Paper SAS3020-2016

A Prompted Application to Easily Create Forest Plots with Inner Margin Tables SAS® Global Forum 2016

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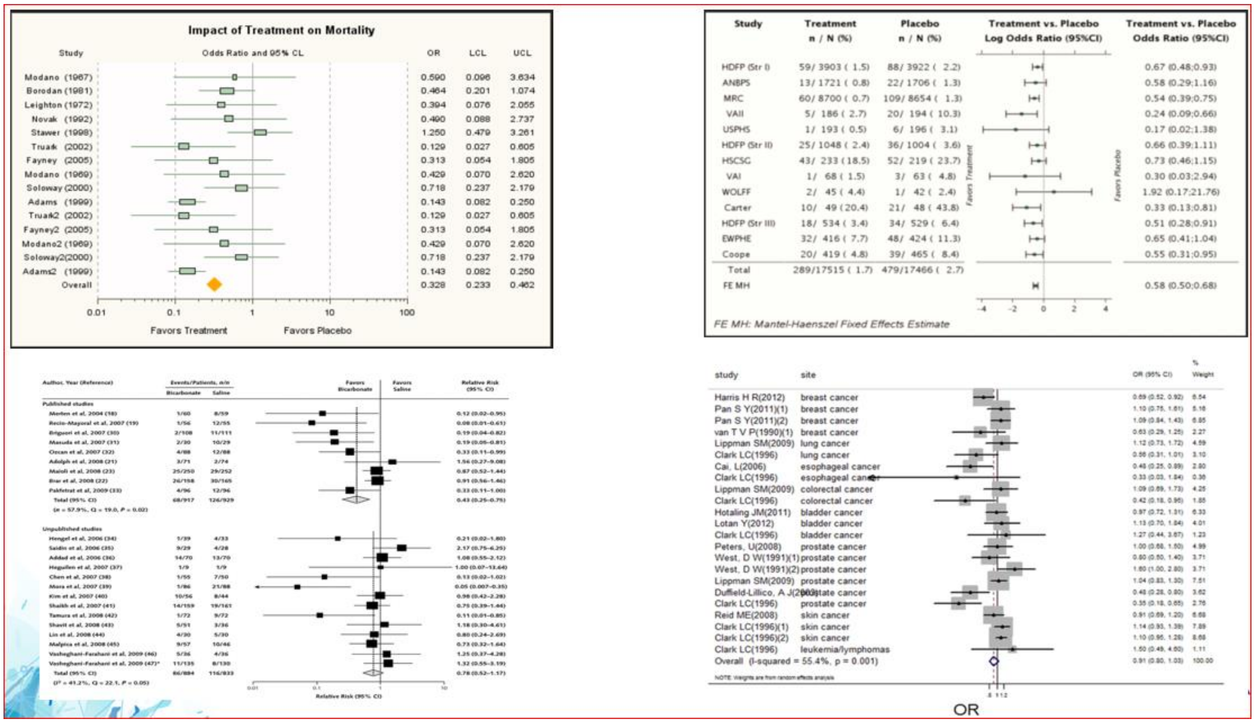
ABSTRACT

Two of the powerful features of ODS Graphics is the ability to create Forest Plots and add Inner-Margin tables to graphics output. The drawback, however, is the syntax required from proc template is complex and tedious. A prompted application or even a parameterized stored process that connects proc template code to a point and click application would make the task of generating the fore-mentioned output much easier.

INTRODUCTION

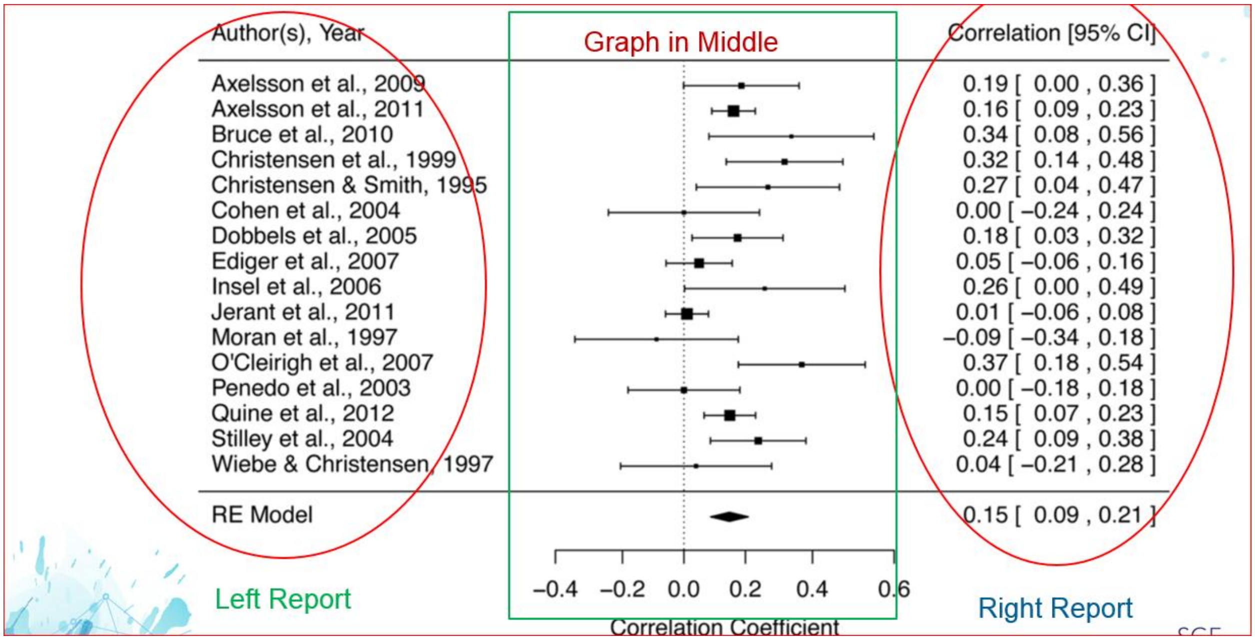
The graphic output featured is designed to compare favorable verses non-favorable results across treatments--remedies used in various kind of health care studies. The output is typically augmented with study information and statistics the left and to the right of the graphic output.

EXAMPLES OF FOREST PLOTS FROM GOOGLE



GENERAL FORM OF FOREST PLOTS

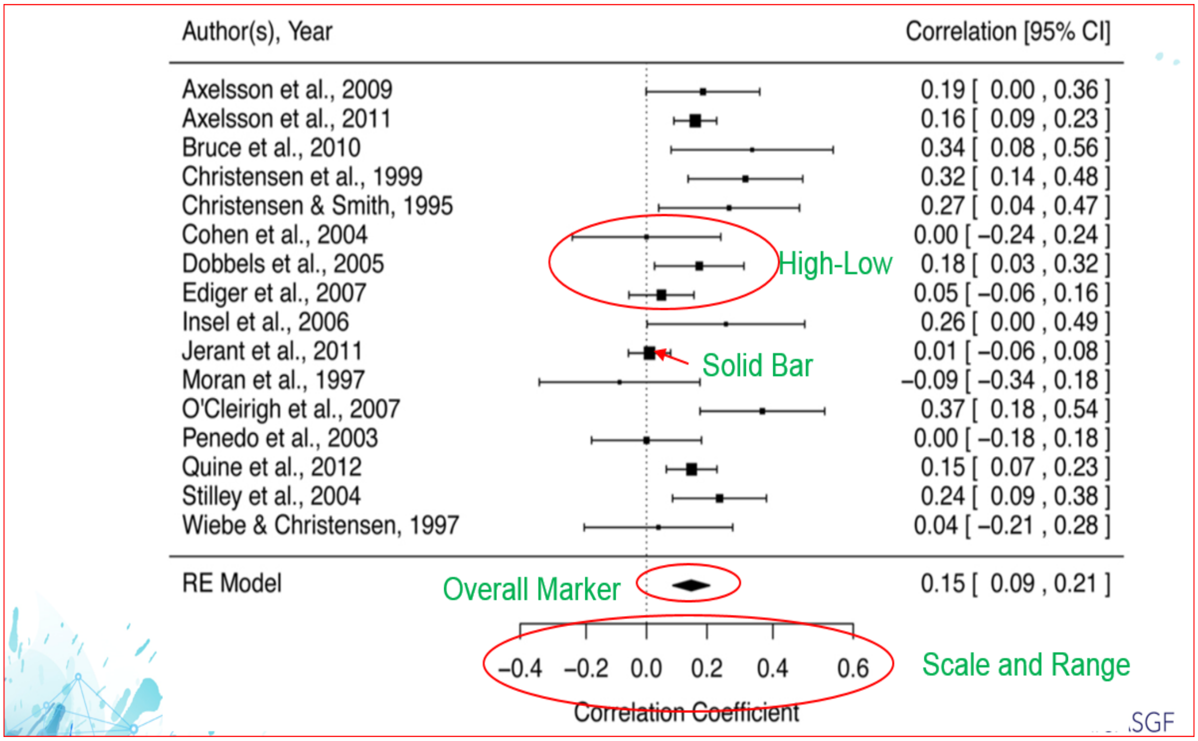
Figure 2



Forest Plots can vary greatly in terms of information and statistics displayed in the Left and Right Report. The graph in the middle is typically of constant form.

GRAPHIC OUTPUT FORM.

Figure 3.



The graphic output in the middle of the Forest Plots consists of two over-laid high-low plots with a logarithmic axis that frequently varies in overall minimum and maximum scale. The overall marker must be calculated from the statistics of the individual weighted studies, and the size of the overall marker will vary based off the range between the overall lower and higher odds-ratio calculated.

