

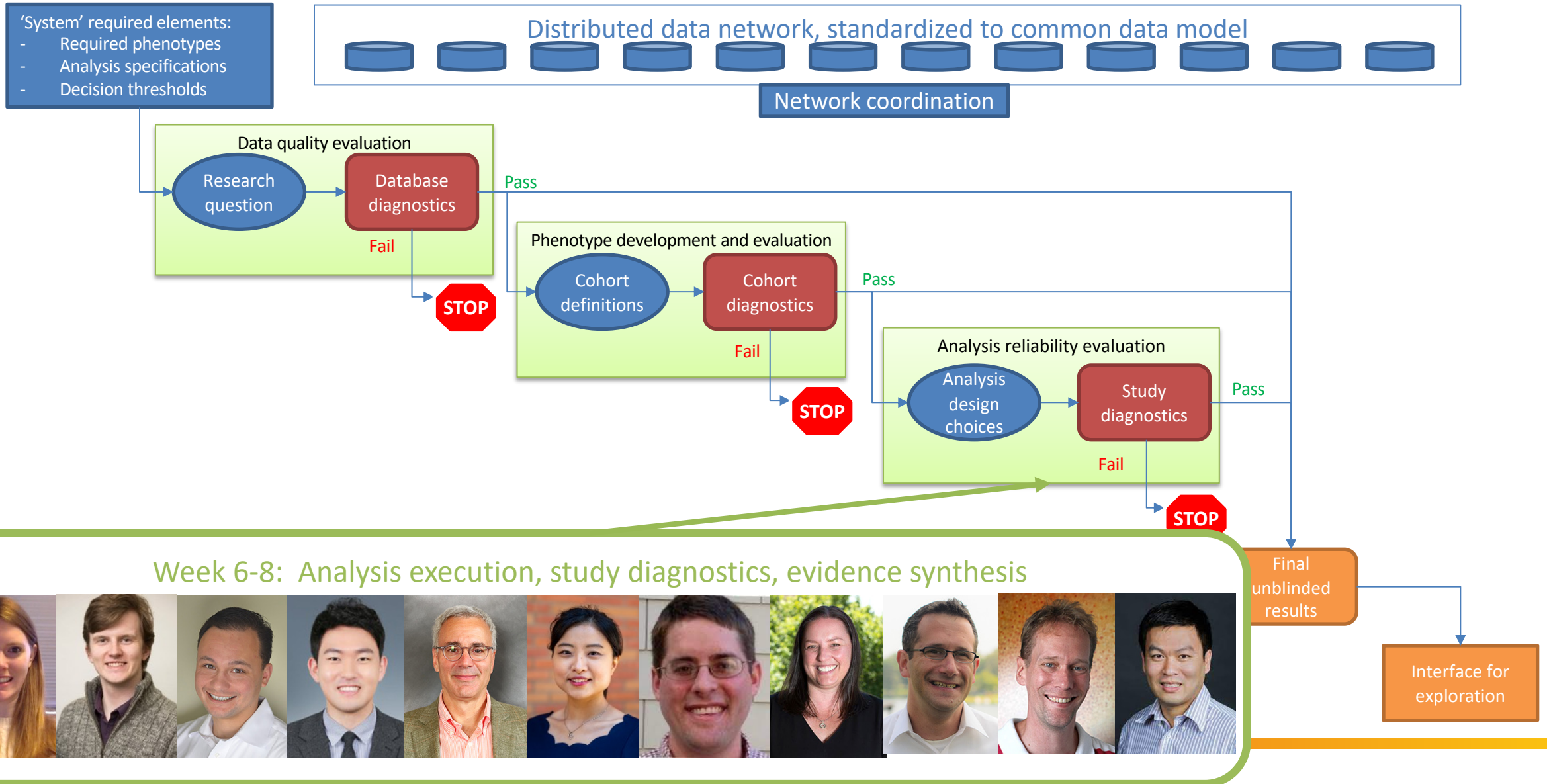


# Sisyphus Challenge Week 6: Strategus execution

Jenna/Jack  
Sena/Chungsoo



# Engineering open science systems that build trust into the real-world evidence generation and dissemination process





# Standardized analyses currently available within Strategus pipeline

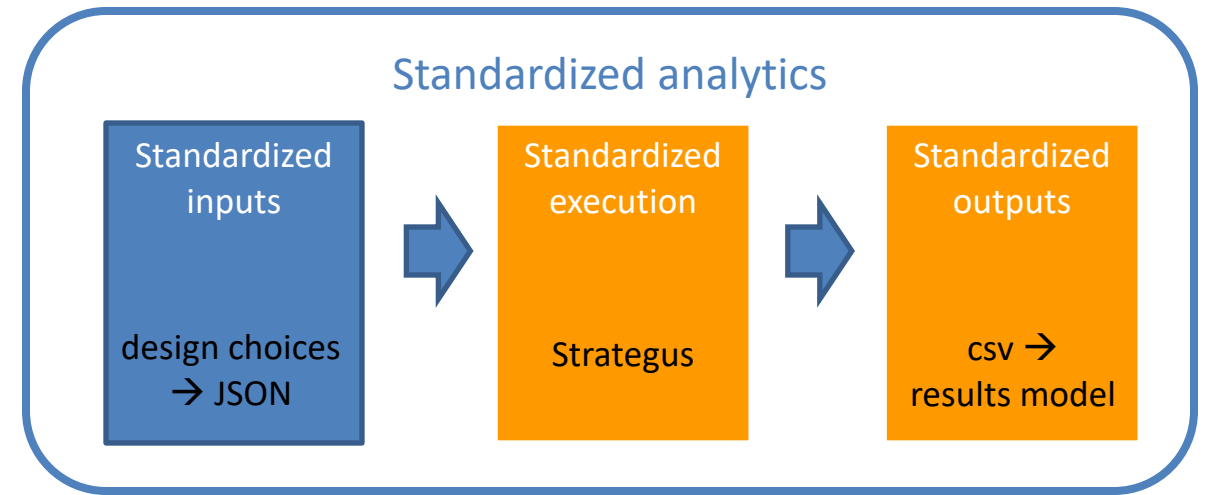
- Characterization

- Cohort diagnostics
- Cohort features
- Incidence rates
- Time-to-event
- Dechallenge / rechallenge

- Patient-level prediction

- Population-level effect estimation

- Comparative cohort
- Self-controlled case-series (SCCS)





