Paper SD11

{teal.builder}: Our Journey After One Year

Freeman Wang, Sanofi, Bridgewater, NJ, USA
Andre Couturier, Sanofi, Bridgewater, NJ, USA

INTRODUCTION

{teal.builder}, an advanced self-service platform built on the {teal} ecosystem, continues to revolutionize clinical data exploration and reporting automation at Sanofi. Originally introduced at PhUSE US Connect 2024, this tool empowers both business users and technical professionals alike to create and deploy fully functional R/Shiny-based {teal} apps. By bridging the gap between low-code functionality for non-programmers and detailed customizability for expert R programmers, {teal.builder} has achieved significant traction for its ability to enhance scalability in addressing the unmet need of interactive data exploration and review.

Over the past year, the platform has undergone substantial development to meet core challenges in both the business and technical domains. Enhancements include improved integration with internal data repositories, enriched module selection capabilities with configuration capability, new standards and automation for verifying data-module compatibility, and more open-source and custom module integration. Looking ahead, these advancements aim to deepen adoption across clinical studies with both self-service and internal customization solutions, while fostering collaboration with a broader open-source community.

ACHIEVEMENTS OVER THE PAST YEAR

Business Advancements

1. Proof-of-Concept Deployments: Pilot {teal} apps were successfully implemented for study-level dashboards, enabling customized internal statistical surveillance and data-review activities.
2. Low-Code User Empowerment: Business teams used {teal.builder}'s intuitive interface to easily make and deploy Teal apps to explore clinical datasets without requiring programming knowledge. Boilerplate code for app developer to further customize for study-level spec using the reproducible {teal} app code.
3. Internal Standardization: Statistical working groups benefited from reusable and standardized internal {teal} modules tailored for specific analysis tasks.
4. By enabling rapid prototyping and leveraging reusable configurations, the platform aims to enhance and transform how clinical programmers and statisticians deploy interactive R/Shiny Teal solutions on clinical data.

Technical Progress

1. Clinical Data Repository Integration: {teal.builder} connected seamlessly with internal clinical data repository, while contains an option to connect with local files for non-Sanofi organization.
2. Module with Configuration Capability: Introducing module-level configurations to support iterative app edits while preserving flexibility.
3. Automated Data Validation: Introduced programmatic checks to verify compatibility between user data and selected modules, ensuring robust error handling.
4. Extensible Deployment: Leveraged GitHub's CI/CD pipelines for production-ready deployment, featured app review, and automatic module-vs-data compatibility test report.
5. Theme Customization: Add options for custom app themes, helping aesthetic uniformity align with organizational branding.

NEW FEATURE DEMONSTRATION (UNDER DEVELOPMENT):

We are introducing module configuration capability, enabling module-level configurations to support iterative app edits while maintaining flexibility (Fig 1). This feature allows for the configuration of individual modules, encompassing both module metadata and parameter configuration. Metadata configuration facilitates adjustments to module specifications such as label, dataset, and description, while parameter configuration enables customization of module-specific parameters (Fig 2 and Fig 3). To enhance usability and portability, the system incorporates exporting and importing functionalities. Users can re-edit and download modified configurations for sharing or future use, and upload previously saved configurations to restore a module's state, thereby streamlining the workflow and promoting efficient collaboration (Fig 1).

