



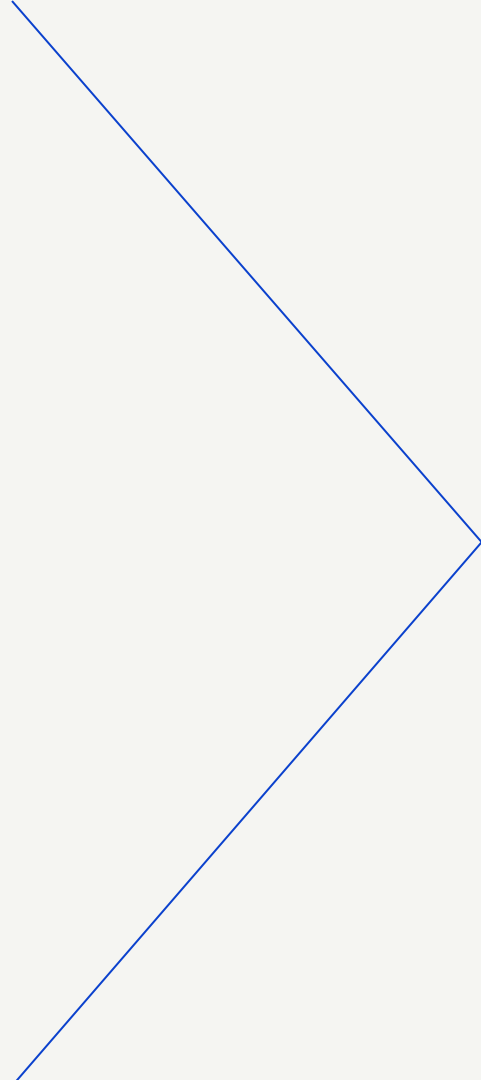
Teal

Enabling Comprehensive Interactive Data Analysis and Exploration in R with an Open-Sourced Scalable Shiny Framework

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Roche/Genentech

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@ PHUSE US Connect 2023 [OS15]

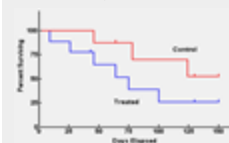
Agenda

- 
- A decorative graphic consisting of a vertical blue line and two diagonal blue lines that meet at a point on the vertical line, forming a large right-pointing arrow shape that spans the height of the slide.
1. Introduction to teal framework
 2. Teal-verse product map
 3. Using teal in clinical trial
 4. Anatomy and key features of teal
 5. Example app demo
 6. Additional resources

Improve efficiency in the way we work

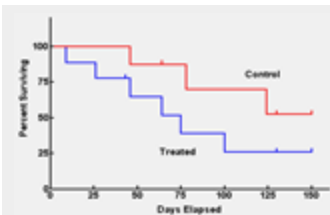
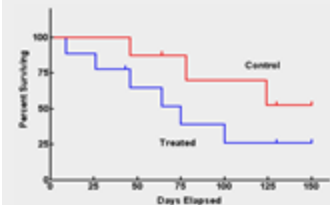
Analyzing clinical trial data requires multiple ways of presenting and interacting with our data