# OHDSI software for network studies

## Strategus

### Pros

- Standardized representation of study inputs as JSON
- Modular composition of HADES analytics packages for study design
- Handles R environment configuration using renv

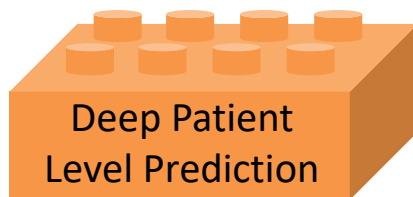
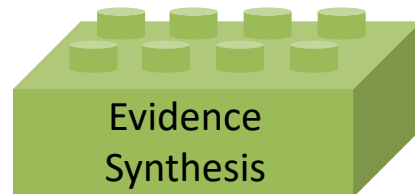
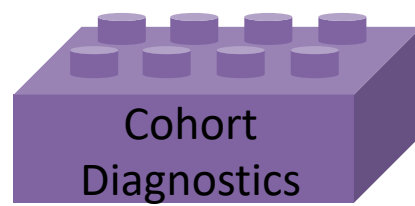
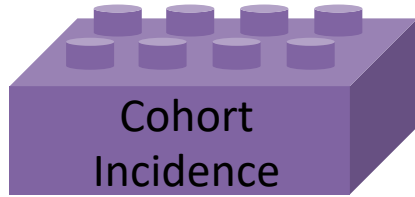
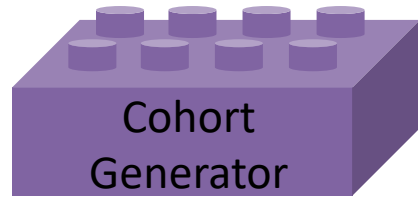
### Reality

- Strategus is still in development





# Strategus Modules



What is inside of a module?  
How is it different from a HADES package?



