

Using R to Query Dataset from SAS Server to Generate Clinical Trial Graphs

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Introduction

The strength of SAS is based on its powerful data manipulation capability, but it can be a challenge when using SAS PROC TEMPLATE to generate customized plots, especially for beginners. Alternatively, R has exceptional flexibility in creating customized plots compared to SAS. However, the data management function of R tends to be time consuming and not as straightforward as SAS. To leverage the strength of each language, we will display how to integrate SAS dataset in R environment to generate clinical trial graphs.

Implementation

Execute SAS program in R

- Change directory to the directory containing the SAS executable files
- Run prepared SAS program by using shell() function in R to get our input dataset
- Read the dataset in R

Code example:

```
File Edit Code View Plots Session Build Debug Profile Tools Help
1 setwd("c:\\Program Files\\SASHome\\SASFoundation\\9.4\\") #change directory
2
3 return.code <- shell("sas.exe -SYSIN c:\\Users\\jlf\\Desktop\\R_DOC\\tbl.sas -PRINT c:\\Users\\jlf\\Desktop\\R_DOC\\log.txt -LOG c:\\Users\\jlf\\Desktop\\R_DOC\\log.txt") #execute sas program in R
4
5 library(rio) #package we use to read dataset in R
6 pdev_3005=c("c:\\Users\\jlf\\Desktop\\R_DOC\\")
7 x=import(paste0(pdev_3005, "tbl.sas7bdat"))
```

