Advancing the OHDSI Analysis Viewer: Enhanced Performance, Integration, and User Experience

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Background

The development of robust, standardized tools that allow users to interactively explore data is an important consideration when considering the evolving landscape of observational health data analytics and large-scale epidemiology research. The OHDSI community has spearheaded the development of numerous open-source packages, primarily through the Health Analytics Data-to-Evidence Suite (HADES), which collectively empower researchers to conduct comprehensive observational studies[1-4]. Despite their efficacy, these tools previously operated in silos, requiring separate installations and producing disparate outputs. Last year's introduction of the OHDSI Analysis Viewer aimed to consolidate these tools into a unified interface. Building on that foundation, this year's enhancements have significantly improved performance, stability, and both the user experience (UX) and user interface (UI), further integrating cutting-edge tools and refining the platform's capabilities.

Methods

Within the OHDSI community, there are several packages within the HADES suite that fuel our ability to conduct observational health research, including CohortGenerator, CohortDiagnostics, Characterization, CohortIncidence, CohortMethod, PatientLevelPrediction, SelfControlledCaseSeries, EvidenceSynthesis, and PheValuator. These packages cover a broad spectrum of functionalities, and have progressed significantly over the last year since the previous presentation of the OHDSI Analysis Viewer. The OHDSI Analysis Viewer continues to utilize Shiny modules written in the R programming language[6], which are self-contained units that encapsulate specific functionalities, promoting modularity and reusability within the larger application. Since the deployment of last year's application, the modules have undergone several iterative improvements, which include: general coding and bug fixes, enhancements to the user input selector buttons, dropdowns, and other interactive elements, expansions to component modules which standardize both the functionality and the final appearance of tables, plots, and other figures within the Viewer, and many others.

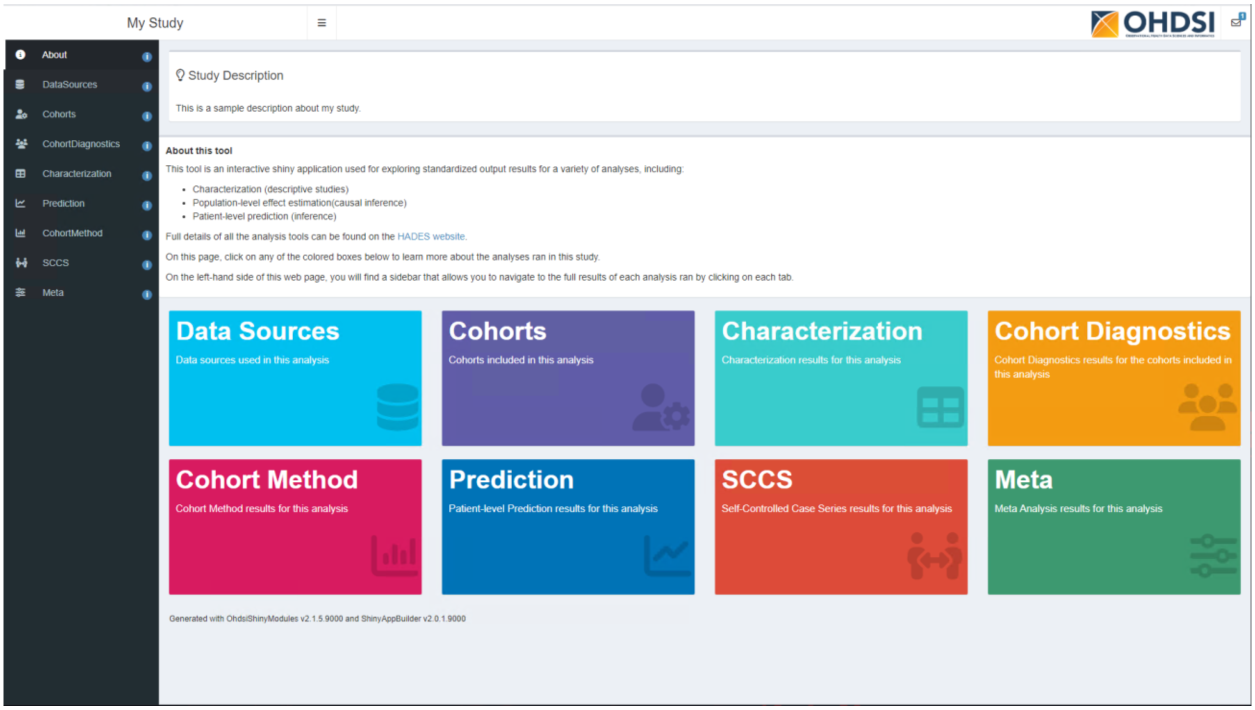
Leveraging the R Shiny framework, the backbone of the OHDSI Analysis Viewer still hinges on both the OhdsiShinyModules and ShinyAppBuilder OHDSI packages. As described above, the OhdsiShinyModules package now provides enhanced modular components that improve interoperability and simplify the development process. Similarly, the ShinyAppBuilder package offers comprehensive R project management features, including automated dependency handling and configuration management, which streamline the integration and deployment of new modules within the Viewer, along with updated styling options utilizing HTML and CSS code.

