How Can I Create Graphs Using SAS?
Ask the Expert

Richann Watson and Kriss Harris
Richann Watson
Statistical Programmer and CDISC Consultant, DataRich Consulting

Richann is an independent statistical programmer and CDISC consultant based in Ohio. She began using SAS in 1996, with most of her experience in the life sciences industry. She specializes in analyzing clinical trial data and implementing CDISC standards. She is a member of the CDISC ADaM team and various sub-teams.

Kriss Harris
Contract Computational Statistician, Eli Lilly and Company

Kriss worked at GlaxoSmithKline for almost six years from 2005 to 2011 as a statistician supporting drug discovery. Whilst at GSK he developed an increasing passion for teaching and taught SAS Graphics to SAS programmers, statisticians and scientists. He is now an independent statistical programmer, consulting at Eli Lilly, supporting early phase oncology and creating edit checks at MedaVante to ensure the correct data is captured.
Agenda

• Statistical Graphics procedures

• Adjust your graph appearance

• ODS output objects

• Graph Template Language for custom graph
Statistical Graphics Procedures
Goal
<table>
<thead>
<tr>
<th>Obs</th>
<th>USUBJID</th>
<th>TRTA</th>
<th>AVISIT</th>
<th>ADY</th>
<th>ADT</th>
<th>PARAM</th>
<th>AVAL</th>
<th>BASE</th>
<th>CHG</th>
<th>A1LO</th>
<th>A1HI</th>
<th>ANRIND</th>
<th>BNRIND</th>
</tr>
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<tbody>
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<td>Placebo</td>
<td>Baseline</td>
<td>-7</td>
<td>26-Dec-13</td>
<td>Albumin (g/L)</td>
<td>38</td>
<td>38</td>
<td>.</td>
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<td>49</td>
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<td>Week 2</td>
<td>15</td>
<td>16-Jan-14</td>
<td>Albumin (g/L)</td>
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<td>1</td>
<td>33</td>
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<td>N</td>
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<td>29</td>
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<td>38</td>
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<td>33</td>
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<td>38</td>
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<td>N</td>
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<td>18-Jun-14</td>
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<td>Placebo</td>
<td>Week 26</td>
<td>182</td>
<td>2-Jul-14</td>
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<td>38</td>
<td>38</td>
<td>0</td>
<td>33</td>
<td>49</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>
Box Plot with Scatter Plot Overlaid

Code

title #byval2 at #byval4;
ods graphics on / imagefmt = png width = 5in noborder;
proc sgplot data = adam.adlbchem noautolegend;
    where paramcd in ('ALB') and avisitn <= 4;
    by paramcd param avisitn avisit;
    format trtan trt.;
    vbox chg / category = trtan
        extreme
        displaystats = (max min std mean n);
    scatter x = trtan y = chg / jitter;
    xaxis type = discrete label = "Treatment";
    yaxis type = linear label = "Change from Baseline";
run;
Box Plot with Scatter Plot Overlaid

