

Seamless R And SAS: For Shiny Visualizations

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ABSTRACT

SAS is a predominant software widely used in pharmaceutical industry. However, many Clinical Pharmacologists mostly use R. R allows for customizable interactive visualizations via shiny package. Though R has superior graphics it lacks in powerful reporting capabilities possible through SAS. SAS2SHINY [1] is a SAS macro which submits Shinyapp to Rstudio session and launches the shiny application in the browser via command line as well as produce high quality, scripted and traceable pdf outputs ready for publishing. Shinypkv[2] package is created to develop Shinyapp's for pharmacokinetic visualizations. A few examples are illustrated in the paper to demonstrate their functions

Prerequisites are SAS installation and R installation (>3.3.2 version)

INTRODUCTION

The two components which will be addressed in this paper are

1. How to invoke R from SAS to incorporate R graphics in SAS reports
2. Interactive Data Visualizations generated using shinypkv package in R

SEAMLESS R AND SAS

R2SAS [1], R2SAS2PDF [1] & SAS2SHINY [1] are scripts allowing to integrate the capabilities of both SAS & R and use template created in SAS to produce high quality, scripted and traceable pdf outputs ready for publishing. R2SAS.sas enables SAS to run Rscript by allowing user to enter R code within SAS. %RSCRIPT [3] macro then creates an Rscript in a user specified location which is then submitted to a backend R session via batch mode by SAS. R2SAS2PDF enables an additional step of creating PDF with standard template from outputs created by R using macros within clinpharmplottemplate.sas [1]. SAS2SHINY follows the similar process by submitting Shinyapp to Rstudio session and launching the shiny application in the browser via command line. ClinPharmPlotTemplate.sas consists of SAS macros which are called using the % prefix. The user needs to simply specify the path where reporting structure folders [1] are created and load the template to use the macros as shown in figure 1.1. %PDFplot1x1[1], %PDFplot2x1[1], %PDFplot2x2[1] are used to create pdf of 1, 2 or 4 plots. Each template has a common header consisting of filename, DNG number, protocol, population, TFL number, title and footnote. A tablecmd or plotcmd is required within these macros to generate output. The statement can be modified to wrap a standard template to any table, listing or figure created within SAS, via Rscript or a picture as shown in Figure 1.2.: R2SAS.sas allowed SAS to run any Rscript through the command line from within SAS. R2SAS2PDF.sas was used to create pdf's using ClinPharmTemplate from plots created through R script. By using these SAS macros, R graphics can be incorporated in standard SAS template reports.

SHINY VISUALIZATIONS

Shiny[4] is an open source R package that provides an elegant and powerful web framework for building web applications using R. Shiny helps you turn your analyses into interactive web applications without requiring HTML, CSS, or JavaScript knowledge. shinypkv is a customized R package requiring shiny to create user specific interactive plots. By using SAS2SHINY SAS macro as well as shinypkv one could create customized Pharmacokinetic Shiny visualizations via SAS as needed and download plots & reports

The source code of SAS2SHINY is available at <https://github.com/PhuseUS2018/sasmacros/blob/master/SAS2SHINY> and shinypkv code is available at <https://github.com/pkvreddy/shinypkv>.

Once R is installed, the below commands can be embedded in SAS macro or in R separately to install shinypkv package

```
if(!require(installr)) {install.packages("installr"); require(installr)}
updateR()
if(!require(devtools)) {install.packages("devtools"); require(devtools)}
if(!require(shiny)) {install.packages("shiny"); require(shiny)}
library(devtools)
install_github("pkvreddy/shinypkv")
library(shinypkv)
library(shiny)
```

Below are two examples to demonstrate functionality of shinypkv package and similar approach can be used to customize for project needs.

VISUALIZE SAS & XPT DATASETS AND CONVERT THEM TO CSV FORMAT

In organizations or groups where there are non-SAS users, programmers often get requests to convert sas or xpt files into csv files. A simple command as mentioned below will give users a web interface behind their firewall to visualize SAS and xpt datasets and download them as csv files.

```
library(shinypkv)
shiny_pkv(options= "sas2csv")
```

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Convert .sas/.xpt to .csv file

Choose .sas or .xpt File

Browse... shoes.sas7bdat

Upload complete

Download.csv

Show 10 entries

Search:

	Region	Product	Subsidiary	Stores	Sales	Invent
			All			A
1	Africa	Boot	Addis Ababa	12	29761	
2	Africa	Men's Casual	Addis Ababa	4	67242	