The Strategus package, which is also now a part of the OHDSI stack, is a key change and addition from last year's Viewer. Strategus is designed to coordinate and execute analytics using HADES modules[5], and aims to streamline the conduct of network studies within the OHDSI community. By installing Strategus, network sites can exchange analysis specifications in a standardized JSON format, encapsulating all methodological choices for a study. This approach facilitates the combination of various HADES modules into cohesive analytical pipelines, ensuring reproducibility by specifying exact module versions required for each study. As outlined in the Strategus documentation, it functions to operationalize studies through three primary steps: creating the analysis specification, which involves defining cohorts, selecting analyses (e.g., Cohort Diagnostics, Comparative Cohort Study), and detailing specific methodological choices; creating execution settings by configuring connections to the OMOP CDM and other environment-specific parameters; and executing the study with Strategus by combining the analysis specification and execution settings to conduct the study and generate results, which can subsequently be viewed using R Shiny (via the OHDSI Analysis Viewer) [5].

Results

This year's software demonstration will comprehensively showcase the OHDSI Analysis Viewer's significant enhancements in performance, integration, and user experience through a detailed sample project. Attendees will witness firsthand the improvements in navigation, interactivity, and the streamlined analysis process, which collectively contribute to a more intuitive and efficient UX. The demonstration will delve into the application's new layout and features (**Figure 1**), highlighting the integration of various HADES modules into a unified platform, much like last year's presentation, but with a focus on the changes and improvements.

Furthermore, the demo will offer an in-depth look at how OhdsiShinyModules and ShinyAppBuilder facilitate backend processes, including module structure, design, and application deployment. Attendees will gain insight into the modular framework provided by OhdsiShinyModules, which allows for easy interoperability and reuse of components across different analyses. The ShinyAppBuilder package's role in simplifying project setup, managing dependencies, and configuring customizable layout and themes will also be demonstrated. This overview will include live examples of how a developer can go about creating and deploying new modules, highlighting the ease with which the platform can be customized and expanded from the backend (**Figure 2**).



My Study

About

DataSources

Cohorts

CohortDiagnostics

Characterization

Prediction

CohortMethod

SCCS

Meta

Study Description

This is a sample description about my study.

About this tool

This tool is an interactive shiny application used for exploring standardized output results for a variety of 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.

On this page, click on any of the colored boxes below to learn more about the analyses ran in this study.

On the left-hand side of this web page, you will find a sidebar that allows you to navigate to the full results of each analysis ran by clicking on each tab.

Data Sources
Data sources used in this analysis

Cohorts
Cohorts included in this analysis

Characterization
Characterization results for this analysis

Cohort Diagnostics
Cohort Diagnostics results for the cohorts included in this analysis

Cohort Method
Cohort Method results for this analysis

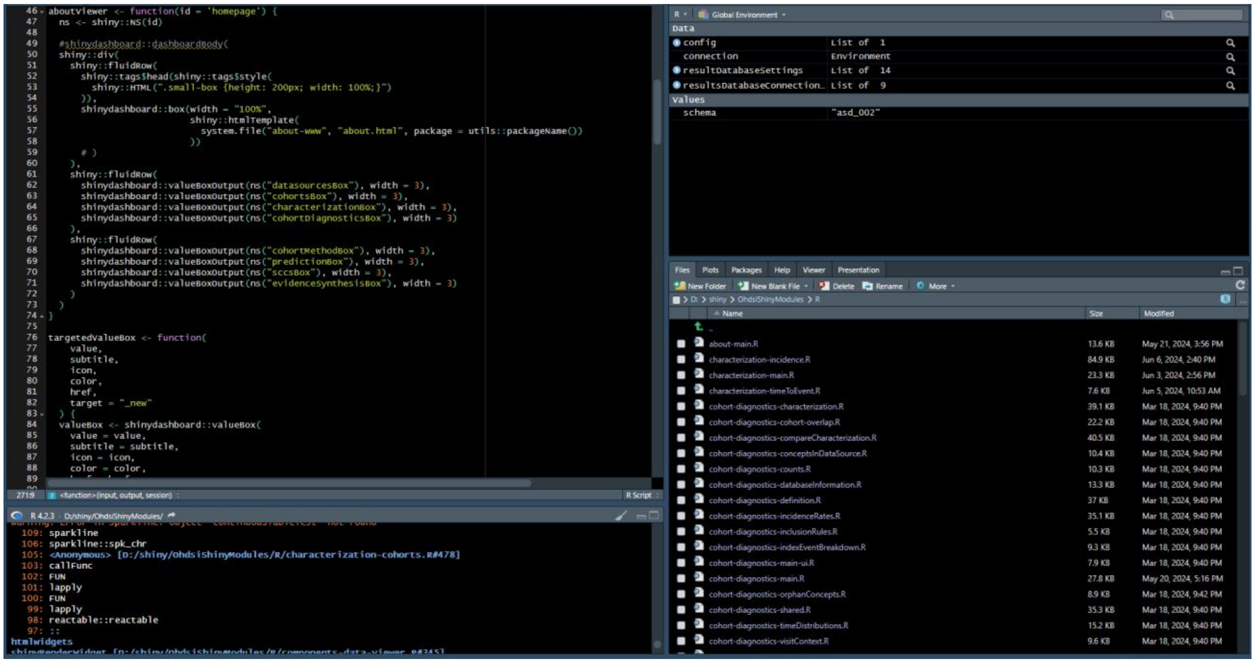
Prediction
Patient-level Prediction results for this analysis