Kaplan Meier Plot
Protocol:1111 Snapshot:222 Cutoff date:Jan 2,2016



Additional Footnotes
Program:<path>/kmpilot.R
Output:<path>/kmpilot_JTT.pdf

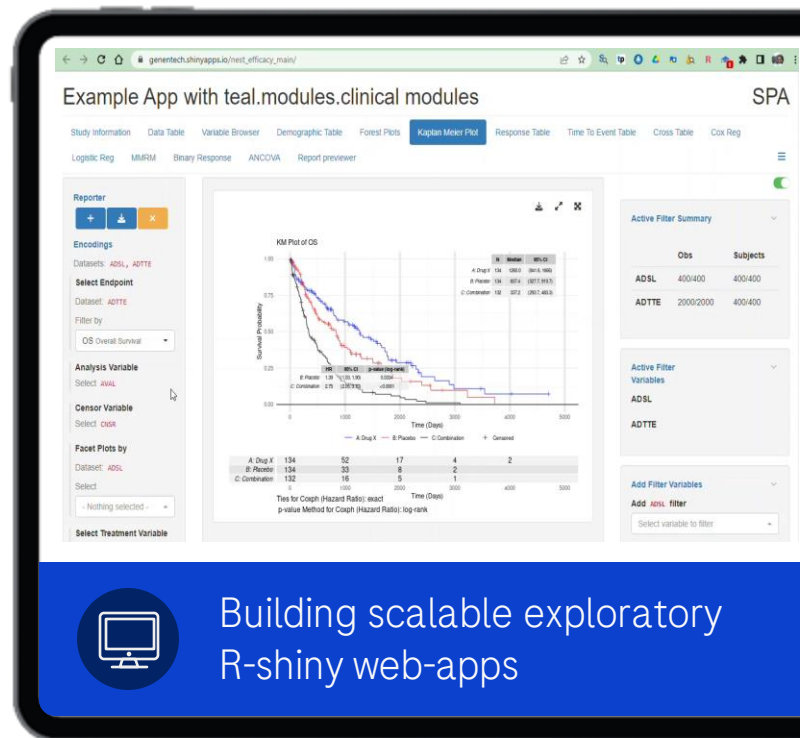
1 of 3



Per-SAP static output
on **OS**

Ad-hoc analysis
on **PFS**

Ad-hoc analysis on **PFS**
in **subpopulation**



What is {teal}?



A Rshiny-based interactive data exploration framework



Modularized and standardized building blocks



Collection of specialized R packages



Streamlines creation of web-apps that offers:

- Dynamic filtering facility
- Code reproducibility
- Reporting engine
- Many data summarization and visualizations



How does {teal} work?



