



# Leveraging the OHDSI ecosystem

*as a developer*

OMOP Team, IQVIA  
March 2021



# Training series plan

## + Session 1 : Course Introduction

- OMOP CDM and vocabulary overview, OMOP conversion, data quality, examples of previous research and use cases, introducing ATLAS and OHDSI tools

## + Session 2: OMOP CDM/Vocabulary Tutorial

- Concept, Concept mapping, Hierarchy, Ancestors, and OMOP CDM

## + Session 3: Cohort and Cohort Characterization

- Concept sets, cohort definition, and cohort characterization

## + Session 4: Treatment Pathways and Incident Rates

- Treatment pathways, Incidence rates, and Characterization using R



# Table of contents

- + Exercise review from previous session
- + Introduction of influenza study in ATLAS
- + **ATLAS concept sets and cohorts**
  - Data sources
  - Concept sets
  - Cohort building
  - Build cohorts for example case study – exercise
- + **ATLAS characterizations**
  - Cohort characterization (default and customized features)
  - Build characterization for example case study – exercise
- + **Homework**



## Ground Rules

- + This session will be recorded
- + Please make sure your microphones are muted
- + Type your questions in the chat or bring them to the Q& A session
- + Turn off your camera

# Exercise Review from Session #1

# Session #1 Homework – Proposed concepts

		CONCEPT ID	CONCEPT NAME	OHDSI SOURCE
Influenza		4266367		
Type 2 diabetes				<a href="https://atlas.ohdsi.org/#/conceptset/27/expression">https://atlas.ohdsi.org/#/conceptset/27/expression</a>
Lung disease			chronic obstructive pulmonary disease (COPD)	<a href="https://atlas.ohdsi.org/#/conceptset/59/expression">https://atlas.ohdsi.org/#/conceptset/59/expression</a>
Cancer		443392	Malignant neoplastic disease	
		4144289	H/O: malignant neoplasm	
Immunodeficiency		433740	Immunodeficiency disorder	
Heart Disease	Cardiomyopathy	321319	Cardiomyopathy	
	Myocardial infarction			<a href="https://atlas.ohdsi.org/#/conceptset/44/expression">https://atlas.ohdsi.org/#/conceptset/44/expression</a>
	Heart Failure			<a href="https://atlas.ohdsi.org/#/conceptset/57/expression">https://atlas.ohdsi.org/#/conceptset/57/expression</a>
Hypertension				<a href="https://atlas.ohdsi.org/#/conceptset/21/expression">https://atlas.ohdsi.org/#/conceptset/21/expression</a>
Asthma				<a href="https://atlas.ohdsi.org/#/conceptset/60/expression">https://atlas.ohdsi.org/#/conceptset/60/expression</a>
Renal Disease		45768812	Anemia in chronic kidney disease	<a href="https://atlas.ohdsi.org/#/cohortdefinition/228/conceptsets">https://atlas.ohdsi.org/#/cohortdefinition/228/conceptsets</a>
		194385	Aneurysm of renal artery	
		46271022	Chronic kidney disease	
		192279	Disorder of kidney due to diabetes mellitus	
		4263367	Glomerulonephritis	
		261071	Glomerulosclerosis	
		201313	Hypertensive renal disease	
		193253	Nephritis	
		195314	Nephrotic syndrome	
		192359	Renal failure syndrome	

# Exercise Review from Session #2

# Session #2 Homework – Proposed solutions

[https://drive.google.com/drive/folders/1-zqBUMOKFC2zk\\_EvPsGPg-c36uWSjNTa](https://drive.google.com/drive/folders/1-zqBUMOKFC2zk_EvPsGPg-c36uWSjNTa)



# Introduction of Influenza Study in ATLAS

# Influenza Study

## *Treatments and outcomes of influenza patients during hospital stay*

### Study Topic

Baseline demographics and clinical characteristics, treatment patterns and outcomes of patients diagnosed with influenza initiating treatment in the US hospital setting: a retrospective cohort study using administrative data.

### Objectives

#### ***Primary Objectives***

- Describe the treatment patterns of hospitalized influenza patients:
  - › Drugs - (a) antivirals (b) antibiotics (c) corticosteroids
  - › Procedures - (a) mechanical ventilation (b) tracheostomy (c) extracorporeal membrane oxygenation (d) oxygen therapy
- Describe the length of the hospital stay by conditions of interest:
  - › (a) diabetes (b) lung disease (c) cancer (d) immunodeficiency (e) heart disease (f) hypertension (g) asthma (h) kidney disease

#### ***Secondary Objectives***

- Describe the baseline demographics and clinical characteristics of hospitalized influenza patients.

# Influenza Study – Cohort Definition

## Study Population

- Persons hospitalized during the **2008-2009 influenza season** with a diagnosis of influenza **21 days prior** or during the **hospital stay**, with **no prior continuous enrollment** required and with **no influenza hospitalization in the 6 months prior** to hospital admission.

## Inclusion Criteria

- Patients with claims for a **hospital stay** between **1st September 2008** and **1st April 2009 (index date)**. All hospital stays during the study period are of interest.
- Patient is **≥ 18** years of age at **index date**.
- Patient has at least **1 diagnosis/measurement** of influenza **21 days prior to index start date** (hospital admission) or up to **index end date** (hospital discharge date).
- Patient has **0 months of prior continuous enrollment** prior to hospital admission.
- **EXCLUDE** patients with evidence of **hospitalization for influenza** in the **6 months prior to index date**.

# Analysis plan for the example study in ATLAS

- **Part 1**

- Build concepts sets
- Build cohort definitions

- **Part 2**

- Characterization of the study cohort

# ATLAS Concept Sets

## Lecture, Demo & Exercise

# ATLAS – Data Sources

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AmbEMR. 2020/08


Dashboard

AmbEMR. 2020/08 Dashboard Report

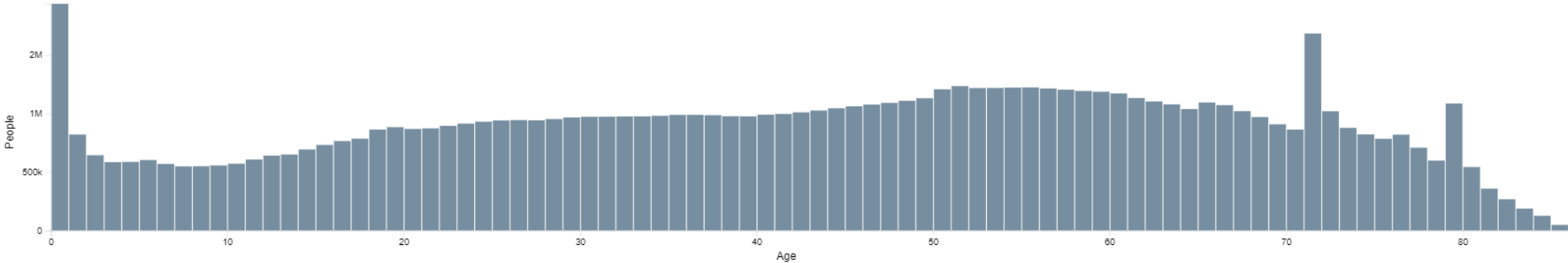
CDM Summary

Source name	DEFAULT
Number of persons	77.607M

Population by Gender




Age at First Observation



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join the journey

Concept Set #2180

Hypertension

Concept Set Expression

Included Concepts 277

Included Source Codes

Explore Evidence

Export

Compare

Show 25 entries

Search:

Showing 1 to 4 of 4 entries

Previous 1 Next

	Concept Id	Concept Code	Concept Name	Domain	Standard Concept Caption	<input type="checkbox"/> Exclude	<input checked="" type="checkbox"/> Descendants	<input type="checkbox"/> Mapped
	4322024	70995007	Pulmonary hypertension	Condition	Standard	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4167493	48194001	Pregnancy-induced hypertension	Condition	Standard	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	316866	38341003	Hypertensive disorder	Condition	Standard	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	42709887	449759005	Hypertensive complication	Condition	Standard	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Classification

Non-Standard

Standard

# ATLAS – Concept Sets

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Concept Set #2130

[UCS] Petit Mal

Concept Set Expression

Included Concepts 24

Included Source Codes

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Export

Compare

Show 25 entries

Showing 1 to 1 of 1 entries

Concept Id	Concept Code	Concept Name	Domain	Standard Concept Caption	Exclude	Descendants	Mapped
381842	7033004	Petit mal status	Condition	Standard	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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[UCS] Petit Mal

Concept Set Expression

Included Concepts 24

Included Source Codes

Explore Evidence

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Column visibility

Copy

CSV

Show 15 entries

Filter:

Showing 1 to 6 of 6 entries

Id	Code	Name	Class	Domain	Vocabulary
45591176	G41.1	Petit mal status epilepticus	ICD10 code	Condition	ICD10
44819586	345.2	Petit mal status	4-dig billing code	Condition	ICD9CM
37083391	G41.1	Petit mal status epilepticus	ICD10 code	Condition	ICD10GM
1411645	G41.101	Absence status epilepticus (machine translation)	ICD10 code	Condition	ICD10CN
1411644	G41.100	Petit mal status epilepticus	ICD10 code	Condition	ICD10CN
		Petit mal status epilepticus	ICD10 code	Condition	ICD10CN

Concept Set #2130

[UCS] Petit Mal

Concept Set Expression

Included Concepts 23

Included Source Codes

Explore Evidence

Export

Compare

Show 25 entries

Showing 1 to 2 of 2 entries

Concept Id	Concept Code	Concept Name	Domain	Standard Concept Caption	Exclude	Descendants	Mapped
381842	7033004	Petit mal status	Condition	Standard	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
44819586	345.2	Petit mal status	Condition	Non-Standard	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>



# ATLAS – Concept Sets (Resources: phenotypes, Phoebe)

← → ↺

data.ohdsi.org/PHOEBE/

PHOEBE

☰

About

Initial Concept

Concept Set Recommender

## PHenotype Observed Entity Baseline Endorsements (PHOEBE)

**Content:**

1) Initial concept recommender provides a single starting concept to be used with descendants for a concept set:

2) Concept set recommender provides a single starting concept to be used with descendants for a concept set:

**Resources:**

- Concept Set Recommender

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OHDSI / PhenotypeLibrary

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master PhenotypeLibrary / extras / PhenotypeDescription.csv

Go to file

gowthamrao Release v 0.0.1 Latest commit 5e61b29 on Oct 17, 2020 History

1 contributor

263 lines (263 sloc) 222 KB

Raw Blame

Search this file...

	phenotypeld	phenotypeName	referentConceptId	clinicalDescription
1				
2	24134000	Neck pain	24134	Overview: Pain in the neck and shoulders. Neck pain can have causes that aren't c
3	24609000	Hypoglycemia	24609	Overview: A condition in which blood sugar (glucose) level is lower than normal.
4	27918000	Eosinophilic esophagitis	27918	Overview: This is a chronic, immune/antigen-mediated, esophageal disease chara
5	30753000	Esophagitis	30753	Overview: Inflammation that damages the esophagus (mouth to the stomach). Pr

# ATLAS – Concept Sets – Demo

- influenza
- type 2 diabetes
- lung disease
- cancer
- immunodeficiency
- heart disease
- hypertension
- asthma
- kidney disease

# ATLAS – Concept Sets – Exercise

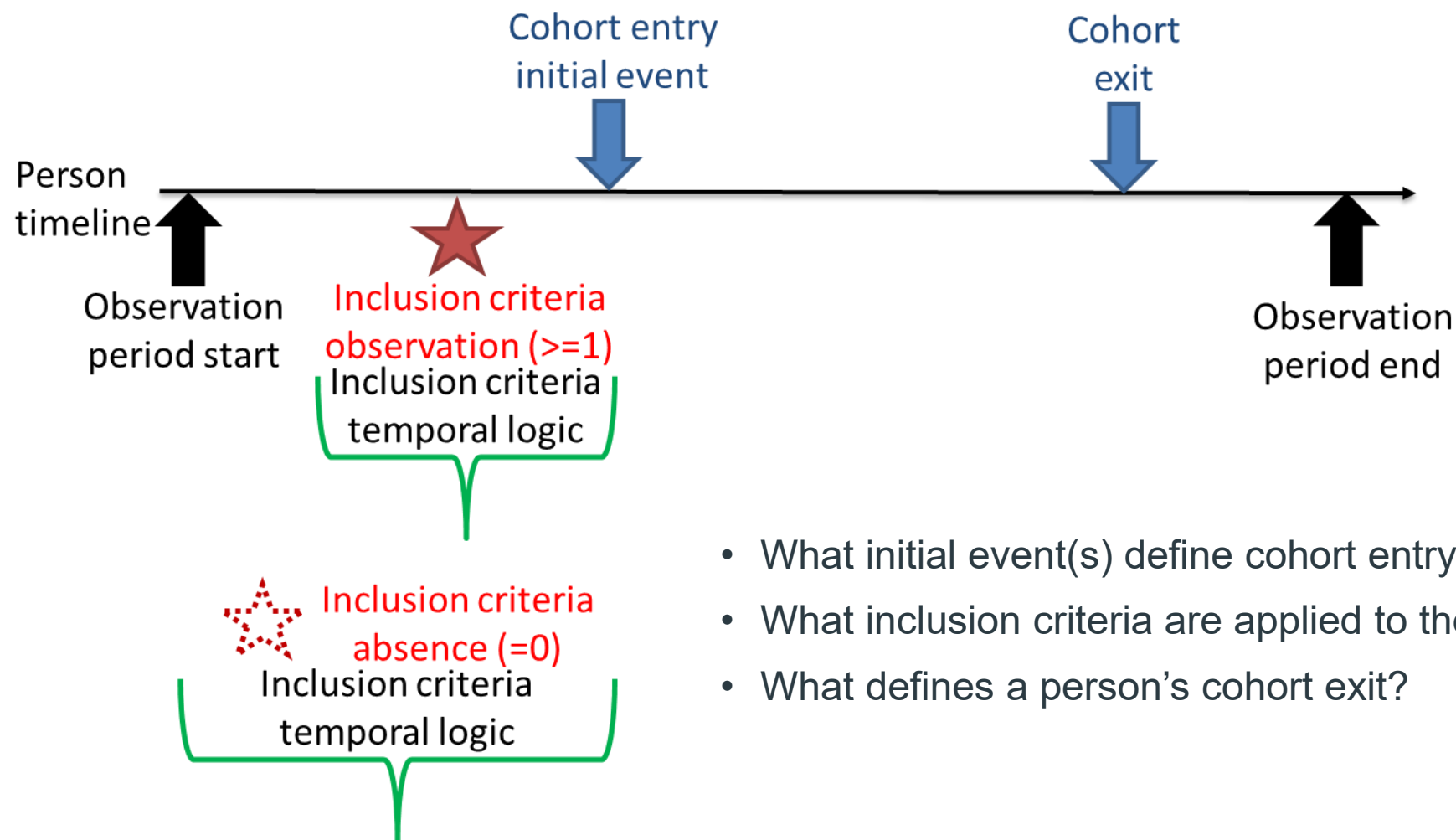
- influenza
- type 2 diabetes
- lung disease
- cancer
- immunodeficiency
- heart disease
- hypertension
- asthma
- kidney disease

# ATLAS Cohort Definition

## Lecture, Demo & Exercise

# ATLAS – Cohort definitions

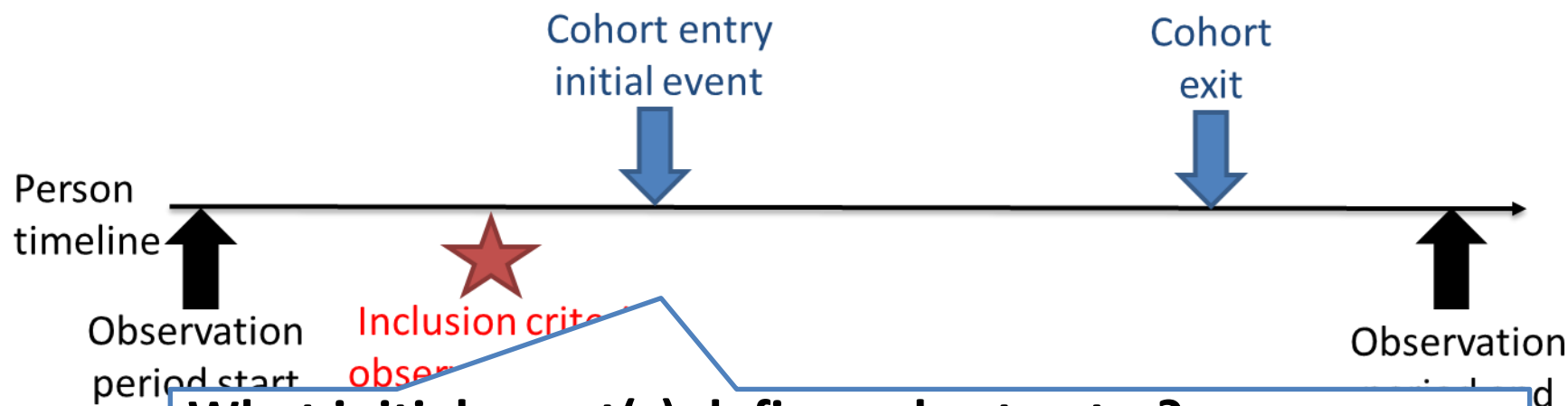
## *Dissecting the anatomy of a cohort definition*



- What initial event(s) define cohort entry?
- What inclusion criteria are applied to the initial events?
- What defines a person's cohort exit?

# ATLAS – Cohort entry event

## *Dissecting the anatomy of a cohort definition*

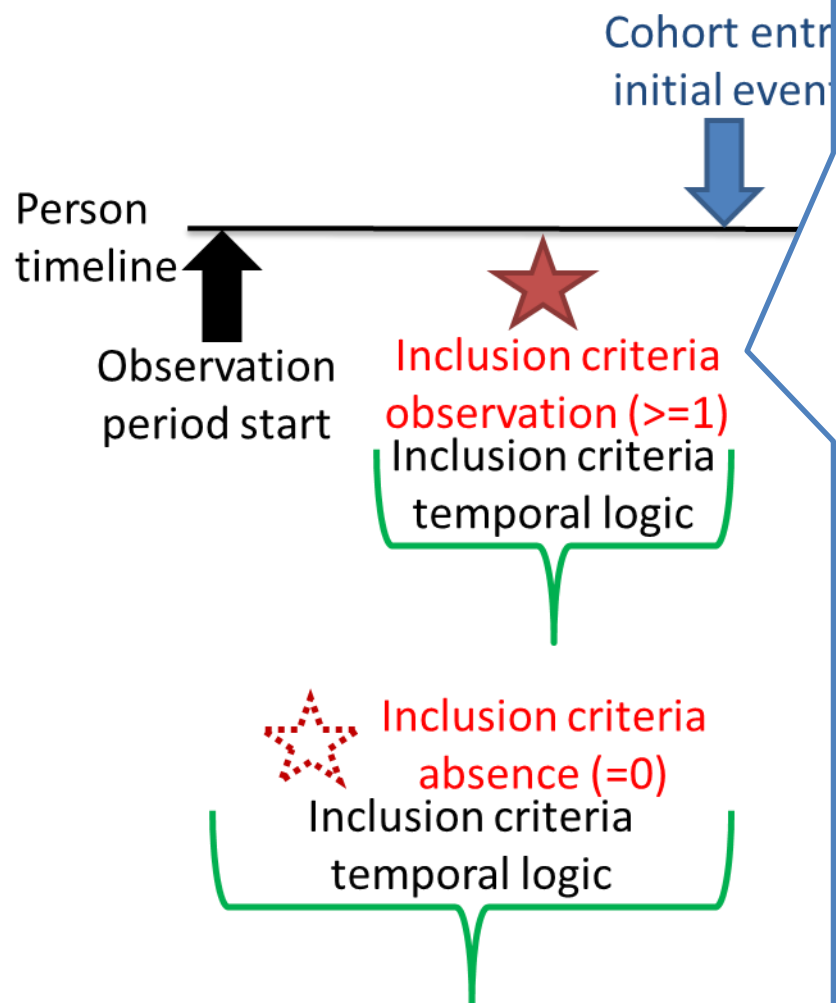


### **What initial event(s) define cohort entry?**

- Events are recorded time-stamped observations for the persons, such as drug exposures, conditions, procedures, measurements and visits.
- The event index date is set to be equal to the event start date
- Initial events defined by a domain, concept set, and any domain-specific attributes required

