

Authors Introduction



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Fill Patterns to the Oncology Plots using SAS

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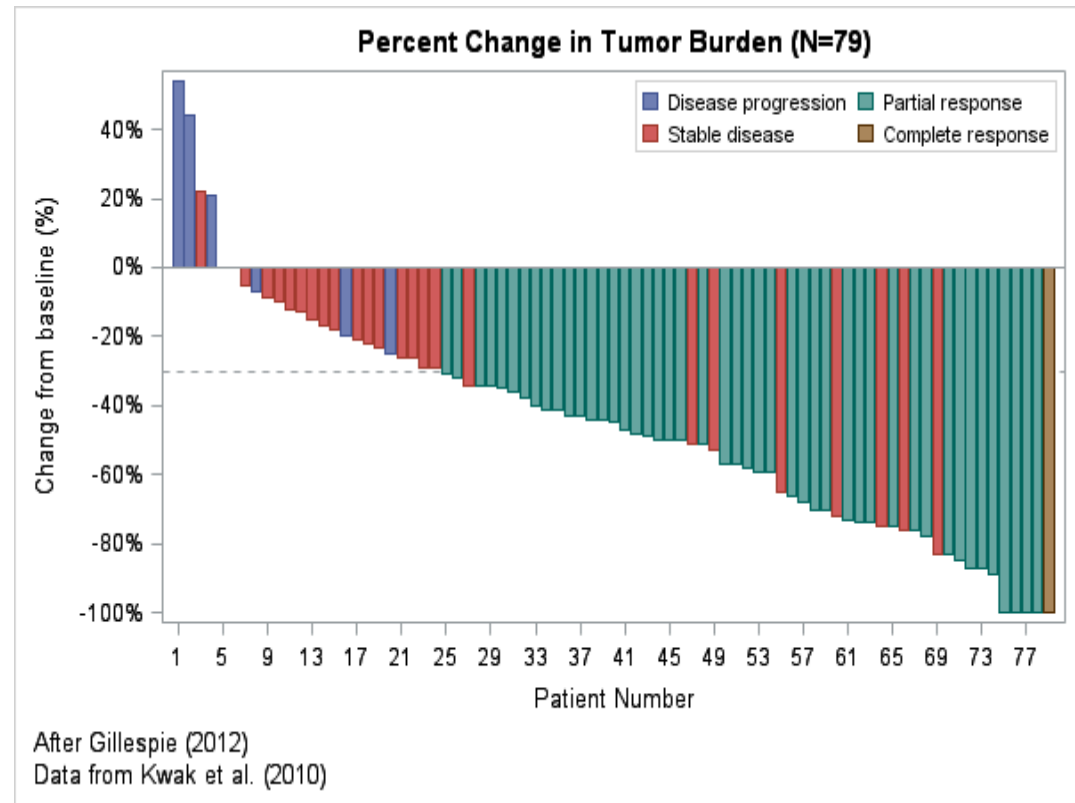
Paper# CT02

Generating Graphs Using SAS

- In Oncology trials, it is very common to produce the plots with color coding based on grouping variables like Disease Responses using PROC SGPLOT. However, in some trials, there will be a requirement to use both fill patterns and color to distinguish between multiple group variables.
- Waterfall plot is the best among the plots to visualize the change in tumor size for each subject in an oncology study.
- It is very common to produce the plots with color coding based on grouping variables like Disease Responses using SGPLOT procedure in SAS. But based on the complexity of the trial, there will be a requirement to distinguish the plot based on multiple grouping variables. One way to represent the Waterfall plot when there are multiple grouping variables is to use fill patterns and colors.