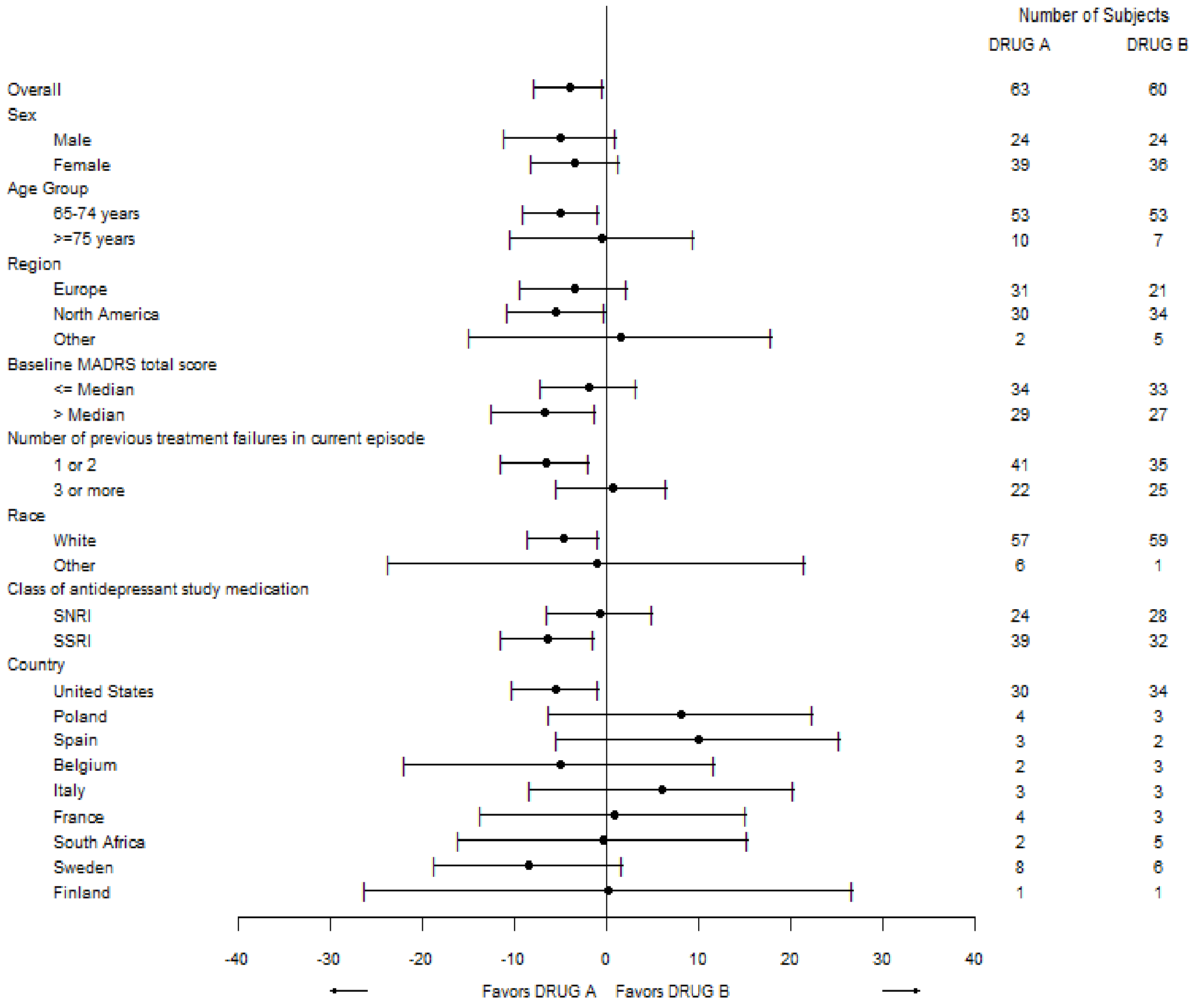
Customized Plots

- Control the size of margin area by calling par function before plotting and using png() to save the plot as a png file.
- Plot points, lines, text and arrows to any place we would like to put on the graph.

Customized Forest Plot

Code example:

```
File Edit Code View Plots Session Build Debug Profile Tools Help
1 dev.new(width=12, height=8)
2 par(mar=c(1,0.5,0), tch=-0.4, cex.axis=1, family="A")
3 png(file.path(pdev_3005,"GEPMADSG01_R2.png"),width=960, height=640)
4
5 plot(mydata$lowervar, mydata$lowerorder, type="n", xlim = xlimit, ylim = ylimit, axes = FALSE, ann=F, xaxs="f", yaxs="f", las=1)
6
7 points(mydata$pointvar, mydata$lowerorder,
8       pch=16,
9       bg = mycol[i],
10      col = mycol[i],
11      cex=1.0)
12
13 lines(c(mydata$lowervar[i], mydata$uppervar[i]), c(mydata$lowerorder[i], mydata$upperorder[i]), col= mycol[i], lty
14       =mylty[i], lwd=1)
15
16 text(45, mydata$lowerorder, mydata$isketamine, cex=0.8)
17
18 abline(v=0)
19
20 arrows(-26, -4.1, -30, -4.1, angle = 20, length = 0.05)
21
22 dev.off()
```



- Advantage:
- ❖ The most flexible way to create any kinds of plot
- ❖ Each element on the plot can be moved to anywhere