Code

```sas
title #byval2 at #byval4;
ods graphics on / imagefmt = png width = 5in noborder;
proc sgplot data = adam.adlbchem noautolegend;
    where paramcd in ('ALB') and avisitn <= 4;
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yaxis type = linear label = "Change from Baseline";
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xaxis type = discrete label = "Treatment";
    yaxis type = linear label = "Change from Baseline";
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Box Plot with Scatter Plot Overlaid

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   by paramcd param avisitn avisit;
   format trtan trt.;
   vbox chg / category = trtan
      extreme
      displaystats = (max min std mean n);
   scatter x = trtan y = chg / jitter;
   xaxis type = discrete label = "Treatment";
   yaxis type = linear label = "Change from Baseline";
run;
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    where paramcd in ('ALB') and avisitn <= 4;
    by paramcd param avisitn avisit;
    format trtan trt.;
    
    vbox chg / category = trtan
        extreme
        displaystats = (max min std mean n);
    
    scatter x = trtan y = chg / jitter;
    
    xaxis type = discrete label = "Treatment";
    yaxis type = linear label = "Change from Baseline";
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   by paramcd param avisitn avisit;
   format trtan trt.;

   vbox chg / category = trtan
       extreme
       displaystats = (max min std mean n);

   scatter x = trtan y = chg / jitter;

   xaxis type = discrete label = "Treatment";
   yaxis type = linear label = "Change from Baseline";
run;
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   where paramcd in ('ALB') and avisitn <= 4;
   by paramcd param avisitn avisit;
   format trtan trt.;
   vbox chg / category = trtan
      extreme
         displaystats = (max min std mean n);
   scatter x = trtan y = chg / jitter;
   xaxis type = discrete label = "Treatment";
   yaxis type = linear label = "Change from Baseline";
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  by paramcd param avisitn avisit;
  format trtan trt.;
  
  vbox chg / category = trtan
      extreme
      displaystats = (max min std mean n);
  
  scatter x = trtan y = chg / jitter;
  
  xaxis type = discrete label = "Treatment";
  yaxis type = linear label = "Change from Baseline";
run;
Box Plot with Scatter Plot Overlaid

Code

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   where paramcd in ('ALB') and avisitn <= 4;
   by paramcd param avisitn avisit;
   format trtan trt.;

   vbox chg / category = trtan
       extreme
       displaystats = (max min std mean n);

   scatter x = trtan y = chg / jitter;

   xaxis type = discrete label = "Treatment";
   yaxis type = linear label = "Change from Baseline";
run;
### Box Plot with Scatter Plot Overlaid

**Output**

#### Albumin (g/L) at Week 2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Nobs</th>
<th>Mean</th>
<th>Std</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>83</td>
<td>-1</td>
<td>2.489</td>
<td>-6</td>
<td>6</td>
</tr>
<tr>
<td>Xanomeline Low Dose</td>
<td>78</td>
<td>-1.09</td>
<td>2.7073</td>
<td>-8</td>
<td>6</td>
</tr>
<tr>
<td>Xanomeline High Dose</td>
<td>78</td>
<td>-1.372</td>
<td>2.5942</td>
<td>-7</td>
<td>7</td>
</tr>
</tbody>
</table>

**Change from Baseline**

-5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5

![Box Plot Diagram](image-url)
Adjusting the Graph Appearance
Basic Output vs. Desired Output

**Basic Output**

### Albumin (g/L) at Week 2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Nobs</th>
<th>Mean</th>
<th>Std</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>63</td>
<td>78</td>
<td>2.89</td>
<td>-8</td>
<td>6</td>
</tr>
<tr>
<td>Xanomeline Low Dose</td>
<td>78</td>
<td>78</td>
<td>2.70</td>
<td>-2</td>
<td>7</td>
</tr>
<tr>
<td>Xanomeline High Dose</td>
<td>78</td>
<td>78</td>
<td>2.59</td>
<td>-1</td>
<td>7</td>
</tr>
</tbody>
</table>

**Desired Output**

### Albumin (g/L) at Week 2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Nobs</th>
<th>Mean (STD)</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6</td>
<td>6</td>
</tr>
<tr>
<td>Xanomeline Low Dose</td>
<td>78</td>
<td>-1.1 (2.71)</td>
<td>-8</td>
<td>6</td>
</tr>
<tr>
<td>Xanomeline High Dose</td>
<td>78</td>
<td>-1.4 (2.59)</td>
<td>-7</td>
<td>7</td>
</tr>
</tbody>
</table>

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## Modified Data

<table>
<thead>
<tr>
<th>Obs</th>
<th>USUBJID</th>
<th>TRTA</th>
<th>AVISIT</th>
<th>PARAM</th>
<th>CHG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01-701-1015</td>
<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
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</tr>
<tr>
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<td>Albumin (g/L)</td>
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</tr>
<tr>
<td>3</td>
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<td>Albumin (g/L)</td>
<td>-4</td>
</tr>
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<td>Albumin (g/L)</td>
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<tr>
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<td>Albumin (g/L)</td>
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</tr>
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<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>3</td>
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<tr>
<td>7</td>
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<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>-1</td>
</tr>
<tr>
<td>8</td>
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<td>Albumin (g/L)</td>
<td>2</td>
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<td>9</td>
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<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>-4</td>
</tr>
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<td>10</td>
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<td>Placebo</td>
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<td>Albumin (g/L)</td>
<td>-2</td>
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</tbody>
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## Modified Data

<table>
<thead>
<tr>
<th>Obs</th>
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<th>AVISIT</th>
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<td>83</td>
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<td>-6, 6</td>
</tr>
<tr>
<td>2</td>
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<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>-4</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
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<td>Placebo</td>
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<td>Albumin (g/L)</td>
<td>-4</td>
<td>83</td>
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<td>-6, 6</td>
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<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
<tr>
<td>5</td>
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<td>1</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
<tr>
<td>6</td>
<td>01-701-1153</td>
<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>3</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
<tr>
<td>7</td>
<td>01-701-1203</td>
<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>-1</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
<tr>
<td>8</td>
<td>01-701-1234</td>
<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>2</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
<tr>
<td>9</td>
<td>01-701-1345</td>
<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>-4</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
<tr>
<td>10</td>
<td>01-701-1363</td>
<td>Placebo</td>
<td>Week 2</td>
<td>Albumin (g/L)</td>
<td>-2</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
</tbody>
</table>
Box Plot with Scatter Plot Overlaid

**Modified Code**

