

Single Day Event

Extending Teal into a Customizable Low-Code Environment for Interactive and Visual Clinical Analytics

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Disclaimer

The opinions expressed in this presentation are those of the author(s) and do not necessarily reflect the official views and policies of Sanofi.

All data presented in this presentation are simulated. No real patient information is used or disclosed.

- **What is {teal}?**
- **The Usability Challenge**
- **Solution**
- **Introducing {teal.builder}**

Agenda



A shiny-based interactive framework for data exploration

Visual

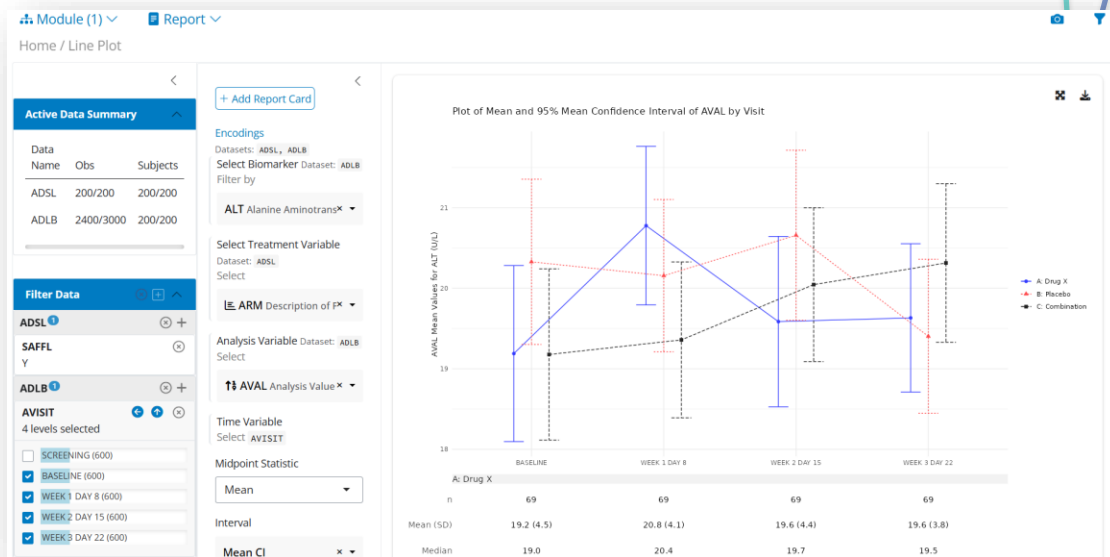
Intuitive, real-time data insights

Interactive

Dynamic, user-driven exploration

Adaptable

CDISC-ready, extends beyond clinical data



Supported Data

CDISC Data

Independent/ Related Data

MultiAssayExperiment object

Supported Analysis

General Data Visualizations

Statistical Model

Summary Tables

Patient-level profile

RNAseq Analysis

...



```
teal.modules.clinical  
teal.modules.general  
teal.modules.hermes  
teal.goshawk
```

The Usability Challenge



High Expertise Barrier Limits Accessibility

Requires writing R code to trigger modules

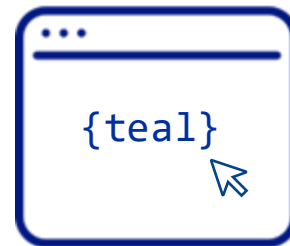
Demands R programming skills

Needs in-depth understanding of teal framework

▶ *Narrow user base, limited adoption*

A Low-code Interface for teal

- Integrate teal into a customizable GUI
(Like Windows for DOS – making powerful tools accessible)
- Implementation with RShiny: One viable front-end
(not the only one)



Our Solution Approach



Use Case Background

Self-Service for Regional Consistency Analysis

- Common need: Compare regional populations vs. study population (e.g. China vs. Non-China)
- But: *Regional* flag is **not in standard ADaM datasets**
- Traditionally: Wait for programmers to derive and deliver datasets
- Solution: Enable researchers to **self-serve**
 - Pre-process data on-demand
 - Directly feed into teal for instant exploration



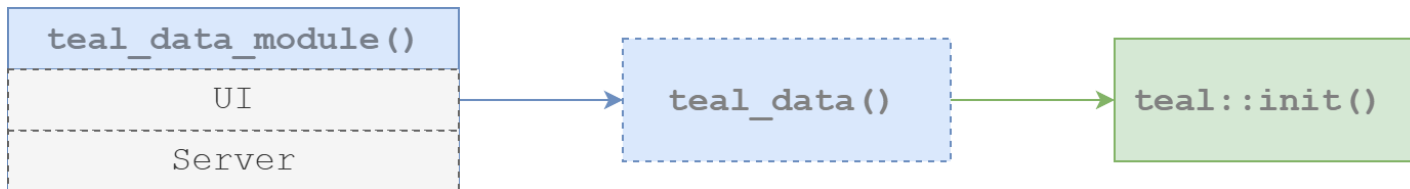
Select the file to upload

Browse...