# ATLAS – Cohort inclusion criteria

## *Dissecting the anatomy of a cohort definition*



### What inclusion criteria are applied to the initial events?

- The qualifying cohort will be defined as all persons who have an initial event and satisfy all qualifying inclusion criteria.
- Each inclusion criteria is defined by domain(s), concept set(s), domain-specific attributes, and the temporal logic relative to initial events
- Each qualifying inclusion criteria can be evaluated to determine the impact of the criteria on the attrition of persons from the initial cohort (example use case: clinical trial feasibility)

# ATLAS – Cohort exit

## *Dissecting the anatomy of a cohort definition*

### **What defines a person's cohort exit?**

- Cohort exit signifies when a person no longer qualifies for cohort membership
- Cohort exit can be defined in multiple ways:
  - End of observation period
  - Fixed time interval relative to initial event
  - Last event in a sequence of related observations (ex: persistent drug exposure)
  - Censoring observations
- Cohort exit strategy will impact whether a person can belong to the cohort multiple times during different time intervals

Cohort  
exit



Observation  
period end







# BREAK

*10 mins*

# ATLAS – Cohort Definition – Demo

Persons hospitalized with influenza, no prior observation required, 2008-2009 season

<https://atlas.ohdsi.org/#/cohortdefinition/117>

## Initial Event Cohort

People having any of the following:

- A visit occurrence of **inpatient visit**
  - Occurrence start is between **2008-09-01** and **2009-04-01** (inclusive)
- With continuous observation of at least **0 days** prior and **0 days** after event **index date**
- Limit initial events to: **all events** per person.

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Cohort #2271

[UCS] Influenza

Definition Concept Sets Generation Reporting Export Messages

enter a cohort definition description here

Cohort Entry Events

Events having any of the following criteria:

a visit occurrence of **Inpatient Visit**

✗ occurrence start is: **Between** **2008-01-01** and **2009-04-01**

with continuous observation of at least **0** days before and **0** days after event index date

Limit initial events to: **all events** per person.

Restrict initial events to:

having **any** of the following criteria:

with **at least** **1** using **all** occurrences of:

a condition occurrence of **Influenza conditions**

where **event starts** between **21** days **Before** and **All** days **After** **index start date**

✗ and **event starts** between **All** days **Before** and **0** days **After** **index end date**

☐ restrict to the same visit occurrence

☐ allow events from outside observation period

or with **at least** **1** using **all** occurrences of:

a measurement of **Influenza positive measurement...**

where **event starts** between **21** days **Before** and **All** days **After** **index start date**

✗ and **event starts** between **All** days **Before** and **0** days **After** **index end date**

☐ restrict to the same visit occurrence

☐ allow events from outside observation period

# ATLAS – Cohort Definition – Demo

For people matching the **Primary Events**, include:

Having any of the following criteria:

- at least 1 occurrence of a **condition occurrence** of **influenza** where **event starts** between **21 days before** and **all days after index start date** and **event starts** between **all days before** and **0 days after index end date**
- or at least 1 occurrence of a **measurement** of **influenza** (pre-coordinated positive measurements) where **event starts** between **21 days before** and **event all days after index start date** **date starts** between **all days before** and **0 days after index end date**

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Cohort #2271

[UCS] Influenza

Definition ? Concept Sets Generation Reporting Export Messages 8

Enter a cohort definition description here

Cohort Entry Events

Events having any of the following criteria:

a visit occurrence of **Inpatient Visit**

✗ occurrence start is: **Between** **2008-01-01** and **2009-04-01**

with continuous observation of at least **0** days before and **0** days after event index date

Limit initial events to: **all events** per person.

Restrict initial events to:  
having **any** of the following criteria:

with **at least** **1** using **all** occurrences of:  
a condition occurrence of **Influenza conditions**

where **event starts** between **21** days **Before** and **All** days **After** **index start date**  
✗ and **event starts** between **All** days **Before** and **0** days **After** **index end date**

☐ restrict to the same visit occurrence  
☐ allow events from outside observation period

or with **at least** **1** using **all** occurrences of:  
a measurement of **Influenza positive measurement...**

where **event starts** between **21** days **Before** and **All** days **After** **index start date**  
✗ and **event starts** between **All** days **Before** and **0** days **After** **index end date**

☐ restrict to the same visit occurrence  
☐ allow events from outside observation period

# ATLAS – Cohort Definition – Demo

For people matching the **Primary Events**, include:

Having any of the following criteria:

- at least 1 occurrences of an **observation** of **influenza** testing (excluding Ab testing)
  - value as concept is any of: detected, positive, presentwhere **event starts** between **21 days before** and **all days after index start date** and **event starts** between **all days before** and **0 days after index end date**
- or at least 1 occurrences of a **measurement** of Influenza testing (excluding Ab testing)
  - value as concept is any of: detected, positive, presentwhere **event starts** between 21 days before and all days after index start date and **event starts** between all days before and 0 days after index end date\*

Limit cohort of initial events to: **all events per person.**

\* **Exercise**

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or with at least 1 using all occurrences of:  
an observation of Influenza test measurements ex...  
with Value as Concept: Detected Detected Positive Positive Present Present Add Import  
where event starts between 21 days Before and All days After index start date  
and event starts between All days Before and 0 days After index end date  
restrict to the same visit occurrence  
allow events from outside observation period  
Limit initial events to: all events per person.  
Remove initial event restriction

Inclusion Criteria  
New inclusion criteria  
1. does not have hospitalization for influenza in the 6 months preceding admission  
Limit qualifying events to: earliest event per person.

Cohort Exit  
Event Persistence:  
Event will persist until: fixed duration relative to initial event  
Fixed Duration Persistence:  
The event end date is derived from adding a number of days to the event's start or end date. If an offset is added to the event's start date, all end date, persons in the cohort may have varying cohort duration times due to the varying event durations (such as eras of persistent drug e selected index event date, plus the days offset.  
Event date to offset from: end date  
Number of days offset: 0 days

# ATLAS – Cohort Definition – Exercise

1.- Download the concept sets from OHDSI Atlas (4 in total – 1xcondition diagnosis, 2xcondition measurements and 1xinpatient visit):

<https://atlas.ohdsi.org/#/cohortdefinition/117/conceptsets>

2.- Build the influenza cohort as shown in the demo and save it as '[UCS] Influenza cohort 2008 to 2009'.

3.- Now, add the following criteria:

For people matching the **Primary Events**, include:

Having any of the following criteria:

- or at least 1 occurrences of a **measurement** of **influenza** testing (excluding Ab testing)
  - value as concept is any of: detected, positive, present (SNOMED and LOINC)

where **event starts** between **21 days Before** and **all days After index start date** and **event starts** between **all days Before** and **0 days After index end date**

4.- Add the following inclusion rules:

Inclusion Criteria #1: age >=18

Inclusion Criteria #2: does not have hospitalization for influenza in the 6 months preceding admission

Limit qualifying cohort to: **earliest event per person**.

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or with at least 1 using all occurrences of:  
an observation of Influenza test measurements ex...  
with Value as Concept: Detected Detected Positive Positive Present Present Add Import  
where event starts between 21 days Before and All days After index start date  
event starts between All days Before and 0 days After index end date  
restrict to the same visit occurrence  
allow events from outside observation period  
Limit initial events to: all events per person.  
Remove initial event restriction  
Inclusion Criteria  
New inclusion criteria  
1. does not have hospitalization for influenza in the 6 months preceding admission  
Limit qualifying events to: earliest event per person.  
Cohort Exit  
Event Persistence:  
Event will persist until: fixed duration relative to initial event  
Fixed Duration Persistence:  
The event end date is derived from adding a number of days to the event's start or end date. If an offset is added to the event's start date, all end date, persons in the cohort may have varying cohort duration times due to the varying event durations (such as eras of persistent drug e selected index event date, plus the days offset.  
Event date to offset from: end date  
Number of days offset: 0 days



