



A Comparison of PROC REPORT in SAS and FLEXTABLE in R

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Advantages of FLEXTABLE
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Background, Objective and Scope

SAS

- Programming tool of choice over many years
- Sustainable features for reporting such as PROC REPORT/TABULATE
- PROC REPORT/TABULATE can also be used to do analysis besides reporting

R

- FLEXTABLE package is incredibly flexible
- Easy tweaking of existing functions to fit the purposes
- Minimal coding

Background, Objective and Scope

- Learn about the advantages and limitations of reporting features of both tools
- How to get an appealing presentation of clinical trial results from both tools

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- R / R Studio (Packages: flextable, officer, magrittr)
- SAS 9.4 (Base)

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Comparison of Both Features

x.1: Time to first event: Cox Regression of outcome <event> by groups

Group	Placebo	Treat1	<Treat k>
<Group1>			
Number of subjects (N, %)	xxx (100 %)	xxx (100 %)	xxx (100 %)
Subjects with events (N, %)	xxx (xx.x %)	xxx (xx.x %)	xxx (xx.x %)
Subjects with censors (N, %)	xxx (xx.x %)	xxx (xx.x %)	xxx (xx.x %)
Comparison vs Placebo			
Hazard Ratio (adjusted#)		xx.xx	xx.xx
95% Confidence interval		(xx.xx,xx.xx)	(xx.xx,xx.xx)
P-value		x.xxxxx	x.xxxxx
< Group2.....>			
Number of subjects (N, %)	xxx (100 %)	xxx (100 %)	xxx (100 %)
Subjects with events (N, %)	xxx (xx.x %)	xxx (xx.x %)	xxx (xx.x %)
Subjects with censors (N, %)	xxx (xx.x %)	xxx (xx.x %)	xxx (xx.x %)
Comparison vs Placebo			
Hazard Ratio (adjusted#)		xx.xx	xx.xx
95% Confidence interval		(xx.xx,xx.xx)	(xx.xx,xx.xx)
P-value		x.xxxxx	x.xxxxx

#Adjustment is for sex, age and treatment.

**SAS: PROC
REPORT**

**Table
Template**

**R Studio:
FLEXTABLE**

Comparison of Both Features

```
proc phreg data=coxdata alpha=0.05;  
  by BYVAR;  
  class TREAT (ref="Placebo") SEX RACE / param=glm order=internal;  
  model AVAL*CNSR(0) = TREAT SEX RACE / risklimits ;  
  lsmeans TREAT/ pdiff=all cl alpha = 0.05 exp;  
run;
```

Execute SAS
Method

```
install.packages(c("survival", "survminer"))  
library(survival)  
library(survminer)  
coxresult<- lapply(split(coxdata, coxdata$BYVAR), function(x)  
  coxph(Surv(AVAL, CNSR==0) ~ (TREAT + SEX + RACE), data = x))
```

Execute R
Method

Comparison of Both Features

Age Group (N)	Group	Placebo	Xanomeline Dose	Page order
1	Age Group: <65			1
1	Number of subjects	14 (100.0)	19 (100.0)	1
1	Subjects with events	5 (35.7)	17 (89.5)	1
1	Subjects with censors	9 (64.3)	2 (10.5)	1
1	Comparison vs Placebo			1
1	Hazard Ratio (adjusted#)		3.78	1
1	95% Confidence interval		(0.64,22.24)	1
1	P-value		0.1418	1
2	Age Group: 65-80			1
2	Number of subjects	42 (100.0)	102 (100.0)	1
2	Subjects with events	14 (33.3)	79 (77.5)	1
2	Subjects with censors	28 (66.7)	23 (22.5)	1
2	Comparison vs Placebo			1
2	Hazard Ratio (adjusted#)		1.79	1
2	95% Confidence interval		(1.13,2.81)	1
2	P-value		0.0124	1
3	Age Group: >80			2
3	Number of subjects	30 (100.0)	47 (100.0)	2
3	Subjects with events	10 (33.3)	27 (57.4)	2
3	Subjects with censors	20 (66.7)	20 (42.6)	2
3	Comparison vs Placebo			2
3	Hazard Ratio (adjusted#)		2.27	2
3	95% Confidence interval		(1.37,3.77)	2
3	P-value		0.0016	2

