Side by Side Display of Table and Plot, Plot and Plot

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ABSTRACT

Programmers sometimes get request to display a table and a plot side by side or display two plots side by side. There are many tools and many ways to do this. The ODS LAYOUT in SAS® can display a table and a plot side by side; the PROC SGPANEL or graph template language in SAS can display two plots side by side. R shiny can also perform these tasks. To display a table and a plot side by side you can specify two columns in the ui part of the R shiny program, one column for the table and the other for the plot. The R shiny package gridExtra can display two plots side by side. These different methods are discussed in this paper.

INTRODUCTION

ODS LAYOUT is a nice feature in SAS as it gives the programmer a lot of control over the output. The programmer can specify the region on a page to display a particular table or plot. This makes it easy to display a table and a plot side by side.

The PROC SGPANEL with the PANELBY statement can create multi-panel plots with ease.

Another tool in SAS to display multi-panel plots is the graph template language. The PROC TEMPLATE can be used to display multiple figures in a desirable format.

R shiny is a popular visualization tool. Programmers can take advantage of many R packages and various options in the shiny package to create beautiful plots.

In this paper we look at a tumor data ADTR and create waterfall plots.

Table 1 shows the variables we will use in ADTR.

Dataset	Variable	Label	Note
ADTR	USUBJID	Unique Subject Identifier for the Study	
ADTR	PARAMCD	Parameter Code	We need a parameter for best percent change from baseline in sum of diameters for the waterfall plot.
ADTR	AVAL	Analysis Value	
ADTR	COHORT	Cohort	There are two cohorts in the data: Cohort X and Cohort Y.
ADTR	PARQUAL	Evaluator	This variable can be "INVESTIGATOR" or "CENTRAL" (the independent central review).

Table 1. the Variables Required in ADTR

In a waterfall plot, the x-axis is the patient ID. The y-axis is the best percent change from baseline in sum of diameters. The patients are ordered from the one with the largest value to the one with the smallest value in terms of the best percent change from baseline.

THE DETAILS

ODS LAYOUT

The ODS LAYOUT in SAS gives users great leeway to control the layout of the output. Users can specify different regions for different output. We use the ODS LAYOUT to display a waterfall plot and the data side by side. See reference [1] and [2] for more information about ODS LAYOUT.

```sas
/** table_plot.sas **/
libname adam 'C:\xxxx\my_papers';
ods pdf file='C:\xxxx\aa.pdf';
ods layout start width = 6in height = 6in;

* first region;
ods region width = 2.5in height = 6in x = 0in y = 0in;

proc sort data=adam.adtr out=waterfall;
by cohort descending aval;
where paramcd='BESTPCHG' and cohort='Cohort X' and parqual='CENTRAL';

data waterfall;
set waterfall;
by cohort descending aval;
if first.cohort then position=0;
position + 1;
run;

proc sgplot data=waterfall noautolegend pad=(bottom=15pct);
   vbar position / response=aval ;
   xaxis label=" " fitpolicy=thin display=(noticks novalues) values=(1 to
10 by 1);
   yaxis label="Best % Change from Baseline in Sum of Diameters" values=(-
100 to 100 by 20 ) ;
   refline -30 20 /axis=y lineattrs=(color=red);
Run;

* second region ;
ods region width = 3.5in height = 6in x = 2.5in y = 0in;

data adtr; set adam.adtr;
where parqual='CENTRAL';

Proc Print Data =adtr(keep= usubjid cohort aval paramcd) ;
where paramcd='BESTPCHG' and cohort='Cohort X';
Run;

ODS layout end;
ods pdf close;
```
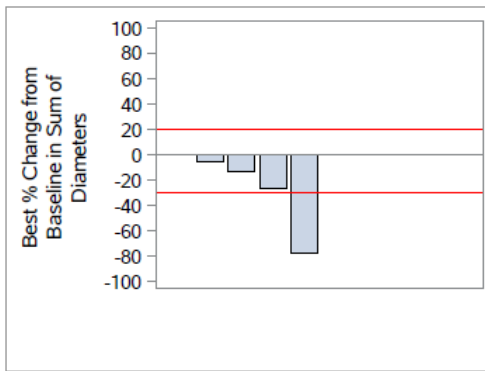
Display 1 shows the output.