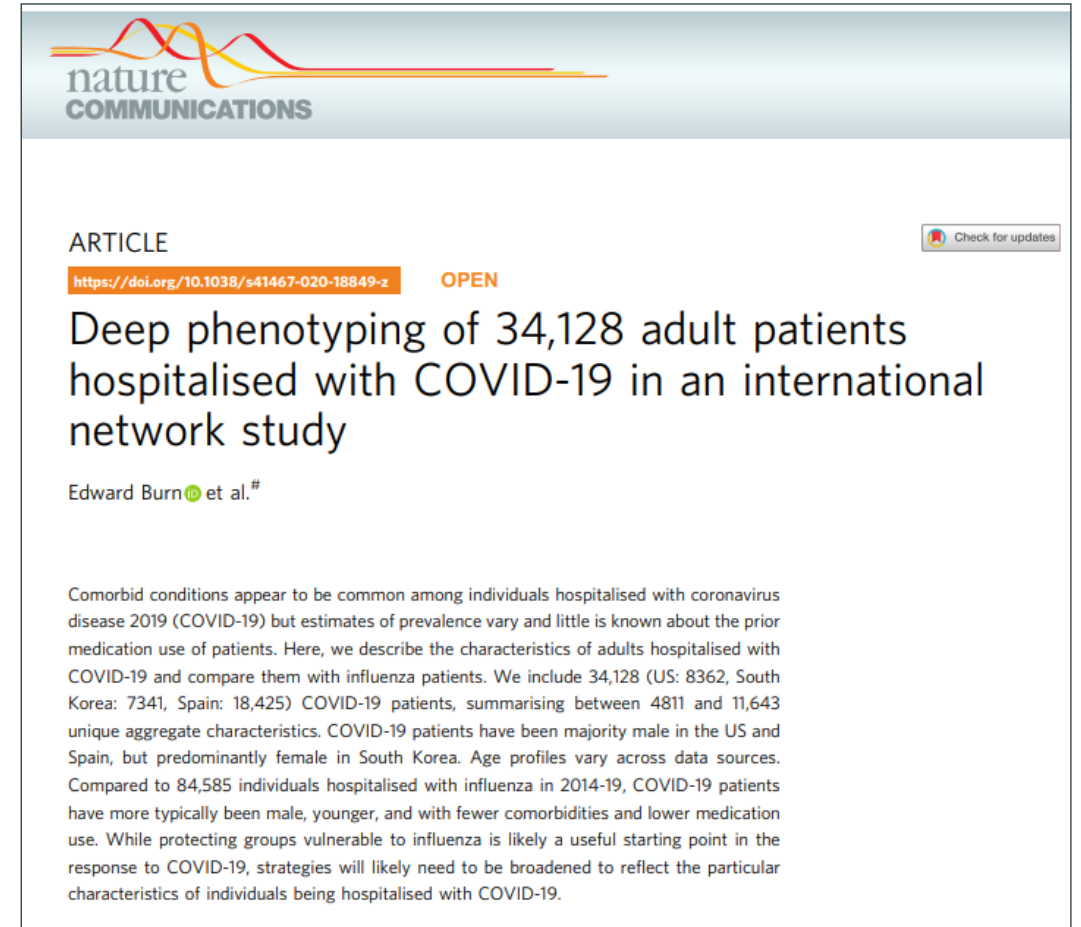
# BREAK

*30 mins*

# ATLAS Characterization Lecture, Demo & Exercise

# Characterization Study Example

- Describe baseline characteristics for those **hospitalized** for **COVID-19** as compared to those hospitalized for **influenza**
- Findings:
  - Patients hospitalized with COVID are systematically different from those hospitalized with flu
  - COVID hospitalized patients, when compared those hospitalized for influenza:
    - Greater proportion are male and slightly younger
    - Fewer comorbidities and lower medication use
- Utilized claims and electronic medical records from 10 databases across 3 different countries