```sas
title #byval2 at #byval4;
proc sgplot data = adam.adlbcstt noautolegend;
  by paramcd param avisitn avisit;
  format trtan trt.;
  vbox chg / category = trtan nofill
    meanattrs = (symbol = diamondfilled color = red size = 10)
    medianattrs = (color = green thickness = 4)
    whiskerattrs = (pattern = 2 color = red thickness = 4)
    outlierattrs = (symbol = starfilled color = green size = 12);

  scatter x = trtan y = chg / jitter;
...
```
Box Plot with Scatter Plot Overlaid

Modified Code

title #byval2 at #byval4;
proc sgplot data = adam.adlbcstt noautolegend;
   by paramcd param avisitn avisit;
   format trtan trt.;
   vbox chg / category = trtan "nofill"
      meanattrs = (symbol = diamondfilled color = red size = 10)
      medianattrs = (color = green thickness = 4)
      whiskerattrs = (pattern = 2 color = red thickness = 4)
      outlierattrs = (symbol = starfilled color = green size = 12);
   scatter x = trtan y = chg / jitter;

...
Box Plot with Scatter Plot Overlaid

Modified Code

title #byval2 at #byval4;
proc sgplot data = adam.adlbcstt noautolegend;
  by paramcd param avisitn avisit;
  format trt trt.;
  vbox chg / category = trt nofill
  meanattrs = (symbol = diamondfilled color = red size = 10)
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  outlierattrs = (symbol = starfilled color = green size = 12);

  scatter x = trt y = chg / jitter;

...
Box Plot with Scatter Plot Overlaid

Modified Code (cont’d)

```plaintext
... xaxistable n_c / x = trtan
  location = inside
  separator
  valueattrs = (size = 10
    color = cadetblue
    weight = bold
    style = italic);

xaxistable mean_sd min_max / x = trtan
  location = inside;

xaxis type = discrete label = "Treatment";
yaxis type = linear label = "Change from Baseline";
run;
```
Box Plot with Scatter Plot Overlaid

Modified Code (cont’d)

```
...  
  xaxistable n_c  / x = trtan
            location = inside
            separator
            valueattrs = (size = 10
                            color = cadetblue
                            weight = bold
                            style = italic);
  
  xaxistable  mean_sd min_max  / x = trtan
              location = inside;
  