Obs	USUBJID	COHORT	PARAMCD	AVAL
52	ABC-MD7-0001	Cohort X	BESTPCHG	-27
98	ABC-MD7-0003	Cohort X	BESTPCHG	-6
195	ABC-MD7-0005	Cohort X	BESTPCHG	-78
221	ABC-MD7-0006	Cohort X	BESTPCHG	0
438	ABC-MD7-0008	Cohort X	BESTPCHG	-14

Display 1. Table and Plot Side by Side Created with ODS LAYOUT in SAS

PROC SGPANEL

If multiple plots are created for different values of a by-variable, PROC SGPLOT with the panelby statement is a perfect tool to use. We use this procedure to display the waterfall plots for two cohorts side by side.

```sas
/** plot_plot.sas **/
libname adam 'C:\xxxx\my_papers';

proc sort data=adam.adtr out=waterfall;
by  cohort descending aval;
where paramcd='BESTPCHG'  and parqual='CENTRAL';

data waterfall;
set waterfall;
by cohort descending aval;
if first.cohort then position=0;
position + 1;
label position='Patient';
run;

proc sgpanel data=waterfall noautolegend pad=(bottom=15pct);
panelby cohort;
    refline -0.3 / axis=y lineattrs=(pattern=shortdash);
    vbar position / response=aval  ;
    refline -30 20 /axis=y lineattrs=(color=red);
    label aval="Best % Change from Baseline in Sum of Diameters";
run;
```
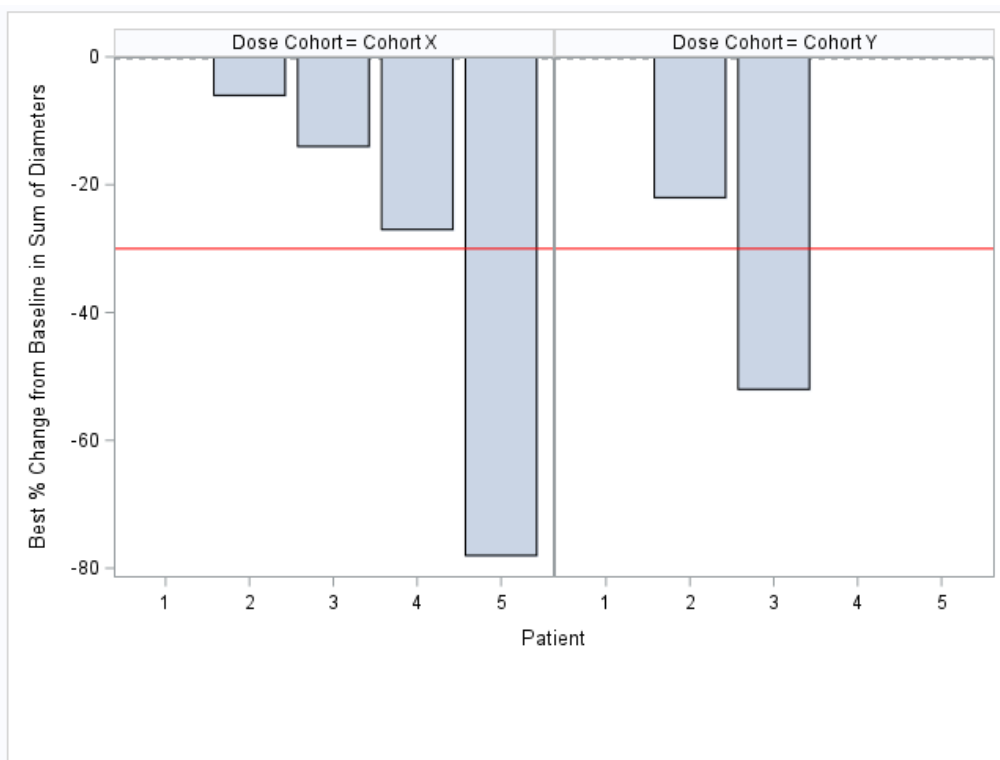
Display 2 shows the output of this program.