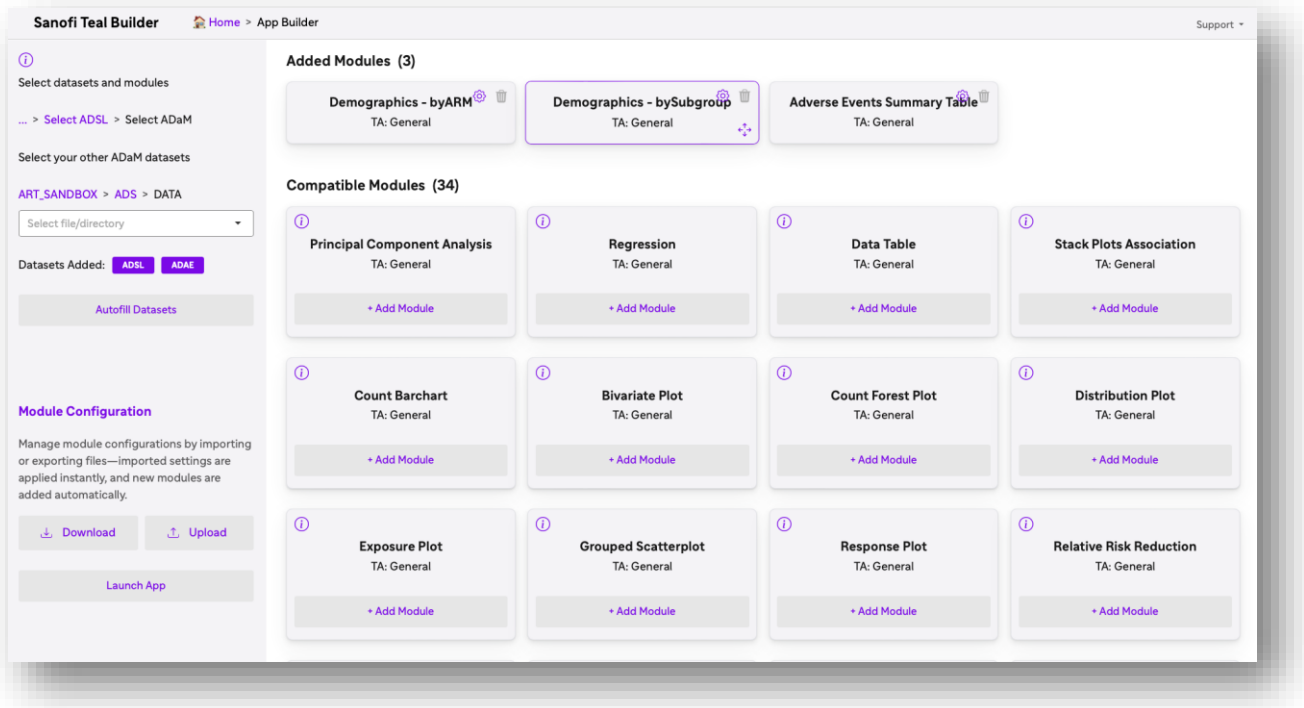

Figure 1 Added modules now can be further configurated, by clicking the gear icon

