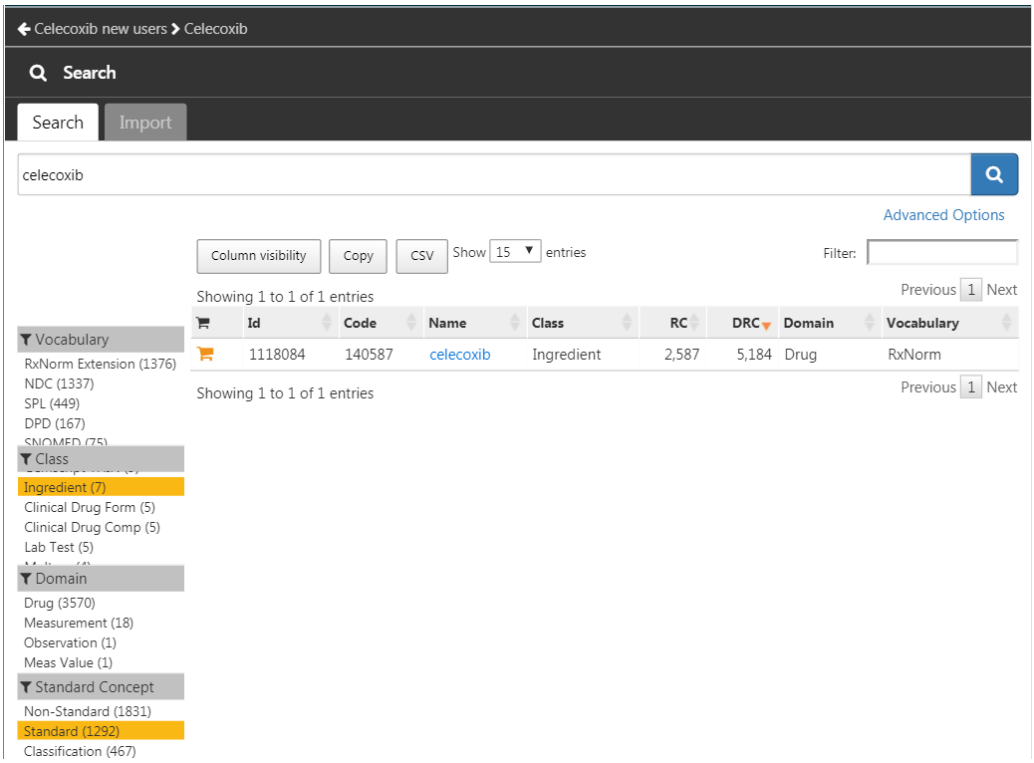


Figure 23.9: □□□□□□□□□□□□□□□□□□□□□□□□

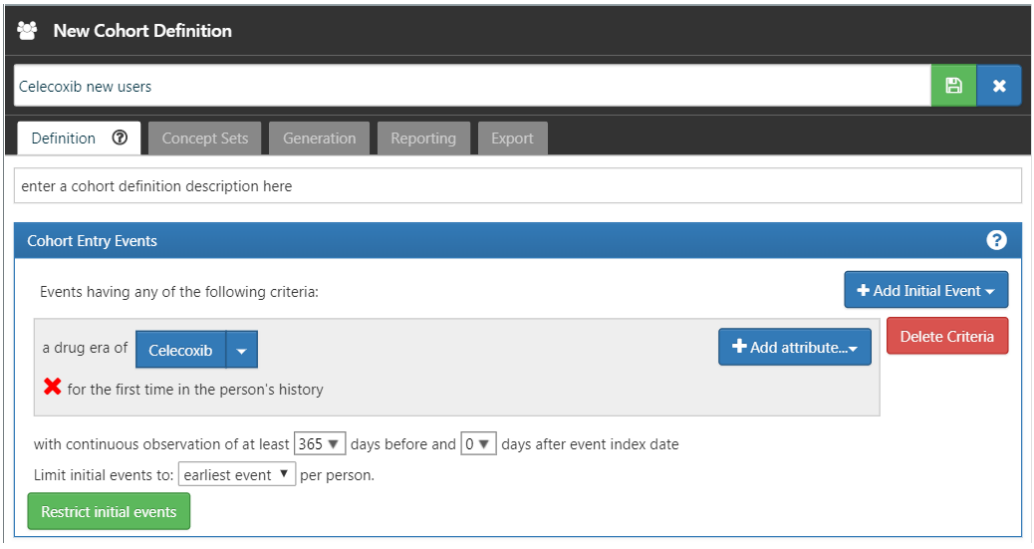


Figure 23.10: □□□□□□□□□□□□□□□□□□□□□□□□

New Characterization

Celecoxib new users characterization

Design | Executions | Utilities

**Cohort characterization** is defined as the process of generating cohort level descriptive summary statistics from person level covariate data. Summary statistics of these person level covariates may be count, mean, sd, var, min, max, median, range, and quantiles. In addition, covariates during a period may be stratified into temporal units of time for time-series analysis such as fixed intervals of time relative to cohort_start_date (e.g. every 7 days, every 30 days etc.), or in absolute calendar intervals such as calendar-week, calendar-month, calendar-quarter, calendar-year.

