Clinical Graphs using SAS® 9.3
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In their 2008 paper “Graphical Approaches to the Analysis of Safety Data from Clinical Trials”, Ohad Amit, et al. have provided valuable insight into and recommendations for the analysis of safety data.

The authors see several opportunities to enhance the evaluation of safety through use of graphical display of data including Dot Plots, Box Plots, Lattice and Matrix Displays. Graphical display of data provides insights into trends and correlations that are just not visible in the tabular data. Often, combining the data and summary statistics on a single display helps improve the analysis and interpretation of the results.

In this handout, we show how you can use the SAS 9.3 SG Procedures and GTL to create clinical graphs by using features such as cluster groups, grouped box plots on discrete and interval axis and attribute maps. Annotation is supported with the SG Procedures, making it easier to create these graphs.

A GTL program may be required to create some of the multi-cell graphs. The data for the graphs shown here is simulated. Some graphs included in this handout have been contributed by Susan Schwartz and Melisa Turner.

The examples shown here include display of Lab Result over Time, Distribution of lab values by Test and Treatment, Lattice and Matrix displays of LFT tests, Patient Profiles, Adverse Event Plots sorted by relative risk and Hazard Function Plots.

The code shown below each graph is reduced to fit the available space. The intention is to show the structure and key statements. The complete programs are available on the support.sas web site. Go to http://support.sas.com/rnd/datavisualization/yourGraphs/analyticalCustom/clinical/ web page and click on the link marked “Clinical Graphs” under “Highly Customized” Analytical Graphs.
Distribution of Maximum Liver Function Test Values by Treatment

For ALT, AST, and ALKP, the Clinical Concern Level is 2 U/L; for BILTOT, the CCL is 1.5 U/L, where ULN is the Upper Level of Normal Range.

Median of Lipid Profile by Visit and Treatment

title 'Median of Lipid Profile by Visit and Treatment';
proc sgplot data=lipid_grp;
scatter x=day y=median / yerrorlower=lcl yerrorupper=ucl group=trt groupdisplay=cluster clusterwidth=0.5 markerattrs=(symbol=circlefilled);
series x=day y=median / group=trt groupdisplay=cluster clusterwidth=0.5 linetype=(thickness=2) name='s';
yaxis label='Median with 95% CL' grid;
xaxis display=(nolabel);
keylegend 's' / title='Treatment' location=inside position=topright across=1;
run;

Hazard Function for Adverse Events of Special Interest

title "Adverse Events for Patient Id = xx-xxx-xxxx";
proc sgplot data=ae2 nocycleattrs dattrmap=attrmap;
highlow y=aeseq low=stday high=enday / group=aesev lowlabel=aedecod type=bar
barwidth=0.8 lineattrs=(color=black) lowcap=lcap highcap=hcap attrid=Severity name='sev';
scatter x=aestdate y=aeseq / markerattrs=(size=0) x2axis;
refline 0 / axis=x lineattrs=(thickness=1 color=black);
yaxis display=(nolabel noticks novalues) type=discrete;
xaxis grid label='Study Days' values=(&minda to &maxday by 2);
x2axis notimesplit values=(&mindate to &maxdate);
keylegend 'sev' / title='Severity' ;
run;
begingraph / <options>;
entrytitle 'Immunology Profile by Treatment';
layout gridded;
layout datalattice columnvar=trt rowvar=lbparm / <options>;
layout prototype;
blockplot x=xval block=cyc / <options>;
seriesplot x=xval y=sival / group=pt name='a' <options>;
endlayout;
discretelegend 'a' / title = 'Patient' across=8;
endlayout;
endgraph;

begingraph / <options>;
entrytitle 'Depression After Treatment by Visit and Treatment';
proc sgpanel data=depression;
panelby phase / layout=columnlattice onepanel novarname uniscale=row spacing=2;
vbox score / category=visit group=trt clusterwidth=0.75 boxwidth=0.9 transparency=0.3 lineattrs=(color=black) whiskerattrs=(color=black);
colaxis display=(nolabel);
rowaxis grid;
run;

begingraph / <options>;
entrytitle 'Depression After Treatment by Visit and Treatment';
proc sgsplot data=depression;
panelby phase / layout=columnlattice onepanel novarname uniscale=row spacing=2;
vbox score / category=visit group=trt clusterwidth=0.75 boxwidth=0.9 transparency=0.3 lineattrs=(color=black) whiskerattrs=(color=black);
colaxis display=(nolabel);
rowaxis grid;
run;

begingraph / <options>;
entrytitle 'Immunology Profile by Treatment';
layout gridded;
layout datalattice columnvar=trt rowvar=lbparm / <options>;
layout prototype;
blockplot x=xval block=cyc / <options>;
seriesplot x=xval y=sival / group=pt name='a' <options>;
endlayout;
discretelegend 'a' / title = 'Patient' across=8;
endlayout;
endgraph;

proc sgsplot data=depression;
panelby phase / layout=columnlattice onepanel novarname uniscale=row spacing=2;
vbox score / category=visit group=trt clusterwidth=0.75 boxwidth=0.9 transparency=0.3 lineattrs=(color=black) whiskerattrs=(color=black);
colaxis display=(nolabel);
rowaxis grid;
run;

proc sgplot data=depression;
panelby phase / layout=columnlattice onepanel novarname uniscale=row spacing=2;
vbox score / category=visit group=trt clusterwidth=0.75 boxwidth=0.9 transparency=0.3 lineattrs=(color=black) whiskerattrs=(color=black);
colaxis display=(nolabel);
rowaxis grid;
run;

title 'Depression After Treatment by Visit and Treatment';
proc sgsplot data=depression;
panelby phase / layout=columnlattice onepanel novarname uniscale=row spacing=2;
vbox score / category=visit group=trt clusterwidth=0.75 boxwidth=0.9 transparency=0.3 lineattrs=(color=black) whiskerattrs=(color=black);
colaxis display=(nolabel);
rowaxis grid;
run;

title 'Depression After Treatment by Visit and Treatment';
proc sgsplot data=depression;
panelby phase / layout=columnlattice onepanel novarname uniscale=row spacing=2;
vbox score / category=visit group=trt clusterwidth=0.75 boxwidth=0.9 transparency=0.3 lineattrs=(color=black) whiskerattrs=(color=black);
colaxis display=(nolabel);
rowaxis grid;
run;

title 'Top Twenty Adverse Events Sorted by Frequency';
proc sgsplot data=aerev;
refline / lineattrs=graphdata1(thickness=16) transparency=0.8;
scatter y=aedecod x=percent / group=arm name='scatter';
keylegend / location=inside position=bottomright across=1;
xaxis display=(nolabel);
yaxis display=(nolabel) offsetmin=0.03 offsetmax=0.03;
run;