A Different Approach to Create Swimmer Plot Using Proc Template and SGRENDER

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ABSTRACT

Creating figures for statistical analysis of clinical trials are challenging when limited to specific SAS version and internal SOP. Previous work (Stacey Phillips, 2014; Sanjay Matange) has been done mainly with PROC SGPLOT. In this paper, I introduce a different way to create swimmer plot by using PROC TEMPLATE and PROC SGRENDER, to give additional information such as dose level, cancer type, or genetic type. Additionally, instead of marking "ongoing response" with annotation, I assign a subject-level format with PROC TEMPLATE function "BARLABELFORMAT" to simplify and automatically update output figures when receiving new data. This paper will demonstrate detailed steps of creating swimmer plot as well as compare the advantages and disadvantages of different methods.

INTRODUCTION

At PharmaSUG 2014, Stacey D. Philips created swimmer plot with SG annotation and SGPLOT, with the need to present related tumor diagnosis information. This paper uses PROC TEMPLATE to add columns to the left of plot. Furthermore, while annotation is a powerful yet flexible facility to add text or symbol into graphics, it can also be time consuming when we need to adjust its position, size, and font. To avoid using annotation, BARLABELFORMAT is a function that can easily achieve this goal.

METHODS

The example output demonstrated in this paper contains five categories of information:

<table>
<thead>
<tr>
<th>Information</th>
<th>Variable Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Group</td>
<td>ARM</td>
</tr>
<tr>
<td>Treatment Duration</td>
<td>TRT_DUR</td>
</tr>
<tr>
<td>Dose</td>
<td>DOSE</td>
</tr>
<tr>
<td>Genetic Information</td>
<td>GI</td>
</tr>
<tr>
<td>Treatment Status</td>
<td>STATUS</td>
</tr>
</tbody>
</table>

Table 1. Contents of Sample Data Set

<table>
<thead>
<tr>
<th>GI</th>
<th>STATUS</th>
<th>ARM</th>
<th>DOSE</th>
<th>TRT_DUR</th>
<th>SUBJD</th>
<th>TRT_DUR</th>
<th>START</th>
<th>END</th>
<th>LABEL</th>
</tr>
</thead>
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<td>00002</td>
<td>020002</td>
<td>9.1000</td>
<td>020002</td>
<td>9.1000</td>
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<tr>
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<td>000001</td>
<td>070001</td>
<td>8.0000</td>
<td>000001</td>
<td>8.0000</td>
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<td>000001</td>
<td>070001</td>
<td>7.7000</td>
<td>000001</td>
<td>7.7000</td>
</tr>
<tr>
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<td>000012</td>
<td>070012</td>
<td>5.3000</td>
<td>000012</td>
<td>5.3000</td>
</tr>
<tr>
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<td>3</td>
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<td>00004</td>
<td>070004</td>
<td>4.1000</td>
<td>00004</td>
<td>4.1000</td>
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<tr>
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<td>ARM 1</td>
<td>250</td>
<td>4.0000</td>
<td>000101</td>
<td>070010</td>
<td>4.0000</td>
<td>000101</td>
<td>4.0000</td>
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<td>00001</td>
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<td>070009</td>
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<td>0009</td>
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<td>0003</td>
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<tr>
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<td>10</td>
<td>2.1000</td>
<td>0012</td>
<td>070012</td>
<td>2.1000</td>
<td>0012</td>
<td>2.1000</td>
</tr>
<tr>
<td>WT</td>
<td>20</td>
<td>ARM 2</td>
<td>10</td>
<td>1.9000</td>
<td>0003</td>
<td>070003</td>
<td>1.9000</td>
<td>0003</td>
<td>1.9000</td>
</tr>
</tbody>
</table>

Figure 1. Sample Data Set

First, a simple swimmer plot looked just like a sorted bar chart, you can find many examples creating such plot with BARCHART function of PROC TEMPLATE, see figure 2.
Figure 2. A Simple Swimmer Plot

Next, to add some subject-level information, two SCATTERPLOT statements are used to show marker character at the left of plot, remember to adjust column weights to avoid plot being squeezed (figure 3).

```sas
proc template;
  define statgraph F1;
  begingraph/ designwidth=600px designheight=410px;
  layout lattice/columns=3 columngutter=2
    column2headers;
    entry halign=center "Dose (mg/kg)"/textattrs=(size=7.5pt weight=bold);
  endgraph;
end;
run;
proc sgrender data=F2 template=F1;
run;
```
A Different Approach to Create Swimmer Plot Using Proc Template and SGRENDER, continued