# Strategus Modules

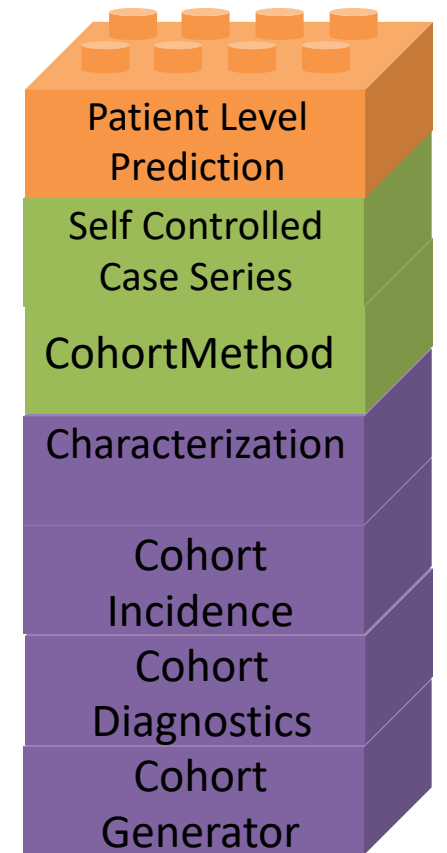
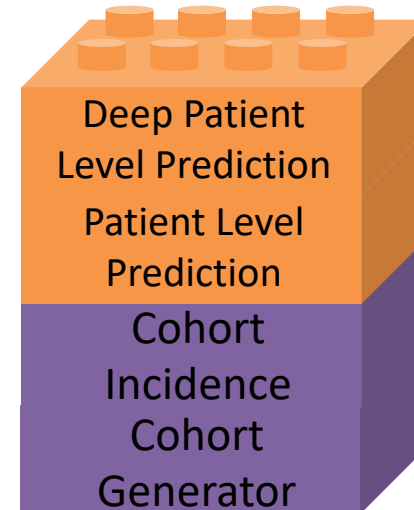
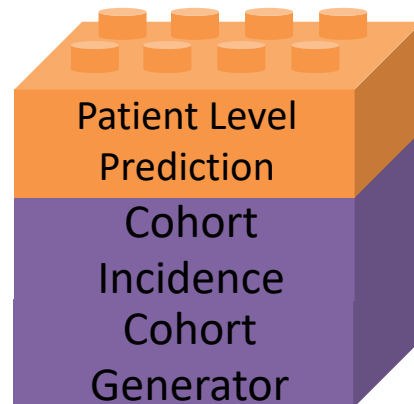
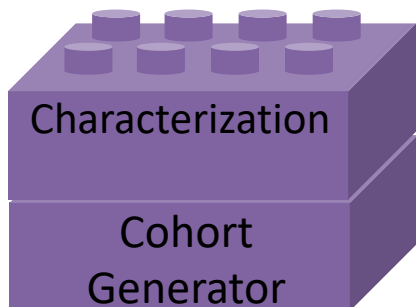
**Strategus Module** is an R Project that acts as a lightweight wrapper around one or more HADES packages. It has the following responsibilities:

- Declaring an renv.lock file for all R dependencies
- Providing functions for defining the module settings to store in the analysis specification JSON
- Implement an “execute” function to perform the analytical tasks based on module settings JSON using HADES packages
- Writing results as CSV files for sharing across the OHDSI network



# Strategus Modules

- Strategus modules can be combined to accommodate various study designs.





# Prerequisites to execute Strategus study

- **Database with OMOP CDM data:** convert your data to OMOP CDM and set up database server
- **Software:** Install R/R Studio + Java + setup GitHub personal access token (see HADES instructions:  
<https://ohdsi.github.io/Hades/rSetup.html> )







# Strategus execution: 5 Steps in < 15 minutes





# Download Project

Download  
project

1. Go to study GitHub  
repo: <https://github.com/ohdsi-studies/AntiVegfKidneyFailure>
2. Download zipped folder
3. Unzip to local folder
4. Open folder and double click  
'AntiVegfKidneyFailure.Rproj'

The screenshot shows the GitHub repository page for `AntiVegfKidneyFailure`. The repository is public and has 2 branches and 0 tags. The current branch is `strategus`. The page shows a commit history table with the following entries:

Commit	Author	Message	Time
<code>AntiVegfKidneyFailure.Rproj</code>	anthony	Re-including R setup, comm	
<code>KeyringSetup.R</code>	anthony	Add keyring setup; move upload to separate script	4 days ago
<code>README.md</code>	anthony	Initial import of bibliography and house-keeping	2 months ago
<code>.gitignore</code>	anthony	Initial commit	
<code>inst</code>	anthony	Update analysis specification	
<code>docs</code>	anthony	added complex esrd outcome	
<code>Documents</code>	anthony	added complex esrd outcome	

The 'Code' button is highlighted with a red box, and the 'Download ZIP' option in the dropdown menu is also highlighted with a red box.