Cohort definitions

Import

Show 10 entries Search:

| ID | Name | | |
|---|---|---|---|
| 1771701 | Celecoxib new users | Edit cohort | Remove |

Showing 1 to 1 of 1 entries Previous 1 Next

Feature analyses

Import

Show 10 entries Search:

| ID | Name | Description | Actions |
|---|---|---|---|
| 15 | Drug Group Era Any Time Prior | One covariate per drug rolled up to ATC groups in the drug_era table overlapping with any time prior to index. | Remove |
| 27 | Condition Group Era Any Time Prior | One covariate per condition era rolled up to groups in the condition_era table overlapping with any time prior to index. | Remove |

Showing 1 to 2 of 2 entries Previous 1 Next

Figure 23.11: □□□□□□□

□□□□□□□□□□□□□□1□□□□□□□□□□□□□□

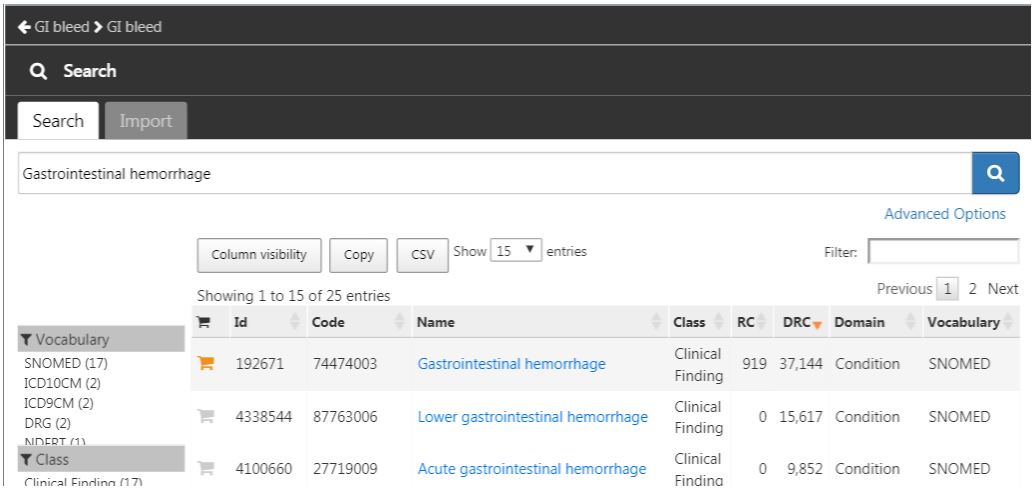


Figure 23.13: □□□□□□□□□□□□□□□□□□□□□

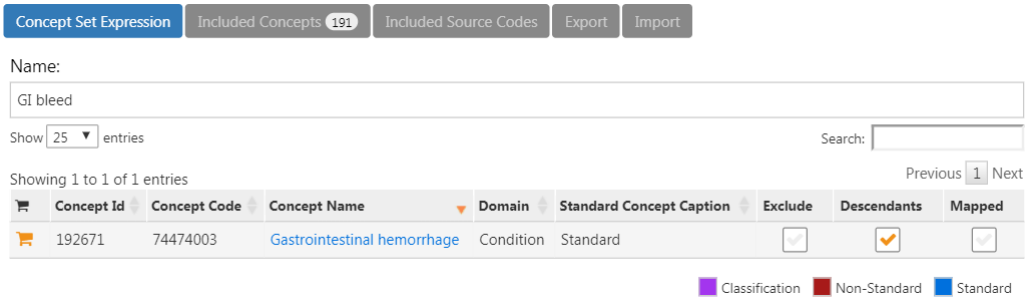


Figure 23.14: □□□□□□□□□□□□□□□□□□□□□

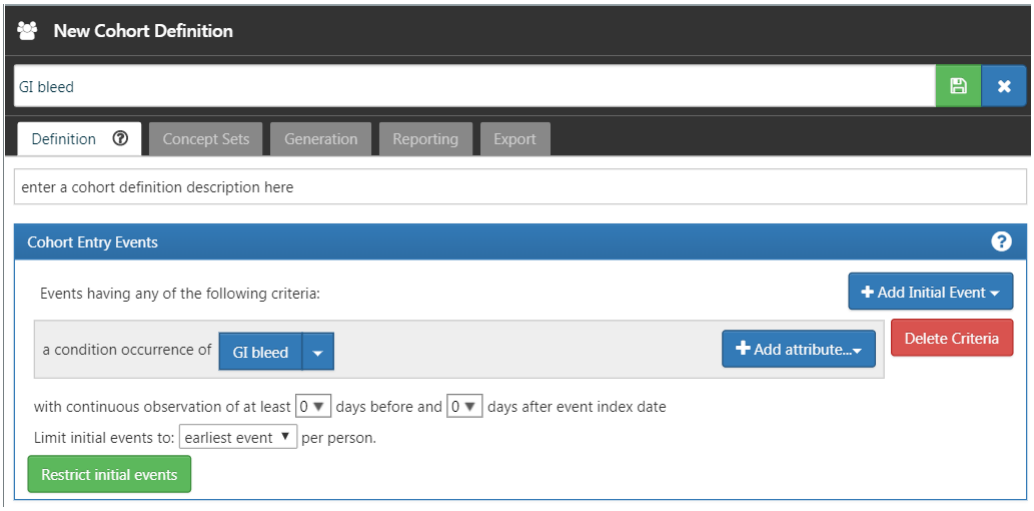


Figure 23.15: □□□□□□□□□□□□□□□□□□

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New Incidence Rate Analysis

Incidence of GI bleed after celecoxib initiation

Definition | Concept Sets | Generation | Utilities

**Study Cohorts**

Target Cohorts

✖ #1771701:Celecoxib new users

Add Target Cohort

Outcome Cohorts

✖ #1771702:GI bleed

Add Outcome Cohort

**Time At Risk**

Time at risk defines the time window relative to the cohort start or end date with an offset to consider the person 'at risk' of the outcome.

- Time at risk starts with start date ▾ plus 0 ▾ days.
- Time at risk ends with start date ▾ plus 1095 ▾ days.

No study window defined. Add Study Window

**Stratify Criteria:** You can provide optional stratification criteria to the analysis that will divide the population into unique groups based on their satisified criteria.

New stratify criteria

Please select a qualifying inclusion criteria to edit.