APPLICATION REQUIREMENTS

- SAS ®Version 9.4
- Base SAS® (ODS Graphics)
- Enterprise Guide version 6.1 or above.
- Business Analytics Environment.
- Office Analytics Add-in for Microsoft Office

KNOWLEDGE REQUIREMENTS

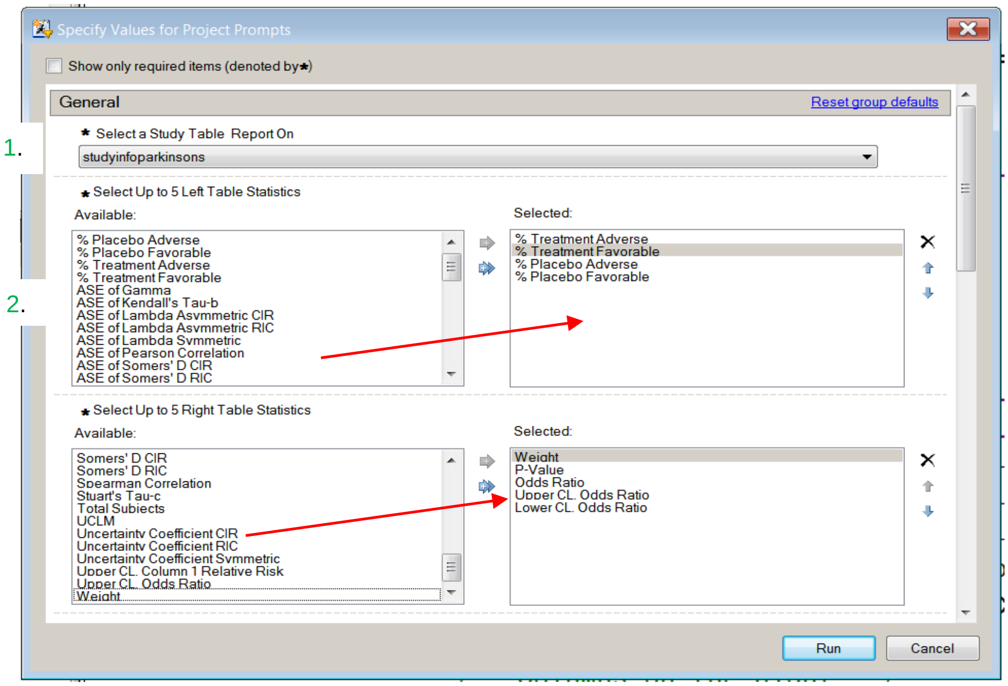
- ODS Graphics syntax SAS® Version9.4
- Data Step Code
- Proc Freq to calculate ODDs Ratio Statistics
- Macro Language concepts
- Creating Prompts in Enterprise Guide
- Generating and Using Stored Processes

FEATURES OF THE APPLICATION

- Select the data set to analyze
- Automatic resizing of output as number of studies in graph varies.
- Pick and choose statistics
- Control the Order of Statistics
- Apply Custom colors to each field
- Add Custom Titles and Footnotes
- Reposition text and markers
- Automatically Surface results in Microsoft Word

DEMO OF THE APPLICATION: SCREEN 1

Figure 4.



Specify Values for Project Prompts

□ Show only required items (denoted by★)

General — Reset group defaults

1. ★ Select a Study Table Report On

studyinfoparkinsons

2. ★ Select Up to 5 Left Table Statistics

Available:

% Placebo Adverse
% Placebo Favorable
% Treatment Adverse
% Treatment Favorable
ASE of Gamma
ASE of Kendall's Tau-b
ASE of Lambda Asymmetric CIR
ASE of Lambda Asymmetric RIC
ASE of Lambda Symmetric
ASE of Pearson Correlation
ASE of Somers' D CIR
ASE of Somers' D RIC

Selected:

% Treatment Adverse
% Treatment Favorable
% Placebo Adverse
% Placebo Favorable

★ Select Up to 5 Right Table Statistics

Available:

Somers' D CIR
Somers' D RIC
Spearman Correlation
Stuart's Tau-c
Total Subjects
UCLM
Uncertainty Coefficient CIR
Uncertainty Coefficient RIC
Uncertainty Coefficient Symmetric
Upper CL Column 1 Relative Risk
Upper CL Odds Ratio
Weight

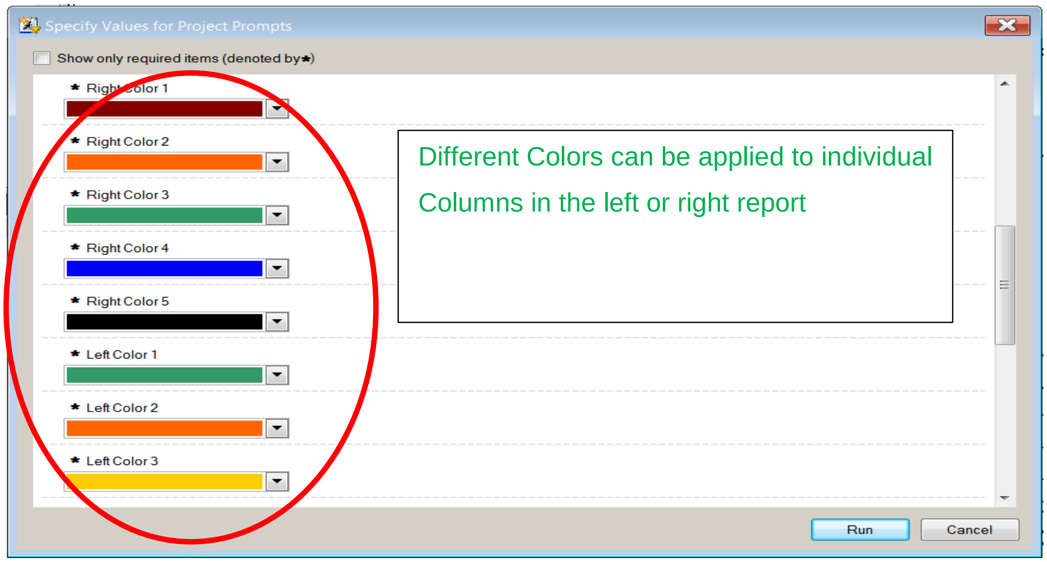
Selected:

Weight
P-Value
Odds Ratio
Upper CL Odds Ratio
Lower CL Odds Ratio

As the Stored Process opens the user 1.) Selects the study data set. 2.) Moves the statistics to include in the report from the left Available window to the right Selected 3.) Include the Statistics for the right report. The overall left to right order of statistical information can be modified with the up and down arrows at the right of the selected window.

DEMO OF THE APPLICATION: SCREEN 2

Figure 5



Specify Values for Project Prompts

□ Show only required items (denoted by★)

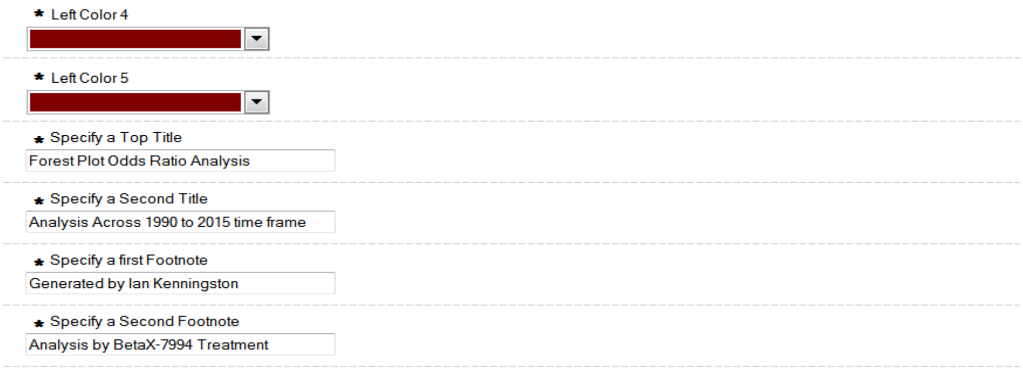
★ Right Color 1
★ Right Color 2
★ Right Color 3
★ Right Color 4
★ Right Color 5
★ Left Color 1
★ Left Color 2
★ Left Color 3

Different Colors can be applied to individual Columns in the left or right report

The color drop-downs shown in Figure 5 represent the individual colors which can be applied to any of the columns in the left or the right report.

DEMO OF THE APPLICATION: SCREEN 3

Figure 6.



* Left Color 4
🟥 ▼

* Left Color 5
🟥 ▼

* Specify a Top Title
Forest Plot Odds Ratio Analysis

* Specify a Second Title
Analysis Across 1990 to 2015 time frame

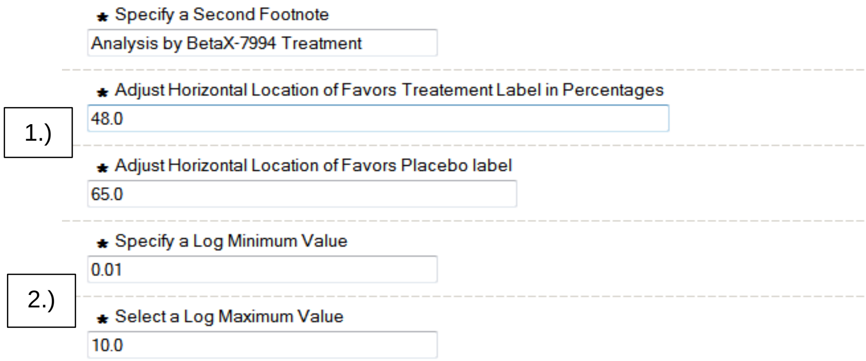
* Specify a first Footnote
Generated by Ian Kenningston

* Specify a Second Footnote
Analysis by BetaX-7994 Treatment

Up to two Titles and Footnotes can be added to the graphic output from the application. The size of the second title will be slightly smaller than the first.

DEMO OF THE APPLICATION: SCREEN 4

Figure 7.



* Specify a Second Footnote
Analysis by BetaX-7994 Treatment

1.)

* Adjust Horizontal Location of Favors Treatement Label in Percentages
48.0

* Adjust Horizontal Location of Favors Placebo label
65.0

2.)