# Configure

Configure local settings

After opening AntiVegfKidneyFailure.Rproj you should see:

The screenshot displays the RStudio interface with the following components:

- Console:** Shows the R version (4.2.2) and the current directory path: `~/Downloads/AntiVegfKidneyFailure-strategus/`. The console contains a series of blue prompt characters (`>`).
- Environment:** Shows the current environment as "Global Environment" with a memory usage of 33 MiB. A data object named "analysisSpecif..." is listed, containing "Large AnalysisSpecifications (2 elem...)".
- Files:** Shows the file explorer for the project directory. The files and folders listed are:

Name	Size	Modified
..		
.gitignore	130 B	May 1, 2023, 9:0
AntiVegfKidneyFailure.Rproj	205 B	May 1, 2023, 3:3
app.R	4.3 KB	May 1, 2023, 9:0
badgesMarkdownCode.md	841 B	May 1, 2023, 9:0
createStrategusAnalysisSpecific...	29.6 KB	May 1, 2023, 9:0
docs		
Documents		
inst		
KeyringSetup.R	2.3 KB	May 1, 2023, 3:5
README.md	637 B	May 1, 2023, 9:0
StrategusCodeToRun.R	2.1 KB	May 1, 2023, 3:4
StrategusResultsUpload.R	6.4 KB	May 1, 2023, 9:0



# Configure

Configure local settings

Click on KeyringSetup.R to open the file in R Studio

The screenshot shows the R Studio interface. The console on the left displays the R version (4.2.2) and the current directory path: `~/Downloads/AntiVegfKidneyFailure-strategus/`. The file explorer on the right shows the contents of the directory, with `KeyringSetup.R` highlighted by a red box. The file explorer also shows other files and folders, including `.gitignore`, `AntiVegfKidneyFailure.Rproj`, `app.R`, `badgesMarkdownCode.md`, `createStrategusAnalysisSpecific...`, `docs`, `Documents`, `inst`, `README.md`, `StrategusCodeToRun.R`, and `StrategusResultsUpload.R`.

Name	Size	Modified
..		
.gitignore	130 B	May 1, 2023, 9:0
AntiVegfKidneyFailure.Rproj	205 B	May 1, 2023, 3:3
app.R	4.3 KB	May 1, 2023, 9:0
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docs		
Documents		
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# Configure

Configure local settings

```
KeyringSetup.R x
Source on Save
Run Source
1 # Install keyring - one time operation -----
2 install.packages("keyring")
3
4 if (Sys.getenv("STRATEGUS_KEYRING_PASSWORD") == "") {
5   # set keyring password by adding STRATEGUS_KEYRING_PASSWORD='sos' to renviron
6   usethis::edit_r_environ()
7   # then add STRATEGUS_KEYRING_PASSWORD='sos', save and close
8   # Restart your R Session to confirm it worked
9   stop("Please add STRATEGUS_KEYRING_PASSWORD='sos' to your .Renviron file
10        via usethis::edit_r_environ() as instructed.")
11 }
12
13 # Provide your environment specific values -----
14 dbms <- "redshift"
15 connectionString <- "jdbc:redshift://your.server.goes.here:5439/your_cdm_database"
16 username <- "username-goes-here"
17 password = "password-goes-here"
18
19 |
20
21 # Run the rest to setup keyring -----
```

1. Install keyring
2. Add strategus password to renviron
3. Configure database settings



# Execute

Execute

- Open 'StrategusCodeToRun.R'

The screenshot shows the RStudio interface. The left pane is the Console, showing the R prompt and several blue arrows indicating execution. The right pane is the Environment pane, showing the Global Environment and a data object named 'analysisSpecif...'. Below the Environment pane is the Files pane, which shows the file explorer for the project directory. The file 'StrategusCodeToRun.R' is highlighted with a red box.