Figure 23.16: □□□□□□

Showing target cohort: Celecoxib new users ▾ and outcome cohort: GI bleed ▾ ▶ Generate Export Analysis to CSV

| | Source Name | Persons | Cases | Proportion [+\|-] per 1k persons | Time At Risk (years) | Rate [+\|-] per 1k years | Started | Duration | |
|---|---|---|---|---|---|---|---|---|---|
| Rerun | SYNPUF 5% | 1,205 | 95 | 78.84 | 1,052 | 90.30 | 08/23/2019 1:59 PM | 00:00:22 | Reports |

Figure 23.17: □□□□□

## 23.7

### □□ 12.1

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□2□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

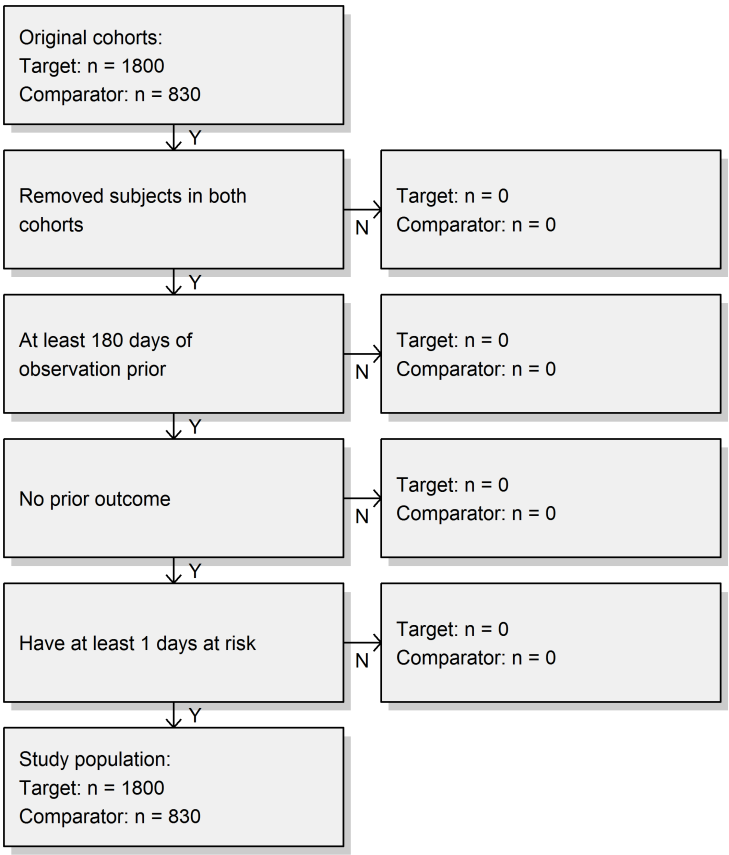
```
library(CohortMethod)
nsaids <- c(1118084, 1124300) #
covSettings <- createDefaultCovariateSettings(
  excludedCovariateConceptIds = nsaids,
  addDescendantsToExclude = TRUE)

#
cmData <- getDbCohortMethodData(
  connectionDetails = connectionDetails,
  cdmDatabaseSchema = "main",
  targetId = 1,
  comparatorId = 2,
  outcomeIds = 3,
  exposureDatabaseSchema = "main",
  exposureTable = "cohort",
  outcomeDatabaseSchema = "main",
  outcomeTable = "cohort",
  covariateSettings = covSettings)
summary(cmData)
```

```
## CohortMethodData
##
##    ID 1
##    ID 2
##    ID 3
##
##       1800
##       830
##
##
##
## 3            479        479
##
##
##     389
##       26923
```

### □□ 12.2

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

```r
studyPop <- createStudyPopulation(
  cohortMethodData = cmData,
  outcomeId = 3,
  washoutPeriod = 180,
  removeDuplicateSubjects = "remove all",
  removeSubjectsWithPriorOutcome = TRUE,
  riskWindowStart = 0,
  startAnchor = "cohort start",
  riskWindowEnd = 99999)
drawAttritionDiagram(studyPop)
```




□□□

```
model <- fitOutcomeModel(population = studyPop,
                         modelType = "cox")
model
```

```
##     cox
##   FALSE
##     FALSE
##          FALSE
##    OK
##
##                .95    .95
##          1.34612    1.10065    1.65741 0.29723    0.1044
```

□□□□□□□

### □□ 12.5

□□□

```
##   TRUE
##     FALSE
##          FALSE
##    OK
##
##                 .95   .95
##          1.13211    0.92132    1.40008 0.12409    0.1068
```

□□□□□□□□□□□□□□□□□□□□□□□□□95□□□□□□□1□□□□□□□□□□□□□□□□□□□□□□□□□

## 23.8

### □□ 13.1

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□getPlpData□□□□□□□□□□

```
library(PatientLevelPrediction)
covSettings <- createCovariateSettings(
  useDemographicsGender = TRUE,
  useDemographicsAge = TRUE,
  useConditionGroupEraLongTerm = TRUE,
  useConditionGroupEraAnyTimePrior = TRUE,
  useDrugGroupEraLongTerm = TRUE,
  useDrugGroupEraAnyTimePrior = TRUE,
  useVisitConceptCountLongTerm = TRUE,
  longTermStartDays = -365,
  endDays = -1)

plpData <- getPlpData(connectionDetails = connectionDetails,
                      cdmDatabaseSchema = "main",
                      cohortDatabaseSchema = "main",
                      cohortTable = "cohort",
                      cohortId = 4,
                      covariateSettings = covSettings,
                      outcomeDatabaseSchema = "main",
                      outcomeTable = "cohort",
                      outcomeIds = 3)

summary(plpData)
```

```
## plpData
##
##         ID -1
##    ID 3
##
##   2630
##
```