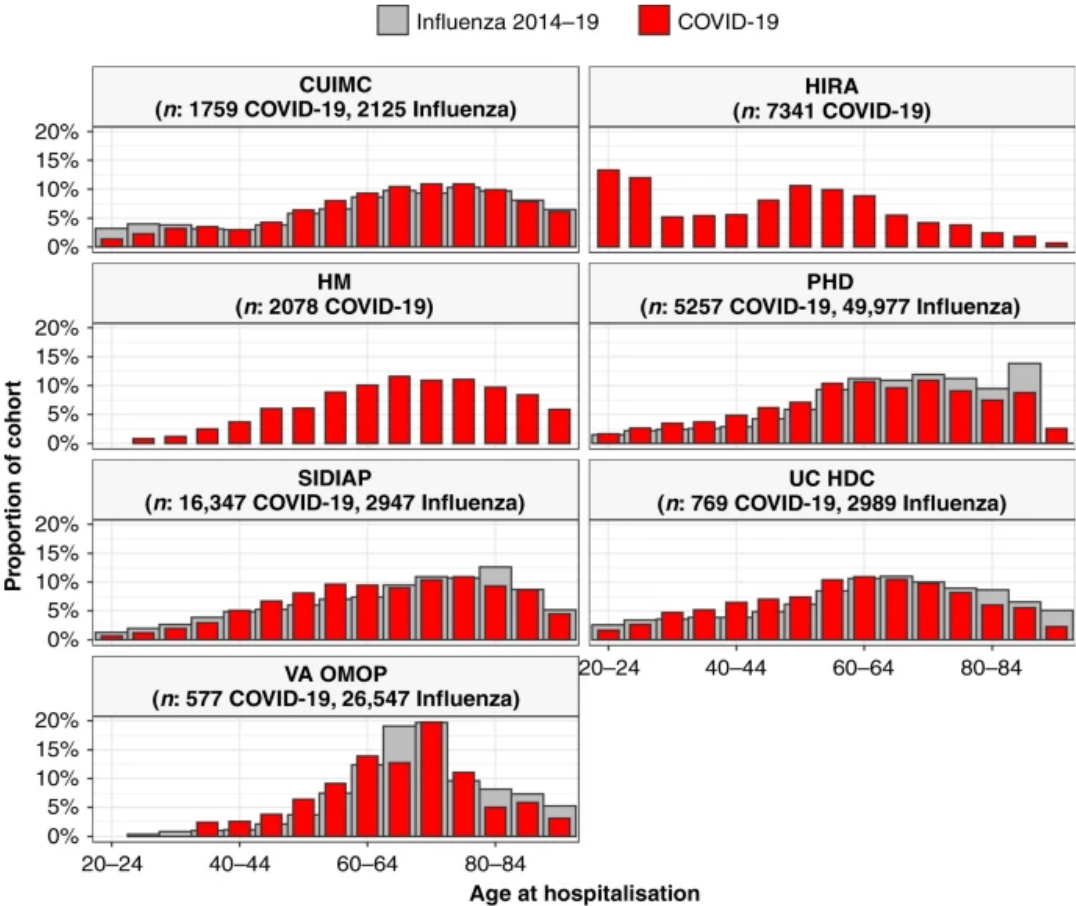


<https://www.nature.com/articles/s41467-020-18849-z>

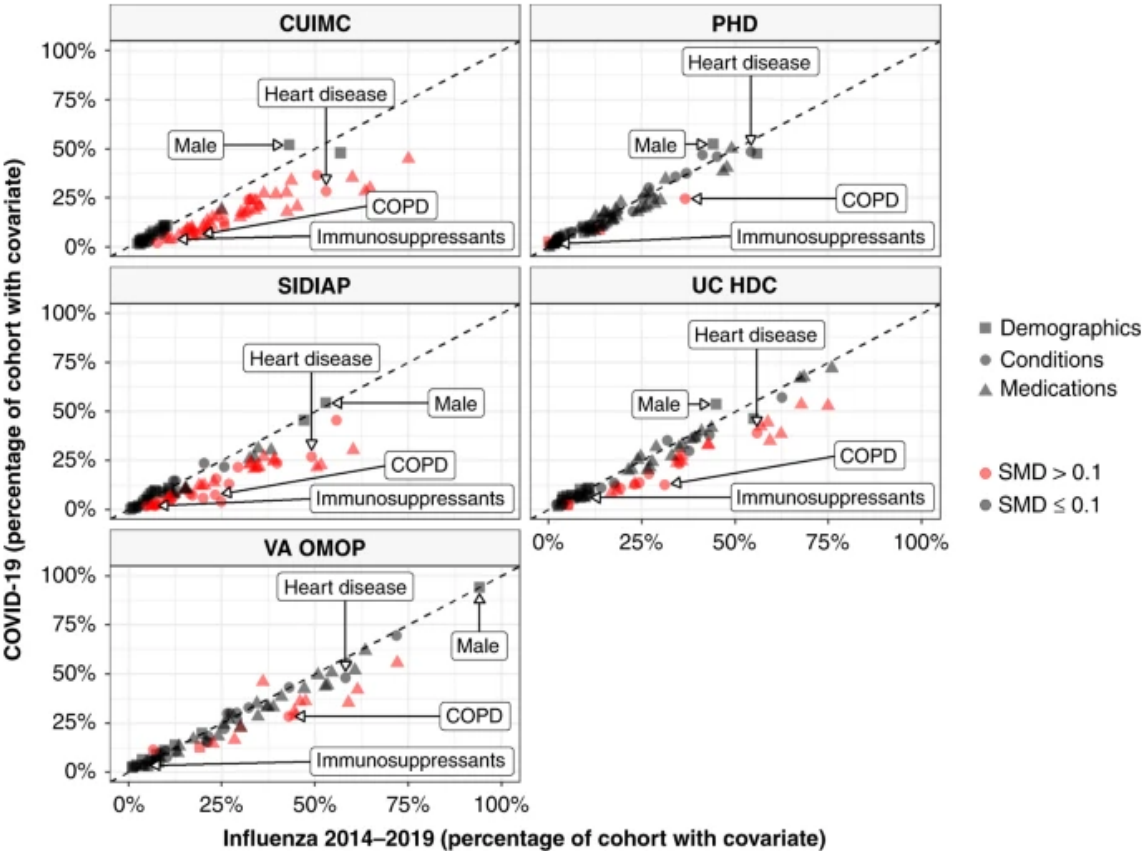


# Characterization Results – Comparison of Sources/Locations

**Fig. 1: Age of patients hospitalised with COVID-19 and of patients hospitalised with influenza.**

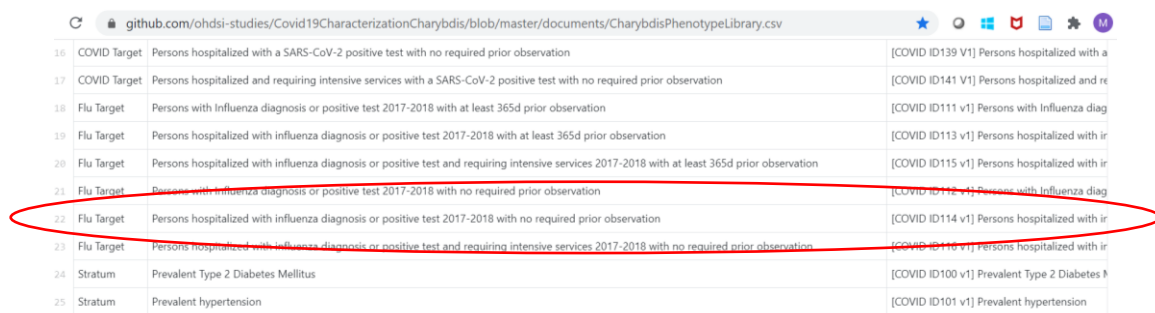


**Fig. 4: Characteristics of COVID-19 patients compared to 2014-2019 Influenza patients.**

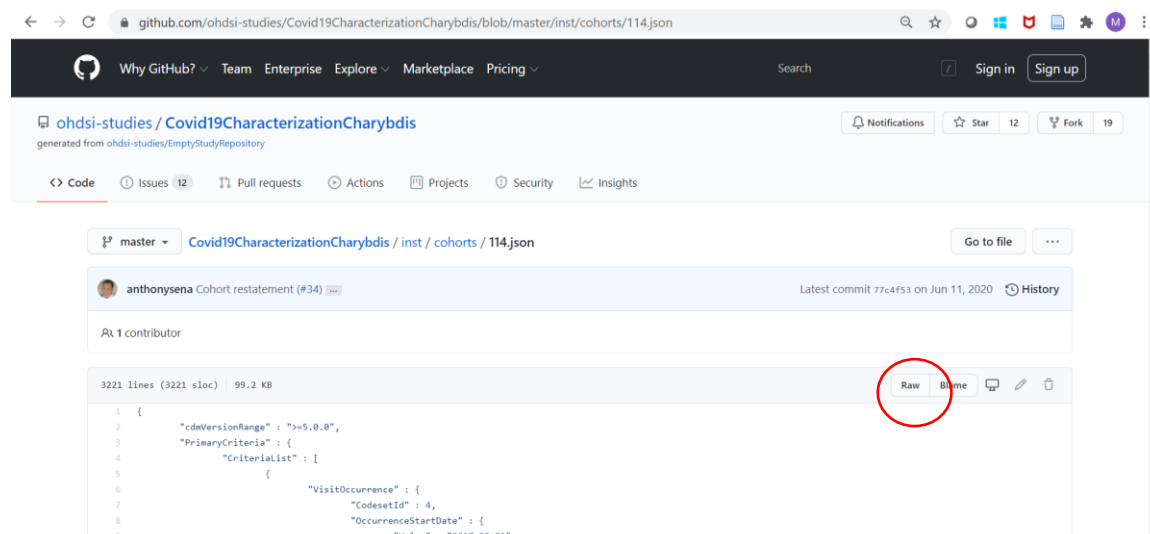


# Characterizations from GitHub to ATLAS – part 1

<https://github.com/ohdsi-studies/Covid19CharacterizationCharybdis>



16	COVID Target	Persons hospitalized with a SARS-CoV-2 positive test with no required prior observation	[COVID ID139 v1] Persons hospitalized with a
17	COVID Target	Persons hospitalized and requiring intensive services with a SARS-CoV-2 positive test with no required prior observation	[COVID ID141 v1] Persons hospitalized and re
18	Flu Target	Persons with Influenza diagnosis or positive test 2017-2018 with at least 365d prior observation	[COVID ID111 v1] Persons with Influenza diag
19	Flu Target	Persons hospitalized with influenza diagnosis or positive test 2017-2018 with at least 365d prior observation	[COVID ID113 v1] Persons hospitalized with ir
20	Flu Target	Persons hospitalized with influenza diagnosis or positive test and requiring intensive services 2017-2018 with at least 365d prior observation	[COVID ID115 v1] Persons hospitalized with ir
21	Flu Target	Persons with influenza diagnosis or positive test 2017-2018 with no required prior observation	[COVID ID112 v1] Persons with Influenza diag
22	Flu Target	Persons hospitalized with influenza diagnosis or positive test 2017-2018 with no required prior observation	[COVID ID114 v1] Persons hospitalized with ir
23	Flu Target	Persons hospitalized with influenza diagnosis or positive test and requiring intensive services 2017-2018 with no required prior observation	[COVID ID116 v1] Persons hospitalized with ir
24	Stratum	Prevalent Type 2 Diabetes Mellitus	[COVID ID100 v1] Prevalent Type 2 Diabetes M
25	Stratum	Prevalent hypertension	[COVID ID101 v1] Prevalent hypertension



github.com/ohdsi-studies/Covid19CharacterizationCharybdis/blob/master/inst/cohorts/114.json

Why GitHub? Team Enterprise Explore Marketplace Pricing

ohdsi-studies / Covid19CharacterizationCharybdis

generated from ohdsi-studies/EmptyStudyRepository

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master Covid19CharacterizationCharybdis / inst / cohorts / 114.json

Go to file

anthonyseana Cohort restatement (#34)

Latest commit 77c4f53 on Jun 11, 2020

1 contributor

3221 lines (3221 sloc) 99.2 KB

Raw Blame

```
1 {
2   "cdmVersionRange": ">=5.0.0",
3   "PrimaryCriteria": {
4     "CriteriaList": [
5       {
6         "VisitOccurrence": {
7           "CodesetId": 4,
8           "OccurrenceStartDate": {
9             "Value": "2017-06-01"
```

To recreate one of the cohorts from the paper:

1. Locate phenotype library in the documents folder

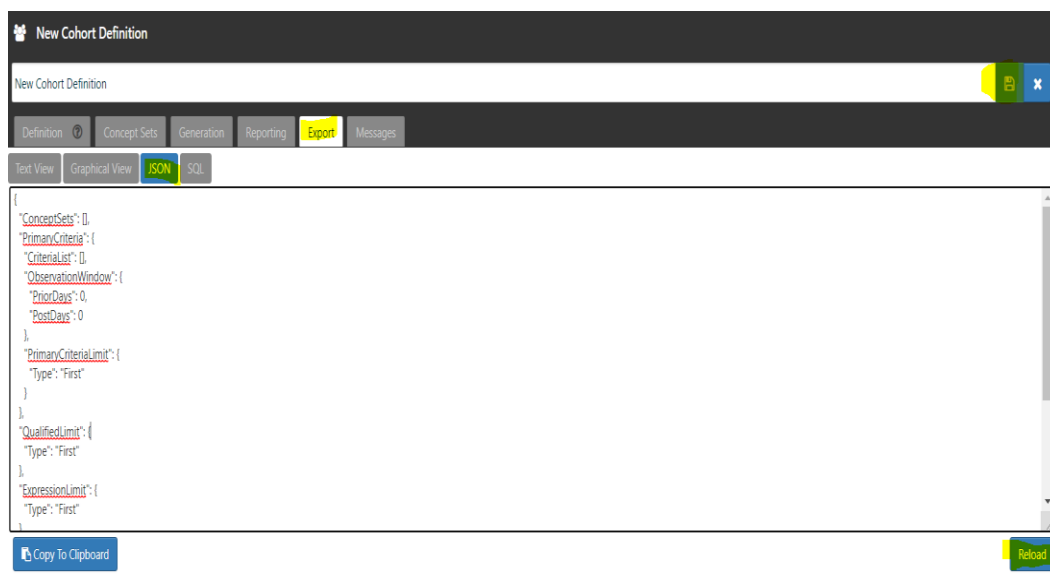
<https://github.com/ohdsi-studies/Covid19CharacterizationCharybdis/blob/master/documents/CharybdisPhenotypeLibrary.csv>

2. Choose the ones of interest from the list (114 and 135)

3. Go to the inst folder
4. Click on the JSON file you chose (114 and 135)
5. Click on the raw button
6. Copy all lines of code or 'Save as...' a JSON file (114.json and 135.json)

# Characterizations from GitHub to ATLAS – part 1

<https://github.com/ohdsi-studies/Covid19CharacterizationCharybdis>



In ATLAS:

1. Create a brand new Cohort Definition
2. Under the Export – JSON tab paste your copied code into this section
3. Press the **Reload** green button
4. Press the **SAVE** green button

# ATLAS characterization stage 1 - definition

training.atlasplus.imshealth.com/#/cohortdefinition/2294

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Cohort #2294

[UCS] Charybdis cohort 114 flu 2008 to 2009

Definition Concept Sets Generation Reporting Export Messages 3

enter a cohort definition description here

Cohort Entry Events

Events having any of the following criteria:

+ Add Initial Event

a visit occurrence of Inpatient Visit

+ Add attribute...

Delete Criteria

occurrence start is: Between 2008-09-01 and 2009-04-01

with continuous observation of at least 0 days before and 0 days after event index date

Limit initial events to: all events per person.

Restrict initial events to:

having any of the following criteria:

+ Add criteria to group...

Delete Criteria

with at least 1 using all occurrences of:

a condition occurrence of Influenza conditions

+ Add attribute...

where event starts between 21 days Before and All days After index start date

\* and event starts between All days Before and 0 days After index end date

☐ restrict to the same visit occurrence

☐ allow events from outside observation period

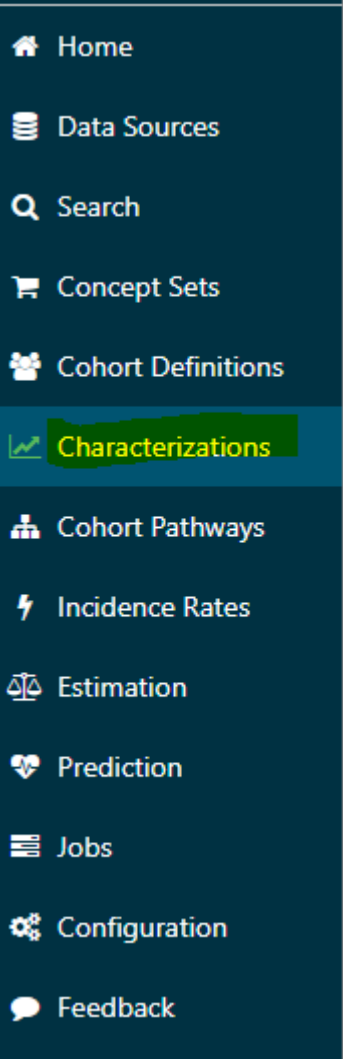
or with at least 1 using all occurrences of:

Delete Criteria

On the 'Definition' tab, the contents of the JSON file are automatically converted into a cohort definition

You can now update the cohort with the dates of the influenza season under study (2008-2009 in our case)

# Characterizations from GitHub to ATLAS – part 2



Go to Characterizations in ATLAS;

Create a New Characterization

Import your cohort(s)

A screenshot of the ATLAS web interface. The browser address bar shows 'training.atlasplus.imshealth.com/#/cc/characterizations/129'. The main content area displays a 'Choose a Cohort definition' dialog box. The dialog has a table with columns: Id, Name, Created, Updated, and Author. The table lists several cohort definitions, including 'UCSJ Charybdis cohort 114 flu 2008 to 2009', 'UCSJ Charybdis cohort 135 covid', 'UCSJ Charybdis cohort 115 flu - 2008 to 2009', 'IASI G/GEJ Cancer and Taxanes 2020', 'UCSJ Influenza and Mech Vent', 'UCSJ Charybdis cohort 132 covid', 'IASI Charybdis cohort 132 covid', and 'IASI G/GEJ Cancer and Taxanes in'. The dialog also shows a 'Cohort definitions' section with an 'Import' button and a 'Feature analyses' section with an 'Import' button. The background shows the ATLAS application interface with a sidebar menu and a main content area.