Traditional shiny app

Data

Dataset 1
Dataset 2
Dataset 3

Shiny

ui
server

{teal} framework with modularized components

- Data agnostic
- Flexible
- Cumulative
- Collaborative
- Crowdsourcing



Data

Dataset 1
Dataset 2
Dataset 3

{teal} modules

Module 1
ui
server

Module 2
ui
server

Module 3
ui
server

{teal} framework

ui
server

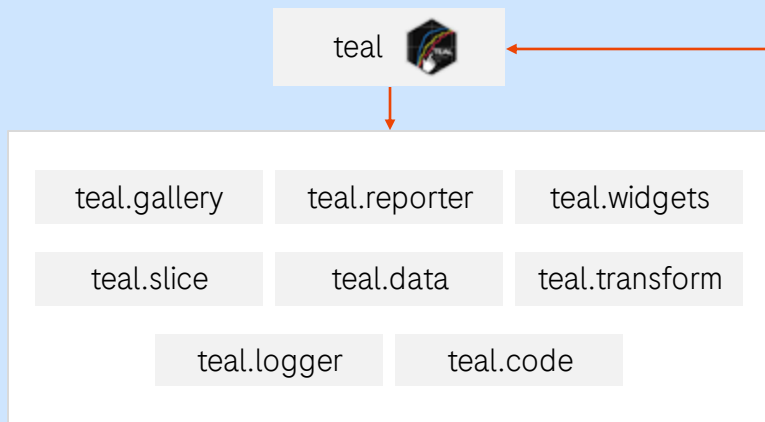
{teal} shiny app



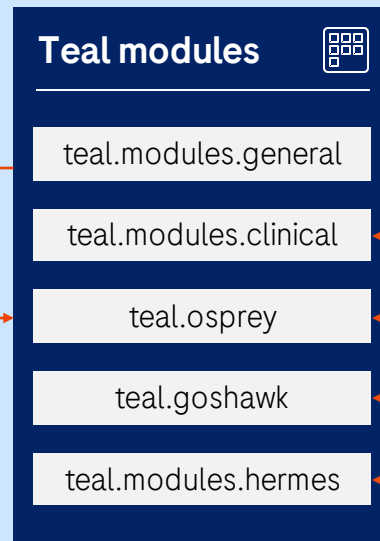
{teal} Universe Products Map



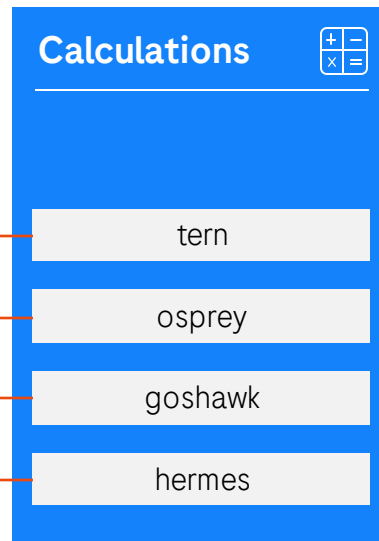
Teal framework



Teal modules



Calculations





Teal Framework R Packages

- [teal](#): shiny-based interactive exploration framework for analyzing data.
- [teal.gallery](#): gallery of sample teal apps.
- [teal.widgets](#): shiny components used within teal.
- [teal.reporter](#): allows teal applications to generate reports.
- [teal.slice](#): provides a filtering panel to allow subset of data.
- [teal.data](#): creating and loading the data needed for teal applications.
- [teal.code](#): handles reproducibility of outputs.
- [teal.transform](#): standardizes extracting and merging data
- [teal.logger](#): standardizes logging within teal framework.



Teal Modules R Packages

- [teal.modules.general](#): general analysis modules for exploring any data types
- [teal.modules.clinical](#): modules for analyzing CDISC data and clinical trial reporting with [tern](#) R package
- [teal.osprey](#): modules for analyzing and reporting early-phase clinical trial data with [osprey](#) R package
- [teal.goshawk](#): modules for analyzing and visualizing biomarker data with [goshawk](#) R package
- [teal.modules.hermes](#): modules for analyzing and visualizing RNAseq data with [hermes](#) R package

Application of {teal} in clinical trial



Clinical trial reporting

- QCing of clinical trial reporting outputs
- Trial monitoring
- Ad-hoc & exploratory analyses
- Content generation to support internal strategic decision meetings
- Complement study milestone events
- Pooled data analysis



Outside of trial reporting setting

- Exploring high-dimensional biomarker
- Exploring real-world data off-label use
- Data quality monitoring
- Operations analytics

Installation

```
Sys.setenv(GITHUB_PAT = "your_access_token_here")  
if (!require("remotes")) install.packages("remotes")  
remotes::install_github("insightsengineering/teal@*release")
```



Anatomy of a teal app

Example App with teal.modules.general modules

Study Information File viewer Data Table Variable Browser Missing Data Distribution Outliers **Association** Response Plot Scatterplot matrix Scatterplot Table Choices Principal Component Analysis Report preview

Reporter

Encodings

Dataset: ADSL

Reference variable

Select

AGE Age

Associated variables

Select

AFMCD

☒ Association with the reference variable

☐ Distribution

☐ Log transformed

Plot settings

Output

Association between Planned Arm Code [AFMCD] and Age [AGE]

Filter Panel

Active Filter Summary

	Obs	Subjects
ADSL	400/400	400/400

Active Filter Variables

ADSL

Add Filter Variables

Add ADSL filter

Select variable to filter

Source: teal.gallery package

Released: 2024-07-01

Header

Menu with tabs

Reporter

Encodings

Reproducibility
Debugging

Output

- * Download
- * Better View
- * Dimensions

* Toggle Filter Panel

Filter Panel

Footer

LIVE DEMO



{teal} Playground

Posit Cloud Link:

- https://posit.cloud/spaces/340990/join?access_code=M52ibtFP2ASLLL1MltA-dThXpPzJvRqnxndNOgejA

Public Docker Image:

- https://github.com/insightsengineering/ci-images/pkgs/container/rstudio-local_4.2.2_bioc_3.16



Example apps

`library(teal.gallery)`

- `launch_app("efficacy")`

- `launch_app("exploratory")`

- `launch_app("safety")`



Public websites

- [Efficacy analysis](#)

- [Exploratory analysis](#)

- [Safety analysis](#)



Additional Resources



{teal} is part of pharmaverse:
<https://pharmaverse.org/>



More information about support:
<https://pharmaverse.org/support/>



Slack channel [#teal](#) under
 pharmaverse workspace



Upcoming course on Coursera
"Hands On Clinical Reporting Using R"
 in Q3 2023

Support

Packages

For all [pharmaverse packages](#) we recommend to use the following for support and communications between user and developer communities:

-  **Slack** - for informal discussions, Q&A and building user community
-  **GitHub Issues** - for direct feedback, enhancement requests or raising bugs

Collaborating on {teal}



We are looking for collaborators to develop this framework further!