Data Preparation with SAS:
Data Step/PROC SQL
Format: SAS7BDAT

Reporting
Dataset

Data Preparation with R
Packages: dplyr/sqlf
Format: DATAFRAME

Comparison of Both Features

Report with SAS Method

```
title "x.1: Time to first event: Cox Regression of outcome event by age groups";
proc report data=final nowd missing headskip headline spacing=2 split='~';
  column byord catc col_0 col_1;

  define byord      / order order=internal noprint;
  define catc       / display width=40 left flow spacing=3;
  define col_0      / order width=22 left flow spacing=1;
  define col_1      / order width=22 left flow spacing=1;

  break after byord/skip;

  compute before _page_;
    line @1 120*'f';
  endcomp;

  compute after _page_;
    line @1 120*'f';
    line @1 "#Adjustment is for sex, race, and treatment.";
  endcomp;
run;
```

Report with R Method

```
report <- flextable(final) %>%
  #Width of columns
  width(j = 2:3, width = 2) %>% width(j = 1, width = 2.5) %>%
  #Alignment of Columns
  align(j = 2:3, align = "center", part = "all") %>%
  align(j = 1, align = "left", part = "all") %>%
  #Add Titles
  add_header_lines(values =
    paste("x.1: Time to first event: Cox Regression of outcome event
          by age groups", sep = "")) %>%
  #Add Footnotes
  add_footer_lines(values =
    paste("#Adjustment is for sex, race, and treatment.", sep = "")) %>%
  #Line at Bottom of the Table
  hline_bottom(border = fp_border(color = "blue"), part = "body") %>%
  #Line below of column names
  hline_bottom(border = fp_border(color = "yellow"), part = "header") %>%
  #Line above column names
  border_inner_h(border = fp_border("red"), part = "header")
```

Comparison of Both Features

x.1: Time to first event: Cox Regression of outcome event by age groups

Group	Placebo	Xanomeline Dose
Age Group: <65		
Number of subjects	14 (100.0)	19 (100.0)
Subjects with events	5 (35.7)	17 (89.5)
Subjects with censors	9 (64.3)	2 (10.5)
Comparison vs Placebo		
Hazard Ratio (adjusted#)		3.78
95% Confidence interval		(0.64,22.24)
P-value		0.1418
Age Group: 65-80		
Number of subjects	42 (100.0)	102 (100.0)
Subjects with events	14 (33.3)	79 (77.5)
Subjects with censors	28 (66.7)	23 (22.5)
Comparison vs Placebo		
Hazard Ratio (adjusted#)		1.79
95% Confidence interval		(1.13,2.81)
P-value		0.0124
Age Group: >80		
Number of subjects	30 (100.0)	47 (100.0)
Subjects with events	10 (33.3)	27 (57.4)
Subjects with censors	20 (66.7)	20 (42.6)
Comparison vs Placebo		
Hazard Ratio (adjusted#)		2.27
95% Confidence interval		(1.37,3.77)
P-value		0.0016

#Adjustment is for sex, race, and treatment.



Final Report

Comparison of Both Features

Scope	PROC REPORT option/statement	FLEXTABLE function
Aligning columns	center/left/right options in the define statement	align function
Width of columns	width option in the define statement	width function
Line above column names	'___' in the column statement (see proc report on page 2)	border_inner_h function
Line below column names	headline option in proc report statement	
Line at the bottom of the table compute after _page_ /<page- variable> block		hline_bottom function
Add footnotes/titles	footnoten/titlen statement /line statement in a compute after block (footnotes only)	add_header_lines (titles) add_footer_lines (footnotes)
Multicolumn header	Embed columns in brackets: ("header" col1 col2)	add_header_row using the colwidths option
Skip lines	break after <var> / skip	none
Page break	break after <var> / page	body_add_break (from the officer package)

Equivalent features of PROC Report are not available in FLEXTABLE.

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Advantages of SAS PROC REPORT

PROC REPORT

```
break after pagen/PAGE;
```

Write Function: FLEXTABLE with OFFICER Package

```
page.break <- function(data, pagevar = "page"){  
  #Loop for number of pages  
  for (i in 1:n) {  
  
    #Filter object dataset for per page  
    subdata<- subset(data, page==i)  
    report <- flextable(subdata)  
  
    # Write first page  
    if (i == 1) {  
      doc <- read_docx() %>% body_add_flextable(value = report)  
      print(doc, target = "Table_cox.docx")  
    }  
    #Add pages with previous pages  
    else {  
      doc <- read_docx("Table_cox.docx") %>%  
        body_add_break() %>% body_add_flextable(value = report)  
      print(doc, target = "Table_cox.docx")} } }
```

Advantages of SAS PROC REPORT

PROC REPORT

```
proc report data=disbp nowd missing headskip headline;  
  column avisitn avisit grouplabel trtp  
         disbp, ("--" N MIN MEAN STD MEDIAN MAX);  
  
  define avisitn    / group noprint;  
  define avisit     / group "Week" width=12;  
  define grouplabel / group "Types of value" width=20;  
  define trtp       / group width=20;  
  define disbp      / analysis N width=11 format=8.1;  
  
  break after grouplabel/skip;  
  break after avisitn/skip;  
run;
```