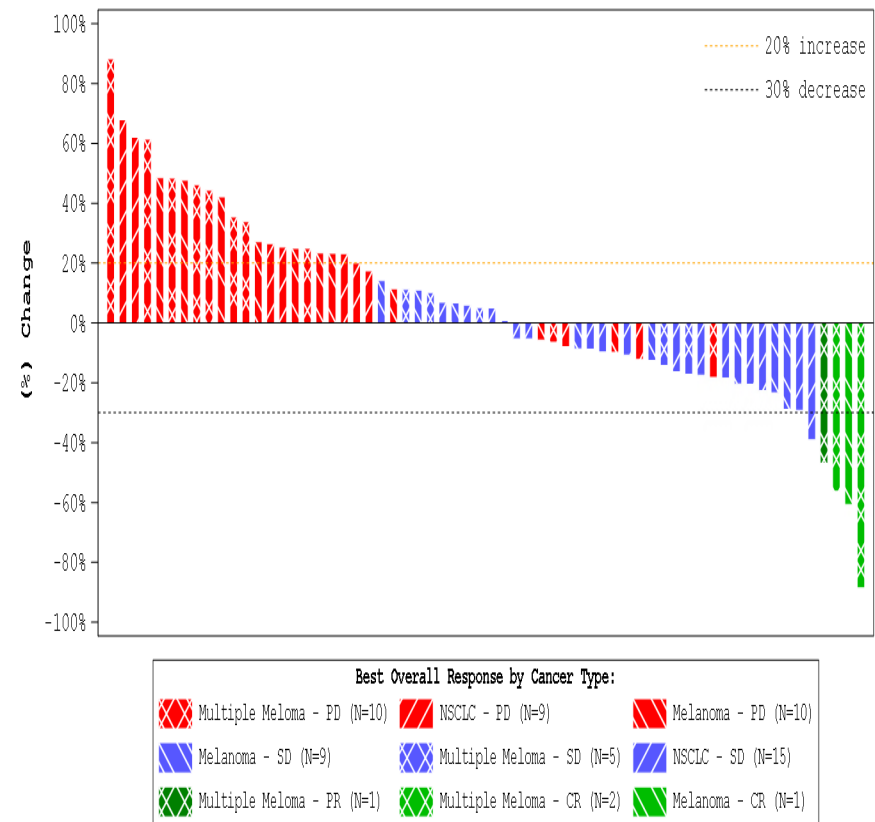
Waterfall Plot with fill colors

- Waterfall plots in oncology are a relatively new way of presenting data from research projects. It's basically a bar graph where each bar typically represents a patient; they are usually ordered from worst results to best.
- We can generate this through SAS using PROC SGPLOT procedure but is limited to fill colors based on the response criteria.



Waterfall plot with fill patterns and fill colors

- Based on the complexity of the trial, there will be a requirement to distinguish the plot based on multiple grouping variables. One way to represent the Waterfall plot when there are multiple grouping variables is to use fill patterns and colors.
- FILLPATTERN option in SGPLOT procedure enables the display of fill patterns for the plot and FILLPATTERNATTRS option enables the fill color and pattern for the plot.
- Options FILLPATTERN and FILLPATTERNATTRS applies only to SAS® v9.4M5 or later releases. There are no such options available in the previous versions of SAS.



Proc Template to add fill patterns and fill colors

- We can apply fill patterns and colors to the plots using the power of PROC TEMPLATE and PROC SGPLOT in SAS versions that came before 9.4M5.
- We use FILLPATTERN style element attribute to add patterns to the bars generated with the SGPLOT procedure. Color attribute is used to specify the color of the bar based on the disease responses and CONTRASTCOLOR is used to specify the color of the pattern.
- ❖ Sample proc template code

```
proc template;  
  define style softtrtf / store = SASUSER.TEMPLAT;  
    parent = styles.printer;  
    style GraphBar from GraphComponent /  
      displayopts = "fillpattern";  
    style GraphData1 from GraphData1 /  
      fillpattern = "X5"  
      color= red  
      ContrastColor = white;  
    style GraphData2 from GraphData2 /  
      fillpattern = "R5"  
      color= red  
      ContrastColor = white;  
  ;  
end;
```