No file selected

Submit

Dismiss



A shiny Module Designed for teal

- A reusable Shiny module with **standard UI and Server** structure
- Key difference: The server **must return a `teal_data()` object**

Ang teal app requires a `teal_data()`

- Ensures **reproducible** and **structured** data flow
- Supports relational data management

```
# create teal_data object
data <- teal_data()

# run code within teal_data
data <- within(data, {
  ADSL <- teal.data::rADSL
  ADLB <- teal.data::rADLB
})
```

```
> data
✔ code verified
<environment: 0x5560e80fa760> 🔒
Parent: <environment:
package:teal.modules.clinical>
Bindings:
- ADLB: [tbl_df]
- ADSL: [tbl_df]
```

A locked Environment with Enhanced Controls

- Similar to `globalEnv()` - but sealed to prevent unintended changes
- Enhanced for traceability, reproducibility, and relational data integrity.
- Data can **only be modified** via:
`teal.code::eval_code()` or `within.genv()`
→ All changes are automatically recorded
→ Guaranteed reproducibility



```
# create teal_data object  
data <- teal_data()
```

```
# run code within teal_data to create data objects  
data <- within(data, {  
  ADSL <- teal.data::rADSL  
  ADLB <- teal.data::rADLB  
})
```

```
retrieve code  
> cat(get_code(data))  
ADSL <- teal.data::rADSL  
ADLB <- teal.data::rADLB
```

`teal_data()`

For any `teal_data()` object:

- Use `get_code()` -> **retrieve all code ever run** on the data



```
# chain and join objects together
data <- teal.code::eval_code(data, 'ADSL <- ADSL |>
  dplyr::mutate(
    REGION = factor(
      dplyr::if_else(COUNTRY == "USA", COUNTRY,
"Non-USA"))
    )')
```

```
# retrieve code
> cat(get_code(data))
ADSL <- teal.data::rADSL
ADLB <- teal.data::rADLB
ADSL <- ADSL |>
  dplyr::mutate(
    REGION = factor(
      dplyr::if_else(COUNTRY == "USA", COUNTRY,
"Non-USA"))
    )
```

`teal_data()`

Chain & join

- Enable modular, step-by-step workflows with fine-grained control



```
# Setting join keys
teal.data::join_keys(data) <-
teal.data::default_cdisc_join_keys[names(data)]
```

```
> join_keys(data)
A join_keys object containing foreign keys between
2 datasets:
ADSL: [STUDYID, USUBJID]
  <-- ADLB: [STUDYID, USUBJID]
ADLB: [STUDYID, USUBJID, PARAMCD, AVISIT]
  --> ADSL: [STUDYID, USUBJID]
```

`teal_data()`

Built-in `join_keys` for Relational Data

- Define and store **linking keys** between datasets
-> Like foreign keys in a database
- Enables **seamless multi-dataset exploration**
-> Join ADaM data on demand



A self-service platform to create & deploy R/Shiny-based {teal} apps



{teal.builder}

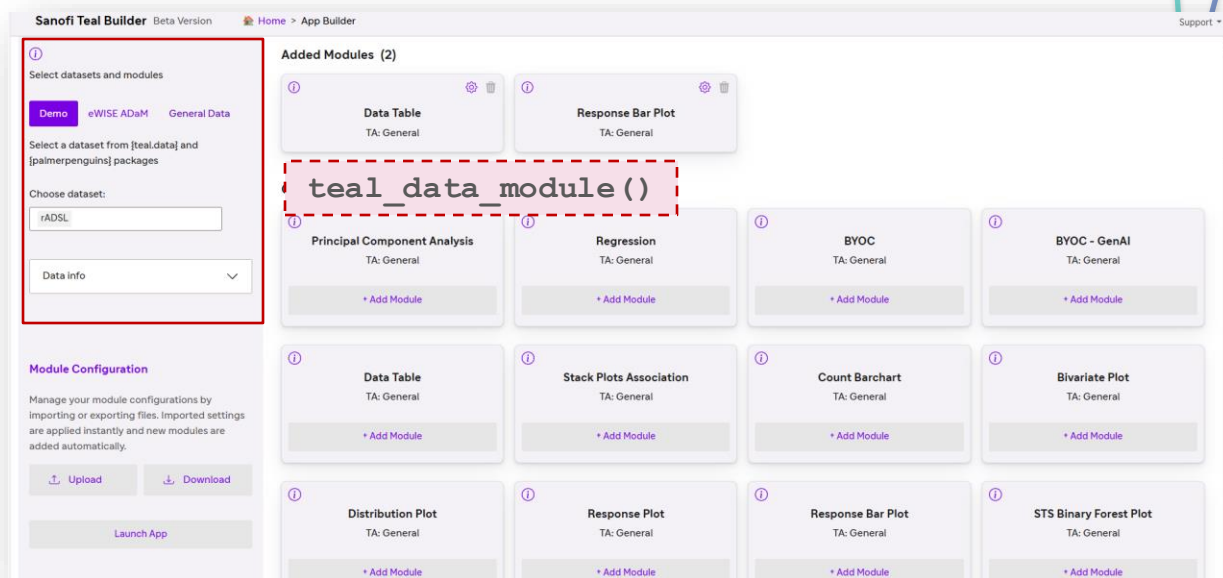
Serves both business users and programmers

- Low-code for accessibility
- Full-code for customization

Enables scalable, interactive exploration & automated reporting

Proven in production at Sanofi

First version to be open-sourced — coming soon to the community





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Our Presentations at Industry Conferences

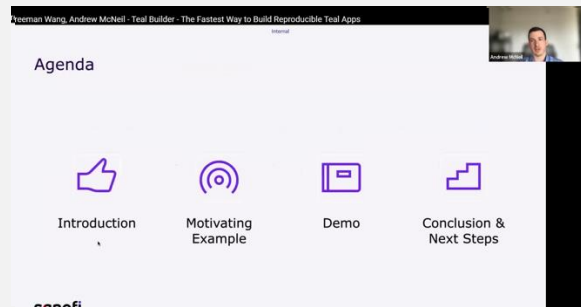
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PhUSE Teal Community Webinar 2025



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For further questions or feedback, please feel free to contact me:

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Thank You!