  xaxis  type = discrete label = "Treatment";
  yaxis  type = linear label = "Change from Baseline" ;
run;
```
Box Plot with Scatter Plot Overlaid

Modified Code (cont’d)

... 

\[ \texttt{xaxistable n\_c / x = trtan} \]

\[ \texttt{location = inside} \]

\[ \texttt{separator} \]

\[ \texttt{valueattrs = (size = 10} \]

\[ \texttt{color = cadetblue} \]

\[ \texttt{weight = bold} \]

\[ \texttt{style = italic);} \]

\[ \texttt{xaxistable mean\_sd min\_max / x = trtan} \]

\[ \texttt{location = inside;} \]

\[ \texttt{xaxis type = discrete label = \"Treatment\);} \]

\[ \texttt{yaxis type = linear label = \"Change from Baseline\);} \]

\[ \texttt{run;} \]

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...  

xaxistable n_c / x = trtan  
  location = inside  
  separator  
  valueattrs = (size = 10  
                color = cadetblue  
                weight = bold  
                style = italic);

xaxistable mean_sd min_max / x = trtan  
  location = inside;

xaxis type = discrete label = "Treatment";  
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Box Plot with Scatter Plot Overlaid

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  separator
  valueattrs = (size = 10
                color = cadetblue
                weight = bold
                style = italic);

xaxistable mean_sd min_max / x = trtan
  location = inside;

xaxis type = discrete label = "Treatment";
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Box Plot with Scatter Plot Overlaid

Desired Output

![Box Plot Image]

**Albumin (g/L) at Week 2**

<table>
<thead>
<tr>
<th>Treatment</th>
<th># Subjects</th>
<th>Mean (Std)</th>
<th>Min, Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>83</td>
<td>-1.0 (2.49)</td>
<td>-6, 6</td>
</tr>
<tr>
<td>Xanomeline Low Dose</td>
<td>78</td>
<td>-1.1 (2.71)</td>
<td>-8, 6</td>
</tr>
<tr>
<td>Xanomeline High Dose</td>
<td>78</td>
<td>-1.4 (2.59)</td>
<td>-7, 7</td>
</tr>
</tbody>
</table>
ODS Output Objects
Kaplan-Meier Plot

LIFETEST Procedure: SurvivalPlot

![Kaplan-Meier Plot Image]

<table>
<thead>
<tr>
<th></th>
<th>Placebo</th>
<th>Low Dose</th>
<th>High Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>86</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>Low Dose</td>
<td>84</td>
<td>48</td>
<td>18</td>
</tr>
<tr>
<td>High Dose</td>
<td>84</td>
<td>76</td>
<td>34</td>
</tr>
</tbody>
</table>

Days from Randomisation

Survival Probability
Obtaining ODS Output Object Names

ods trace on;
proc lifetest data = adam.adtteeff
   plots=survival(atrisk=0 to 210 by 30);
   time aval * cnsr(1);
   strata trtpn;
run;
ods trace off;
Obtaining ODS Output Object Names

