PROC SGPLOTによるSwimmer Plot
– 見やすさを求めて –

吉田 秀幸2、韓 士栄1、若菜 明1
○福田 裕章1（発表のみ）
（1MSD株式会社、2株式会社タクミインフォメーションテクノロジー）

Drawing the Useful and Clear Swimmer Plot Using PROC SGPLOT

Hideyuki Yoshida2, Shi Rong Han1, Akira Wakana1
OHiroaki Fukuda1 (Presentation Only)
1MSD K.K., 2Takumi Information Technology, Inc.
要旨:

本発表では、PROC SGPLOTのannotationを利用した、従来よりも明瞭なswimmer plot作成のSASプログラムを紹介する。

キーワード:

Swimmer Plot, SGPLOT, annotation, Immuno-Oncology Therapy
What is Swimmer Plot?

- Time to Response
- RECIST
  - CR
  - PR
  - SD
  - PD
- Other Information (e.g. Treatment Group)

Swimmer Plot

Know a subject’s response “story” in one glance
Immuno-Oncology and Swimmer Plot

Late and long-term effects emerge in immuno-oncology therapy in comparison to traditional chemotherapy. (like right figure)

Understanding whether a subject continues the treatment is significant.

Swimmer plots previously reported do NOT include “treatment ongoing” information or NOT so beautiful even if it is included.

We try to create the ideal plot!
### Input Data for Swimmer Plot

<table>
<thead>
<tr>
<th>USUBJID</th>
<th>GROUP</th>
<th>STARTLINE</th>
<th>ENDLINE</th>
<th>ENDLINE01</th>
<th>ENDLINE02</th>
<th>CR</th>
<th>PR</th>
<th>PD</th>
<th>SD</th>
<th>LASTDOSE</th>
<th>ONGOING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRUG A-001</td>
<td>1</td>
<td>0</td>
<td>40</td>
<td>40</td>
<td>23.1</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>30.2</td>
<td>30.2</td>
</tr>
<tr>
<td>DRUG A-002</td>
<td>2</td>
<td>0</td>
<td>35</td>
<td>.</td>
<td>35</td>
<td>.</td>
<td>.</td>
<td>25</td>
<td>.</td>
<td>.</td>
<td>25.2</td>
</tr>
<tr>
<td>DRUG A-003</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>20</td>
<td>.</td>
<td>.</td>
<td>16</td>
<td>.</td>
<td>.</td>
<td>18.2</td>
<td>18.2</td>
</tr>
<tr>
<td>DRUG A-004</td>
<td>1</td>
<td>0</td>
<td>22</td>
<td>22</td>
<td>.</td>
<td>.</td>
<td>16</td>
<td>.</td>
<td>.</td>
<td>18.2</td>
<td>18.2</td>
</tr>
<tr>
<td>DRUG A-005</td>
<td>1</td>
<td>0</td>
<td>24</td>
<td>24</td>
<td>22.1</td>
<td>.</td>
<td>.</td>
<td>15</td>
<td>.</td>
<td>22.2</td>
<td>22.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USUBJID</th>
<th>Unique Subject Identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP</td>
<td>Treatment Group</td>
</tr>
<tr>
<td>STARTLINE</td>
<td>Start time</td>
</tr>
<tr>
<td>ENDLINE</td>
<td>End of treatment time for subject</td>
</tr>
<tr>
<td>ENDLINE01</td>
<td>End of treatment time for DRUG A High Dose</td>
</tr>
<tr>
<td>ENDLINE02</td>
<td>End of treatment time for DRUG A Low Dose</td>
</tr>
<tr>
<td>CR</td>
<td>Start time of complete response as best response</td>
</tr>
<tr>
<td>PR</td>
<td>Start time of partial response as best response</td>
</tr>
<tr>
<td>PD</td>
<td>Start time of progressive disease as best response</td>
</tr>
<tr>
<td>SD</td>
<td>Start time of sable disease</td>
</tr>
<tr>
<td>LASTDOSE</td>
<td>Last time of Drug A dose</td>
</tr>
<tr>
<td>ONGOING</td>
<td>Time of Treatment ongoing</td>
</tr>
</tbody>
</table>
Completely Basic Swimmer Plot

Requirements

- Treatment ongoing status
- Group legend with text format
- RECIST category
- Last drug dose timing
- Change colors freely
- Change symbols freely

Clinicians need beautiful plots!!

```
proc sgplot data = SWIMMER_PLOT;
  hbar Y_ORDER/group = group response = ENDLINE barwidth = 1 transparency = 0 dataskin = none;
  yaxis type = discrete discreteorder = data display = ( nolabel noticks novalues ) ;
  xaxis type = linear label = "Time, weeks" values = ( 0 to 70 by 10 ) ;
run ;
```
Plots Customization with Annotations in SGPLOT Procedure

By annotation ...
• Use various symbols
• Use various line patterns
• Adjust colors
• Add texts
• Add images
etc.