Showing 1 to 10 of 395 entries

Previous 1 2 3 4 5 ... 40 Next

NONMEM DATASET VISUALIZATION

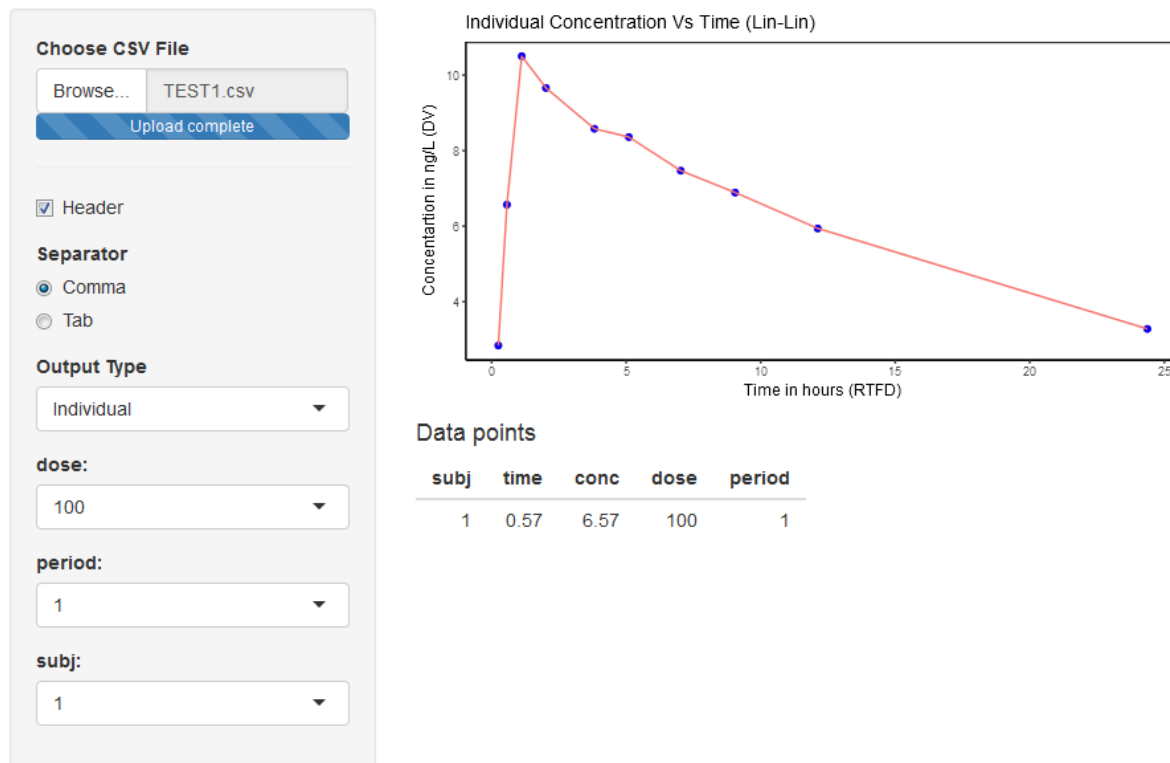
One of the key remits of Clinical Pharmacology Modelling and Simulation (CPMS) is to identify the optimal dose and dosing regimen for molecule as they progress in clinic towards registration. CPMS utilizes various approaches to characterize the drug exposure and response (efficacy and/or safety).

Pharmacokinetic analysis can be classified into two areas non-compartmental analysis (NCA) and Population Analysis. Analysis of longitudinal exposure (pharmacokinetics – PK) and response (pharmacodynamics – PD) data is often performed with NONMEM software used for analyzing population PK/PD data using nonlinear mixed effects modelling [5]. The dataset prepared to input into this analysis is often referred to as NONMEM dataset. An interactive visualization that allows to check for concentration time profile and identify outliers enables data checking a

```
library(shinypkv)
```

```
shiny_pkv(options="nm_dataviz")
```

NONMEM dataset visualization



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CONCLUSION

Visualizations provide a powerful representation of the data. There are several tools currently being used and developed to simplify the creation of graphics. Finding ways to integrate the outputs of these visualization tools and allow for standard reporting will allow flexibility in choosing tools, capability development of talent for using different tools and making best use of the features that are available. Demonstrating integration of SAS and R and providing example Shinyapp's using shinypkv package is one such attempt. There is a huge opportunity to develop many such customizable visualization and reporting tools.

REFERENCES

1. Location of code on Github: <https://github.com/PhuseUS2018/sasmacros>
2. Location of shinypkv package on Github : <https://github.com/pkvreddy/shinypkv>
3. Superior gRaphics in Statistical Reports -Sameer Bamnote
http://www.phusewiki.org/wiki/index.php?title=Superior_gRaphics_in_Statistical_Reports
4. Package 'shiny' <https://cran.r-project.org/web/packages/shiny/shiny.pdf>
5. Pharmacokinetic analysis <https://www.certara.com/2011/03/14/what-is-the-difference-between-individual-and-population-pk/>

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