```sas
ods trace on;
proc lifetest data = adam.adtteeff
    plots=survival(atrisk=0 to 210 by 30);
    time aval * cnsr(1);
    strata trtpn;
run;
ods trace off;
```
ODS Output Object Names

Output Added:

Name: SurvivalPlot
Label: Survival Curves
Path: Lifetest.SurvivalPlot
ODS Table Names

Seen in the details tab within the help guide

Table 72.6: ODS Tables Produced by PROC LIFETEST

<table>
<thead>
<tr>
<th>ODS Table Name</th>
<th>Description</th>
<th>Statement / Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>BreslowEstimates</td>
<td>Breslow estimates</td>
<td>PROC LIFETEST METHOD=</td>
</tr>
<tr>
<td>CensoredSummary</td>
<td>Number of event and censored observations</td>
<td>PROC LIFETEST METHOD=PL</td>
</tr>
<tr>
<td>CIF</td>
<td>Cumulative incidence function estimates</td>
<td>TIME / EVENTCODE</td>
</tr>
<tr>
<td>FailureSummary</td>
<td>Summary of failure outcomes for competing-risks data</td>
<td>TIME / EVENTCODE</td>
</tr>
<tr>
<td>FlemingEstimates</td>
<td>Fleming-Harrington estimates</td>
<td>PROC LIFETEST METHOD=FH</td>
</tr>
<tr>
<td>FlemingHomCov</td>
<td>Covariance matrix for $k$-sample FLEMING statistics</td>
<td>STRATA / TEST=FLEMING</td>
</tr>
<tr>
<td>GrayTest</td>
<td>Results of $k$-sample test of Gray (1988) comparing CIFs</td>
<td>TIME / EVENTCODE; STRATA</td>
</tr>
<tr>
<td>HomStats</td>
<td>Test statistics for $k$-sample tests</td>
<td>STRATA / TEST=</td>
</tr>
<tr>
<td>HomTests</td>
<td>Results of $k$-sample tests</td>
<td>STRATA / TEST=</td>
</tr>
<tr>
<td>LifetableEstimates</td>
<td>Life-table survival estimates</td>
<td>PROC LIFETEST METHOD=LT</td>
</tr>
<tr>
<td>LogForStepSeq</td>
<td>Forward stepwise sequence for the log-rank statistics for association</td>
<td>TEST</td>
</tr>
</tbody>
</table>
## ODS Graph Names

Seen in the details tab within the help guide

<table>
<thead>
<tr>
<th>ODS Graph Name</th>
<th>Plot Description</th>
<th>PLOTS= Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>cifPlot</td>
<td>Cumulative incidence function</td>
<td>CIF</td>
</tr>
<tr>
<td>cifPlot</td>
<td>Cumulative incidence function with pointwise confidence limits</td>
<td>CIF(CL)</td>
</tr>
<tr>
<td>cifPlot</td>
<td>Cumulative incidence function with Gray’s test</td>
<td>CIF(TEST)</td>
</tr>
<tr>
<td>DensityPlot</td>
<td>Density function for life-table method</td>
<td>PDF</td>
</tr>
<tr>
<td>FailurePlot</td>
<td>Cumulative distribution function</td>
<td>survival(Failure)</td>
</tr>
<tr>
<td>HazardPlot</td>
<td>Hazard function for life-table method or smoothed hazard for product-limit, Breslow, or Fleming-Harrington method</td>
<td>HAZARD</td>
</tr>
<tr>
<td>LogNegLogSurvivalPlot</td>
<td>Log(-log(survivor function))</td>
<td>LOGLOGS</td>
</tr>
<tr>
<td>NegLogSurvivalPlot</td>
<td>Log(survivor function)</td>
<td>LOGSURV</td>
</tr>
<tr>
<td>SurvivalPlot</td>
<td>Survivor function</td>
<td>SURVIVAL</td>
</tr>
<tr>
<td>SurvivalPlot</td>
<td>Survivor function with number of subjects at risk</td>
<td>(ATRISK)</td>
</tr>
<tr>
<td>SurvivalPlot</td>
<td>Survivor function with pointwise confidence limits</td>
<td>SURVIVAL(CL)</td>
</tr>
<tr>
<td>SurvivalPlot</td>
<td>Survivor function with equal-precision band</td>
<td>SURVIVAL(CB=EP)</td>
</tr>
<tr>
<td>SurvivalPlot</td>
<td>Survivor function with Hall-Wellner band</td>
<td>SURVIVAL(CB=HW)</td>
</tr>
<tr>
<td>SurvivalPlot</td>
<td>Survivor function with homogeneity test</td>
<td>SURVIVAL(TEST)</td>
</tr>
</tbody>
</table>
Kaplan-Meier Plot

LIFETEST Procedure

```sas
ods output SurvivalPlot = SurvivalPlot;
ods output HomTests=HomTests=(test=(where"Log-Rank"));
proc lifetest data = adam.adtteeff plots=survival(atrisk=0 to 210 by 30);
  time aval * cnsr(1);
  strata trtpn;
run;
```
Kaplan-Meier Plot
LIFETEST Procedure

ods output SurvivalPlot = SurvivalPlot;
ods output HomTests=HomTests=(test=(where"Log-Rank");
proc lifetest data = adam.adtteeff plots=survival(atrisk=0 to 210 by 30);
   time aval * cnsr(1);
   strata trtpn;
run;
Kaplan-Meier Plot

LIFETEST Procedure

```sas
ods output SurvivalPlot = SurvivalPlot;
ods output HomTests=HomTests=(test=(where"Log-Rank"));
proc lifetest data = adam.adtteeff plots=survival(atrisk=0 to 210 by 30);
   time aval * cnsr(1);
   strata trtpn;
run;
```
ods output SurvivalPlot = SurvivalPlot;
ods output HomTests=HomTests=(test=(where"Log-Rank"));
proc lifetest data = adam.adtteeff plots=survival(atrisk=0 to 210 by 30);
   time aval * cnsr(1);
   strata trtpn;
run;
Kaplan-Meier Plot
LIFETEST Procedure

ods output SurvivalPlot = SurvivalPlot;
ods output HomTests=HomTests=(test=(where"Log-Rank"));
proc lifetest data = adam.adtteeff plots=survival(atrisk=0 to 210 by 30);
  time aval * cnsr(1);
  strata trtpn;
run;
Kaplan-Meier Plot

LIFETEST Procedure

ods output SurvivalPlot = SurvivalPlot;
ods output HomTests=HomTests=(test=(where"Log-Rank"));
proc lifetest data = adam.adtteeff plots=survival(atrisk=0 to 210 by 30);
    time aval * cnsr(1);
    strata trtpn;
run;
Kaplan-Meier Plot

LIFETEST Procedure