Example: annotation data set

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>DRAWSpace</th>
<th>_TYPE</th>
<th>X1</th>
<th>Y1</th>
<th>WIDTH</th>
<th>TEXTCOLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEXT</td>
<td>WALLPERCENT</td>
<td>SYMBOL</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>GRAY</td>
</tr>
<tr>
<td>TEXT</td>
<td>WALLPERCENT</td>
<td>SYMBOL</td>
<td>60</td>
<td>35</td>
<td>100</td>
<td>GREEN</td>
</tr>
</tbody>
</table>

Example: SG annotation functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>Draw a text on the graph</td>
</tr>
<tr>
<td>Textcont</td>
<td>Continue a text string from the text function</td>
</tr>
<tr>
<td>Image</td>
<td>Draw an image on the graph</td>
</tr>
<tr>
<td>Line</td>
<td>Draw a line on the graph</td>
</tr>
<tr>
<td>Arrow</td>
<td>Draw a line with an arrowhead on the graph</td>
</tr>
<tr>
<td>Polygon</td>
<td>Draw a polygon on the graph</td>
</tr>
<tr>
<td>Polyline</td>
<td>Draw a polyline on the graph</td>
</tr>
<tr>
<td>Polycont</td>
<td>Continue a polygon/polyline from the polygon/polyline function</td>
</tr>
</tbody>
</table>

```
proc sgplot data = input_data sganno = anno;
   ::
run ;
```
Annotation Data for Data Symbols

Draw data symbols by annotation data
Example: Annotation Data Set (SGANNO_SYMBOLS)

Define symbols including ...

- Treatment ongoing status
- RECIST category
- Last drug dose timing

- Freely change symbols and colors
Annotation Data for Legend

Create annotation data set

data SGANNO;
  set SGANNO_SYMBOL
  SGANNO_LEGEND;
run;

Set sganno option to SGANNO data set

proc sgplot
  data = SWIMMER_PLOT sganno = SGANNO;
run;
Customized Swimmer Plot with Annotation Data

```sas
proc sgplot data = SWIMMER_PLOT sganno = SGANNO noautolegend ;
  hbar Y_ORDER /
    response = ENDLINE01
    barwidth = 1 fillattrs = ( color = gray )
    transparency = 0 dataskin = none ;
  hbar Y_ORDER /
    response = ENDLINE02
    barwidth = 1 fillattrs = ( color = green )
    transparency = 0 dataskin = none ;
  yaxis
    type = discrete discreteorder = data
    display = ( nolabel noticks novalues )
    offsetmin = 0.02 offsetmax = 0.02 ;
  xaxis
    type = linear label = "Time, weeks"
    labelattrs = (family = "Arial" size = 12)
    values = ( 0 to 70 by 10 )
    valueattrs = ( family = "Arial" size = 12 )
    offsetmin = 0 offsetmax = 0.1 ;
run ;
```

Complete all requirements!!
Brief explanation on the program developed for Swimmer Plot

Program Name: SwimmerPlotUnicodeSymbol.sas

Description:
The program makes swimmer plot with arrow for treatment ongoing mainly for oncology Phase 1 and Phase 2 studies as shown below. SGPLOT from SAS.9.3 is used to create the swimmer plot.

General design:
In order to make the graph looks better, annotation dataset is created for symbols and legend. The annotation data set of SGANNO is consisted from two parts: one is for symbols and the other is for legend. Based on the sample size, some modification is needed on the contents of the data set, which is easily done. Based on the data set, the following two parts in the program need to be modified:

- "TEXTSIZE", "X1" and "Y1" in annotation data set are needed to be adjusted to make the size of symbols and location of legend suitable in the whole figure.
- In the proc sgplot, the values for xaxis are also needed to be adjusted based on the concrete data.
Conclusion and Issue

Conclusion
• We created a clear swimmer plot including necessary information, especially “treatment ongoing” status.

Issue
<Targets of this swimmer plot program>
• 40 - 50 subjects in oncology clinical trials
• Phase 1 or Phase 2 trials

When there are a very large number of subjects, such as global studies with several arms, it’s difficult to show all subjects in one plot.
References