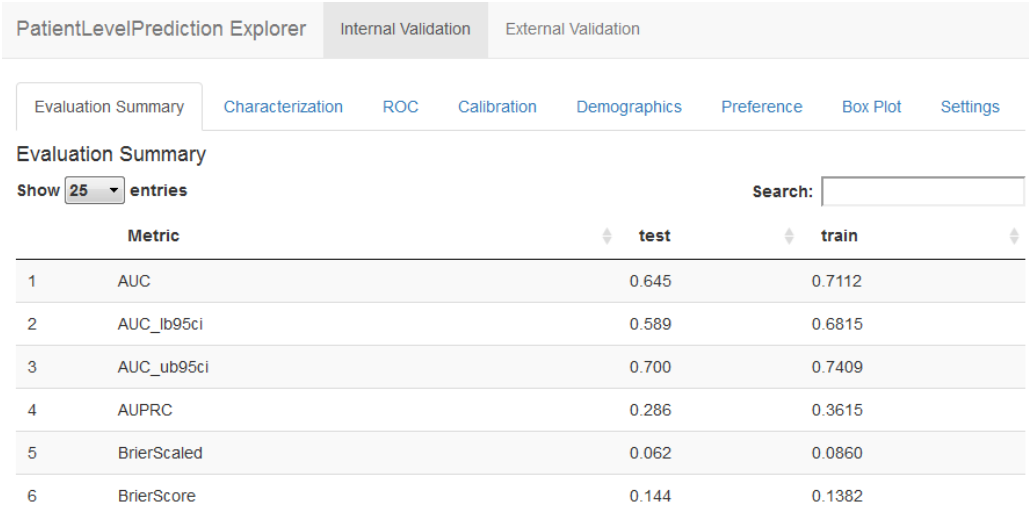
```
##
##
## 3            479        479
##
##
##     245
##       54079
```

### □□ 13.2

□□□

```
viewPlp(lassoResults)
```

□□□□□□□23.18□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□AUC□0.645□□□□□□□




| | Metric | test | train |
|---|---|---|---|
| 1 | AUC | 0.645 | 0.7112 |
| 2 | AUC_lb95ci | 0.589 | 0.6815 |
| 3 | AUC_ub95ci | 0.700 | 0.7409 |
| 4 | AUPRC | 0.286 | 0.3615 |
| 5 | BrierScaled | 0.062 | 0.0860 |
| 6 | BrierScore | 0.144 | 0.1382 |

Figure 23.18: □□□□□□□Shiny□□□□

## 23.9

### □□ 15.1

ACHILLES□□□□□□□:

```
library(ACHILLES)
result <- achilles(connectionDetails,
                   cdmDatabaseSchema = "main",
                   resultsDatabaseSchema = "main",
                   sourceName = "Eunomia",
                   cdmVersion = "5.3.0")
```

### □□ 15.2

□□□□□□□□□□□□□□□□□□□□:

```
DataQualityDashboard::executeDqChecks(
  connectionDetails,
  cdmDatabaseSchema = "main",
  resultsDatabaseSchema = "main",
```

```
  cdmSourceName = "Eunomia",
  outputFolder = "C:/dataQualityExample")
```

□□ **15.3**

□□□□□□□□□□□□□□□□□□□□:

```
DataQualityDashboard::viewDqDashboard(
  "C:/dataQualityExample/Eunomia/results_Eunomia.json")
```

## 23.10

## 23.11 NA

# Bibliography


Allison, D. B., Brown, A. W., George, B. J., and Kaiser, K. A. (2016). Reproducibility: A tragedy of errors. *Nature*, 530(7588):27–29.

Arnold, B. F., Ercumen, A., Benjamin-Chung, J., and Colford, J. M. (2016). Brief Report: Negative Controls to Detect Selection Bias and Measurement Bias in Epidemiologic Studies. *Epidemiology*, 27(5):637–641.

Austin, P. C. (2011). Optimal caliper widths for propensity-score matching when estimating differences in means and differences in proportions in observational studies. *Pharmaceutical statistics*, 10(2):150–161.

Banda, J. M., Halpern, Y., Sontag, D., and Shah, N. H. (2017). Electronic phenotyping with APHRODITE and the Observational Health Sciences and Informatics (OHDSI) data network. *AMIA Jt Summits Transl Sci Proc*, 2017:48–57.

Boland, M. R., Parhi, P., Li, L., Miotto, R., Carroll, R., Iqbal, U., Nguyen, P. A., Schuemie, M., You, S. C., Smith, D., Mooney, S., Ryan, P., Li, Y. J., Park, R. W., Denny, J., Dudley, J. T., Hripcsak, G., Gentine, P., and Tatonetti, N. P. (2017). Uncovering exposures responsible for birth season - disease effects: a global study. *J Am Med Inform Assoc*.

Botsis, T., Hartvigsen, G., Chen, F., and Weng, C. (2010). Secondary use of ehr: data quality issues and informatics opportunities. *Summit on Translational Bioinformatics*, 2010:1.

Byrd, J. B., Adam, A., and Brown, N. J. (2006). Angiotensin-converting enzyme inhibitor-associated angioedema. *Immunol Allergy Clin North Am*, 26(4):725–737.

Callahan, T. J., Bauck, A. E., Bertoch, D., Brown, J., Khare, R., Ryan, P. B., Staab, J., Zozus, M. N., and Kahn, M. G. (2017). A comparison of data quality assessment checks in six data sharing networks. *eGEMs*, 5(1).

Cepeda, M. S., Reps, J., Fife, D., Blacketer, C., Stang, P., and Ryan, P. (2018). Finding treatment-resistant depression in real-world data: How a data-driven approach compares with expert-based heuristics. *Depress Anxiety*, 35(3):220–228.