Display 2. Plot and Plot Side by Side Created with PROC SGPANEL in SAS

GRAPH TEMPLATE LANGUAGE

The graph template language with ODS graphics can be used to display two plots side by side. See reference [3] for an introduction to the graph template language. In the layout statements of the PROC TEMPLATE, programmers can set up all the details for the two plots.

```
/** plot_plot_gtl.sas **/
libname adam 'C:\xxxx\my_papers';

proc sort data=adam.adtr out=waterfall;
by  cohort descending aval;
where paramcd='BESTPCHG'  and parqual='CENTRAL';

data Waterfall;
set Waterfall;
by cohort descending aval;
if first.cohort then position=0;
position + 1;
label position='Patient';
if cohort='Cohort X' then y1=aval;
else if cohort='Cohort Y' then y2=aval;
run;

proc template;
define statgraph graph.side_by_side;
begingraph;
```

```
entrytitle halign=center 'Waterfall Plot';

layout lattice / columngutter=10 columns=2
 rowdatarange=union ;
 layout overlay/xaxisopts=(label="Patient in Cohort X");
 barchart y=y1 x=position;
 endlayout;

 layout overlay / xaxisopts=(label="Patient in Cohort Y");
 barchart y=y2 x=position;
 endlayout;

 rowaxes;
 rowaxis / griddisplay=ON label='Best Percent Change from Baseline in Sum
of Diameters';
 endrowaxes;
 endlayout;
endgraph;
end;
run;

ods graphics on;
proc sgrender data=waterfall
template=graph.side_by_side;
run;
```
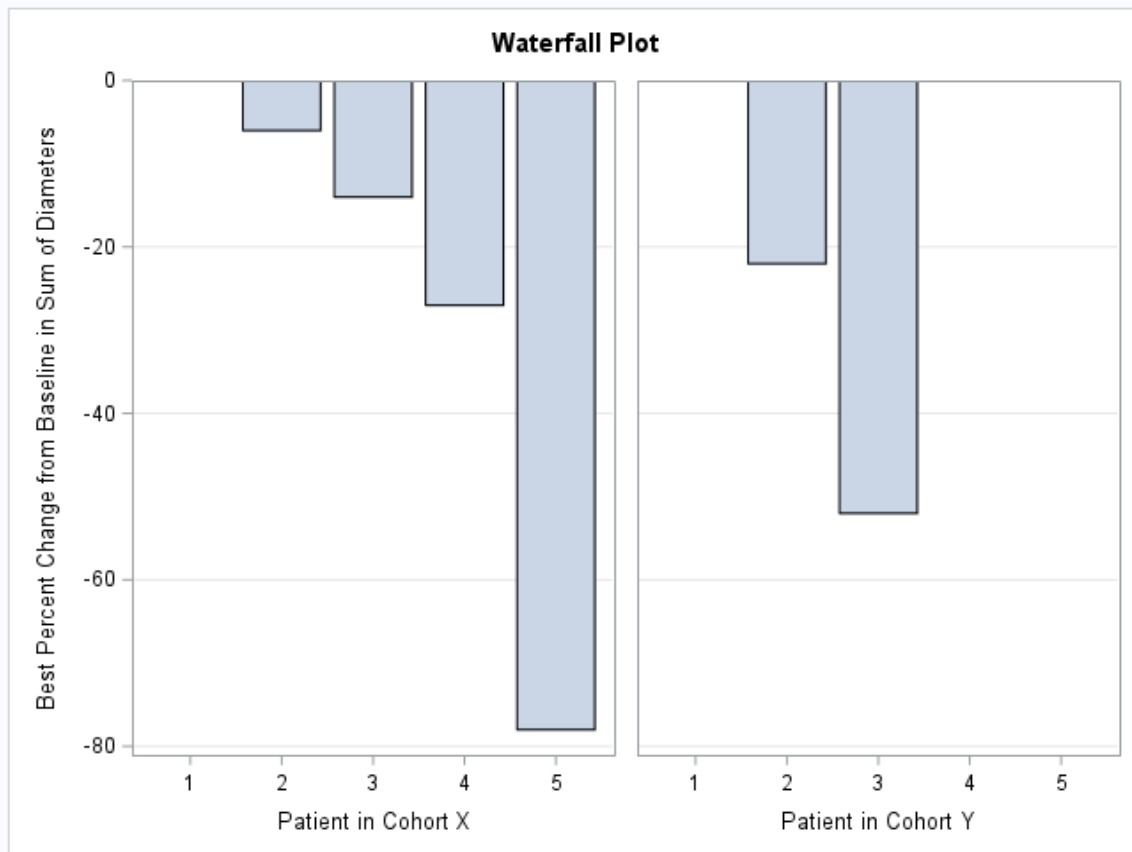
The Output is shown in display 3 .