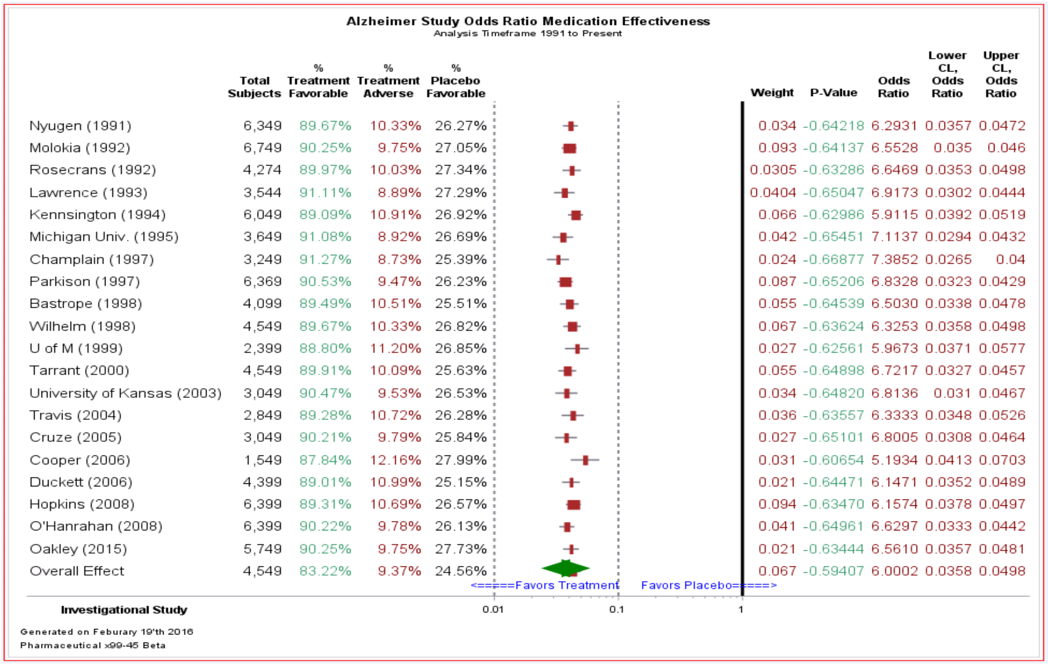
* Specify a Log Minimum Value
0.01

* Select a Log Maximum Value
10.0

Often as the number of studies in the overall analysis increases and decreases the horizontal location of the “Favor Treatment” and “Favors Placebo” will have to be adjusted. Often the overall logarithmic scale and range will change from one Forest Plot to another. The smaller the axis scale the wider the high-low plots on the graph will get.

FINAL RESULT

Figure 8.



Alzheimer Study Odds Ratio Medication Effectiveness
Analysis Timeframe 1991 to Present

	Total Subjects	% Treatment Favorable	% Treatment Adverse	% Placebo Favorable	Weight	P-Value	Odds Ratio	Lower CL, Odds Ratio	Upper CL, Odds Ratio
Nyugen (1991)	6,349	89.67%	10.33%	26.27%	0.034	-0.64218	6.2931	0.0357	0.0472
Molokia (1992)	6,749	90.25%	9.75%	27.05%	0.093	-0.64137	6.5528	0.035	0.046
Rosecrans (1992)	4,274	89.97%	10.03%	27.34%	0.0305	-0.63286	6.6469	0.0353	0.0498
Lawrence (1993)	3,544	91.11%	8.89%	27.29%	0.0404	-0.65047	6.9173	0.0302	0.0444
Kennsington (1994)	6,049	89.09%	10.91%	26.92%	0.066	-0.62986	5.9115	0.0392	0.0519
Michigan Univ. (1995)	3,649	91.08%	8.92%	26.69%	0.042	-0.65451	7.1137	0.0294	0.0432
Champlain (1997)	3,249	91.27%	8.73%	25.39%	0.024	-0.66877	7.3852	0.0265	0.04
Parkison (1997)	6,369	90.53%	9.47%	26.23%	0.087	-0.65206	6.8328	0.0323	0.0429
Bastrope (1998)	4,099	89.49%	10.51%	25.51%	0.055	-0.64539	6.5030	0.0338	0.0478
Wilhelm (1998)	4,549	89.67%	10.33%	26.82%	0.067	-0.63624	6.3253	0.0358	0.0498
U of M (1999)	2,399	88.80%	11.20%	26.85%	0.027	-0.62561	5.9673	0.0371	0.0577
Tarrant (2000)	4,549	89.91%	10.09%	25.63%	0.055	-0.64898	6.7217	0.0327	0.0457
University of Kansas (2003)	3,049	90.47%	9.53%	26.53%	0.034	-0.64820	6.8136	0.031	0.0467
Travis (2004)	2,849	89.28%	10.72%	26.28%	0.036	-0.63557	6.3333	0.0348	0.0526
Cruze (2005)	3,049	90.21%	9.79%	25.84%	0.027	-0.65101	6.8005	0.0308	0.0464
Cooper (2006)	1,549	87.84%	12.16%	27.99%	0.031	-0.60654	5.1934	0.0413	0.0703
Duckett (2006)	4,399	89.01%	10.99%	25.15%	0.021	-0.64471	6.1471	0.0352	0.0489
Hopkins (2008)	6,399	89.31%	10.69%	26.57%	0.094	-0.63470	6.1574	0.0378	0.0497
O'Hanrahan (2008)	6,399	90.22%	9.78%	26.13%	0.041	-0.64961	6.6297	0.0333	0.0442
Oakley (2015)	5,749	90.25%	9.75%	27.73%	0.021	-0.63444	6.5610	0.0357	0.0481
Overall Effect	4,549	83.22%	9.37%	24.56%	0.067	-0.59407	6.0002	0.0358	0.0498

Generated on Feburary 19'th 2016
Pharmaceutical x99-45 Beta

Forest Plot for Alzheimer Study is displayed.

GENERAL APPROACH USED TO DEVELOP APPLICATION

- Stabilize Graphic Model.
- Calculate ODDs Ratio Statistics with Proc Freq
- Program works with hardcoded values.
- Generalize solution with macro references.
- Create Macro Sub-routine
- Add decision logic and iterative code.
- Create Prompts in Enterprise Guide
- Connect Prompts to SAS Program
- Convert overall routine into a Stored Process
- Surface results across BA Tools

ORIGINAL HARDCODED PROC TEMPLATE SYNTAX

Figure 9.

```
proc template;
      define statgraph Forest_three;
             dynamic STUDY N Combo weight pertry
                    pertrn perplY perplN trY plY trN plN
                    _PCORR_  U_RROR L_RROR X_High x_Low _RRC2_ L_RRC2
                    U_RRC2;
             mvar obsid group subgroup lstats rstats;
             begingraph / designheight=1000 designwidth=1400;
                    entrytitle "Impact of Treatment on Mortality by Study";
                    entrytitle textattrs=(size=8) 'Odds Ratio and 95% CL';
                    layout lattice / columns=1 /*columnweights=(0.35 0.30
                 0.32);
                    layout overlay / walldisplay=none
                                   xaxisopts=(label=' <---Favor Treatment---- ----
                            Favor Plecebo--->'
                                   display=(ticks tickvalues line)
                                   type=log logopts=(viewmin=0.01 viewmax=100
                            MinorTicks=true))
                                   y2axisopts=(labelFitPolicy=Split offsetmin=.05
                            offsetmax=.05)
                                   yaxisopts=(display=none labelFitPolicy=Split
                            type=discrete
                                   reverse=true offsetmin=.;
/* Left Table Statistics  */
innermargin / align=left opaque=false  /* pad=(top=2px bottom=2px)*/;
   axistable y='study'n value='study'n / display=(label) labelposition=max
      labelattrs=(size=10pt weight=bold) valueattrs=(size=12pt);
   axistable y='study'n value='try'n / display=(label) labelposition=max
      labelattrs=(size=10pt weight=bold) valueattrs=(size=12pt);
   axistable y='study'n value='trn'n / display=(label) labelposition=max
      labelattrs=(size=10pt weight=bold ) valueattrs=(size=12pt);
   axistable y='study'n value='pertry'n / display=(label) labelposition=max
      labelattrs=(size=10pt weight=bold ) valueattrs=(size=12pt);
   axistable y='study'n value='pertrn'n / display=(label) labelposition=max
      labelattrs=(size=10pt weight=bold);
endinnermargin;


/*--Graph in the middle--*/
HighLowPlot Y='study'n High='U_RROR'n Low='L_RROR'n / primary=true Lineattrs=( Color=CX83838C
thickness=2px) LegendLabel="study" NAME="HIGHLOW";
HighLowPlot Y='study'n High='x_high'n Low='x_low'n / type=bar barwidth=.4 Display=( Fill )
FillAttrs=(Color=CXA52A2A) LegendLabel="study" NAME="HIGHLOW1";

/*Reference Lines  */
ReferenceLine x=0.10 / clip=true Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);
ReferenceLine x=0.01 / clip=true Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);
ReferenceLine x=1 / Lineattrs=( Color=black Pattern=1 Thickness=3px);
ReferenceLine x=10 / Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);
ReferenceLine x=100 / Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);

/*--Columns on the Right--*/
innermargin / align=right opaque=false /*pad=(top=2px bottom=2px)*/;
   axistable y='study'n value='WEIGHT'n / display=(label)
          labelposition=max labelattrs=(size=10pt weight=bold)
          valueattrs=(size=12pt);
   axistable y='study'n value='_PCORR_'n / display=(label)
          labelposition=max labelattrs=(size=10pt weight=bold)
          valueattrs=(size=12pt);
```

The original graphic syntax required from Proc template and sgrender is lengthy, layered and tedious to make individual edits to. As an application like this is developed, one has to make sure that the graphic model is stable and creates the basic graphic output required. The hardcoded solution will be connected to the prompted application, and automated thru use of the SAS Macro Language.

PROC FREQ CODE GENERATED BY ENTERPRISE GUIDE

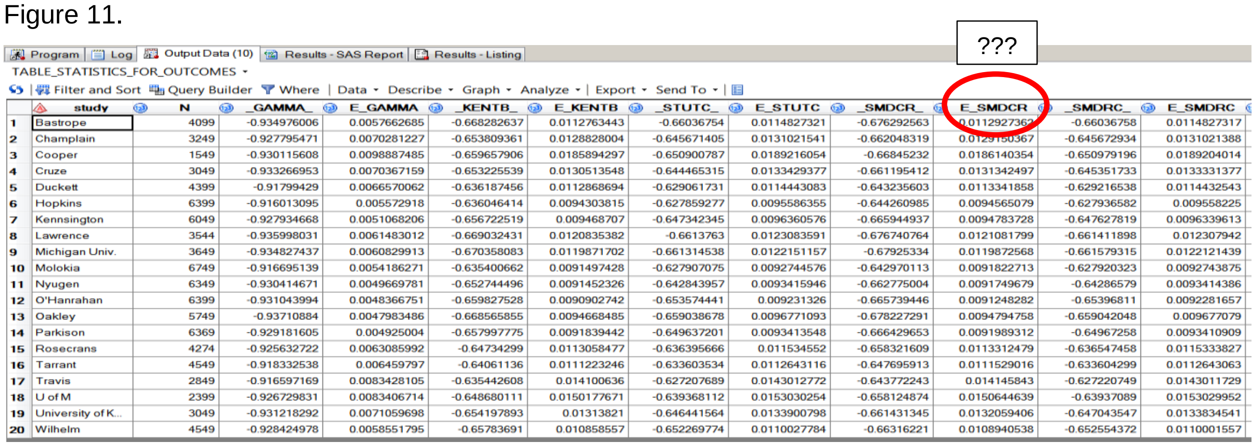
Fig 10.

```
PROC FREQ DATA = WORK.Studydata1
        ORDER=INTERNAL
  ;
        BY study;
        TABLES outcome * type /
              NOROW
              NOCOL
              NOPERCENT
              NOCUM
              MEASURES
              SCORES=TABLE
              ALPHA=0.05   OUT=WORK.Cell_statistics_for_outcome
  ;
        OUTPUT       MEASURES
              OUT=WORK.Table_statistics_for_outcomes
           ;
  run;
```

The above proc freq syntax is needed to calculate Odds Ratio’s. The code above in Fig 10. Was originally generated by the One-Way frequencies task in Enterprise Guide. Most importantly the “Measures option” had to be selected.