- Disadvantage:
- ❖ Need to modify the coordinate based on different datasets

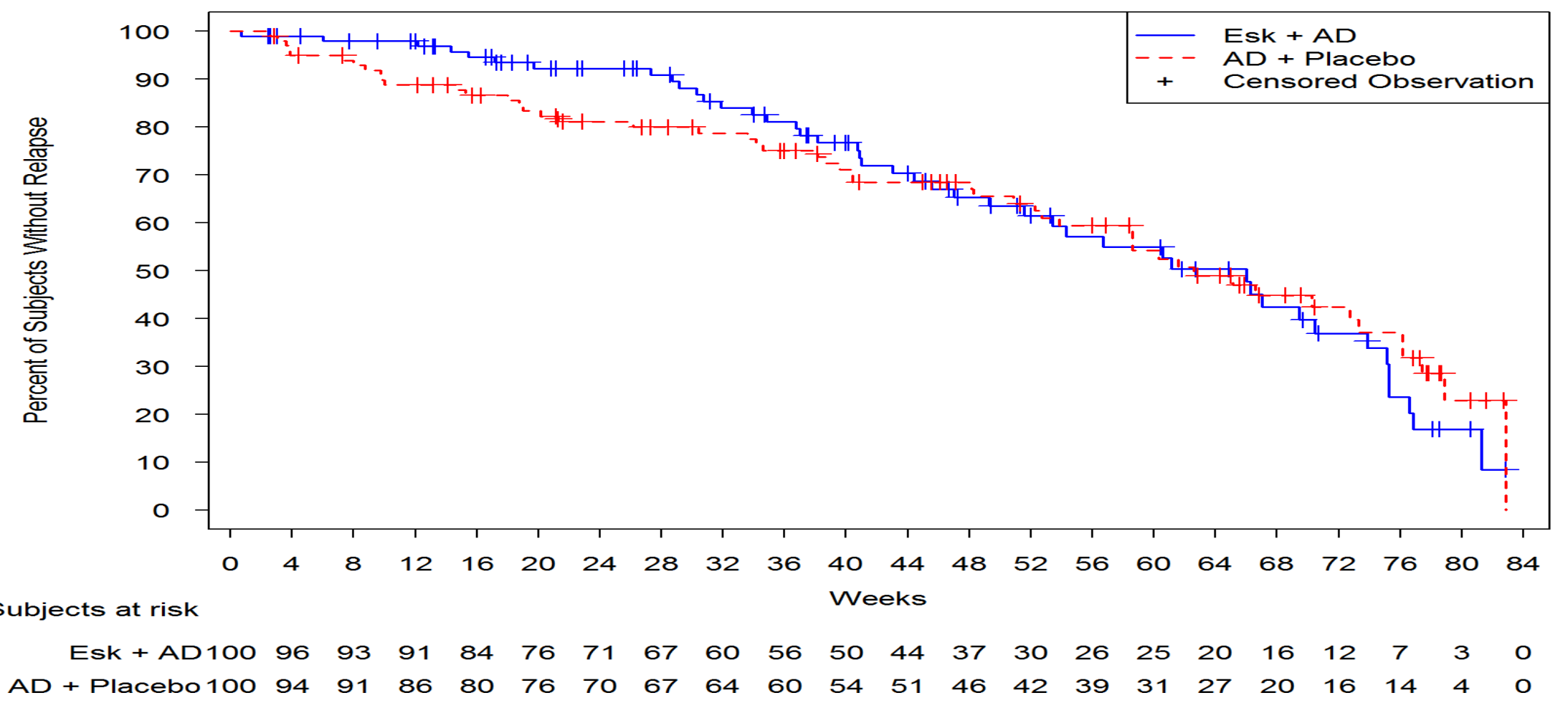
Customized Kaplan Meier Curve

- To create Kaplan Meier Curve is also easy by using R. It is very similar to how we create customized forest plot.
- In order to get a Kaplan Meier plot, we first set up the margin and plot the dataset to get a KM plot.