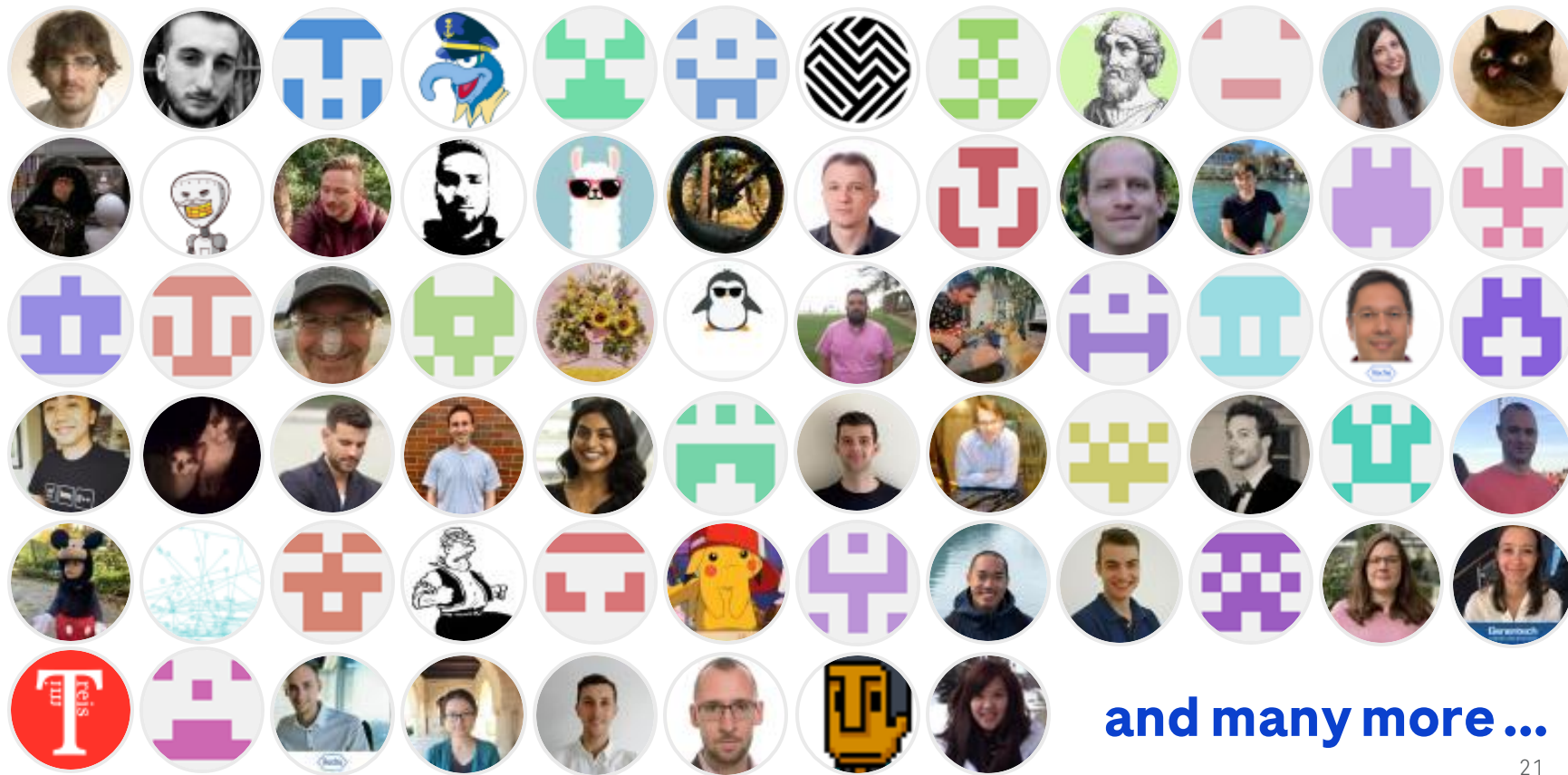
If you're an individual please contribute on GitHub and join us the [#teal](#) channel of [pharmaverse](#) Slack



If you're an organization wanting to adopt {teal} and co-develop it please get in touch with thomas.neitmann@roche.com



Acknowledgement



and many more...

Doing now what patients need next