# Characterizations from GitHub to ATLAS – part 3

Choose a Feature analyses

Select All

Deselect All

Filter:

Showing 1 to 15 of 107 entries

Previous 1 2 3 4 5 ... 8 Next

Type	ID	Name	Description
Preset (104)	107	[APAC HTN] History of CVD	History of CVD
Criteria set (3)	106	[FDA CP] Age Groups	
Domain	78	Chads 2	The CHADS2 score using all conditions prior to the window end.
CONDITION (32)	82	Chads 2 Vasc	The CHADS2VAsc score using all conditions prior to the window end.
DRUG (23)	49	Charlson Index	The Charlson comorbidity index (Romano adaptation) using all conditions prior to the window end.
DEMOGRAPHICS (13)	10	Condition Era Any Time Prior	One covariate per condition in the condition_era table overlapping with any time prior to index.
None (8)	23	Condition Era Long Term	One covariate per condition in the condition_era table overlapping with any part of the long term window.
OBSERVATION (7)	16	Condition Era Medium Term	One covariate per condition in the condition_era table overlapping with any part of the medium term window.
Created	17	Condition Era Overlapping	One covariate per condition in the condition_era table overlapping with the end of the risk window.
2+ Weeks Ago (107)	4	Condition Era Short Term	One covariate per condition in the condition_era table overlapping with any part of the short term window.
Updated	9	Condition Era Start Long Term	One covariate per condition in the condition_era table starting in the long term window.
2+ Weeks Ago (107)	21	Condition Era Start Medium Term	One covariate per condition in the condition_era table starting in the medium term window.
Author	18	Condition Era Start Short Term	One covariate per condition in the condition_era table starting in the short term window.
anonymous (104)	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.
mfernandezchas@uk.imshealt			
(2)			
1117@ca.imshealth.com (1)			

Showing 1 to 15 of 107 entries

Previous 1 2 3 4 5 ... 8 Next

Cancel

Import

Select preset feature analysis, import

Save the characterization (green button by title)

Go to the Executions tab, click Generate to create results from data sources

View latest results to see data for your chosen cohort(s) on that data source – next slide

# Characterizations from GitHub to ATLAS – part 4

training.atlasplus.imshealth.com/#/cc/characterizations/129/executions

Characterization #129

[UCS] Charybdis Session 3

Design Executions Utilities

Executions

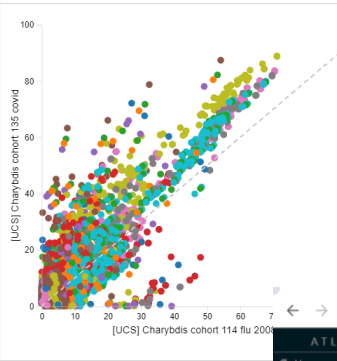
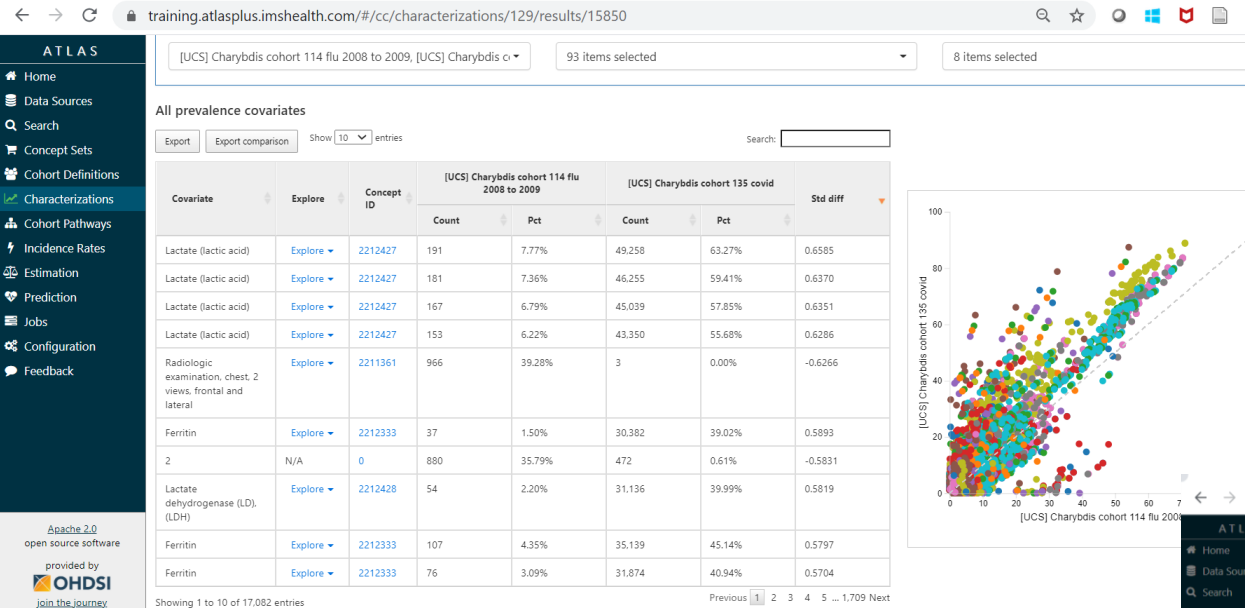
AmbEMR. 2020/08	Generate	View latest result	All executions (0)
AmbEMR. 2020/11	Generate	View latest result	All executions (0)
Australia. LPD 2020/09	Generate	View latest result	All executions (0)
Belgium. LPD 2020/06	Generate	View latest result	All executions (0)
Brazil. 2018/07	Generate	View latest result	All executions (0)
France. DA 2020/Q4	Generate	View latest result	All executions (0)
France. LPD 2020/05	Generate	View latest result	All executions (0)
Germany. DA 2020Q3	Generate	View latest result	All executions (0)
Hospital. Full 2020/09	Cancel	View latest result	All executions (2)
OncoEMR. Full 2020/09	Generate	View latest result	All executions (0)
Open Claims. Full 2020/10	Generate	View latest result	All executions (0)
PharMetrics Plus Expanded. 2020/06	Generate	View latest result	All executions (0)

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Go to the Executions tab,  
click 'generate' for desired  
data source(s)

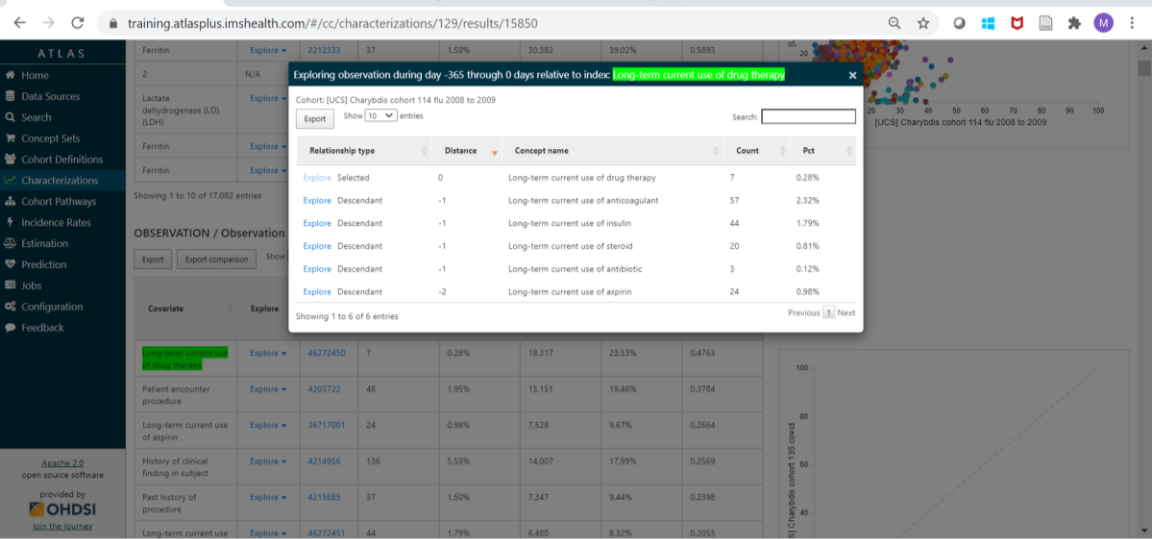
View latest results to see  
data for your chosen  
cohort(s) on that data source

# Characterizations from GitHub to ATLAS – part 4



Results for the characterization will be shown in the Execution tab

Use Explore to view detail of covariates





# ATLAS Characterization – Exercise 1

From the list of the **RD2D consortium** questions already answered :

- **Among adults hospitalized with influenza, how many were put on a mechanical ventilator per subgroup (age, gender)?**

## **Influenza Cohort**

- Use your influenza cohort or download the one from the OHDSI ATLAS website:

<https://atlas.ohdsi.org/#/cohortdefinition/117>

And save it as '[UCS] Influenza cohort 2008 to 2009' or any other name of your preference

- Update the dates to reflect the 2008-2009 influenza season (1st September 2008 and 1st April 2009)

## **Mechanical Ventilation Inclusion**

- Add mechanical ventilation to the inclusion criteria during the hospital stay (between index date and end date). Note that this is a multidomain concept (condition, observation and procedure). You will need to add one criteria per domain, and then select 'having ANY of the following criteria', otherwise, if the default 'ALL' is left, you will get 0 counts:

<https://atlas.ohdsi.org/#/conceptset/49/expression>

- Save the new cohort as '[UCS] Influenza cohort 2008 to 2009 mech. vent.' or any other name of your preference.