Chen, X., Dallmeier-Tiessen, S., Dasler, R., Feger, S., Fokianos, P., Gonzalez, J. B., Hirvonsalo, H., Kousidis, D., Lavasa, A., Mele, S., Rodriguez, D. R., Šimko, T., Smith, T., Trisovic, A., Trzcinska, A., Tsanaktsidis, I., Zimmermann, M., Cranmer, K., Heinrich,

L., Watts, G., Hildreth, M., Iglesias, L. L., Lassila-Perini, K., and Neubert, S. (2018). Open is not enough. *Nature Physics*, 15(2):113–119.

Cicardi, M., Zingale, L. C., Bergamaschini, L., and Agostoni, A. (2004). Angioedema associated with angiotensin-converting enzyme inhibitor use: outcome after switching to a different treatment. *Arch. Intern. Med.*, 164(8):910–913.

Dasu, T. and Johnson, T. (2003). *Exploratory data mining and data cleaning*, volume 479. John Wiley & Sons.

Defalco, F. J., Ryan, P. B., and Soledad Cepeda, M. (2013). Applying standardized drug terminologies to observational healthcare databases: a case study on opioid exposure. *Health Serv Outcomes Res Methodol*, 13(1):58–67.

Duke, J. D., Ryan, P. B., Suchard, M. A., Hripcsak, G., Jin, P., Reich, C., Schwalm, M. S., Khoma, Y., Wu, Y., Xu, H., Shah, N. H., Banda, J. M., and Schuemie, M. J. (2017). Risk of angioedema associated with levetiracetam compared with phenytoin: Findings of the observational health data sciences and informatics research network. *Epilepsia*, 58(8):e101–e106.

Farrington, C. P. (1995). Relative incidence estimation from case series for vaccine safety evaluation. *Biometrics*, 51(1):228–235.

Farrington, C. P., Anaya-Izquierdo, K., Whitaker, H. J., Hocine, M. N., Douglas, I., and Smeeth, L. (2011). Self-controlled case series analysis with event-dependent observation periods. *Journal of the American Statistical Association*, 106(494):417–426.

Garza, M., Del Fiol, G., Tenenbaum, J., Walden, A., and Zozus, M. N. (2016). Evaluating common data models for use with a longitudinal community registry. *J Biomed Inform*, 64:333–341.

Hernan, M. A. and Robins, J. M. (2016). Using Big Data to Emulate a Target Trial When a Randomized Trial Is Not Available. *Am. J. Epidemiol.*, 183(8):758–764.

Hersh, W. R., Weiner, M. G., Embi, P. J., Logan, J. R., Payne, P. R., Bernstam, E. V., Lehmann, H. P., Hripcsak, G., Hartzog, T. H., Cimino, J. J., et al. (2013). Caveats for the use of operational electronic health record data in comparative effectiveness research. *Medical care*, 51(8 0 3):S30.

Hill, A. B. (1965). THE ENVIRONMENT AND DISEASE: ASSOCIATION OR CAUSATION? *Proc. R. Soc. Med.*, 58:295–300.

Hripcsak, G. and Albers, D. J. (2017). High-fidelity phenotyping: richness and freedom from bias. *J Am Med Inform Assoc*.

Hripcsak, G., Duke, J. D., Shah, N. H., Reich, C. G., Huser, V., Schuemie, M. J., Suchard, M. A., Park, R. W., Wong, I. C. K., Rijnbeek, P. R., van der Lei, J., Pratt, N., Norén, G. N., Li, Y.-C., Stang, P. E., Madigan, D., and Ryan, P. B. (2015). Observational Health Data Sciences and Informatics (OHDSI): Opportunities for Observational Researchers. *Studies in health technology and informatics*, 216:574–578.

Hripcsak, G., Levine, M. E., Shang, N., and Ryan, P. B. (2018). Effect of vocabulary mapping for conditions on phenotype cohorts. *J Am Med Inform Assoc*, 25(12):1618–1625.

Hripcsak, G., Shang, N., Peissig, P. L., Rasmussen, L. V., Liu, C., Benoit, B., Carroll, R. J., Carrell, D. S., Denny, J. C., Dikilitas, O., Gainer, V. S., Marie Howell, K., Klann, J. G., Kullo, I. J., Lingren, T., Mentch, F. D., Murphy, S. N., Natarajan, K., Pacheco, J. A., Wei, W. Q., Wiley, K., and Weng, C. (2019). Facilitating phenotype transfer using a common data model. *J Biomed Inform*, page 103253.

Huser, V., DeFalco, F. J., Schuemie, M., Ryan, P. B., Shang, N., Velez, M., Park, R. W., Boyce, R. D., Duke, J., Khare, R., Utidjian, L., and Bailey, C. (2016). Multisite Evaluation of a Data Quality Tool for Patient-Level Clinical Data Sets. *EGEMS (Washington, DC)*, 4(1):1239.

Huser, V., Kahn, M. G., Brown, J. S., and Gouripeddi, R. (2018). Methods for examining data quality in healthcare integrated data repositories. *Pacific Symposium on Biocomputing. Pacific Symposium on Biocomputing*, 23:628–633.

Johnston, S. S., Morton, J. M., Kalsekar, I., Ammann, E. M., Hsiao, C. W., and Reps, J. (2019). Using Machine Learning Applied to Real-World Healthcare Data for Predictive Analytics: An Applied Example in Bariatric Surgery. *Value Health*, 22(5):580–586.

Kahn, M. G., Brown, J. S., Chun, A. T., Davidson, B. N., Meeker, D., Ryan, P. B., Schilling, L. M., Weiskopf, N. G., Williams, A. E., and Zozus, M. N. (2015). Transparent reporting of data quality in distributed data networks. *EGEMS (Washington, DC)*, 3(1):1052.