OUTPUT TABLE CREATED BY PROC FREQ (WHAT HAS BEEN GENERATED??)

Figure 11.

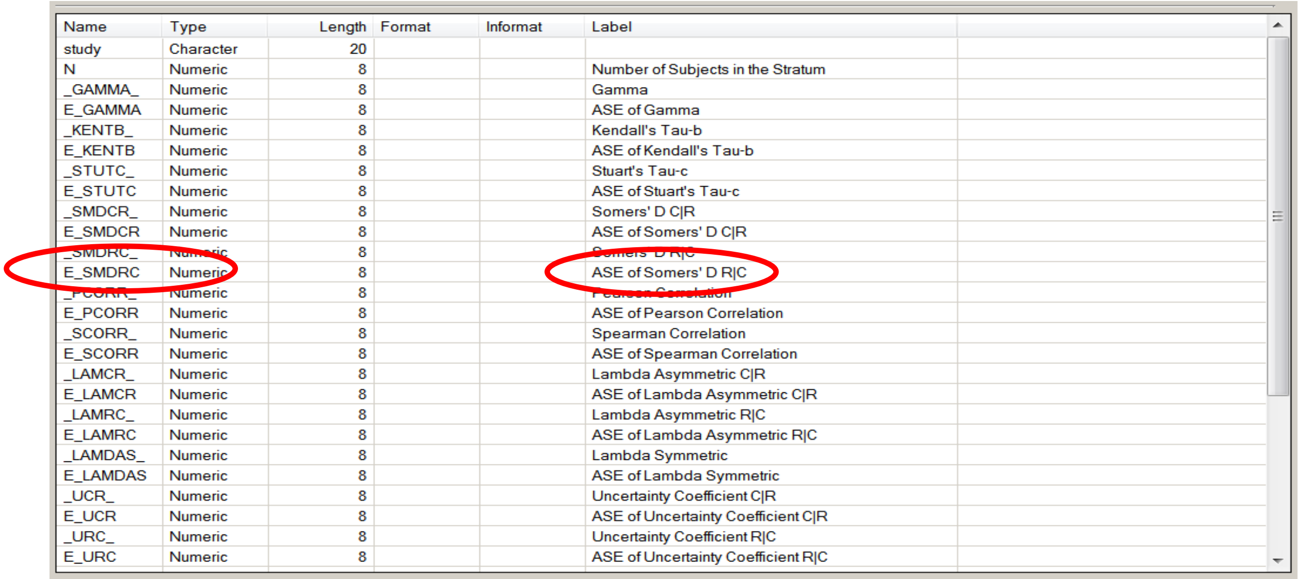


	study	N	_GAMMA_	E_GAMMA	_KENTB_	E_KENTB	_STUTC_	E_STUTC	_SMDCR_	E_SMDCR	_SMDRC_	E_SMDRC
1	Bastrope	4099	-0.934976006	0.0057662685	-0.668282637	0.0112763443	-0.66036754	0.0114827321	-0.676292563	0.0112927362	-0.66036758	0.0114827317
2	Champlain	3249	-0.927795471	0.0070281227	-0.653809361	0.0128828004	-0.645671405	0.0131021541	-0.662048319	0.0129150367	-0.645672934	0.0131021388
3	Cooper	1549	-0.930115608	0.0098887485	-0.659657906	0.0185894297	-0.650900787	0.0189216054	-0.66845232	0.0186140354	-0.650979196	0.0189204014
4	Cruze	3049	-0.933266953	0.0070367159	-0.653225539	0.0130513548	-0.644465315	0.0133429377	-0.661195412	0.0131342497	-0.645351733	0.0133331377
5	Duckett	4399	-0.91799429	0.0066570062	-0.636187456	0.0112868694	-0.629061731	0.0114443083	-0.643235603	0.0113341858	-0.629216538	0.0114432543
6	Hopkins	6399	-0.916013095	0.005572918	-0.636046414	0.0094303815	-0.627859277	0.0095586355	-0.644260985	0.0094565079	-0.627936582	0.009558225
7	Kennsington	6049	-0.927934668	0.0051068206	-0.656722519	0.009468707	-0.647342345	0.0096360576	-0.665944937	0.0094783728	-0.647627819	0.0096339613
8	Lawrence	3544	-0.935998031	0.0061483012	-0.669032431	0.0120835382	-0.6613763	0.0123083591	-0.676740764	0.0121081799	-0.661411898	0.012307942
9	Michigan Univ.	3649	-0.934827437	0.0060829913	-0.670358083	0.0119871702	-0.661314538	0.0122151157	-0.67925334	0.0119872568	-0.661579315	0.0122121439
10	Molokia	6749	-0.916695139	0.0054186271	-0.635400662	0.0091497428	-0.627907075	0.0092744576	-0.642970113	0.0091822713	-0.627920323	0.0092743875
11	Nyugen	6349	-0.930414671	0.0049669781	-0.652744496	0.0091452326	-0.642843957	0.0093415946	-0.662775004	0.0091749679	-0.64286579	0.0093414386
12	O'Hanrahan	6399	-0.931043994	0.0048366751	-0.659827528	0.0090902742	-0.653574441	0.009231326	-0.665739446	0.0091248282	-0.65396811	0.0092281657
13	Oakley	5749	-0.93710884	0.0047983486	-0.668565855	0.0094668485	-0.659038678	0.0096771093	-0.678227291	0.0094794758	-0.659042048	0.009677079
14	Parkison	6369	-0.929181605	0.004925004	-0.657997775	0.0091839442	-0.649637201	0.0093413548	-0.666429653	0.0091989312	-0.64967258	0.0093410909
15	Rosecrans	4274	-0.925632722	0.0063085992	-0.64734299	0.0113058477	-0.636395666	0.011534552	-0.658321609	0.0113312479	-0.636547458	0.0115333827
16	Tarrant	4549	-0.918332538	0.006459797	-0.64061136	0.0111223246	-0.633603534	0.0112643116	-0.647695913	0.0111529016	-0.633604299	0.0112643063
17	Travis	2849	-0.916597169	0.0083428105	-0.635442608	0.014100636	-0.627207689	0.0143012772	-0.643772243	0.014145843	-0.627220749	0.0143011729
18	U of M	2399	-0.926729831	0.0083406714	-0.648680111	0.0150177671	-0.639368112	0.0153030254	-0.658124874	0.0150644639	-0.63937089	0.0153029952
19	University of K...	3049	-0.931218292	0.0071059698	-0.654197893	0.01313821	-0.646441564	0.0133900798	-0.661431345	0.0132059406	-0.647043547	0.0133834541
20	Wilhelm	4549	-0.928424978	0.0058551795	-0.65783691	0.010858557	-0.652269774	0.0110027784	-0.66316221	0.0108940538	-0.652554372	0.0110001557

This output measures table was created by proc freq. The biggest challenge was determining what each of the cryptic field names meant and which one were required or might be optionally included in a Forest Plot.

FINDING A DESCRIPTION OF THE STATISTICS CALCULATED

Figure 12.

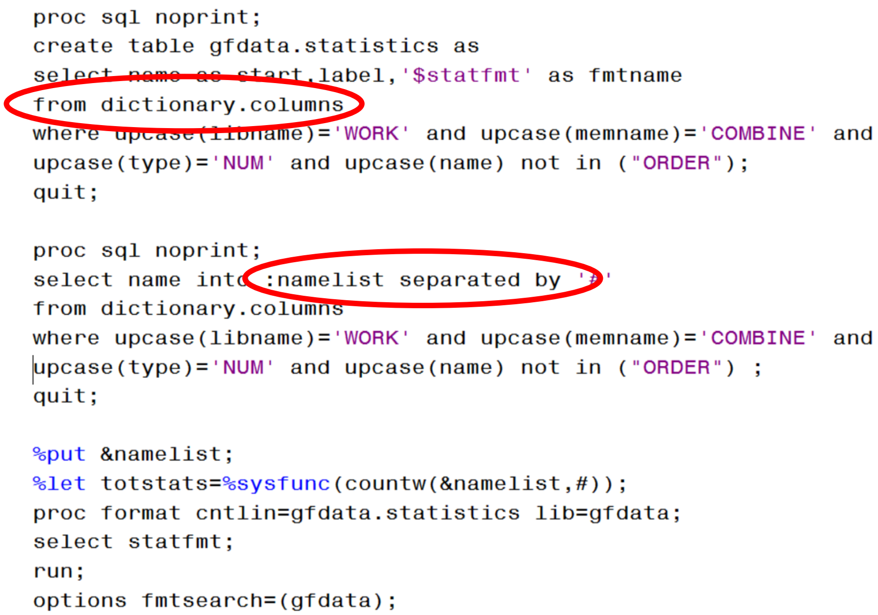


Name	Type	Length	Format	Informat	Label
study	Character	20			
N	Numeric	8			Number of Subjects in the Stratum
GAMMA	Numeric	8			Gamma
E_GAMMA	Numeric	8			ASE of Gamma
KENTB	Numeric	8			Kendall's Tau-b
E_KENTB	Numeric	8			ASE of Kendall's Tau-b
STUTC	Numeric	8			Stuart's Tau-c
E_STUTC	Numeric	8			ASE of Stuart's Tau-c
SMDCR	Numeric	8			Somers' D C|R
E_SMDCR	Numeric	8			ASE of Somers' D C|R
SMDRC	Numeric	8			Somers' D R|C
E_SMDRC	Numeric	8			ASE of Somers' D R|C
PCORR	Numeric	8			Pearson Correlation
E_PCORR	Numeric	8			ASE of Pearson Correlation
SCORR	Numeric	8			Spearman Correlation
E_SCORR	Numeric	8			ASE of Spearman Correlation
LAMCR	Numeric	8			Lambda Asymmetric C|R
E_LAMCR	Numeric	8			ASE of Lambda Asymmetric C|R
LAMRC	Numeric	8			Lambda Asymmetric R|C
E_LAMRC	Numeric	8			ASE of Lambda Asymmetric R|C
LAMDAS	Numeric	8			Lambda Symmetric
E_LAMDAS	Numeric	8			ASE of Lambda Symmetric
UCR	Numeric	8			Uncertainty Coefficient C|R
E_UCR	Numeric	8			ASE of Uncertainty Coefficient C|R
URC	Numeric	8			Uncertainty Coefficient R|C
E_URC	Numeric	8			ASE of Uncertainty Coefficient R|C

Looking at the column properties of the output table created by proc freq, a label or description appears which is very helpful in determining what is needed by the Forest Plot. Wouldn't it be nice if these labels could automatically be loaded into the point and click application and selected as the reference to the columns to include in the left and right report.