```sas
ods output SurvivalPlot = SurvivalPlot;
ods output HomTests=HomTests=(test=(where"Log-Rank"));
proc lifetest data = adam.adtteeff plots=survival(atrisk=0 to 210 by 30);
   time aval * cnsr(1);
   strata trtpn;
run;
```
Graph Template Language

Creating Custom Graphs
Creating Kaplan-Meier Plot

with Median Survival Times and HR table
Creating Kaplan-Meier Plot
with Median Survival Times and HR table

• Use Time-to-event Dataset, for example, ADTTE
• Use PROC LIFETEST to obtain Kaplan Meier survival dataset and median survival times
• Use PROC PHREG to obtain hazard ratios
• Create macro variables that contain the median survival times and hazard ratios
• Use GTL (or SGPLOT) to create the Kaplan-Meier plot
Creating Basic Kaplan-Meier Plot
proc template;
  define statgraph kmtemplate;
  begingraph;
    layout overlay;
      stepplot x = time y = survival;
      discretelegend "Survival";
    endlayout;
  endgraph;
end;
run;
proc template;
  define statgraph kmtemplate;
    begingraph;
      layout overlay;
        stepplot x = time y = survival;
        discretelegend "Survival";
      endlayout;
    endgraph;
  end;
run;
proc template;
    define statgraph kmtemplate;
        begingraph;
            layout overlay;
                stepplot x = time y = survival;
                discretelegend "Survival";
            endlayout;
        endgraph;
    end;
run;
PROC TEMPLATE;
   DEFINE STATGRAPH KMTEMPLATE;
      BEGINGRAPH;
         LAYOUT OVERLAY;
            STEPPLOT X = TIME Y = SURVIVAL;
            DISCRETELEGEND "Survival";
         ENDLAYOUT;
      ENDDOCUMENT;
   END;
RUN;
proc template;
  define statgraph kmtemplate;
    begingraph;
      layout overlay;
        stepplot x = time y = survival;
        discretelegend "Survival";
      endlayout;
    endgraph;
  end;
run;
proc template;
  define statgraph kmtemplate;
    begingraph;
      layout overlay;
        stepplot x = time y = survival;
        discretelegend "Survival";
      endlayout;
    endgraph;
  end;
run;
proc sgrender data = Survivalplot
    template = kmtemplate;
run;
PROC SGRENDER

```sas
proc sgrender data = Survivalplot
    template = kmtemplate;
run;
```
PROC SGRENDER

proc sgrender data = Survivalplot
    template = kmtemplate;
run;
Creating Kaplan-Meier Plot

Step 1

![Kaplan-Meier plot with survival probability against days from randomisation. The plot shows three groups: Placebo, Low Dose, and High Dose, with censored data indicated by + signs. The table below the plot provides the number of subjects for each group at different time points:]

<table>
<thead>
<tr>
<th></th>
<th>Placebo</th>
<th>Low Dose</th>
<th>High Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days 0-30</td>
<td>86</td>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>Days 31-60</td>
<td>24</td>
<td>48</td>
<td>76</td>
</tr>
<tr>
<td>Days 61-90</td>
<td>6</td>
<td>18</td>
<td>34</td>
</tr>
<tr>
<td>Days 91-120</td>
<td>1</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Days 121-150</td>
<td>0</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Days 151-180</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Days 181-210</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Creating Kaplan-Meier Plot

Step 1

![Kaplan-Meier Plot Diagram]
Creating Kaplan-Meier Plot

Step 1

LAYOUT OVERLAY

DISCRETELEGEND

STEPPLOT

SCATTERPLOT
Creating Kaplan-Meier Plot

Step 1

- LAYOUT OVERLAY
- LAYOUT OVERLAY
- AXISTABLE
- DISCRETELEGEND
- STEPPLOT
- SCATTERPLOT
Step 1 – SAS Code

KM Curve

stepplot x = time y = survival / group = stratum name="Survival"
legendlabel="Survival";

scatterplot x=time y=censored / markerattrs=(symbol=plus)
group=stratum;
Step 1 – SAS Code

Censored Legend