Name	Size	Modified
..		
.gitignore	130 B	May 1, 2023, 9:0
AntiVegfKidneyFailure.Rproj	205 B	May 1, 2023, 3:3
app.R	4.3 KB	May 1, 2023, 9:0
badgesMarkdownCode.md	841 B	May 1, 2023, 9:0
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docs		
Documents		
inst		
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<b>StrategusCodeToRun.R</b>	2.1 KB	May 1, 2023, 3:4
StrategusResultsUpload.R	6.4 KB	May 1, 2023, 9:0



# Execute

Execute

```
KeyringSetup.R x StrategusCodeToRun.R* x
Source on Save Run Source
1 # install the network package
2 install.packages('remotes')
3 remotes::install_github("OHDSI/Strategus", ref="results-upload")
4 library(Strategus)
5
6 ##===== START OF INPUTS =====
7 connectionDetailsReference <- "Jmdc"
8 workDatabaseSchema <- 'scratch_asena5'
9 cdmDatabaseSchema <- 'cdm_jmdc_v2325'
10 outputLocation <- 'D:/git/anthonyasena/AntiVegfKidneyFailure'
11 minCellCount <- 5
12 cohortTableName <- "sos_vegf_kf"
13
14 # the keyring entry should correspond to what you selected in KeyringSetup.R
15 connectionDetails = DatabaseConnector::createConnectionDetails(
16   dbms = keyring::key_get("dbms", keyring = "sos-challenge"),
17   connectionString = keyring::key_get("connectionString", keyring = "sos-challenge"),
18   user = keyring::key_get("username", keyring = "sos-challenge"),
19   password = keyring::key_get("password", keyring = "sos-challenge")
20 )
21
```

1. Install Strategus
2. Specify result output location and database settings
3. Specify connection details



# Review CSV results

Review

This PC > Local Disk (D:) > sos > AntiVegfKidneyFailure > ccae

Name	Date modified	Type	Size
strategusExecution	4/28/2023 4:32 PM	File folder	
StrategusInstantiatedModules	4/27/2023 11:28 PM	File folder	
strategusOutput	4/28/2023 4:38 PM	File folder	
strategusWork	4/28/2023 4:38 PM	File folder	
results-schema-setup-log	4/28/2023 1:08 PM	Text Document	1 KB
upload-log	4/28/2023 1:08 PM	Text Document	1 KB

The 'strategusOutput' folder contains the results for each module that was executed.





# Inside strategusOutput folder

Review

📁 > This PC > Local Disk (D:) > sos > AntiVegfKidneyFailure > ccae > strategusOutput >

Name	Date modified	Type
CharacterizationModule_3	4/28/2023 4:46 PM	File folder
CohortDiagnosticsModule_2	4/28/2023 5:03 PM	File folder
CohortGeneratorModule_1	4/28/2023 4:32 PM	File folder
CohortIncidenceModule_4	4/28/2023 4:32 PM	File folder
CohortMethodModule_5	4/28/2023 4:33 PM	File folder
DatabaseMetaData	4/28/2023 9:49 AM	File folder
PatientLevelPredictionModule_7	4/28/2023 4:46 PM	File folder
PIPModels	4/28/2023 1:44 PM	File folder
SelfControlledCaseSeriesModule_6	4/28/2023 4:38 PM	File folder

# Each module folder contains csv files

Review

## CohortGeneratorModule

This PC > Local Disk (D:) > sos > AntiVegfKidneyFailure > ccae > strategusOutput > CohortGeneratorModule

Name	Date modified	Type	Size
cg_cohort_count	4/28/2023 4:32 PM	CSV File	2 KB
cg_cohort_count_neg_ctrl	4/28/2023 4:32 PM	CSV File	2 KB
cg_cohort_definition	4/28/2023 4:32 PM	CSV File	271 KB
cg_cohort_generation	4/28/2023 9:58 AM	CSV File	4 KB
cg_cohort_inc_result	4/28/2023 4:32 PM	CSV File	1 KB
cg_cohort_inc_stats	4/28/2023 4:32 PM	CSV File	1 KB
cg_cohort_inclusion	4/28/2023 4:32 PM	CSV File	1 KB
cg_cohort_summary_stats	4/28/2023 4:32 PM	CSV File	1 KB
cohortGeneratorResults	4/28/2023 4:32 PM	Compressed (zipp...	31 KB
done	4/28/2023 4:32 PM	File	1 KB
log	4/28/2023 4:32 PM	Text Document	16 KB
resultsDataModelSpecification	4/28/2023 4:32 PM	CSV File	4 KB