Automation

- There may be cases where we may require many patterns and colors and proc template procedure can be long.
- We can use PROC SQL to make this process easy by getting the counts for number of patterns and colors required, and then assigns the patterns and colors to the macro variables as shown in the below SQL procedure.
- Density of the lines is specified by a number from 1 to 5. The number 1 produces the lightest shading and 5 produces the heaviest shading.

```
proc sql noprint;
select count(distinct fingrp) into:numptrn trimmed from attr_ptrn ;
select strip(fillpattern) into: pattr1 - :pattr&numptrn. from attr_ptrn;
select strip(fillcolor) into: color1 - :color&numptrn. from attr_ptrn;
quit;
*** PROC TEMPLATE code for Waterfall plots **;
proc template;
define style softtrtf /
store = SASUSER.TEMPLAT;
parent = styles.printer;
style GraphBar from GraphComponent /
displayopts = "fillpattern";
%do i=1 %to &numptrn.;
style GraphData&i. from GraphData&i. /
fillpattern = "&pattr&i"
color= &color&i.
ContrastColor = white;
%end;
End;
run;
```

Intermediate SAS Dataset – ATTR_PTRN

fillcolor	ptmgrp	fillpattern	fingrp	Best_Response
red	Multiple Meloma	X1	Multiple Meloma - PD	Multiple Meloma - PD (N=10)
red	NSCLC	R1	NSCLC - PD	NSCLC - PD (N=9)
red	Melanoma	L1	Melanoma - PD	Melanoma - PD (N=10)
light blue	Melanoma	L1	Melanoma - SD	Melanoma - SD (N=9)
light blue	Multiple Meloma	X1	Multiple Meloma - SD	Multiple Meloma - SD (N=5)
light blue	NSCLC	R1	NSCLC - SD	NSCLC - SD (N=15)
green	Multiple Meloma	X1	Multiple Meloma - PR	Multiple Meloma - PR (N=1)
dark green	Multiple Meloma	X1	Multiple Meloma - CR	Multiple Meloma - CR (N=2)
dark green	Melanoma	L1	Melanoma - CR	Melanoma - CR (N=1)

- ATTR_PTRN is the intermediate dataset where we assign fill patterns and fill colors.
- The fill patterns and fill colors in the ATTR_PTRN dataset are assigned to the macro variables.