```sas
scatterplot x=time y=censored / markerattrs=(symbol=plus color=black) name="Censored";

discretelegend "Censored" / location = inside autoalign = (topright);
```
Step 1 – SAS Code

At-Risk Table

```
layout overlay /
  xaxisopts=(display=none
    linearopts=(tickvaluesequence=(start=0
      end=210 increment=30)))
  border=off;

  axistable value=atrisk x=tatrisk /
    class=stratum colorgroup=stratum;
endlayout;
```
Creating Kaplan-Meier Plot

Step 2

Log-Rank: p-value = <.0001
HR: High Dose vs Placebo = 0.20
HR: Low Dose vs Placebo = 0.36
Creating Kaplan-Meier Plot

Step 2

ENTRY

MVAR

Log-Rank: $p$-value $= <0.0001$

HR: High Dose vs Placebo $= 0.20$

HR: Low Dose vs Placebo $= 0.36$
mvar log_rank_pvalue HazardRatio1 HazardRatio2;

layout gridded / columns=2 rows = 3 border = true
  halign = right valign = to outerpad=(top=25px);
entry halign = right "Log-Rank: "
  textattrs=(style=italic) "p"
  textattrs=(style=normal) "-value = ";
entry halign = left log_rank_pvalue;
<Other Entry Statements>
endlayout;
Step 2 – SAS Code

Summary Statistics Table

```sas
mvar log_rank_pvalue HazardRatio1 HazardRatio2;

layout gridded / columns=2 rows = 3 border = true
    halign = right valign = to outerpad=(top=25px);
entry halign = right "Log-Rank: "
    textattrs=(style=italic) "p"
    textattrs=(style=normal) "-value = ";
entry halign = left log_rank_pvalue;
<Other Entry Statements>
endlayout;
```
Step 2 – SAS Code

Summary Statistics Table

```sas
mvar log_rank_pvalue HazardRatio1 HazardRatio2;

layout gridded / columns=2 rows = 3 border = true
    halign = right valign = to outerpad=(top=25px);
entry halign = right "Log-Rank: "
    textattrs=(style=italic) "p"
    textattrs=(style=normal) "-value = ";
entry halign = left log_rank_pvalue;
<Other Entry Statements>
endlayout;
```
Step 2 – SAS Code

Summary Statistics Table

```sas
mvar log_rank_pvalue HazardRatio1 HazardRatio2;
layout gridded / columns=2 rows = 3 border = true
   halign = right valign = to outerpad=(top=25px);
entry halign = right "Log-Rank: "
   textattrs=(style=italic) "p"
   textattrs=(style=normal) "-value = ";
entry halign = left log_rank_pvalue;
<Other Entry Statements>
endlayout;
```
Step 2 – SAS Code

Summary Statistics Table

mvar log_rank_pvalue HazardRatio1 HazardRatio2;

layout gridded / columns=2 rows = 3 border = true
   halign = right valign = to outerpad=(top=25px);
entry halign = right "Log-Rank: "
   textattrs=(style=italic) "p"
   textattrs=(style=normal) "-value = ";
entry halign = left log_rank_pvalue;
<Other Entry Statements>
endlayout;
Creating Kaplan-Meier Plot

Final Step

Log-Rank: p-value = <.0001
HR: High Dose vs Placebo = 0.20
HR: Low Dose vs Placebo = 0.36
Creating Kaplan-Meier Plot

Final Step

![Kaplan-Meier Plot Diagram]

- Log-Rank: p-value = <.0001
- HR: High Dose vs Placebo = 0.20
- HR: Low Dose vs Placebo = 0.36
Final Step – SAS Code

Median Survival Time

```sas
nmvar MedianSurvival1 MedianSurvival2 MedianSurvival3;
mvar CMedianSurvival1 CMedianSurvival2 CMedianSurvival3;

%do i = 3 %to 1 %by -1;
   dropline y = 0.50 x = MedianSurvival&i /
      dropto = both
      lineattrs=(thickness=1px
                  color=graphdata&i:color
                  pattern=graphdata&i:linestyle)
      label=CMedianSurvival&i;
%end;
```
Final Step – SAS Code

Median Survival Time