Kahn, M. G., Callahan, T. J., Barnard, J., Bauck, A. E., Brown, J., Davidson, B. N., Estiri, H., Goerg, C., Holve, E., Johnson, S. G., Liaw, S.-T., Hamilton-Lopez, M., Meeker, D., Ong, T. C., Ryan, P. B., Shang, N., Weiskopf, N. G., Weng, C., Zozus, M. N., and Schilling, L. (2016). A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic Health Record Data. *EGEMS (Washington, DC)*, 4(1):1244.

Kahn, M. G., Raebel, M. A., Glanz, J. M., Riedlinger, K., and Steiner, J. F. (2012). A pragmatic framework for single-site and multisite data quality assessment in electronic health record-based clinical research. *Medical care*, 50.

Liaw, S.-T., Rahimi, A., Ray, P., Taggart, J., Dennis, S., de Lusignan, S., Jalaludin, B., Yeo, A., and Talaei-Khoei, A. (2013). Towards an ontology for data quality in integrated chronic disease management: a realist review of the literature. *International journal of medical informatics*, 82(1):10–24.

Lipsitch, M., Tchetgen Tchetgen, E., and Cohen, T. (2010). Negative controls: a tool for detecting confounding and bias in observational studies. *Epidemiology*, 21(3):383–388.

Maclure, M. (1991). The case-crossover design: a method for studying transient effects on the risk of acute events. *Am. J. Epidemiol.*, 133(2):144–153.

Madigan, D., Ryan, P. B., and Schuemie, M. (2013). Does design matter? Systematic evaluation of the impact of analytical choices on effect estimates in observational studies. *Ther Adv Drug Saf*, 4(2):53–62.

Magid, D. J., Shetterly, S. M., Margolis, K. L., Tavel, H. M., O'Connor, P. J., Selby, J. V., and Ho, P. M. (2010). Comparative effectiveness of angiotensin-converting enzyme inhibitors versus beta-blockers as second-line therapy for hypertension. *Circ Cardiovasc Qual Outcomes*, 3(5):453–458.

Makadia, R. and Ryan, P. B. (2014). Transforming the Premier Perspective Hospital Database into the Observational Medical Outcomes Partnership (OMOP) Common Data Model. *EGEMS (Wash DC)*, 2(1):1110.

Martin, R. C. (2008). *Clean Code: A Handbook of Agile Software Craftsmanship*. Prentice Hall PTR, Upper Saddle River, NJ, USA, 1 edition.

Matcho, A., Ryan, P., Fife, D., and Reich, C. (2014). Fidelity assessment of a clinical practice research datalink conversion to the OMOP common data model. *Drug Saf*, 37(11):945–959.

Noren, G. N., Caster, O., Juhlin, K., and Lindquist, M. (2014). Zoo or savannah? Choice of training ground for evidence-based pharmacovigilance. *Drug Saf*, 37(9):655–659.

Norman, J. L., Holmes, W. L., Bell, W. A., and Finks, S. W. (2013). Life-threatening ACE inhibitor-induced angioedema after eleven years on lisinopril. *J Pharm Pract*, 26(4):382–388.

Oliveira, J. L., Trifan, A., and Silva, L. A. B. (2019). EMIF catalogue: A collaborative platform for sharing and reusing biomedical data. *International Journal of Medical Informatics*, 126:35–45.

Olsen, L., Aisner, D., McGinnis, J. M., et al. (2007). *The learning healthcare system: workshop summary*. Natl Academy Pr.

O'Mara, N. B. and O'Mara, E. M. (1996). Delayed onset of angioedema with angiotensin-converting enzyme inhibitors: case report and review of the literature. *Pharmacotherapy*, 16(4):675–679.

Overhage, J. M., Ryan, P. B., Reich, C. G., Hartzema, A. G., and Stang, P. E. (2012). Validation of a common data model for active safety surveillance research. *J Am Med Inform Assoc*, 19(1):54–60.

Powers, B. J., Coeytaux, R. R., Dolor, R. J., Hasselblad, V., Patel, U. D., Yancy, W. S., Gray, R. N., Irvine, R. J., Kendrick, A. S., and Sanders, G. D. (2012). Updated report on comparative effectiveness of ACE inhibitors, ARBs, and direct renin inhibitors for patients with essential hypertension: much more data, little new information. *J Gen Intern Med*, 27(6):716–729.

Ramcharran, D., Qiu, H., Schuemie, M. J., and Ryan, P. B. (2017). Atypical Antipsychotics and the Risk of Falls and Fractures Among Older Adults: An Emulation Analysis and an Evaluation of Additional Confounding Control Strategies. *J Clin Psychopharmacol*, 37(2):162–168.

Rassen, J. A., Shelat, A. A., Myers, J., Glynn, R. J., Rothman, K. J., and Schneeweiss, S. (2012). One-to-many propensity score matching in cohort studies. *Pharmacoepidemiol Drug Saf*, 21 Suppl 2:69–80.

Reps, J. M., Rijnbeek, P. R., and Ryan, P. B. (2019). Identifying the DEAD: Development and Validation of a Patient-Level Model to Predict Death Status in Population-Level Claims Data. *Drug Saf.*

Reps, J. M., Schuemie, M. J., Suchard, M. A., Ryan, P. B., and Rijnbeek, P. R. (2018). Design and implementation of a standardized framework to generate and evaluate patient-level prediction models using observational healthcare data. *Journal of the American Medical Informatics Association*, 25(8):969–975.

Roebuck, K. (2012). *Data quality: high-impact strategies-what you need to know: definitions, adoptions, impact, benefits, maturity, vendors*. Emereo Publishing.

Rosenbaum, P. and Rubin, D. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70:41–55.