Display 3. Plot and Plot Side by Side Created by Graph Template Language in SAS

R SHINY

How to use R Shiny to display a table and a plot side by side? We can specify two columns in the ui of the shiny program, one column for the plot and the other column for the data. See reference [4]. As in the data there are Cohort X and Cohort Y, we add a radio button to give users the choice of looking at the plot and data for either cohort. In R shiny there are many interactive features, radio button being one of them.

```
#table_plot.R
#with interactive feature radio button

library(haven)
library(tidyverse)
library(lubridate)
library(DT)
library(shiny)
library(ggplot2)

# Read in the SAS data
adtr <- read_sas("adtr.sas7bdat")
data.frame(adtr)

tr <- adtr[(adtr$PARAMCD=='BESTPCHG' & adtr$PARQUAL=='CENTRAL'),]
tr$bestpchg <- tr$AVAL
tr <- tr[c("bestpchg", "COHORT", "USUBJID")]

tr$USUBJID <- factor(tr$USUBJID,
                levels = tr$USUBJID[order(tr$bestpchg, decreasing = TRUE)])

tr <- tr[order(-tr$bestpchg),]

ui <- fluidPage(
  radioButtons("cohort","Select a cohort for plot:", c("Cohort X", "Cohort
Y")),

  tabPanel(
    "2 columns",
    fluidRow(
      column(width = 4,
```

```
                h2("Plot"),
                plotOutput("wfPlot")),
        column(width = 8,
                h2("Data"),
                tableOutput('table'))
    ))
)


server <- function(input, output) {

  dataInput <- reactive({
    tr[(tr$COHORT == input$cohort),]
  })


  output$table <- renderTable({
    dataInput()
  })


  output$wfPlot <- renderPlot({
    myPlot <- ggplot(dataInput(), aes( x = USUBJID, y = bestpchg)) +
      labs(title = "Waterfall Plot",
           x = "Patient", y = "Best Percent Change from Baseline in Sum of
Diameters") +
      theme(axis.text.x = element_blank()) +
      geom_col( width = 0.9)
    print(myPlot) })
}
shinyApp(ui=ui, server=server)
```
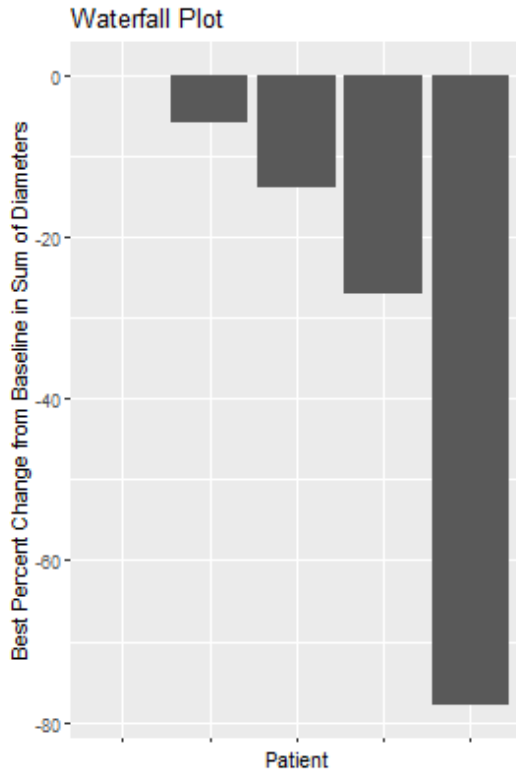
Display 4 shows the output from the R Shiny program.

Select a cohort for plot:

◉ Cohort X

◯ Cohort Y

Plot

bestpchg	COHORT	USUBJID
0.00	Cohort X	ABC-MD7-0006
-6.00	Cohort X	ABC-MD7-0003
-14.00	Cohort X	ABC-MD7-0008
-27.00	Cohort X	ABC-MD7-0001
-78.00	Cohort X	ABC-MD7-0005