SCCS
Self-Controlled Case Series results for this analysis

Meta
Meta Analysis results for this analysis

Generated with OhdsiShinyModules v2.1.5.9000 and ShinyAppBuilder v2.0.1.9000

Figure 1. The OHDSI Analysis Viewer user interface (UI).



```
aboutViewer <- function(id = 'homepage') {
  ns <- shiny::NS(id)

  #shinydashboard::dashboardBody(
  shiny::div(
    shiny::fluidRow(
      shiny::tags$head(shiny::tags$style(
        shiny::HTML(".small-box {height: 200px; width: 100%;}")
      )),
      shinydashboard::box(width = "100%",
                          shiny::htmlTemplate(
                            system.file("about-www", "about.html", package = utils::packageName())
                          ))
      # )
    ),
    shiny::fluidRow(
      shinydashboard::valueBoxOutput(ns("datasourcesBox"), width = 3),
      shinydashboard::valueBoxOutput(ns("cohortsBox"), width = 3),
      shinydashboard::valueBoxOutput(ns("characterizationBox"), width = 3),
      shinydashboard::valueBoxOutput(ns("cohortDiagnosticsBox"), width = 3)
    ),
    shiny::fluidRow(
      shinydashboard::valueBoxOutput(ns("cohortMethodBox"), width = 3),
      shinydashboard::valueBoxOutput(ns("predictionBox"), width = 3),
      shinydashboard::valueBoxOutput(ns("sccsBox"), width = 3),
      shinydashboard::valueBoxOutput(ns("evidenceSynthesisBox"), width = 3)
    )
  )
}

targetedValueBox <- function(
    value,
    subtitle,
    icon,
    color,
    href,
    target = "_new"
  ) {
  valueBox <- shinydashboard::valueBox(
    value = value,
    subtitle = subtitle,
    icon = icon,
    color = color,
```

```
271:9   <function>(input, output, session)                R Script
```

```
R 4.2.3 · D:/shiny/OhdsiShinyModules/
Warning: Error in sparkline: object 'continuousTableTest' not found
  109: sparkline
  106: sparkline::spk_chr
  105: <Anonymous> [D:/shiny/ohdsiShinyModules/R/characterization-cohorts.R#478]
  103: callFunc
  102: FUN
  101: lapply
  100: FUN
   99: lapply
   98: reactable::reactable
   97: ::
htmlwidgets
shinyRenderWidget [D:/shiny/ohdsiShinyModules/R/components-data-viewer.R#345]
```

```
R · Global Environment
Data
config                          List of  1
connection                      Environment
resultDatabaseSettings          List of  14
resultsDatabaseConnection…      List of  9
Values
schema                          "asd_002"
```

D: > shiny > OhdsiShinyModules > R

Name	Size	Modified
..		
about-main.R	13.6 KB	May 21, 2024, 3:56 PM
characterization-incidence.R	84.9 KB	Jun 6, 2024, 2:40 PM
characterization-main.R	23.3 KB	Jun 3, 2024, 2:56 PM
characterization-timeToEvent.R	7.6 KB	Jun 5, 2024, 10:53 AM
cohort-diagnostics-characterization.R	39.1 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-cohort-overlap.R	22.2 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-compareCharacterization.R	40.5 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-conceptsInDataSource.R	10.4 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-counts.R	10.3 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-databaseInformation.R	13.3 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-definition.R	37 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-incidenceRates.R	35.1 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-inclusionRules.R	5.5 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-indexEventBreakdown.R	9.3 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-main-ui.R	7.9 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-main.R	27.8 KB	May 20, 2024, 5:16 PM
cohort-diagnostics-orphanConcepts.R	8.9 KB	Mar 18, 2024, 9:42 PM
cohort-diagnostics-shared.R	35.3 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-timeDistributions.R	15.2 KB	Mar 18, 2024, 9:40 PM
cohort-diagnostics-visitContext.R	9.6 KB	Mar 18, 2024, 9:40 PM

Figure 2. The backend of the OHDSI Analysis Viewer

Conclusion

The updated OHDSI Analysis Viewer represents a significant step forward in visualizing and disseminating real-world evidence derived from observational health data. Particularly, the updates that have been incorporated both on the front and back-end are important to highlight the ability to rapidly improve and evolve the way we conduct large-scale epidemiological studies. The platform's enhanced performance, stability, UX, and the integration of the new Strategus package underscore its value as a comprehensive tool for scalable observational research. This software demonstration will emphasize the practical benefits of the OHDSI Analysis Viewer and its underlying modular components, fueled by the HADES packages, encouraging their continued development and adoption within the OHDSI community.

References

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