Rubbo, B., Fitzpatrick, N. K., Denaxas, S., Daskalopoulou, M., Yu, N., Patel, R. S., Hemingway, H., Danesh, J., Allen, N., Atkinson, M., Blaveri, E., Brannan, R., Brayne, C., Brophy, S., Chaturvedi, N., Collins, R., deLusignan, S., Denaxas, S., Desai, P., Eastwood, S., Gallacher, J., Hemingway, H., Hotopf, M., Landray, M., Lyons, R., O'Neil, T., Pringle, M., Sprosen, T., Strachan, D., Sudlow, C., Sullivan, F., Zhang, Q., and Flaig, R. (2015). Use of electronic health records to ascertain, validate and phenotype acute myocardial infarction: A systematic review and recommendations. *Int. J. Cardiol.*, 187:705–711.

Rubin, D. B. (2001). Using propensity scores to help design observational studies: application to the tobacco litigation. *Health Services and Outcomes Research Methodology*, 2(3-4):169–188.

Ryan, P. B., Buse, J. B., Schuemie, M. J., DeFalco, F., Yuan, Z., Stang, P. E., Berlin, J. A., and Rosenthal, N. (2018). Comparative effectiveness of canagliflozin, SGLT2 inhibitors and non-SGLT2 inhibitors on the risk of hospitalization for heart failure and amputation in patients with type 2 diabetes mellitus: A real-world meta-analysis of 4 observational databases (OBSERVE-4D). *Diabetes Obes Metab*, 20(11):2585–2597.

Ryan, P. B., Schuemie, M. J., and Madigan, D. (2013). Empirical performance of a self-controlled cohort method: lessons for developing a risk identification and analysis system. *Drug Saf*, 36 Suppl 1:95–106.

Ryan, P. B., Schuemie, M. J., Ramcharran, D., and Stang, P. E. (2017). Atypical Antipsychotics and the Risks of Acute Kidney Injury and Related Outcomes Among Older

Adults: A Replication Analysis and an Evaluation of Adapted Confounding Control Strategies. *Drugs Aging*, 34(3):211–219.

Sabroe, R. A. and Black, A. K. (1997). Angiotensin-converting enzyme (ACE) inhibitors and angio-oedema. *Br. J. Dermatol.*, 136(2):153–158.

Schuemie, M. J., Hripcsak, G., Ryan, P. B., Madigan, D., and Suchard, M. A. (2016). Robust empirical calibration of p-values using observational data. *Stat Med*, 35(22):3883–3888.

Schuemie, M. J., Hripcsak, G., Ryan, P. B., Madigan, D., and Suchard, M. A. (2018a). Empirical confidence interval calibration for population-level effect estimation studies in observational healthcare data. *Proc. Natl. Acad. Sci. U.S.A.*, 115(11):2571–2577.

Schuemie, M. J., Ryan, P. B., DuMouchel, W., Suchard, M. A., and Madigan, D. (2014). Interpreting observational studies: why empirical calibration is needed to correct p-values. *Stat Med*, 33(2):209–218.

Schuemie, M. J., Ryan, P. B., Hripcsak, G., Madigan, D., and Suchard, M. A. (2018b). Improving reproducibility by using high-throughput observational studies with empirical calibration. *Philos Trans A Math Phys Eng Sci*, 376(2128).

Sherman, R. E., Anderson, S. A., Dal Pan, G. J., Gray, G. W., Gross, T., Hunter, N. L., LaVange, L., Marinac-Dabic, D., Marks, P. W., Robb, M. A., et al. (2016). Real-world evidence—what is it and what can it tell us. *N Engl J Med*, 375(23):2293–2297.

Simpson, S. E., Madigan, D., Zorych, I., Schuemie, M. J., Ryan, P. B., and Suchard, M. A. (2013). Multiple self-controlled case series for large-scale longitudinal observational databases. *Biometrics*, 69(4):893–902.

Stang, P. E., Ryan, P. B., Racoosin, J. A., Overhage, J. M., Hartzema, A. G., Reich, C., Welebob, E., Scarnecchia, T., and Woodcock, J. (2010). Advancing the science for active surveillance: rationale and design for the Observational Medical Outcomes Partnership. *Ann. Intern. Med.*, 153(9):600–606.

Suchard, M. A., Simpson, S. E., Zorych, I., Ryan, P. B., and Madigan, D. (2013). Massive parallelization of serial inference algorithms for a complex generalized linear model. *ACM Trans. Model. Comput. Simul.*, 23(1):10:1–10:17.

Suissa, S. (1995). The case-time-control design. *Epidemiology*, 6(3):248–253.

Swerdel, J. N., Hripcsak, G., and Ryan, P. B. (2019). PheValuator: Development and Evaluation of a Phenotype Algorithm Evaluator. *J Biomed Inform*, page 103258.

Thompson, T. and Frable, M. A. (1993). Drug-induced, life-threatening angioedema revisited. *Laryngoscope*, 103(1 Pt 1):10–12.

Tian, Y., Schuemie, M. J., and Suchard, M. A. (2018). Evaluating large-scale propensity score performance through real-world and synthetic data experiments. *Int J Epidemiol*, 47(6):2005–2014.

Toh, S., Reichman, M. E., Houstoun, M., Ross Southworth, M., Ding, X., Hernandez, A. F., Levenson, M., Li, L., McCloskey, C., Shoaibi, A., Wu, E., Zornberg, G., and Hennessy, S. (2012). Comparative risk for angioedema associated with the use of drugs that target the renin-angiotensin-aldosterone system. *Arch. Intern. Med.*, 172(20):1582–1589.

van der Lei, J. (1991). Use and abuse of computer-stored medical records. *Methods of information in medicine*, 30(02):79–80.