```sas
nmvar MedianSurvival1 MedianSurvival2 MedianSurvival3;

mvar CMedianSurvival1 CMedianSurvival2 CMedianSurvival3;

%do i = 3 %to 1 %by -1;
    dropline y = 0.50 x = MedianSurvival&i /
    dropto = both
    lineattrs=(thickness=1px
                color=graphdata&i:color
                pattern=graphdata&i:linestyle)
    label=CMedianSurvival&i;
%end;
```
Final Step – SAS Code

Median Survival Time

```
nmvar MedianSurvival1 MedianSurvival2 MedianSurvival3;
mvar CMedianSurvival1 CMedianSurvival2 CMedianSurvival3;

%do i = 3 %to 1 %by -1;
   dropline y = 0.50 x = MedianSurvival&i / dropto = both
   lineattrs=(thickness=1px color=graphdata&i:color pattern=graphdata&i:linestyle)
   label=CMedianSurvival&i;
%end;
```
Final Step – SAS Code

Median Survival Time

```sas
nmvar MedianSurvival1 MedianSurvival2 MedianSurvival3;
mvar CMedianSurvival1 CMedianSurvival2 CMedianSurvival3;

%do i = 3 %to 1 %by -1;
    dropline y = 0.50 x = MedianSurvival&i /
        dropto = both
        lineattrs=(thickness=1px
                    color=graphdata&i:color
                    pattern=graphdata&i:linestyle)
        label=CMedianSurvival&i;
%end;
```
Final Step – SAS Code

Median Survival Time

```
nmvar MedianSurvival1 MedianSurvival2 MedianSurvival3;
mvar CMedianSurvival1 CMedianSurvival2 CMedianSurvival3;

%do i = 3 %to 1 %by -1;

dropline y = 0.50 x = MedianSurvival%i /
   dropto = both
   lineattrs=(thickness=1px
               color=graphdata%i:color
               pattern=graphdata%i:linestyle)
   label=CMedianSurvival%i;
%end;
```
Final Step – SAS Code

Median Survival Time

```
\texttt{nmvar MedianSurvival1 MedianSurvival2 MedianSurvival3;}
\texttt{mvar CMedianSurvival1 CMedianSurvival2 CMedianSurvival3;}

\%do i = 3 \%to 1 \%by -1;
\hspace{1cm} \texttt{dropline y = 0.50 x = MedianSurvival\&i /}
\hspace{2cm} \texttt{dropto = both}
\hspace{2cm} \texttt{lineattrs=(thickness=1px}
\hspace{3.5cm} \texttt{color=graphdata\&i:color}
\hspace{4.5cm} \texttt{pattern=graphdata\&i:linestyle)}
\hspace{6.5cm} \texttt{label=CMedianSurvival\&i;}
\%end;
```
Conclusion
Conclusion

• SG procedures are great for creating standard graphs

• Each plot statement within SG procedures have options that allow you to control the appearance of the graph

• Data from a procedure can be saved in ODS output object to be used

• Creating a custom template and associating with the necessary data allows you to create custom graphs
Questions?
Contact Information

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https://twitter.com/krissharris
For More Information on Graphs
Explore Helpful Resources

Ask the Expert
View other user webinars that provide insights into using SAS products to make your job easier.

FREE Training
Learn from home – free for 30 days. Get software labs to practice and online support if needed.

SAS Support Communities
Ask questions, get answers and share insights with SAS users.

SAS Analytics Explorers
An exclusive platform to collaborate, learn and share your expertise. Gain access to a diverse network to advance your career. Special rewards and recognition exclusively for SAS users.

SAS Users YouTube Channel
A plethora of videos on hundreds of topics, just for SAS users.

Newsletters
Get the latest SAS news plus tips, tricks and more.

Users Groups
Meet local SAS users, network and exchange ideas – virtually.

SAS Profile
If you haven’t already done so, create your SAS Profile to access free training, SAS Support Communities, technical support, software downloads, newsletters and more.
Tip Sheets

**SAS 9.3 and 9.4 Procedures Tip Sheet**
Tip sheet to help you get started on many of the features included in SG Procedures.

**ODS Graphics Tip Sheet**
Tip sheet on commonly used ODS Graphics elements.

**Graph Style Tip Sheet**