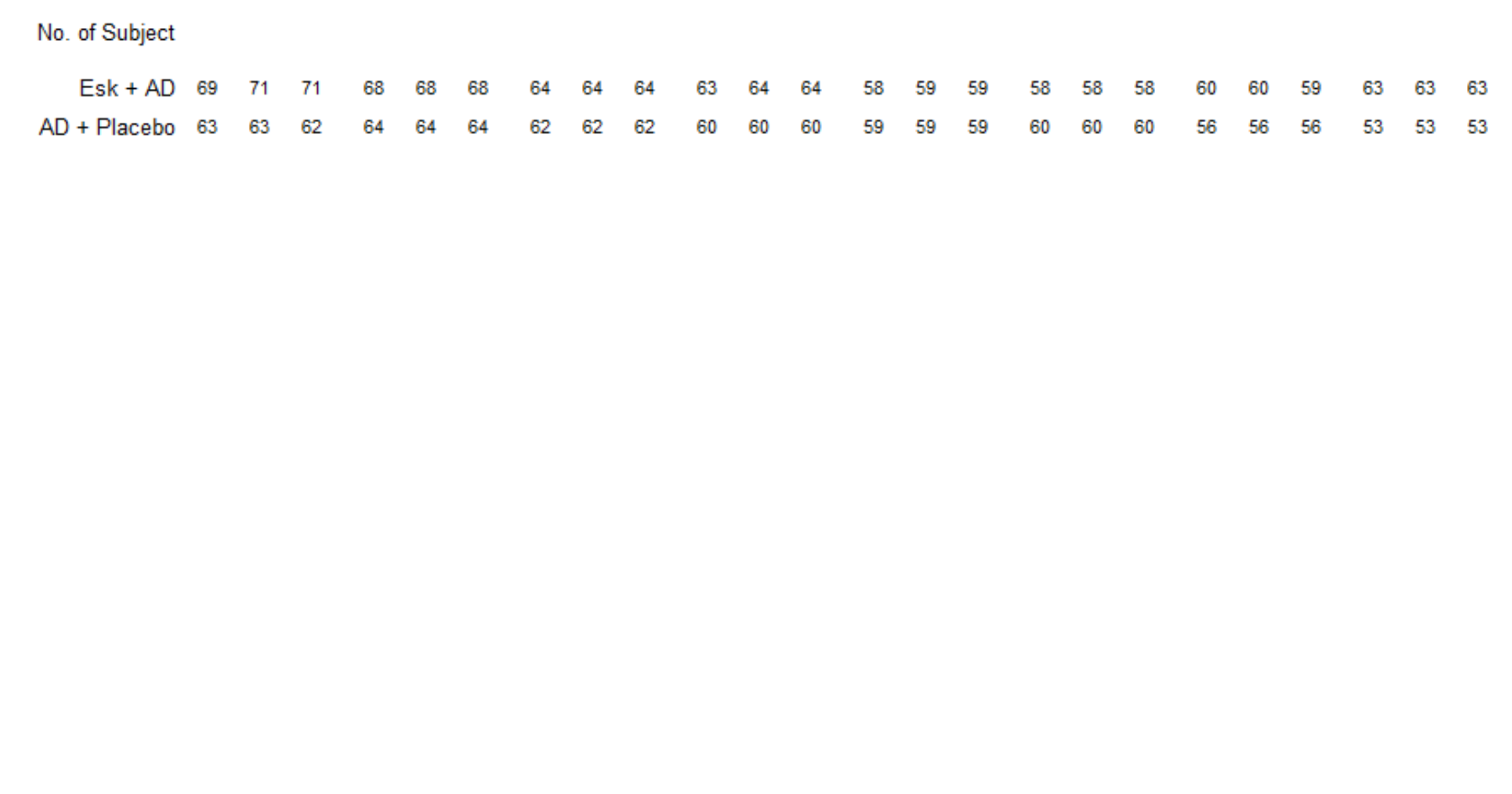
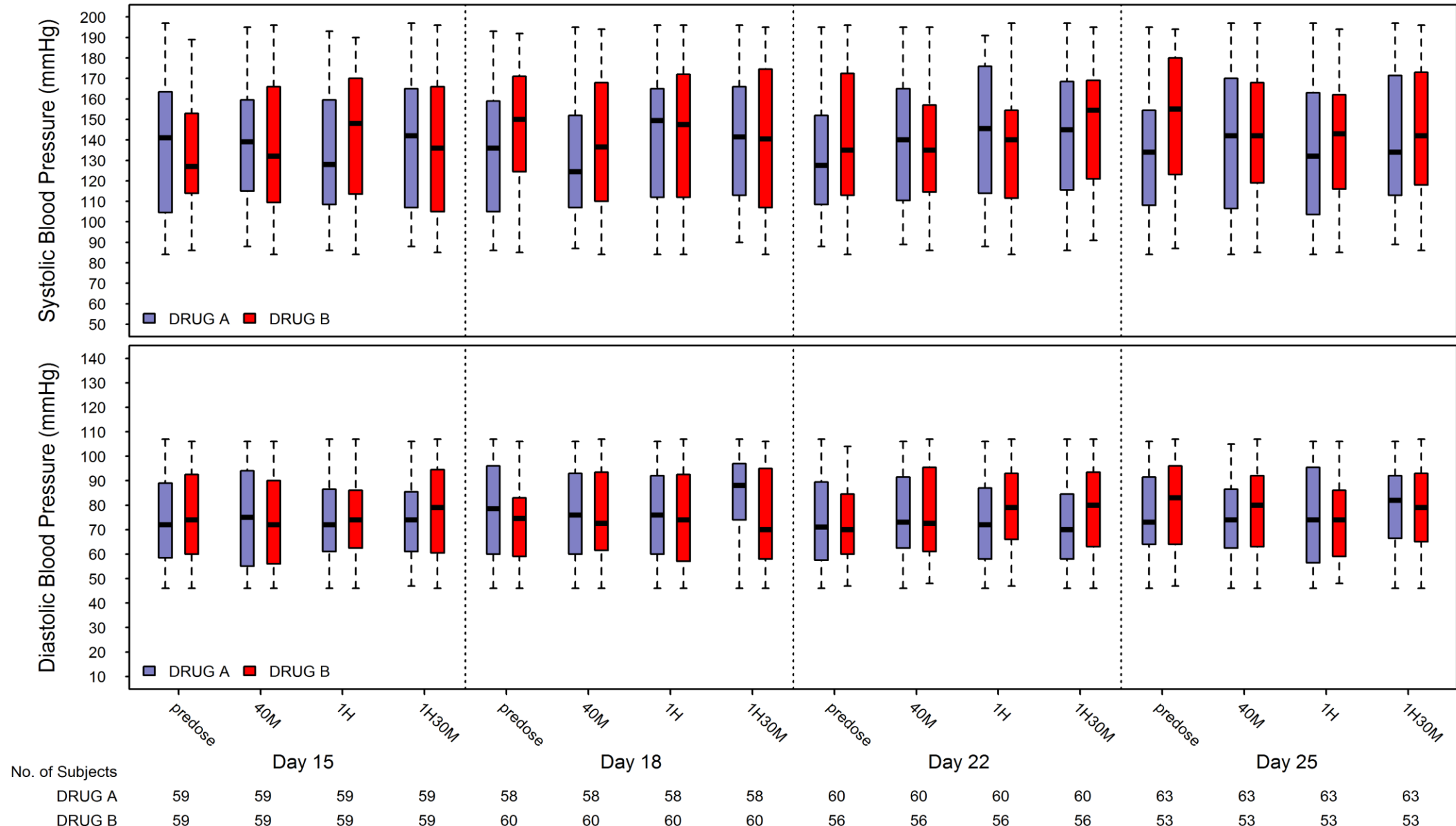