Vandenbroucke, J. P. and Pearce, N. (2012). Case-control studies: basic concepts. *Int J Epidemiol*, 41(5):1480–1489.

Vashisht, R., Jung, K., Schuler, A., Banda, J. M., Park, R. W., Jin, S., Li, L., Dudley, J. T., Johnson, K. W., Shervey, M. M., Xu, H., Wu, Y., Natrajan, K., Hripcsak, G., Jin, P., Van Zandt, M., Reckard, A., Reich, C. G., Weaver, J., Schuemie, M. J., Ryan, P. B., Callahan, A., and Shah, N. H. (2018). Association of Hemoglobin A1c Levels With Use of Sulfonylureas, Dipeptidyl Peptidase 4 Inhibitors, and Thiazolidinediones in Patients With Type 2 Diabetes Treated With Metformin: Analysis From the Observational Health Data Sciences and Informatics Initiative. *JAMA Netw Open*, 1(4):e181755.

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., and Vandenbroucke, J. P. (2008). The strengthening the reporting of observational studies in epidemiology (strobe) statement: guidelines for reporting observational studies. *Journal of Clinical Epidemiology*, 61(4):344 – 349.

Voss, E. A., Boyce, R. D., Ryan, P. B., van der Lei, J., Rijnbeek, P. R., and Schuemie, M. J. (2016). Accuracy of an Automated Knowledge Base for Identifying Drug Adverse Reactions. *J Biomed Inform*.

Voss, E. A., Ma, Q., and Ryan, P. B. (2015a). The impact of standardizing the definition of visits on the consistency of multi-database observational health research. *BMC Med Res Methodol*, 15:13.

Voss, E. A., Makadia, R., Matcho, A., Ma, Q., Knoll, C., Schuemie, M., DeFalco, F. J., Londhe, A., Zhu, V., and Ryan, P. B. (2015b). Feasibility and utility of applications of the common data model to multiple, disparate observational health databases. *J Am Med Inform Assoc*, 22(3):553–564.

Walker, A. M., Patrick, A. R., Lauer, M. S., Hornbrook, M. C., Marin, M. G., Platt, R., Roger, V. L., Stang, P., and Schneeweiss, S. (2013). A tool for assessing the feasibility of comparative effectiveness research. *Comp Eff Res*, 3:11–20.

Wang, Y., Desai, M., Ryan, P. B., DeFalco, F. J., Schuemie, M. J., Stang, P. E., Berlin, J. A., and Yuan, Z. (2017). Incidence of diabetic ketoacidosis among patients with type 2 diabetes mellitus treated with SGLT2 inhibitors and other antihyperglycemic agents. *Diabetes Res. Clin. Pract.*, 128:83–90.

Weinstein, R. B., Ryan, P., Berlin, J. A., Matcho, A., Schuemie, M., Swerdel, J., Patel, K., and Fife, D. (2017). Channeling in the Use of Nonprescription Paracetamol and Ibupro-

fen in an Electronic Medical Records Database: Evidence and Implications. *Drug Saf*, 40(12):1279–1292.

Weiskopf, N. G. and Weng, C. (2013). Methods and dimensions of electronic health record data quality assessment: enabling reuse for clinical research. *Journal of the American Medical Informatics Association: JAMIA*, 20(1):144–151.

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., Collins, K. J., Dennison Himmelfarb, C., DePalma, S. M., Gidding, S., Jamerson, K. A., Jones, D. W., MacLaughlin, E. J., Muntner, P., Ovbiagele, B., Smith, S. C., Spencer, C. C., Stafford, R. S., Taler, S. J., Thomas, R. J., Williams, K. A., Williamson, J. D., and Wright, J. T. (2018). 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*, 138(17):e426–e483.

Whitaker, H. J., Farrington, C. P., Spiessens, B., and Musonda, P. (2006). Tutorial in biostatistics: the self-controlled case series method. *Stat Med*, 25(10):1768–1797.

Who, A. (2013). Global brief on hypertension. *World Health Organization*.

Wikipedia (2019a). Open science — Wikipedia, the free encyclopedia. http://en.wikipedia.org/w/index.php?title=Open%20science&oldid=900178688. [Online; accessed 24-June-2019].

Wikipedia (2019b). Science 2.0 — Wikipedia, the free encyclopedia. http://en.wikipedia.org/w/index.php?title=Science%202.0&oldid=887565958. [Online; accessed 09-July-2019].

Wikiquote (2019). Ronald fisher — wikiquote,. [Online; accessed 2-August-2019].

Yoon, D., Ahn, E. K., Park, M. Y., Cho, S. Y., Ryan, P., Schuemie, M. J., Shin, D., Park, H., and Park, R. W. (2016). Conversion and Data Quality Assessment of Electronic Health Record Data at a Korean Tertiary Teaching Hospital to a Common Data Model for Distributed Network Research. *Healthc Inform Res*, 22(1):54–58.

Yuan, Z., DeFalco, F. J., Ryan, P. B., Schuemie, M. J., Stang, P. E., Berlin, J. A., Desai, M., and Rosenthal, N. (2018). Risk of lower extremity amputations in people with type 2 diabetes mellitus treated with sodium-glucose co-transporter-2 inhibitors in the USA: A retrospective cohort study. *Diabetes Obes Metab*, 20(3):582–589.

Zaadstra, B. M., Chorus, A. M., van Buuren, S., Kalsbeek, H., and van Noort, J. M. (2008). Selective association of multiple sclerosis with infectious mononucleosis. *Mult. Scler.*, 14(3):307–313.

Zaman, M. A., Oparil, S., and Calhoun, D. A. (2002). Drugs targeting the renin-angiotensin-aldosterone system. *Nat Rev Drug Discov*, 1(8):621–636.

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