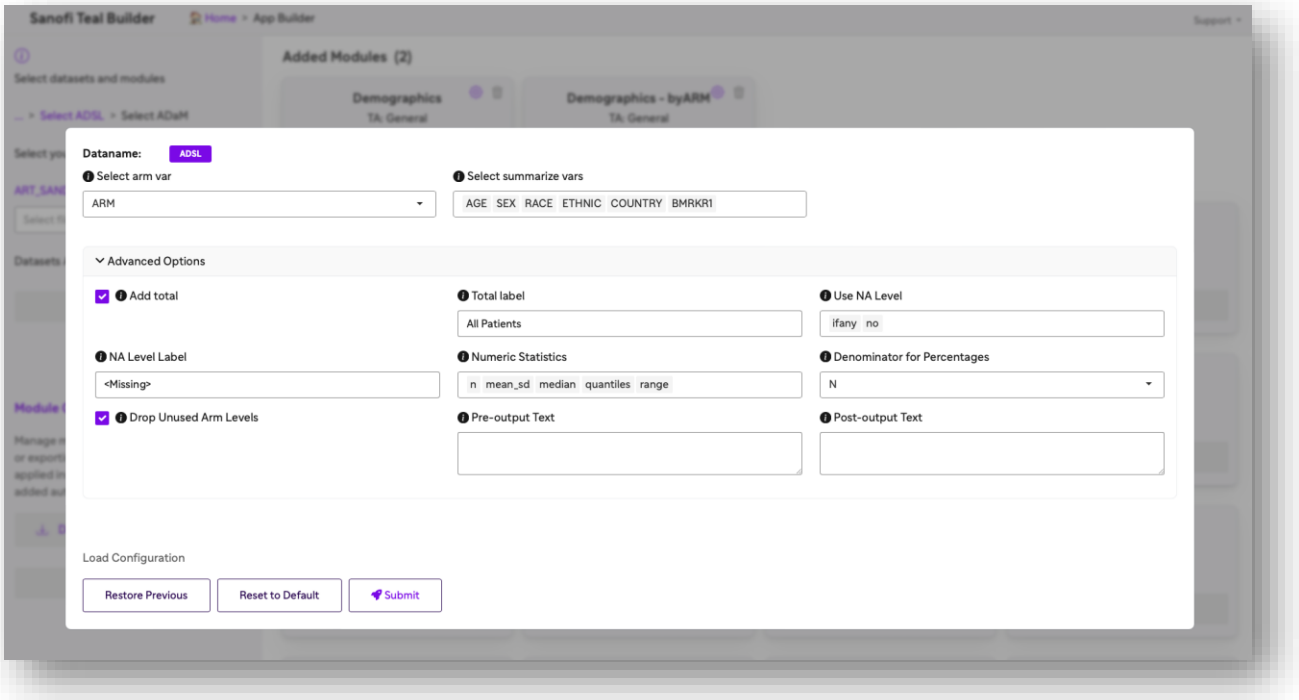

Figure 2 Configuration panel for one module, after clicking the gear icon

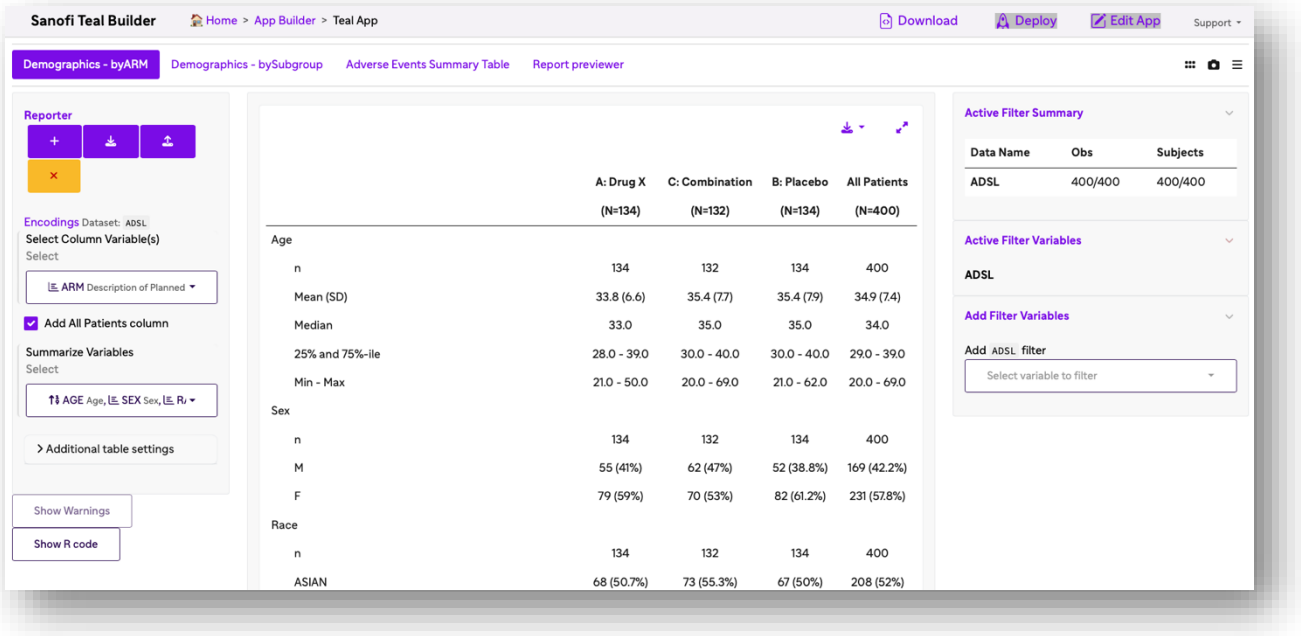

Figure 3 Launch Teal app after configuration. Here user can still re-edit the configuration by clicking the "Edit App" button.

CONCLUSION

After a year of development, working closely with the business on live study-level pilots, {teal.builder} has become a valuable asset in Sanofi's R adoption journey. This tool paves the way for scaling up study-level interactive data display needs, supporting data report communication and exploration activities. It has the potential to become an internal tool for producing standard TLGs interactively in the future, thanks to its code generation capability and centralized approach. We will continue our open-source journey and maintain our dedication to enhancing efficiency and scalability in clinical data analysis and reporting workflows.

REFERENCES

[1] Kaledkowski D, Rucki P, Chlebowski A, Verissimo A, Kirar K, Viyash V, Kosinski M, Waddell A, Burkoff N, Hallal M, Nasinski M, Pagacz K, Zhao J, Lewandowski T (2024). *teal: Exploratory Web Apps for Analyzing Clinical Trials Data*. https://github.com/insightsengineering/teal/

[2] Chang W, Cheng J, Allaire J, Sievert C, Schloerke B, Xie Y, Allen J, McPherson J, Dipert A, Borges B (2023). shiny: Web Application Framework for R. https://shiny.posit.co

[3] Shiny App Successfully Reviewed by FDA CDER Staff. R Consortium October 2023. https://www.r-consortium.org/announcement/2023/10/05/shiny-app-successfully-reviewed-by-fda-cder-staff-pilot-2-announcement-2

[4] Code-First Data Science for the Enterprise. Posit 2021. https://posit.co/blog/code-first-data-science-for-the-enterprise2/

[5] PhUSE US Connect 2024 teal.builder paper

[6] R/Pharma Conference 2024 teal.builder talk

ACKNOWLEDGMENTS

We gratefully thank {teal} development team for open-sourcing such exceptional tools.

We thank our Sanofi colleagues and the development team: Gautier Paux, Qi Zhang, Shilpy Malla, Guy Blate, Paulin Charliquart, Andrew McNeil, Crystal Luckett, Aleks Chlebowski, Edward Gillian, Chenghua Wu, Ying Wen, Kartikey Kirar, for their contribution in the development of this tool.

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Author Name: Freeman Wang
Company: Sanofi
Email: freeman.wang@sanofi.com

Author Name: Andre Couturier
Company: Sanofi
Email: andre.couturier@sanofi.com