CONVERTING FIELD NAMES INTO MACRO VARIABLE AND LIST OF VALUES IN PROMPTED APPLICATION

Figure 13.

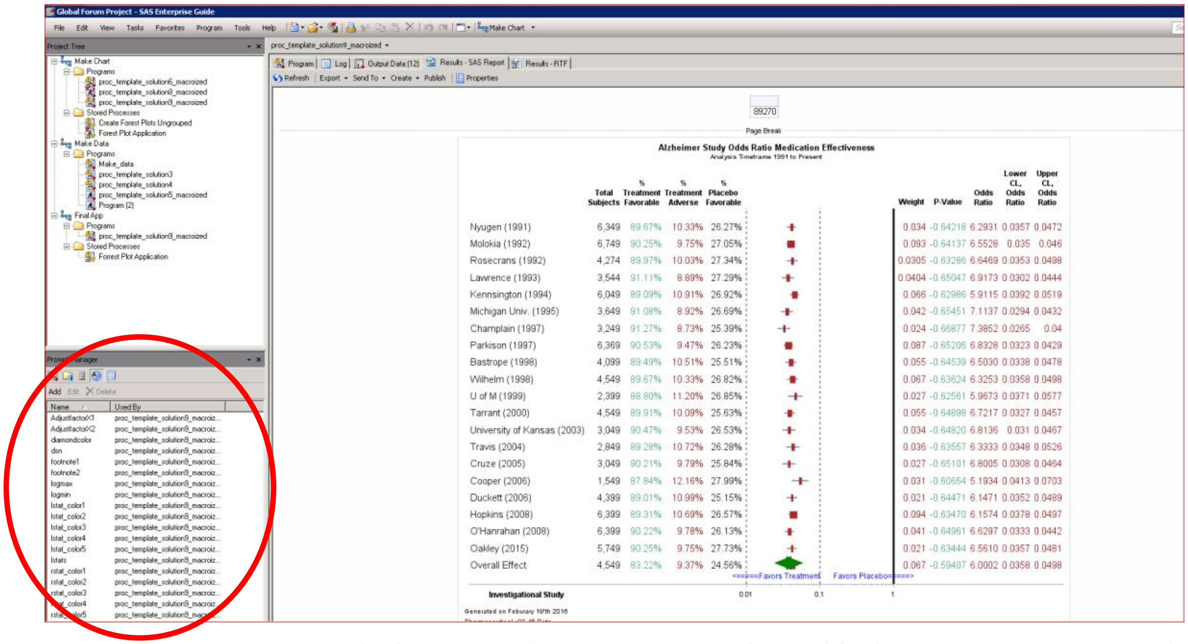


```
proc sql noprint;
create table gfdata.statistics as
select name as start,label,'$statfmt' as fmtname
from dictionary.columns
where upcase(libname)='WORK' and upcase(memname)='COMBINE' and
upcase(type)='NUM' and upcase(name) not in ("ORDER");
quit;

proc sql noprint;
select name into :namelist separated by '#'
from dictionary.columns
where upcase(libname)='WORK' and upcase(memname)='COMBINE' and
upcase(type)='NUM' and upcase(name) not in ("ORDER") ;
quit;

%put &namelist;
%let totstats=%sysfunc(countw(&namelist,#));
proc format cntlin=gfdata.statistics lib=gfdata;
select statfmt;
run;
options fmtsearch=(gfdata);
```

These three coded steps use dictionary columns to dynamically get the field names created by proc freq. The information is converted into a macro list and user-defined format that is used later in the application.

USING THE PROMPT MANAGER

Figure 14.



Name	Used By
AdjustfactorX1	proc_template_solution9_macroiz...
AdjustfactorX2	proc_template_solution9_macroiz...
diamondcolor	proc_template_solution9_macroiz...
dsn	proc_template_solution9_macroiz...
footnote1	proc_template_solution9_macroiz...
footnote2	proc_template_solution9_macroiz...
logmax	proc_template_solution9_macroiz...
logmin	proc_template_solution9_macroiz...
lstat_color1	proc_template_solution9_macroiz...
lstat_color2	proc_template_solution9_macroiz...
lstat_color3	proc_template_solution9_macroiz...
lstat_color4	proc_template_solution9_macroiz...
lstat_color5	proc_template_solution9_macroiz...
lstats	proc_template_solution9_macroiz...
rstat_color1	proc_template_solution9_macroiz...
rstat_color2	proc_template_solution9_macroiz...
rstat_color3	proc_template_solution9_macroiz...
rstat_color4	proc_template_solution9_macroiz...
rstat_color5	proc_template_solution9_macroiz...

Alzheimer Study Odds Ratio Medication Effectiveness
Analysis Timeframe 1991 to Present

	Total Subjects	% Treatment Favorable	% Treatment Adverse	% Placebo Favorable	Weight	P-Value	Odds Ratio	Lower CL, Odds Ratio	Upper CL, Odds Ratio
Nyugen (1991)	6,349	89.67%	10.33%	26.27%	0.034	-0.64218	6.2931	0.0357	0.0472
Molokia (1992)	6,749	90.25%	9.75%	27.05%	0.093	-0.64137	6.5528	0.035	0.046
Rosecrans (1992)	4,274	89.97%	10.03%	27.34%	0.0305	-0.63286	6.6469	0.0353	0.0498
Lawrence (1993)	3,544	91.11%	8.89%	27.29%	0.0404	-0.65047	6.9173	0.0302	0.0444
Kennsington (1994)	6,049	89.09%	10.91%	26.92%	0.066	-0.62986	5.9115	0.0392	0.0519
Michigan Univ. (1995)	3,649	91.08%	8.92%	26.69%	0.042	-0.65451	7.1137	0.0294	0.0432
Champlain (1997)	3,249	91.27%	8.73%	25.39%	0.024	-0.66877	7.3852	0.0265	0.04
Parkison (1997)	6,369	90.53%	9.47%	26.23%	0.087	-0.65206	6.8328	0.0323	0.0429
Bastrope (1998)	4,099	89.49%	10.51%	25.51%	0.055	-0.64539	6.5030	0.0338	0.0478
Wilhelm (1998)	4,549	89.67%	10.33%	26.82%	0.067	-0.63624	6.3253	0.0358	0.0498
U of M (1999)	2,399	88.80%	11.20%	26.85%	0.027	-0.62561	5.9673	0.0371	0.0577
Tarrant (2000)	4,549	89.91%	10.09%	25.63%	0.055	-0.64898	6.7217	0.0327	0.0457
University of Kansas (2003)	3,049	90.47%	9.53%	26.53%	0.034	-0.64820	6.8136	0.031	0.0467
Travis (2004)	2,849	89.28%	10.72%	26.28%	0.036	-0.63557	6.3333	0.0348	0.0526
Cruze (2005)	3,049	90.21%	9.79%	25.84%	0.027	-0.65101	6.8005	0.0308	0.0464
Cooper (2006)	1,549	87.84%	12.16%	27.99%	0.031	-0.60654	5.1934	0.0413	0.0703
Duckett (2006)	4,399	89.01%	10.99%	25.15%	0.021	-0.64471	6.1471	0.0352	0.0489
Hopkins (2008)	6,399	89.31%	10.69%	26.57%	0.094	-0.63470	6.1574	0.0378	0.0497
O'Hanrahan (2008)	6,399	90.22%	9.78%	26.13%	0.041	-0.64961	6.6297	0.0333	0.0442
Oakley (2015)	5,749	90.25%	9.75%	27.73%	0.021	-0.63444	6.5610	0.0357	0.0481
Overall Effect	4,549	83.22%	9.37%	24.56%	0.067	-0.59407	6.0002	0.0358	0.0498

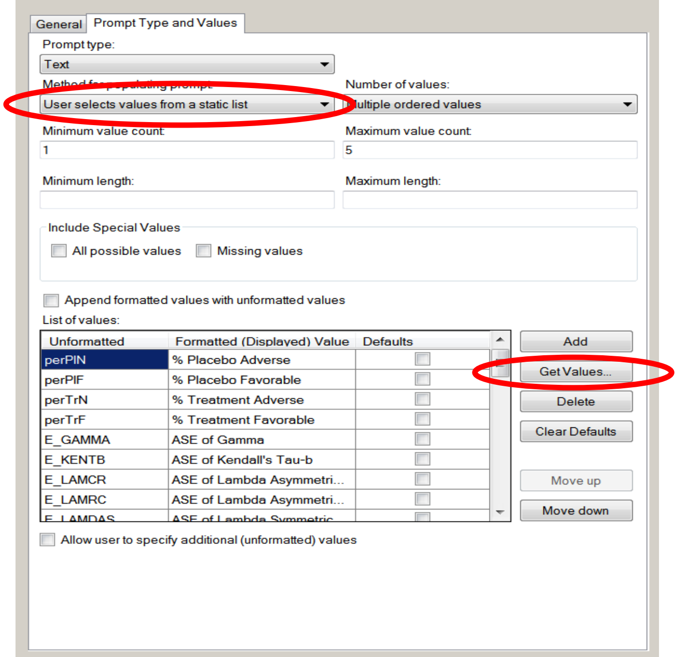
Investigational Study

Generated on Feburary 19th 2016

From the Resources pane in the lower left corner of Enterprise Guide the Prompt manager can be accessed and opened. Items or Objects in the point and click application, like list boxes, text entry fields, color selectors can be configured and added to the application.

CONFIGURING A PROMPT

Figure 15.