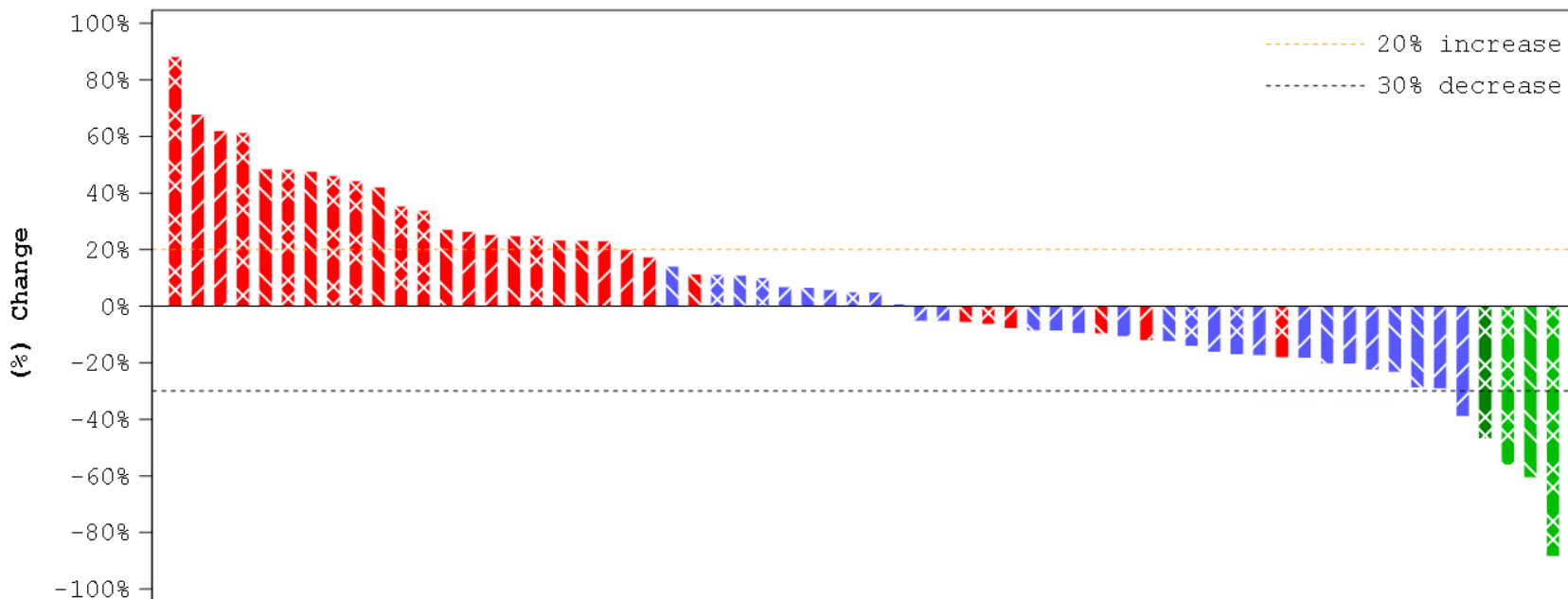
SGPLOT PROCEDURE TO GENERATE WATERFALL PLOT WITH A CUSTOMIZED TEMPLATE FOR FILL COLORS AND PATTERNS:

```
ods rtf file=<Path> style=softtrtf nogtitle nogfootnote;  
options replace formchar="|----|+|---+=|-\<>*" missing=" ";  
ods listing close;  
ODS ESCAPECHAR = '~';  
ods graphics on/ reset MAXLEGENDAREA=50 width=8in height=4in noborder;
```

```
proc Sgplot Data=wf_fin;  
  vbar n /response=PCHG GROUP=Best_Response BARWIDTH=0.6 dataskin=none name='c';  
  keylegend 'c' / location=outside position=bottom title="Best Overall Response by Cancer Type:~n";  
  refline 0.2 /axis=y legendlabel="20% increase" lineattrs=(color='orange' pattern=shortdash) name="d";  
  refline -0.3 /axis=y legendlabel="30% decrease" lineattrs=(color='black' pattern=shortdash) name="e";  
  keylegend 'd' 'e' / valueattrs=(size=9) location=inside position=topright down=10 noborder;  
  xaxis display=none;  
  Yaxis values=(-1 to -0.1 by 0.1 0 to 1 by 0.1) valuesformat=percentn7.0 label="(%) Change";  
run;
```

```
ods rtf close;  
ods listing;
```

Waterfall plot with fill patterns and fill colors



Best Overall Response by Cancer Type:		
Multiple Meloma - PD (N=10)	NSCLC - PD (N=9)	Melanoma - PD (N=10)
Melanoma - SD (N=9)	Multiple Meloma - SD (N=5)	NSCLC - SD (N=15)
Multiple Meloma - PR (N=1)	Multiple Meloma - CR (N=2)	Melanoma - CR (N=1)

CONCLUSION

- We can generate fill patterns and colors to the Waterfall plots by updating STYLE in TEMPLATE procedure using SAS versions before 9.4M5.
- In addition, the ability to create a centralized template and call it across logically related outputs will enable overall consistency in results.

References

[1] Using Fill Patterns to Distinguish Categories of Data. (n.d.).

Retrieved from

<http://support.sas.com/documentation/cdl/en/grstatproc/65235/HTML/default/viewer.htm#p0relmtk2s8ac9n13bnmicsgsmwu.htm>

[2] Bar chart using fill patterns. (n.d.). Retrieved from

<http://support.sas.com/kb/45/663.html>



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