## CohortmethodModule

This PC > Local Disk (D:) > sos > AntiVegfKidneyFailure > ccae > strategusOutput > CohortMethodModule\_5

Name	Date modified	Type	Size
cm_analysis	4/28/2023 4:32 PM	CSV File	7 KB
cm_attrition	4/28/2023 4:33 PM	CSV File	4 KB
cm_covariate	4/28/2023 4:33 PM	CSV File	6,468 KB
cm_covariate_analysis	4/28/2023 4:33 PM	CSV File	1 KB
cm_covariate_balance	4/28/2023 4:33 PM	CSV File	19 KB
cm_diagnostics_summary	4/28/2023 4:33 PM	CSV File	1 KB
cm_follow_up_dist	4/28/2023 4:33 PM	CSV File	1 KB
cm_interaction_result	4/28/2023 4:33 PM	CSV File	1 KB
cm_kaplan_meier_dist	4/28/2023 4:33 PM	CSV File	19 KB
cm_likelihood_profile	4/28/2023 4:33 PM	CSV File	350 KB
cm_preference_score_dist	4/28/2023 4:33 PM	CSV File	28 KB
cm_propensity_model	4/28/2023 4:33 PM	CSV File	63 KB
cm_result	4/28/2023 4:33 PM	CSV File	33 KB
cm_shared_covariate_balance	4/28/2023 4:33 PM	CSV File	5,914 KB
cm_target_comparator_outcome	4/28/2023 4:33 PM	CSV File	4 KB
done	4/28/2023 4:33 PM	File	1 KB
log	4/28/2023 4:33 PM	Text Document	176 KB
resultsDataModelSpecification	4/28/2023 4:33 PM	CSV File	19 KB

## PatientLevelPredictionModule

This PC > Local Disk (D:) > sos > AntiVegfKidneyFailure > ccae > strategusOutput > PatientLevelPredictionModule\_7

Name	Date modified	Type	Size
models	4/28/2023 12:22 PM	File folder	
attrition	4/28/2023 4:46 PM	CSV File	1 KB
calibration_summary	4/28/2023 4:46 PM	CSV File	147 KB
cohort_definition	4/28/2023 4:46 PM	CSV File	9 KB
cohorts	4/28/2023 4:46 PM	CSV File	1 KB
covariate_settings	4/28/2023 4:46 PM	CSV File	1 KB
covariate_summary	4/28/2023 4:46 PM	CSV File	27 KB
database_details	4/28/2023 4:46 PM	CSV File	1 KB
database_meta_data	4/28/2023 4:46 PM	CSV File	1 KB
demographic_summary	4/28/2023 4:46 PM	CSV File	36 KB
diagnostic_designs	4/28/2023 4:46 PM	CSV File	1 KB
diagnostic_outcomes	4/28/2023 4:46 PM	CSV File	18 KB
diagnostic_participants	4/28/2023 4:46 PM	CSV File	3 KB
diagnostic_predictors	4/28/2023 4:46 PM	CSV File	20 KB
diagnostic_summary	4/28/2023 4:46 PM	CSV File	1 KB
diagnostics	4/28/2023 4:46 PM	CSV File	1 KB
done	4/28/2023 4:46 PM	File	1 KB
evaluation_statistics	4/28/2023 4:46 PM	CSV File	8 KB
feature_engineering_settings	4/28/2023 4:46 PM	CSV File	1 KB
log	4/28/2023 4:46 PM	Text Document	186 KB
model_designs	4/28/2023 4:46 PM	CSV File	1 KB
model_settings	4/28/2023 4:46 PM	CSV File	3 KB
models	4/28/2023 4:46 PM	CSV File	1 KB
performances	4/28/2023 4:46 PM	CSV File	1 KB
plp_data_settings	4/28/2023 4:46 PM	CSV File	1 KB
population_settings	4/28/2023 4:46 PM	CSV File	1 KB
prediction_distribution	4/28/2023 4:46 PM	CSV File	4 KB
recalibrations	4/28/2023 4:46 PM	CSV File	1 KB
sample_settings	4/28/2023 4:46 PM	CSV File	1 KB
split_settings	4/28/2023 4:46 PM	CSV File	1 KB
tars	4/28/2023 4:46 PM	CSV File	1 KB
threshold_summary	4/28/2023 4:46 PM	CSV File	498 KB
tidy_covariates_settings	4/28/2023 4:46 PM	CSV File	1 KB