FLEXTABLE

- ❖ No statistical computation is possible
- ❖ All the required computation needs to be manipulated beforehand

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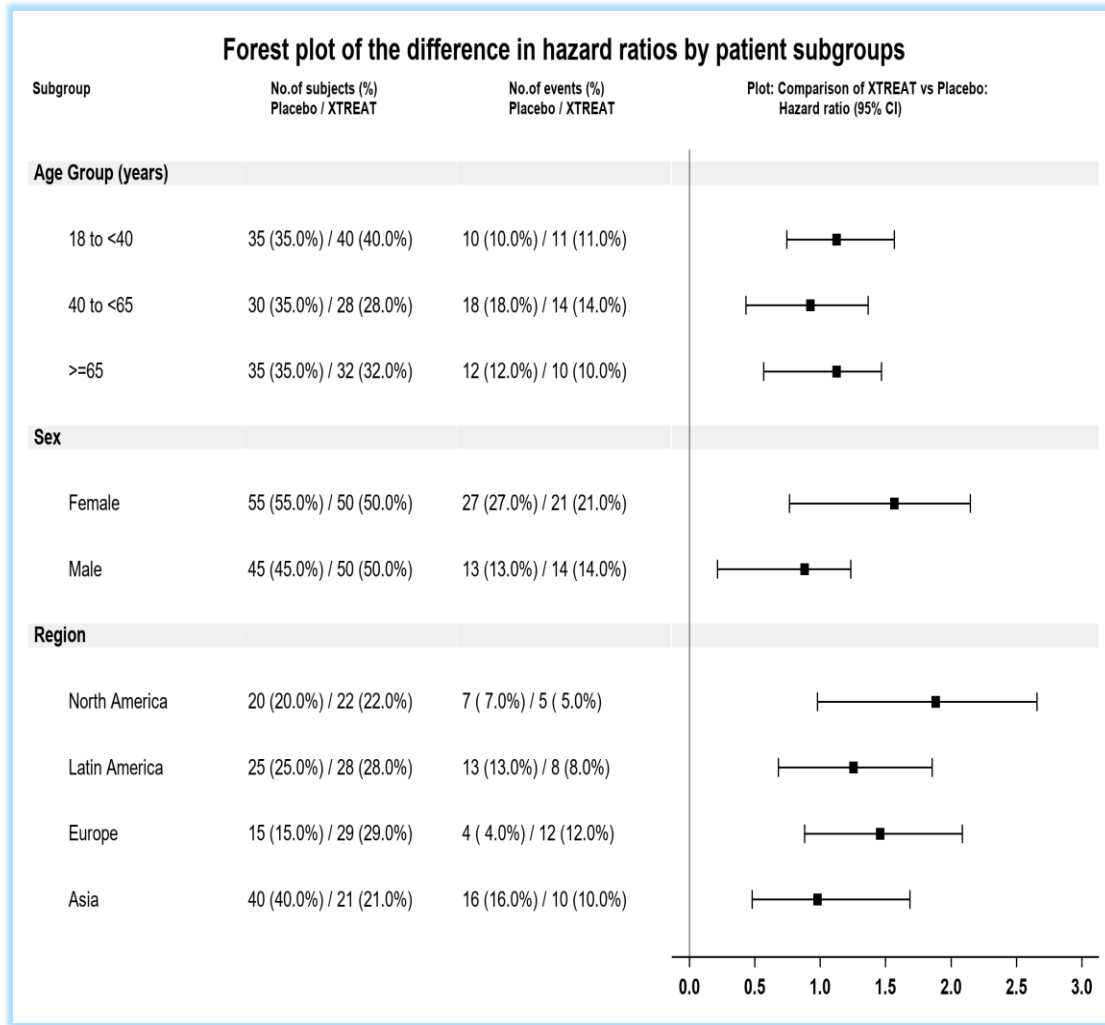
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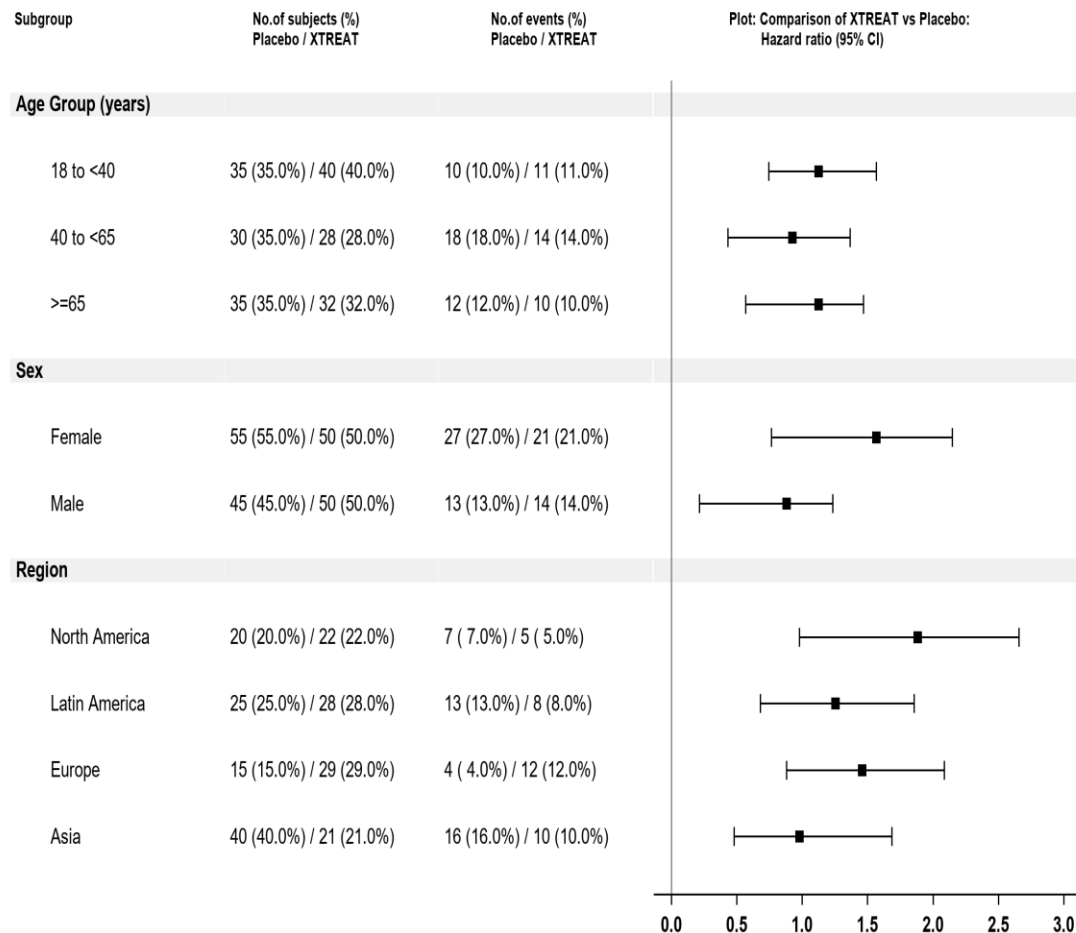