## **Characterization**

- Create a new characterization and save it as '[UCS] Influenza cohort 2008 to 2009 mech. vent. analysis'
- Import your new influenza and ventilation cohort
- Include the age group and gender features
- Execute in the OHDSI CDM V5 database and check the results

# ATLAS Characterization – Exercise 1 Answer

Profiles

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DEMOGRAPHICS / Demographics Gender

Export Show 10 entries

Search:

Covariate	Concept ID	Count	Pct
MALE	8507	1	100.00%

Showing 1 to 1 of 1 entries

Previous 1 Next

DEMOGRAPHICS / Demographics Age Group

Export Show 10 entries

Search:

Covariate	Concept ID	Count	Pct
65-69	0	1	100.00%

Showing 1 to 1 of 1 entries

Previous 1 Next

# ATLAS Characterization – Exercise 2

- Among adults hospitalized with influenza and pneumonia between 1st September 2008 and 1st April 2009, which group has the highest Charlson comorbidity index?

## Influenza Cohort

- It has already been defined in the previous exercise

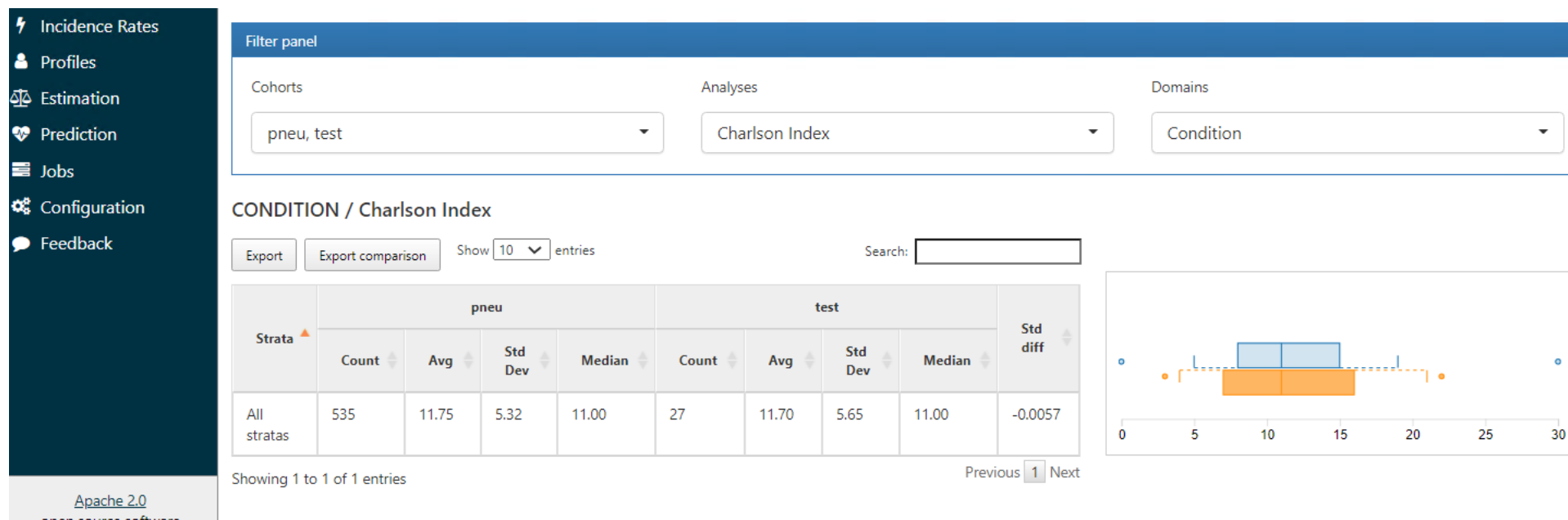
## Pneumonia Cohort

- Create a copy of this influenza cohort and rename as '[UCS] Pneumonia 2008 to 2009'. Replace the condition 'influenza' by the condition 'pneumonia' and delete the measurement criteria. You will need a new concept for 'pneumonia' (concept\_id = 255848 and descendants).

## Characterization

- Create a new characterization and save it as '[UCS] Influenza and Pneumonia cohort 2008 to 2009 Analysis'
- Import your new influenza and pneumonia cohorts
- Include the Charlson Index as the feature of the analysis (Preset feature ID = 49 calculates the Charlson comorbidity index using all conditions prior to the window end)
- Execute in the OHDSI CDM V5 database and check the results

# ATLAS Characterization – Exercise 2 Answer



# ATLAS Characterization – Homework

From the list of the **RD2D consortium** questions already answered :

- **Among adults hospitalized with COVID-19, how many were put on a mechanical ventilator per subgroup (age, gender)?**

- Download the COVID-19 cohort from the Charybdis website:

<https://atlas.ohdsi.org/#/cohortdefinition/198>

- Add mechanical ventilation as described in Exercise 1
- Save the new cohort as '[UCS] Covid-19 cohort mech. vent.' or any other name of your preference.
- Create a new characterization and save it as '[UCS] Covid-19 cohort mech. vent. analysis'
- Import your new COVID-19 and mechanical ventilation cohort
- Include the age group and gender features
- Execute in your own database and check the results

- **Compare your results with the RD2D consortium results for COVID-19:**

<https://covid19questions.org/component/content/article/32-q-a/70-among-adults-hospitalized-with-covid-19-how-many-were-put-on-a-mechanical-ventilator-per-subgroup-age-ethnicity-gender-and-race?Itemid=279>

# ATLAS Characterization – Customized Features – Demo

## Subgroup Analyses

- Patients under 65, over 65

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Subgroup analyses

New subgroup

Stratified by

☐ Calculate subgroup analyses only

< 65

having all of the following criteria:

+ Add criteria to group...

with the following event criteria:

+ Add attribute...

with age Less Than 65

Delete Criteria

>= 65

having all of the following criteria:

+ Add criteria to group...

with the following event criteria:

+ Add attribute...

with age Greater or Equal To 65

Delete Criteria

# ATLAS Characterization – Customized Features – Demo

## Subgroup Analyses

- Patients under 65, over 65

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training.atlasplus.imshealth.com/#/cc/characterizations/133/results/15876

Filter panel

Cohorts

Analyses

Domains

[UCS] Charybdis cohort 114 Flu 2008 to 2009, [

Charlson Index

Condition

CONDITION / Charlson Index

Export

Export comparison

Show 10 entries

Search:

Strata	[UCS] Charybdis cohort 114 Flu 2008 to 2009				[UCS] Pneumonia 2008 to 2009				Std diff
	Count	Avg	Std Dev	Median	Count	Avg	Std Dev	Median	
< 65 years old	5	10.80	3.83	10.00	95	11.39	4.64	11.00	0.0980
All stratas	24	11.04	3.86	11.00	635	11.25	5.04	11.00	0.0333
>= 65 years old	19	11.11	3.97	11.00	540	11.23	5.11	11.00	0.0191

Showing 1 to 3 of 3 entries

Previous

1

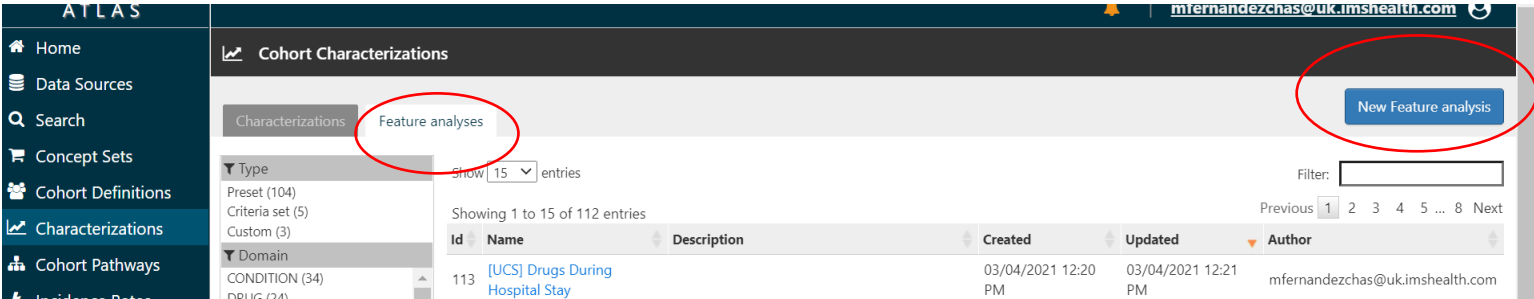
Next

IQVIA

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# ATLAS Characterization – Customized Features – Demo

## Customized features using SQL



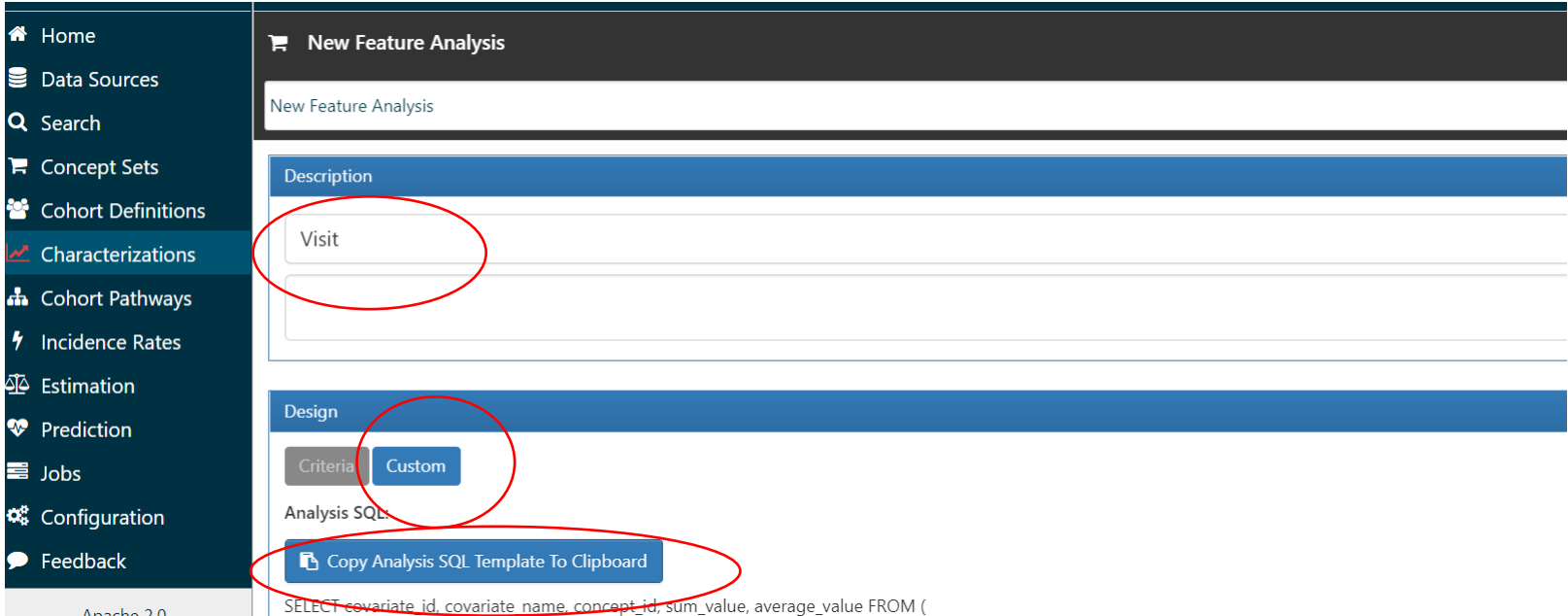
1.- Select Feature Analysis on the left

2.- Select New Feature Analysis on the right

3.- Choose the Visit Domain

4.- Click on the Custom button

5.- Click on 'Copy Analysis SQL Template to Clipboard'