# Share results

Share

main ▾ AntiVegfKidneyFailure / ShareResults.R

 anthonyseena Fix FTP folder name

1 contributor

57 lines (53 sloc) | 2.52 KB

```
1  ##### START OF INPUTS #####
2  connectionDetailsReference <- "Jmdc"
3  outputLocation <- 'D:/git/anthonyseena/AntiVegfKidneyFailure'
4  # For uploading the results. You should have received the key file from the study coordinator:
5  keyFileName <- "[location where you are storing: e.g. ~/keys/study-data-site-covid19.dat]"
6  userName <- "study-data-site-covid19"
7  ##### END OF INPUTS #####
8  #####
9  # DO NOT MODIFY BELOW THIS POINT
10 #####
11
12 rootFTPFolder <- function() {
13   return("/sos-anti-vegf-kf/")
14 }
15
16 zipResults <- function(outputLocation, connectionDetailsReference) {
17   resultsFolder <- file.path(outputLocation, connectionDetailsReference, "strategusOutput")
18   zipFileName <- file.path(resultsFolder, paste0("Results_", connectionDetailsReference, ".zip"))
19   DatabaseConnector::createZipFile(
```

To share csv results:

Add database reference

Add location of results

**Get keyFileName and userName  
from study coordinator**



## 5 Step Summary

- **Download:** Download zip in github page (<https://github.com/ohdsi-studies/AntiVegfKidneyFailure>), unzip folder in local directory and open R project (AntiVegfKidneyFailure.Rproj).
- **Configure:** Open KeyringSetup.R to configure database connection settings and keyring password using keyring
- **Execute:** Open StrategusCodeToRun.R to edit local output directory and database parameters and then run study using those settings
- **Review:** explore csv files in StrategusOutput and/or launch shiny
- **Share:** open ShareResults.R to export result files to OHDSI



## Viewing shiny app

- First you need to upload the results to a database, we recommend sqlite for local viewing.
- To upload results into local sqlite database open the file "StrategusResultsUpload.R"





# You only need to specify two inputs then run the script to insert the results into a local sqlite database

strategus ▾

[AntiVegfKidneyFailure](#) / StrategusResultsUpload.R



**anthonyseena** Updates for upload and shiny

1 contributor

163 lines (151 sloc) | 6.4 KB

```
1  ##===== START OF INPUTS =====
2
3  connectionDetailsReference <- "Jmdc"
4  outputLocation <- 'D:/git/anthonyseena/AntiVegfKidneyFailure'
5
6  ##===== END OF INPUTS =====
7  #####
```

Set the connectionDetailsReference to a reference for your OMOP CDM database

Set the outputLocation to a folder location on your hard drive where you can read/write from



# Your data are now ready for the shiny app

- Launch shiny app open the file "app.R"

```
strategus - AntiVegfKidneyFailure / app.R  
  
anthonyseana Updates for upload and shiny  
  
1 contributor  
  
132 lines (119 sloc) | 4.28 KB  
  
1 # View Strategus results in the results database  
2 # remotes::install_github("ohdsi/ShinyAppBuilder", ref = "develop")  
3 # remotes::install_github("ohdsi/OhdsiShinyModules", ref = "develop")  
4  
5 library(dplyr)  
6 library(ShinyAppBuilder)  
7 library(markdown)  
8  
9 ##### START OF INPUTS #####  
10  
11 connectionDetailsReference <- "Jmdc"  
12 outputLocation <- 'D:/git/anthonyseana/AntiVegfKidneyFailure'  
13  
14 ##### END OF INPUTS #####
```

Only two inputs are required (the same values used when creating the local sqlite database on slide 22)



# Shiny App

Let's explore...