Data

Display 4. Table and Plot Side by Side Created by R Shiny

Finally, we use R Shiny to display two figures side by side. For this we use the R package gridExtra which can create multi-panel plots. The function grid.arrange allows users to specify the number of rows and number of columns in the figure being created by the program. See reference [5] for more discussions about this topic.

```
#plot_plot.R

library(haven)
library(tidyverse)
library(lubridate)
library(DT)
library(shiny)
library(ggplot2)
```

```r
library(gridExtra)

# Read in the SAS data
adtr <- read_sas("adtr.sas7bdat")
data.frame(adtr)


tr <- adtr[(adtr$PARAMCD=='BESTPCHG' & adtr$PARQUAL=='CENTRAL'),]
tr$bestpchg <- tr$AVAL
tr <- tr[c("USUBJID","bestpchg", "COHORT")]


tr$USUBJID <- factor(tr$USUBJID,
               levels = tr$USUBJID[order(tr$bestpchg, decreasing = TRUE)])


tr <- tr[order(-tr$bestpchg),]
tr1 <- tr[(tr$COHORT=='Cohort X'),]
tr2 <- tr[(tr$COHORT=='Cohort Y'),]


ui <- fluidPage(
     mainPanel(plotOutput("plotgraph")
   ))


server <- function(input, output) {

  myPlot1 <- ggplot(tr1, aes( x = USUBJID, y = bestpchg)) +
    labs(title = "Waterfall plot for Cohort X",
         x = "Patient", y = "Best Percent Change from Baseline in Sum of
Diameters") +
    theme(axis.text.x = element_blank()) +
    geom_col( width = 0.9) +
    ylim(-80,0)

  myPlot2 <- ggplot(tr2, aes( x = USUBJID, y = bestpchg)) +
    labs(title = "Waterfall plot for Cohort Y",
         x = "Patient", y = "Best Percent Change from Baseline in Sum of
Diameters") +
    theme(axis.text.x = element_blank()) +
    geom_col( width = 0.9) +
    ylim(-80, 0)
```

```
    output$plotgraph <- renderPlot({


      ptlist <- list(myPlot1,myPlot2)
      grid.arrange(grobs=ptlist,ncol=2, nrow=1)
    })


  }
  shinyApp(ui=ui, server=server)
```
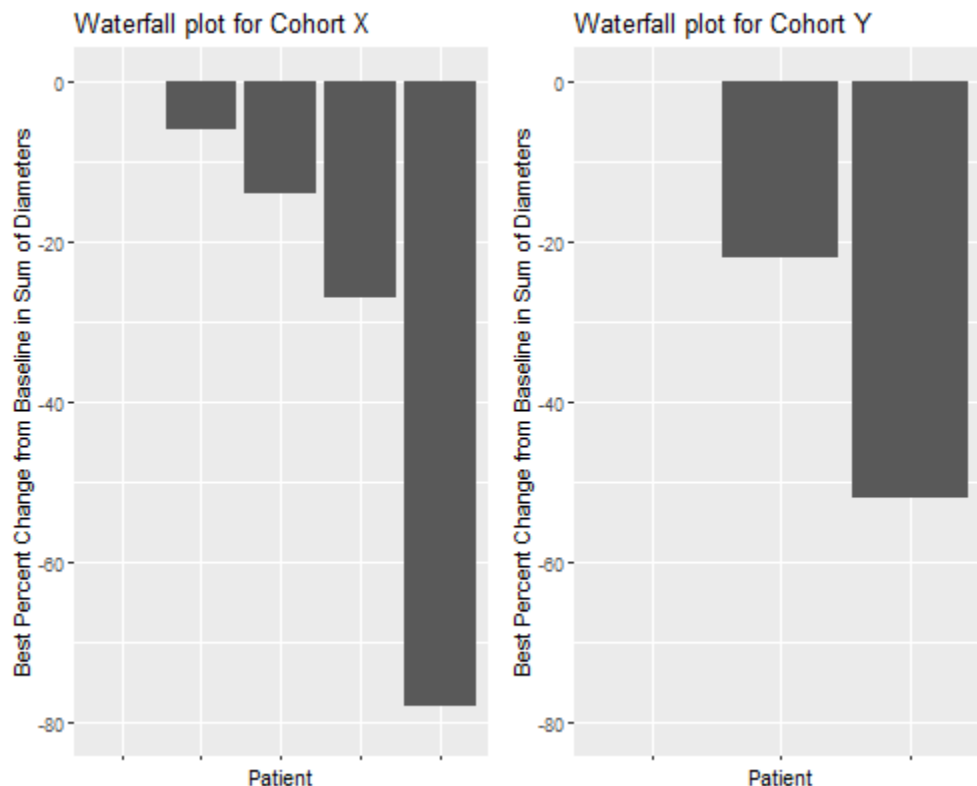
Display 5 shows the output.

Display 5. Plot and Plot Side by Side Created by R Shiny

CONCLUSION

Both SAS and R Shiny have great functionalities to display a table and a plot side by side or create multi-panel plots. Programmers can take advantage of these functionalities and create good-looking output for analysis and presentation.

REFERENCES

[1] Lassman, Doug. Producing Patient Profiles Using PROC DOCUMENT and ODS Layout. Paper CC24. PharmaSUG 2005.

[2] Pandya, Niraj. Multiple Graphical and Tabular Reports on One Page, Multiple Ways to Do it. Paper TT11, PharmaSUG 2009

[3] Matange, Sanjay. Introduction to Graph Template Language. Paper DV09, MWSUG 2012

[4] Display table and plot side by side in R Shiny, available at

https://stackoverflow.com/questions/58237866/display-table-and-chart-side-by-side-in-r-shiny

[5] Use the R package gridExtra to display plots side by side, available at

https://stackoverflow.com/questions/1249548/side-by-side-plots-with-ggplot2

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