Prompt type: Text

Method for populating prompt: User selects values from a static list

Number of values: Multiple ordered values

Minimum value count: 1

Maximum value count: 5

Minimum length:

Maximum length:

Include Special Values

☐ All possible values ☐ Missing values

☐ Append formatted values with unformatted values

List of values:

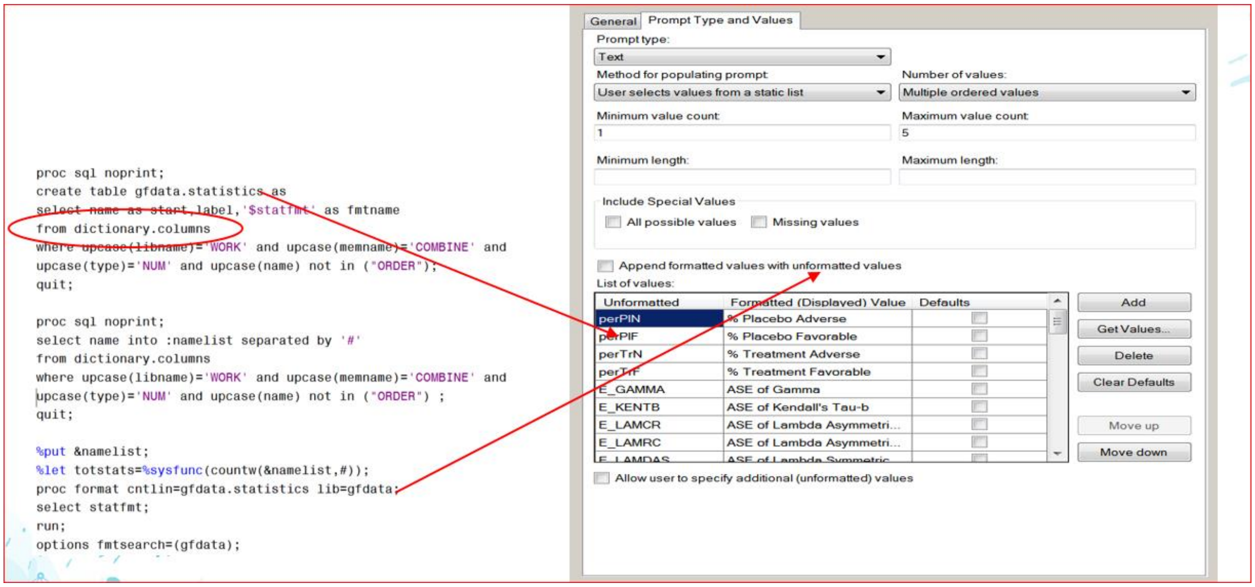
Unformatted	Formatted (Displayed) Value	Defaults
perPIN	% Placebo Adverse	☐
perPIF	% Placebo Favorable	☐
perTrN	% Treatment Adverse	☐
perTrF	% Treatment Favorable	☐
E_GAMMA	ASE of Gamma	☐
E_KENTB	ASE of Kendall's Tau-b	☐
E_LAMCR	ASE of Lambda Asymmetri...	☐
E_LAMRC	ASE of Lambda Asymmetri...	☐
E_LAMDAS	ASE of Lambda Symmetric	☐

☐ Allow user to specify additional (unformatted) values

From Fig 15 on the previous page. 1.) The type of prompt, text, is selected. 2.) In the Business Analytics environment the List box can loaded statically, or dynamically. 3.) The Prompt Type and Values tab allows for the creation of ordered multi-selection list boxes in EG Version 7.1. This latest feature allows statistics, therefore columns in the final graphic output to be selected in specific left to right order.

HOW CODE LOADS STATISTICS INTO A PROMPT

Figure 16.



```
proc sql noprint;
create table gfdata.statistics as
select name as start,label,'$statfmt' as fmtname
from dictionary.columns
where upcase(libname)='WORK' and upcase(memname)='COMBINE' and
upcase(type)='NUM' and upcase(name) not in ("ORDER");
quit;

proc sql noprint;
select name into :namelist separated by '#'
from dictionary.columns
where upcase(libname)='WORK' and upcase(memname)='COMBINE' and
upcase(type)='NUM' and upcase(name) not in ("ORDER") ;
quit;

%put &namelist;
%let totstats=%sysfunc(countw(&namelist,#));
proc format cntlin=gfdata.statistics lib=gfdata;
select statfmt;
run;
options fmtsearch=(gfdata);
```

Prompt type: Text

Method for populating prompt: User selects values from a static list

Number of values: Multiple ordered values

Minimum value count: 1

Maximum value count: 5

Minimum length:

Maximum length:

Include Special Values

□ All possible values □ Missing values

□ Append formatted values with unformatted values

List of values:

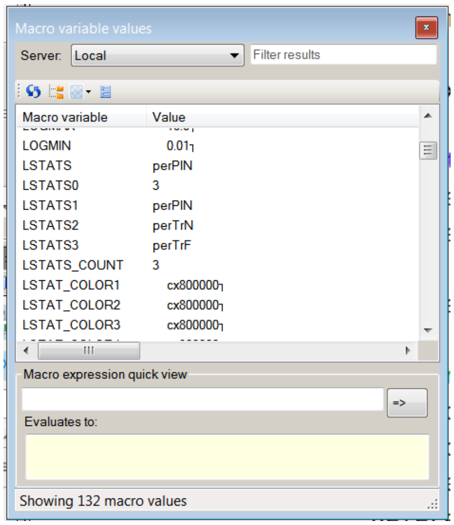
Unformatted	Formatted (Displayed) Value	Defaults
perPIN	% Placebo Adverse	□
perPIF	% Placebo Favorable	□
perTrN	% Treatment Adverse	□
perTrF	% Treatment Favorable	□
E_GAMMA	ASE of Gamma	□
E_KENTB	ASE of Kendall's Tau-b	□
E_LAMCR	ASE of Lambda Asymmetri...	□
E_LAMRC	ASE of Lambda Asymmetri...	□
E_LAMDAS	ASE of Lambda Symmetric	□

□ Allow user to specify additional (unformatted) values

From the Get values push button in Figure 16. The statistic field names created by proc freq can be loaded into a point and click prompt. And the formatted label/descriptions can displayed in the application that the user sees.

USING MACRO VARIABLE VIEWER TO FIND NAMES CREATED BY PROMPTS

Figure 17.



Server: Local

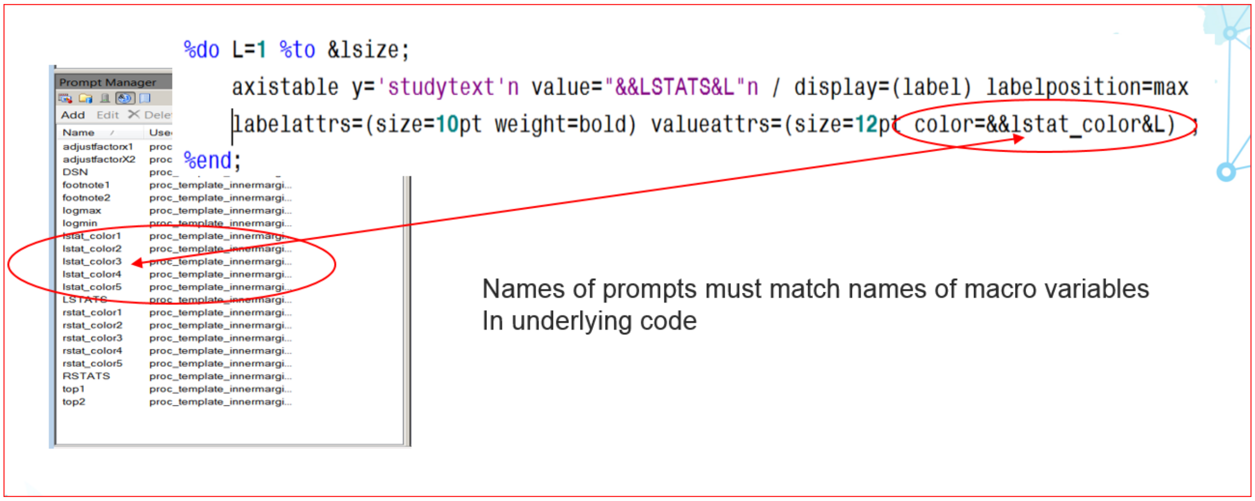
Macro variable	Value
LOGMIN	0.01
LSTATS	perPIN
LSTATS0	3
LSTATS1	perPIN
LSTATS2	perTrN
LSTATS3	perTrF
LSTATS_COUNT	3
LSTAT_COLOR1	cx800000
LSTAT_COLOR2	cx800000
LSTAT_COLOR3	cx800000

Showing 132 macro values

Once the prompt is configured going to Tools➔Macro Variable Viewer and a developer can record the name of the macro variables that will have to be incorporated in the underlying program.

CONNECTING PROMPT NAMES TO CODE

Figure 18.



```
%do L=1 %to &lsize;
    axistable y='studytext'n value="&&LSTATS&L"n / display=(label) labelposition=max
    labelattrs=(size=10pt weight=bold) valueattrs=(size=12pt color=&&lstat_color&L) ;
%end;
```

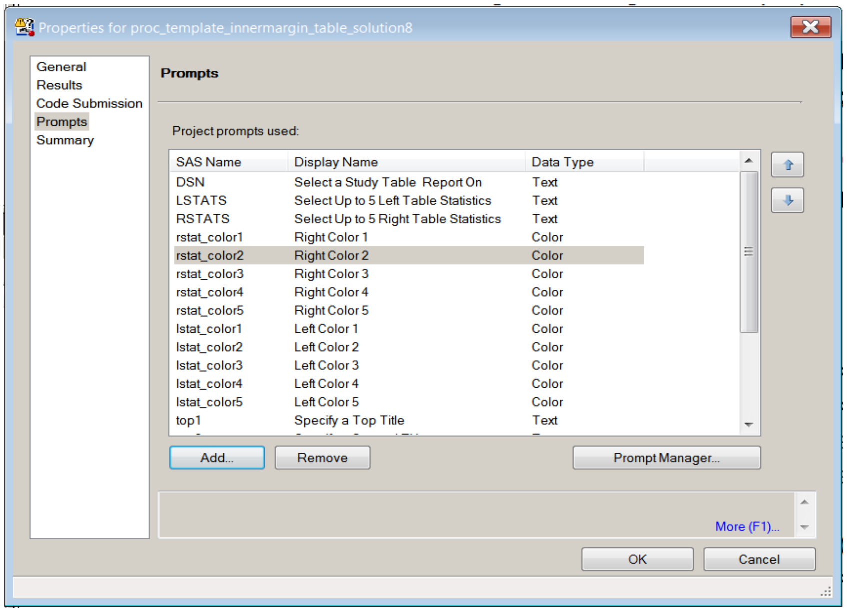
Name	Use
adjustfactorx1	proc
adjustfactorX2	proc
DSN	proc_
footnote1	proc_template_innermargi...
footnote2	proc_template_innermargi...
logmax	proc_template_innermargi...
logmin	proc_template_innermargi...
lstat_color1	proc_template_innermargi...
lstat_color2	proc_template_innermargi...
lstat_color3	proc_template_innermargi...
lstat_color4	proc_template_innermargi...
lstat_color5	proc_template_innermargi...
LSTATS	proc_template_innermargi...
rstat_color1	proc_template_innermargi...
rstat_color2	proc_template_innermargi...
rstat_color3	proc_template_innermargi...
rstat_color4	proc_template_innermargi...
rstat_color5	proc_template_innermargi...
RSTATS	proc_template_innermargi...
top1	proc_template_innermargi...
top2	proc_template_innermargi...