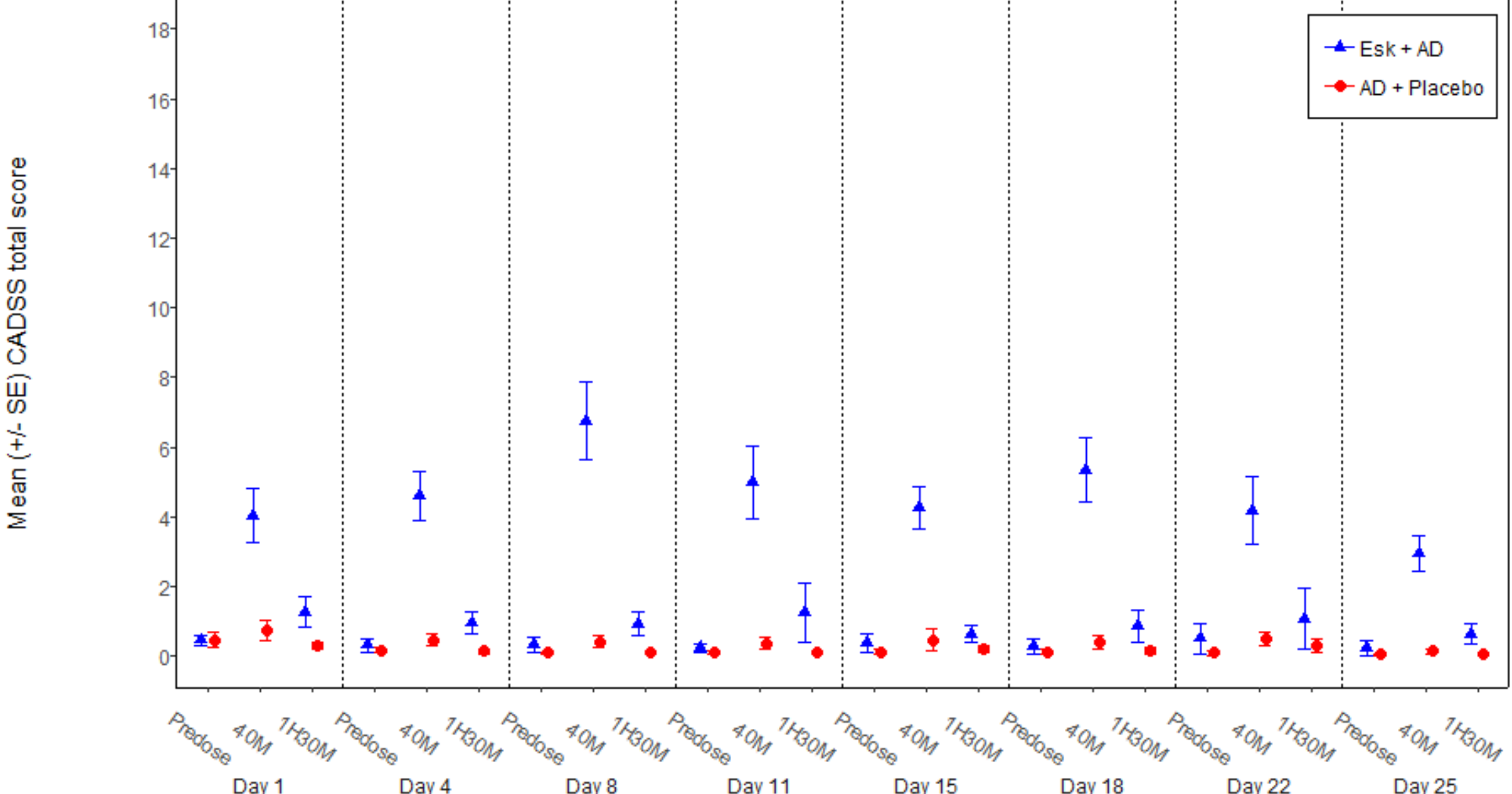
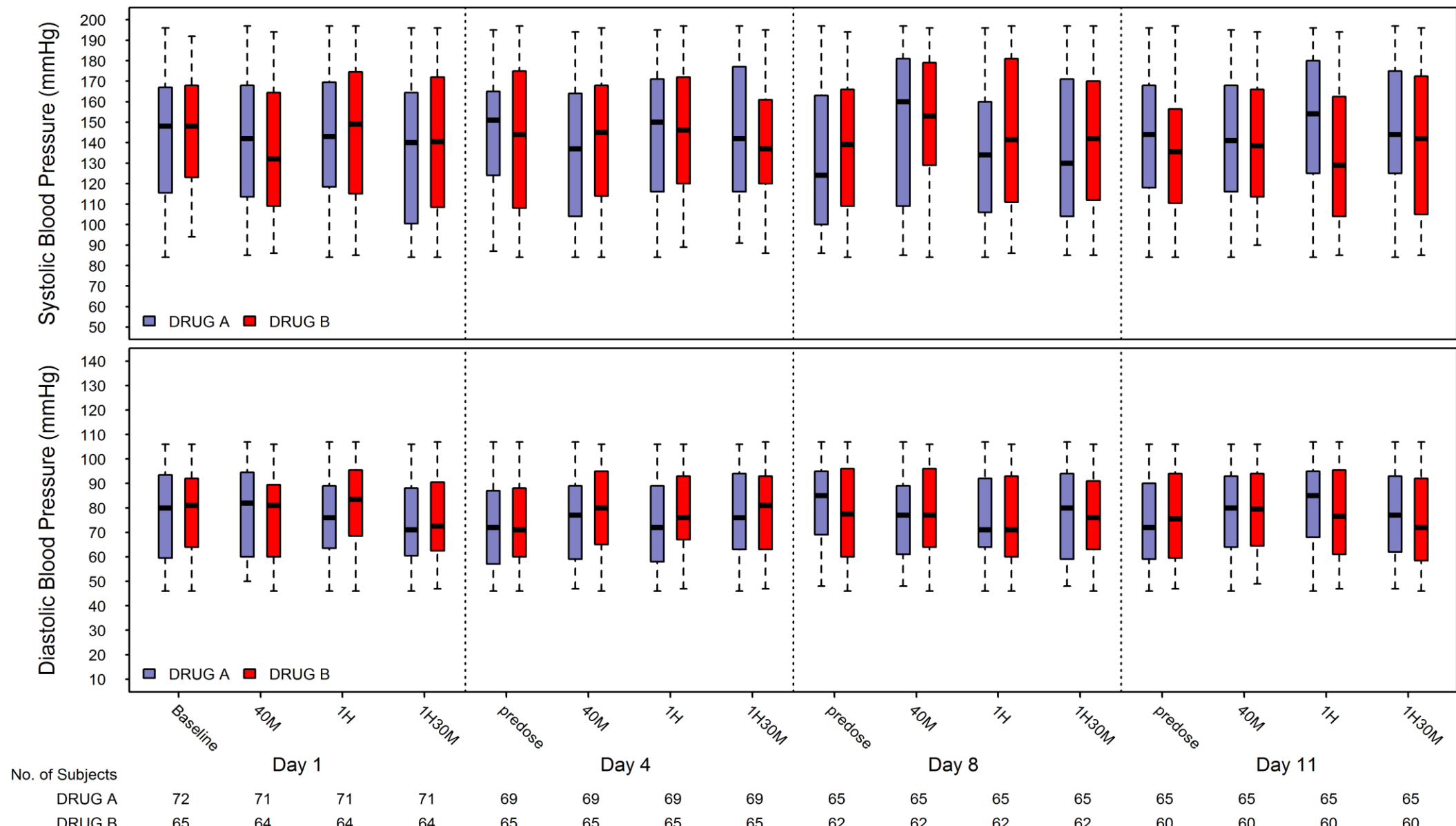
- Then use text() and legend() to add labels and legend into the graph.
- text() function can be used to add a table under the plot.