entry halign=center "Genetic Info"/textattrs=(size=7.5pt weight=bold);
endcolumn2headers;
/*Dose*/
layout overlay/walldisplay=none border=false
   yaxisopts=(display=none reverse=true type=discrete)
   xaxisopts=(display=none offsetmin=0.3 offsetmax=0);
scatterplot y=SUBJID x=constant/markercharacter=DOSE markerattrs=(size=0);
endlayout;
/*Genetic Information*/
layout overlay/walldisplay=none border=false
   yaxisopts=(display=none reverse=true type=discrete)
   xaxisopts=(display=none offsetmin=0.3 offsetmax=0);
scatterplot y=SUBJID x=constant/markercharacter=GI markerattrs=(size=0);
endlayout;
/*Swimmer Plot*/
layout overlay/yaxisopts=(reverse=true display=none
tickvalueattrs=(weight=bold))
xaxisopts=(griddisplay=on labelattrs=(weight=bold)
label="Treatment Duration (months)"
linearopts=(tickvalueformat=(extractscale=true)));
barchart x=SUBJID y=TRT_DUR/name="ARM" barwidth=0.6 orient=horizontal
group=ARM grouporder=ascending
outlineattrs=(color=black);
discretelegend "ARM";
endlayout;
endgraph;
end;
run;

proc sgrender data=F2 template=F1;
run;

Figure 3. Swimmer Plot with Dosage and Genetic Information
The last step is to put treatment status at the end of each bar. In this case, we want to know how long has each subject taken study treatment, and whether the subject is still taking it or had dropped from study. This can be done by adding a bar label, however, to prevent from two or more subjects with exactly the same treatment duration, which can mess up the bar label, each record requires a unique and non-overlapping format value. Here I concatenate treatment duration and subject id (which is unique! Or you can generate some non-repeat random number), and to avoid affecting bar length, I add some 0s right behind original treatment duration.

```sas
data F2;
set F2;
length _TRTDUR $15.;
_TRTDUR=strip(put(TRT_DUR, 3.1))||"000"||strip(SUBJID);
TRT_DUR=input(strip(_TRTDUR), 12.10);
constant=1;
START=TRT_DUR;
if TRT_DUR>10 then END=TRT_DUR+0.00001;
else END=TRT_DUR;
if STATUS="ONGOING" then LABEL=put(START,4.1)||"+";
else LABEL=put(START,4.1);
retain FMTNAME "ONGOING" TYPE "n";
run;

data CTRL(keep=START END LABEL FMTNAME TYPE);
set F2;
run;

proc format library=work cntlin=CTRL;
run;

proc template;
define statgraph F2;
begingraph/ designwidth=600px designheight=410px;
layout lattice/columns=3 columngutter=2
    columnweights=(.12 .18 .70);
column2headers;
    entry halign=center "Dose (mg/kg)"/textattrs=(size=7.5pt weight=bold);
    entry halign=center "Genetic Info"/textattrs=(size=7.5pt weight=bold);
endcolumn2headers;
/*Dose*/
layout overlay/walldisplay=none border=false
    yaxisopts=(display=none reverse=true type=discrete)
    xaxisopts=(display=none offsetmin=0.3 offsetmax=0);
scatterplot y=SUBJID x=constant/markercharacter=DOSE markerattrs=(size=0);
endlayout;
/*Genetic Information*/
layout overlay/walldisplay=none border=false
    yaxisopts=(display=none reverse=true type=discrete)
    xaxisopts=(display=none offsetmin=0.3 offsetmax=0);
scatterplot y=SUBJID x=constant/markercharacter=GI markerattrs=(size=0);
endlayout;
/*Swimmer Plot*/
layout overlay/yaxisopts=(reverse=true label="Treatment Duration (months)"
    tickvalueattrs=(weight=bold)) display=none
    xaxisopts=(griddisplay=on labelattrs=(weight=bold)
        linearopts=(tickvalueformat=(extractscale=true)));
barchart x=SUBJID y=TRT_DUR/name="ARM" barlabel=true barlabelformat=ONGOING.
    barwidth=0.6 orient=horizontal
    group=ARM grouporder=ascending outlineattrs=(color=black);
 discretelegend "ARM";
endlayout;
endgraph;
end;
run;
```
A Different Approach to Create Swimmer Plot Using Proc Template and SGRENDER, continued

```sas
proc sgrender data=F2 template=F2;
run;
```

Now, by adding BARLABEL, we have a final version of swimmer plot with all the requested information. Notice that numbers with a "+" sign means that treatment is still ongoing for this subject.

![Swimmer Plot with Treatment Status](image)

**CONCLUSION**

Creating ad hoc outputs based on the requirements of analysis and version/package of SAS always forces you to use different combination of procedures and functions. While annotation certainly has more flexibility, choosing a ready-to-use function without inputing extra settings manually can save you some efforts, and shorten the time you needed to update your program whenever new data comes in.

**REFERENCES**


http://blogs.sas.com/content/graphicallyspeaking/2014/06/22/swimmer-plot/

**CONTACT INFORMATION**

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

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