Names of prompts must match names of macro variables
In underlying code

The ampersand references, (macro variable names), used in the underlying program, must match the names of the prompts generated from the prompt manager.

PROGRAM PROPERTIES (CONNECTING PROMPTS TO APPLICATION PROGRAM)

Figure 19.



Prompts

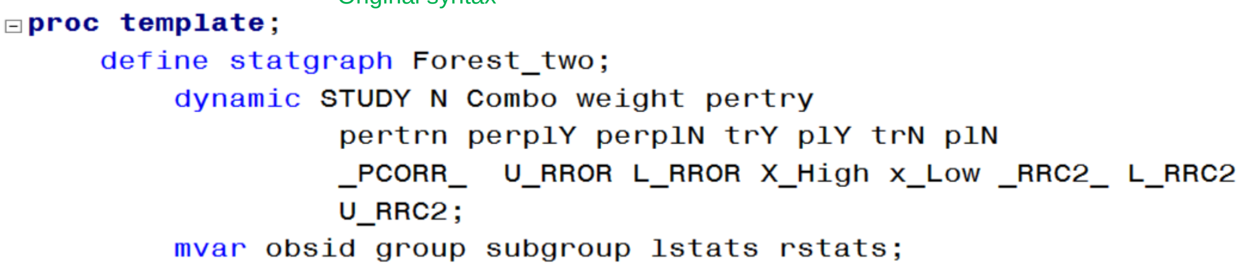
Project prompts used:

SAS Name	Display Name	Data Type
DSN	Select a Study Table Report On	Text
LSTATS	Select Up to 5 Left Table Statistics	Text
RSTATS	Select Up to 5 Right Table Statistics	Text
rstat_color1	Right Color 1	Color
rstat_color2	Right Color 2	Color
rstat_color3	Right Color 3	Color
rstat_color4	Right Color 4	Color
rstat_color5	Right Color 5	Color
lstat_color1	Left Color 1	Color
lstat_color2	Left Color 2	Color
lstat_color3	Left Color 3	Color
lstat_color4	Left Color 4	Color
lstat_color5	Left Color 5	Color
top1	Specify a Top Title	Text

Each of the Prompts in the Application must be also be manually connected to the properties of the Forest plot program. The up and down arrows at the right-hand side of the current window, control the relative top to bottom order of the object items in the application.

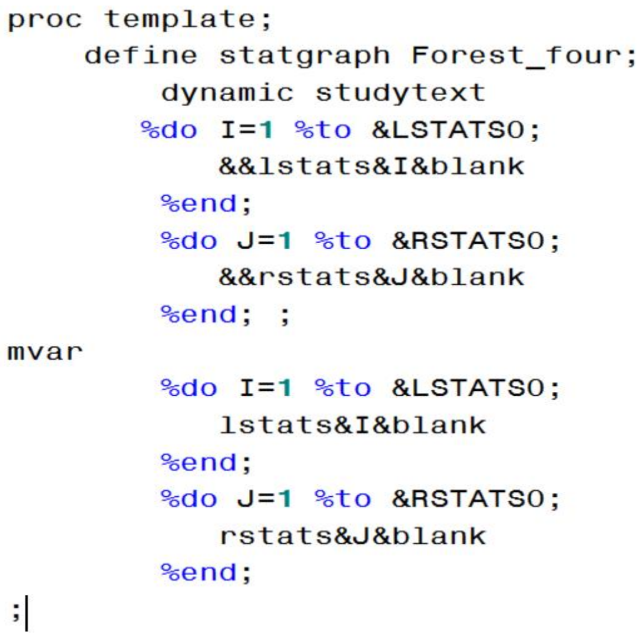
CONVERTING HARDCODED TEMPLATE SYNTAX INTO DYNAMIC MACRO SYNTAX

Figure 20. Original syntax



```
proc template;
     define statgraph Forest_two;
         dynamic STUDY N Combo weight pertry
                  pertrn perplY perplN trY plY trN plN
                  _PCORR_  U_RROR L_RROR X_High x_Low _RRC2_ L_RRC2
                  U_RRC2;
         mvar obsid group subgroup lstats rstats;
```

Figure 21. Automated Macro Equivalent



```
 proc template;
     define statgraph Forest_four;
         dynamic studytext
        %do I=1 %to &LSTATS0;
           &&lstats&I&blank
         %end;
         %do J=1 %to &RSTATS0;
           &&rstats&J&blank
         %end; ;
 mvar
         %do I=1 %to &LSTATS0;
           lstats&I&blank
         %end;
         %do J=1 %to &RSTATS0;
           rstats&J&blank
         %end;
 ;
```

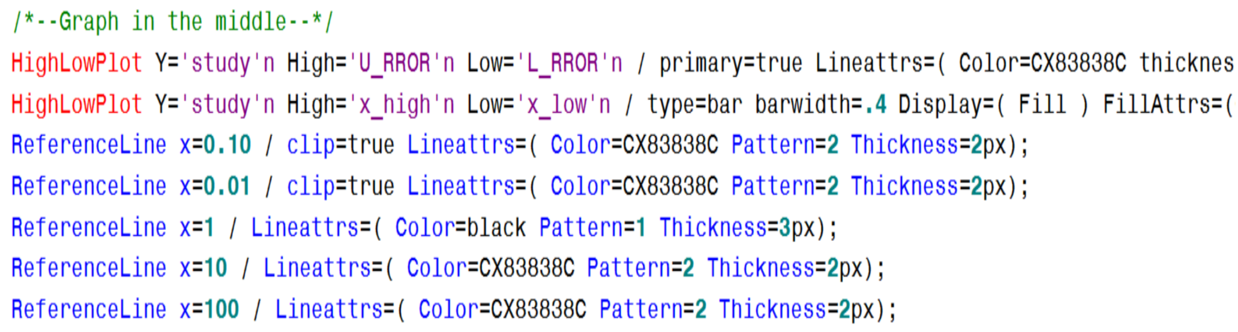
Syntax Generated by Macro Program

```
MPRINT(FORREST2):   proc template;
MPRINT(FORREST2):   define statgraph Forest_five;
MPRINT(FORREST2):   dynamic studytext N perTrF perTrN perPIF weight
_PCORR_  _RRC2_   L_RROR U_RROR mvar lstats1 lstats2 lstats3
stats4 rstats1 rstats2 rstats3 rstats4 rstats5 pcorr_color
odcolor overr overu overl;
```

The three sections of syntax listed in the figures above represent the original hard-coded proc template dynamic statement (figure 20). The macro version of the syntax (figure 21). And the final code generated by the macro program and displayed with the MPRINT option in the log (figure). If a user changes the columns used in the left or right report, the underlying program syntax is automatically modified and in this case the new dynamic statement is created with the latest required syntax.

SYNTAX WHICH GENERATES BASIC GRAPHIC OUTPUT

Figure 22.

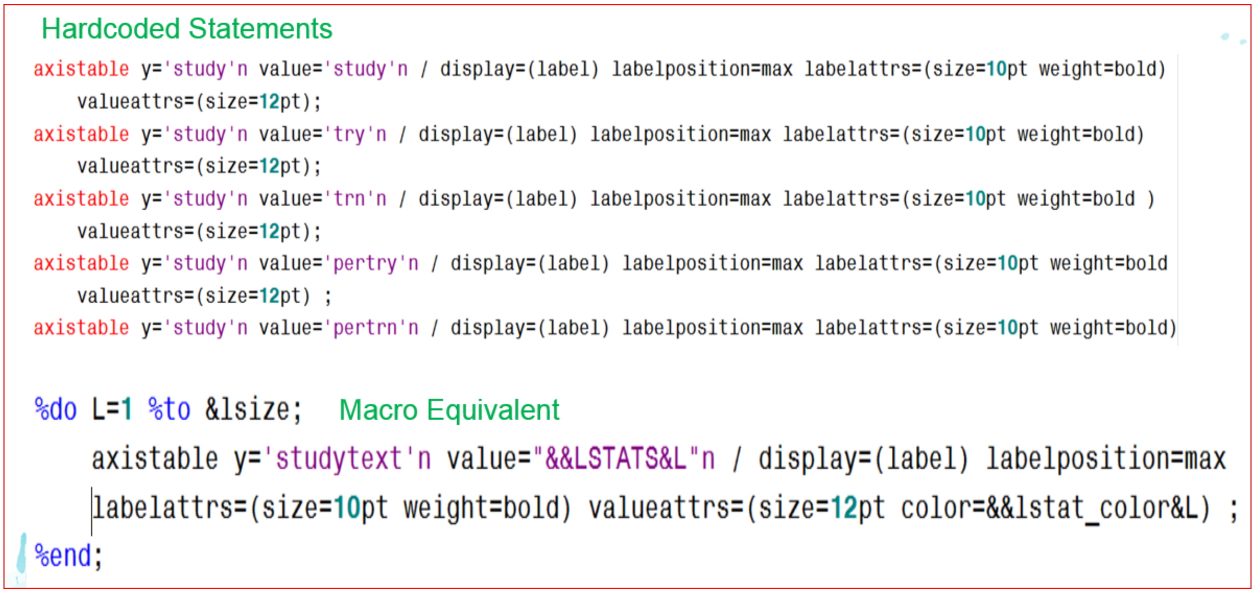


```
/*--Graph in the middle--*/
HighLowPlot Y='study'n High='U_RROR'n Low='L_RROR'n / primary=true Lineattrs=( Color=CX83838C thicknes
HighLowPlot Y='study'n High='x_high'n Low='x_low'n / type=bar barwidth=.4 Display=( Fill ) FillAttrs=(
ReferenceLine x=0.10 / clip=true Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);
ReferenceLine x=0.01 / clip=true Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);
ReferenceLine x=1 / Lineattrs=( Color=black Pattern=1 Thickness=3px);
ReferenceLine x=10 / Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);
ReferenceLine x=100 / Lineattrs=( Color=CX83838C Pattern=2 Thickness=2px);
```

The two different versions of the high-low statement will create a high-low line with a high low bar overlaid on top of it. The U_RROR, and L_RROR field used in the syntax were calculated by the proc freq code shown previously. Reference line will be included for the logarithmic horizontal axis. Very little macro conversion was required for this syntax

COLUMNS OF REPORT OUTPUT CREATED BY AXIS TABLE STATEMENTS

Figure 23.