Code example:

```
File Edit Code View Plots Session Build Debug Profile Tools Help
1 png("Survival1.png",width=1700,height=1300,res=200)
2
3 par(mar=c(9,7,1,1)+0.1)
4
5 plot(fit13, lty=c(1,2), col=c("#0000FF","#FF0001"), ylab="", xlab="", mark.time=T, xlim=c(-10,600), yaxt="n", xaxt
6      ="n", lwd=1.7,cex=1.3)
7
8 out1=NULL; day1=c(0:21)*4*7
9 for (j in 1:length(day1)) {
10   out1=rbind(out1, data.frame(day=day1[j], Esketamine=sum(dat12$AVAL>=day1[j] & grep("Esketamine",dat12$TRT03P
11   )),Placebo=sum(dat12$AVAL>=day1[j] & grep("Placebo",dat12$TRT03P)))
12 }
13 text(out1$day+0.1, par("usr")$[3] - 0.22, labels = out1$Esketamine, srt = 0, pos = 1, xpd = TRUE,cex=cex1)
14 text(out1$day+0.1, par("usr")$[3] - 0.29, labels = out1$Placebo, srt = 0, pos = 1, xpd = TRUE,cex=cex1)
15
16 dev.off()
```



Other customized clinical trail graphs by using similar R code



Conclusion

- R code is clean and simple compare to SAS PROC TEMPLATE when creating customized plots.
- R is an open-source platform. Many people contribute to the development of R with numerous available R functions for Graphical display. All the up-to-date graph templates can be found in **R Graph Gallery** (<https://www.r-graph-gallery.com>).