PROC REPORT

- ❖ Not possible
- ❖ GTL is required

Advantages of FLEXTABLE in R

Forest plot of the difference in hazard ratios by patient subgroups



FLEXTABLE with ggplot2

```
dat <- forestdt
dat <- dat %>%
  tidyr::nest(data = -c(group, n, nevents )) %>%
  dplyr::mutate(
    #Create forest plots with ggplots
    forest = lapply(data, function(x)
      gg(x,
        cols = c("estimate", "lower", "upper", "groupn")))) %>%
  dplyr::select(-data)

ft <- flextable(dat[, c("group", "n", "nevents", "forest")])
ft <- compose(ft,
  #Render Forest Plots
  j = c("forest"),
  value = as_paragraph
    (gg_chunk(value = ., height =1, width = 3)),
  use_dot = TRUE)
```

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Best of Both Features

Reporting Clinical Trial Results select either FLEXTABLE or PROC Report, whichever is

- more appealing
- requires minimal coding

Best of Both Features

SAS

- Take advantages of PROC IML

R

- Connect R Server with SAS Server

```
callSAS <- function (f, path=getwd(), workDir=sprintf("E:", sys.info()["user"])) {  
  # Usage:  
  # > callSAS("getClaimsMed.sas")  
  if (grepl(".sas$", f)) {  
    exeFile <- "E:\\Apps\\SASHome\\SASFoundation\\9.4\\sas.exe"  
    sasFile <- sprintf("%s\\%s", path, f)  
    logFile <- sprintf("%s\\%s", path, gsub(".sas$", ".log", f))  
    lstFile <- sprintf("%s\\%s", path, gsub(".sas$", ".lst", f))  
    cmd <- sprintf("%s\\%s -sysin \"%s\" -log \"%s\" -print \"%s\"",  
                  exeFile,  
                  sasFile,  
                  logFile,  
                  lstFile  
                  )  
    system(cmd, invisible=FALSE)  
    cat(readLines(sasFile), sep="\n")  
  }  
}
```

Thank you for your attention

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