OHDSI Analysis Viewer



- About
- Cohorts
- CohortDiagnostics
- Characterization
- Prediction
- Estimation
- SCCS

About OHDSI Viewer

## OHDSI Analysis Viewer

### Table of contents

1. Introduction
2. How to use the viewer
3. Analysis types
  1. Characterization
  2. Population-level effect estimation
  3. Patient-level prediction

### Introduction

This is an interactive shiny app for exploring standardized outputs for OHDSI analyses including:

- characterization (descriptive studies)
- population-level effect estimation(causal inference)
- patient-level prediction (inference)

Full details of all the analysis tools can be found on the [HADES website](#)





# Characterization

Explore incidence rates, event timing, compare those target patients with and without the outcome during the time at risk...

OHDSI Analysis Viewer



The screenshot shows the 'Characterization Viewer' interface. On the left is a dark sidebar with navigation items: About, Cohorts, CohortDiagnostics, Characterization (selected), Prediction, Estimation, and SCCS. The main content area has a blue header 'Characterization Viewer' and a tabbed interface with 'Incidence Rate' selected. Below the tabs, there is a section for 'Incidence Rates' with a plus sign, and an 'Options' section with a minus sign. The 'Options' section contains two dropdown menus: 'Target id' set to '[SOS Phenotype Devt] aflibercept exposures after new use' and 'Outcome id' set to '[SOS] End-stage renal disease'. A 'Generate Report' button is located below the dropdowns. At the bottom, a 'Selected:' section displays the target and outcome details: 'Target: [SOS Phenotype Devt] aflibercept exposures after new use with 3 exposures in 21-70d windows - in cohorts: (1782480) starts within D: -99999 - D: 0 of cohort start and ends D: -99999 - D: 99999 of cohort start, first ever occurrence with at least 365' and 'Outcome: [SOS] End-stage renal disease'.



# Cohort Method

View diagnostics and cohort method results (if they passed diagnostics), explore the analyses...

OHDSI Analysis Viewer



- About
- Cohorts
- CohortDiagnostics
- Characterization
- Prediction
- Estimation
- SCCS

### Cohort Method

#### Cohort Method Evidence Explorer

Diagnostics **Results**

**Target**


[SOS Phenotype Devt] aflibercept exposures after new use with 3 exposures in 21-70d windows - in cohorts: (1782480) starts within D: -99999 - D: 0 of cohort start and ends D: -99999 -


	Analysis	Data source	HR	LB	UB	P
<input type="radio"/>	Cohort method, On treatment	IBM CCAE	0.98	0.64	1.52	0.94



# Self-Controlled Case Series

View diagnostics and SCCS method results (if they passed diagnostics), explore the analyses...

OHDSI Analysis Viewer 



**Self Controlled Case Series**

Info +

Diagnostics **Results**

Options -

<b>Exposure:</b> [SOS Phenotype Devt] bevacizumab exposures after new ▼	<b>Outcome:</b> [SOS] End-stage renal disease ▼
<b>Database:</b> IBM CCAE ▼	<b>Analysis:</b> SCCS, having [SOS Phenotype Devt] persons with blindin ▼

Generate Report



# PatientLevelPrediction

View how feasible it was to predict the outcomes within the target populations during the time at risk...



OHDSI Analysis Viewer



- About
- Cohorts
- CohortDiagnostics
- Characterization
- Prediction
- Estimation
- SCCS

## Prediction Viewer

### Model Designs Summary

Design.ID	Model.Type	Target.Pop	Outcome	TAR	min.AUROC	mean.AUROC	max.AUROC
1	logistic	Cohort: 1782483001	[SOS] End-stage renal disease	(cohort start + 1) - (cohort start + 365)	0.925	0.925	0.925
2	logistic	Cohort: 1782483002	[SOS] End-stage renal disease	(cohort start + 1) - (cohort start + 365)	0.930	0.930	0.930



## We have a central shiny app

- Results will be uploaded to <https://data.ohdsi.org/AntiVegfKidneyFailure/>
- Check out that app throughout the week as more results are added...