# ATLAS Characterization – Customized Features – Demo

## Customized features using SQL

### SQL Template

```
Feature SQL Template.sql
1 SELECT covariate_id, covariate_name, concept_id, sum_value, average_value FROM (
2
3 -- Custom analysis producing same results as Feature Extraction's "One covariate per drug in
4 -- the drug_era table overlapping with any time prior to index."
5 -- Available variables:
6 -- @cdm_database_schema
7 -- @cohort_table
8 -- @cohort_id
9 -- @analysis_id
10 -- all variables specified in Cohort Characterization parameters
11 SELECT
12 CAST(drug_concept_id AS BIGINT) * 1000 + @analysis_id AS covariate_id,
13 c.concept_name AS covariate_name,
14 drug_concept_id AS concept_id,
15 COUNT(*) AS sum_value,
16 COUNT(*) * 1.0 / stat.total_cnt * 1.0 AS average_value
17 FROM (
18 SELECT DISTINCT
19 drug_concept_id,
20 cohort.subject_id,
21 cohort.cohort_start_date
22 FROM @cohort_table cohort
23 INNER JOIN @cdm_database_schema.drug_era ON cohort.subject_id = drug_era.person_id
24 WHERE drug_era_start_date <= cohort.cohort_start_date
25 AND drug_concept_id != 0
26 AND cohort.cohort_definition_id = @cohort_id
27 ) drug_entries
28 JOIN @cdm_database_schema.concept c ON drug_entries.drug_concept_id = c.concept_id
29 CROSS JOIN (SELECT COUNT(*) total_cnt
30 FROM @cohort_table
31 WHERE cohort_definition_id = @cohort_id) stat
32 GROUP BY drug_concept_id, c.concept_name, stat.total_cnt
33 )
```

Paste the SQL code in your editor of preference and update the code highlighted in gray accordingly.

# ATLAS Characterization – Customized Features – Demo

## Customized features using SQL

### Length of Visit

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Limit initial events to: 

all events

 per person.

Remove initial event restriction

Inclusion Criteria

New inclusion criteria

1. does not have hospitalization for influenza in the 6 months preceding admission

Limit qualifying events to: 

earliest event

 per person.

Cohort Exit

Event Persistence:

Event will persist until: 

fixed duration relative to initial event

Fixed Duration Persistence:

The event end date is derived from adding a number of days to the event's start or end date. If an offset is used, persons in the cohort may have varying cohort duration times due to the varying event duration selected index event date, plus the days offset.

Event date to offset from: 

end date

Number of days offset: 

0


 days

Censoring Events:

Exit Cohort based on the following criteria:

No censoring events selected.

- Make sure the **index event end date** is set to 0 days from **end date**.
- This way the patients will **exit the cohort** at the end of the hospital visit.

 IQVIA

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# ATLAS Characterization – Customized Features – Demo

## Customized features using SQL

### Length of Visit

```
Visit Length.sql
1 SELECT
2 1000 + @analysis_id AS covariate_id,
3 'Visit Length' AS covariate_name,
4 0 AS concept_id,
5 avg(datediff(day, cohort.cohort_start_date, cohort.cohort_end_date)) AS sum_value,
6 0 AS average_value
7 FROM @cohort_table cohort
8
```

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Feature Analysis #139

[UCS] Visit Length Average

Description

Visit

Design

Criteria Custom

Analysis SQL:

Copy Analysis SQL Template To Clipboard

```
SELECT covariate_id, covariate_name, concept_id, sum_value, average_value FROM (
SELECT
1000 + @analysis_id AS covariate_id,
'Visit Length' AS covariate_name,
0 AS concept_id,
avg(datediff(day, cohort.cohort_start_date, cohort.cohort_end_date)) AS sum_value,
0 AS average_value
FROM @cohort_table cohort
)
```



Create a new feature analysis, paste the code above and save with a new name.

- Simple code to extract the **length of the visit** from our influenza cohort.
- Since our **index event** is the hospital stay, the **start** and **end date** of the cohort will match the **start** and **end** date of the **hospital stay**.
- Hence the **length of the stay** is just the difference between the **two dates**.



# BREAK

*10 mins*

# ATLAS Characterization – Customized Features – Exercise

## Customized features using SQL

### Length of Visit

From the list of the **RD2D consortium pending** questions :

- **Among adults hospitalized with influenza what is the length of stay in hospital for patients with (a) Diabetes, (b) Lung Disease, (c) Cancer, (d) Immunodeficiency, (e) Heart Disease, (f) Hypertension, (g) Asthma, (h) Kidney Disease (1) Overall and (2) per subgroup  $\geq 65$  and  $< 65$ ?**

#### **Influenza Cohort**

- It has already been defined in the previous exercises

#### **Inclusion Criteria**

- Create a copy of this influenza cohort and rename as '[UCS] Covid-19 cohort and diabetes'. Add the 'diabetes' condition as a new inclusion criteria any time prior to the index date. Use the answers from the Session #1 Exercise to build the concept set for 'diabetes'
- Repeat this process for all conditions in the list above (8 in total)

#### **Characterization 1**

- Create a new characterization
- Import all your new influenza cohorts (8)
- Create a customised new feature analysis for the length of the visit and import this new feature into the characterization
- Execute and check the results

#### **Characterization 2**

- Make a copy of **Characterization 1** and rename it
- Create the subgroups for  $\geq 65$  and  $< 65$  years old
- Execute and check the results

# ATLAS Characterization – Customized Features – Homework

## Customized features using SQL

### Top Drugs

- Among adults hospitalized with influenza what are the top drugs taken during the hospital stay?

#### Influenza Cohort

- As already defined during this session

#### Characterization

- Create a new characterization
- Import your influenza cohort
- Create a customised new feature analysis for the drugs below taken during the hospital stay as shown in the slide and import this new feature into the characterization
- Execute and check the results

```
[UCS] Drugs During Hospital Stay.sql
1  SELECT
2    CAST(drug_concept_id AS BIGINT) * 1000 + @analysis_id AS covariate_id,
3    c.concept_name AS covariate_name,
4    drug_concept_id AS concept_id,
5    COUNT(*) AS sum_value,
6    COUNT(*) * 1.0 / stat.total_cnt * 1.0 AS average_value
7  FROM (
8    SELECT DISTINCT
9      drug_concept_id,
10     cohort.subject_id,
11     cohort.cohort_start_date
12   FROM @cohort_table cohort
13   INNER JOIN @cdm_database_schema.drug_exposure ON cohort.subject_id = drug_exposure.person_id
14   WHERE drug_exposure_start_date >= cohort.cohort_start_date
15         AND drug_exposure_start_date <= cohort.cohort_end_date
16         AND drug_concept_id != 0
17         AND cohort.cohort_definition_id = @cohort_id
18   ) drug_entries
19   JOIN @cdm_database_schema.concept c ON drug_entries.drug_concept_id = c.concept_id
20   CROSS JOIN (SELECT COUNT(*) total_cnt
21               FROM @cohort_table
22               WHERE cohort_definition_id = @cohort_id) stat
23  GROUP BY drug_concept_id, c.concept_name, stat.total_cnt
```

# ATLAS Characterization – Customized Features – Homework Answer

## Customized features using SQL

### Top Drugs

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DRUG / [UCS] Drugs During Hospital Stay

Export

Export comparison

Show 10 entries

Covariate	Explore	Concept ID	[UCS] Charybdis cohort 114 Flu 2008 to 2009		[UCS] Pneumonia 2008 to 2009	
			Count	Pct	Count	Pct
""	Explore	2213440	1	4.17%	7	1.10%
Epoetin Alfa	Explore	1301125	0	0.00%	7	1.10%
Triamcinolone 10 MG	Explore	40950844	0	0.00%	6	0.94%
atorvastatin 10 MG Oral Tablet	Explore	1545997	0	0.00%	4	0.63%
Hydrochlorothiazide 50 MG Oral Tablet	Explore	19019044	0	0.00%	4	0.63%
Cefazolin 500 MG Prefilled Syringe	Explore	36889829	0	0.00%	4	0.63%
Omeprazole 20 MG Delayed Release Oral Capsule	Explore	19019418	0	0.00%	4	0.63%

# Discussion & Homework



# Homework



# Training series plan

## + Session 1 : Course Introduction

- OMOP CDM and vocabulary overview, examples of previous research and use cases, introducing ATLAS and OHDSI tools

## + Session 2: Common Data Model

- Data source profiling, building concept sets, building cohorts, exercises and discussion

## + Session 3: Leveraging the OHDSI ecosystem as a developer

- Concept sets, cohort definitions and their application to analytical use cases
- Study design and development in ATLAS

## + Session 4: Leveraging the OHDSI ecosystem to run Network Studies

- Characterization and treatment pathways, in ATLAS, SQL and R



Thank you