Hardcoded Statements

```
axistable y='study'n value='study'n / display=(label) labelposition=max labelattrs=(size=10pt weight=bold)
    valueattrs=(size=12pt);
axistable y='study'n value='try'n / display=(label) labelposition=max labelattrs=(size=10pt weight=bold)
    valueattrs=(size=12pt);
axistable y='study'n value='trn'n / display=(label) labelposition=max labelattrs=(size=10pt weight=bold )
    valueattrs=(size=12pt);
axistable y='study'n value='pertry'n / display=(label) labelposition=max labelattrs=(size=10pt weight=bold
    valueattrs=(size=12pt) ;
axistable y='study'n value='pertrn'n / display=(label) labelposition=max labelattrs=(size=10pt weight=bold)
```

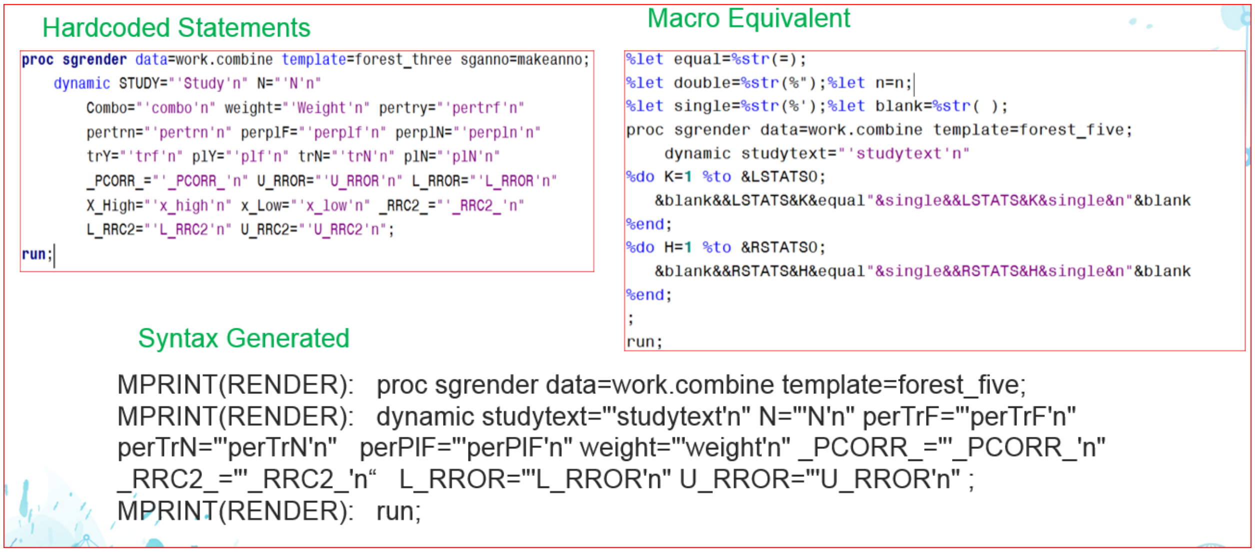
Macro Equivalent

```
%do L=1 %to &lsize;
    axistable y='studytext'n value="&&LSTATS&L"n / display=(label) labelposition=max
    labelattrs=(size=10pt weight=bold) valueattrs=(size=12pt color=&&lstat_color&L) ;
%end;
```

The iterative macro %DO loop syntax will create a separate custom axistable statement for every left and right statistic that was selected from the application. The specific color for the column is incorporated here as well.

MACRO CONVERSION OF SGRENDER STATEMENTS NEEDED TO DISPLAY TEMPLATE

Figure 24.



Hardcoded Statements

```
proc sgrender data=work.combine template=forest_three sganno=makeanno;
    dynamic STUDY="'Study'n" N="'N'n"
        Combo="'combo'n" weight="'Weight'n" pertry="'pertrf'n"
        pertrn="'pertrn'n" perplF="'perplf'n" perplN="'perpln'n"
        trY="'trf'n" plY="'plf'n" trN="'trN'n" plN="'plN'n"
        _PCORR_="'_PCORR_'n" U_RROR="'U_RROR'n" L_RROR="'L_RROR'n"
        X_High="'x_high'n" x_Low="'x_low'n" _RRC2_="'_RRC2_'n"
        L_RRC2="'L_RRC2'n" U_RRC2="'U_RRC2'n";
run;
```

Macro Equivalent

```
%let equal=%str(=);
%let double=%str(%");%let n=n;
%let single=%str(%');%let blank=%str( );
proc sgrender data=work.combine template=forest_five;
    dynamic studytext="'studytext'n"
%do K=1 %to &LSTATS0;
   &blank&&LSTATS&K&equal"&single&&LSTATS&K&single&n"&blank
%end;
%do H=1 %to &RSTATS0;
   &blank&&RSTATS&H&equal"&single&&RSTATS&H&single&n"&blank
%end;
;
run;
```

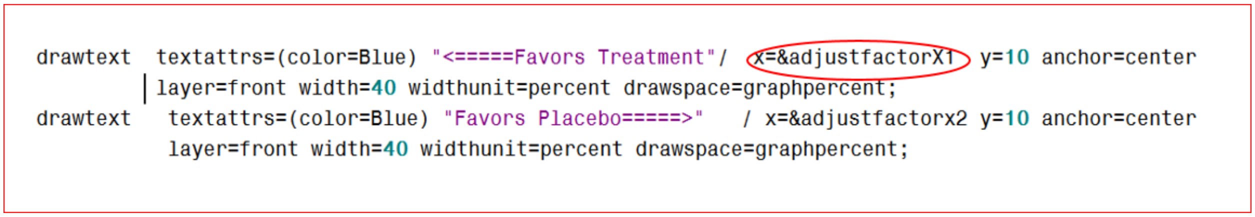
Syntax Generated

```
MPRINT(RENDER):   proc sgrender data=work.combine template=forest_five;
MPRINT(RENDER):   dynamic studytext="'studytext'n" N="'N'n" perTrF="'perTrF'n"
perTrN="'perTrN'n"   perPlF="'perPlF'n" weight="'weight'n" _PCORR_="'_PCORR_'n"
_RRC2_="'_RRC2_'n"   L_RROR="'L_RROR'n" U_RROR="'U_RROR'n" ;
MPRINT(RENDER):   run;
```

The final syntax required in the program to display the graphic template is proc sgrender. Automated macro generated DYNAMIC statements had to be generated here as well.

CUSTOM VERBAGE ADDED TO GRAPH WITH DRAWTEXT

Figure 25.

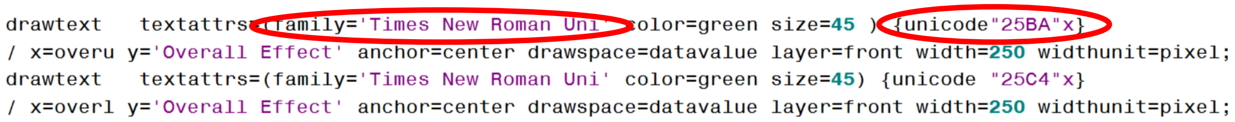


```
drawtext  textattrs=(color=Blue) "<=====Favors Treatment"/  x=&adjustfactorX1  y=10 anchor=center
          layer=front width=40 widthunit=percent drawspace=graphpercent;
drawtext   textattrs=(color=Blue) "Favors Placebo=====>"   / x=&adjustfactorx2 y=10 anchor=center
           layer=front width=40 widthunit=percent drawspace=graphpercent;
```

For ODS Graphics SAS version 9.4 and later a new drawtable statement is available, which simplifies the old required SGANNOTATE syntax. The code in Figure adds and dynamically positions the “Favors” label near the bottom axis.

CUSTOM VERBAGE ADDED TO GRAPH WITH DRAWTEXT

Figure 26.

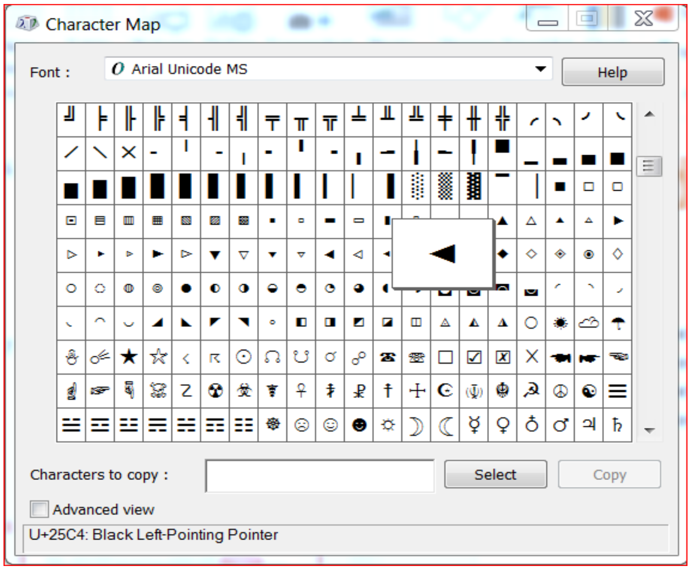


```
drawtext   textattrs=(family='Times New Roman Uni' color=green size=45 ) {unicode"25BA"x}
/ x=overu y='Overall Effect' anchor=center drawspace=datavalue layer=front width=250 widthunit=pixel;
drawtext   textattrs=(family='Times New Roman Uni' color=green size=45) {unicode "25C4"x}
/ x=overl y='Overall Effect' anchor=center drawspace=datavalue layer=front width=250 widthunit=pixel;
```

The other drawtext statements add a green leftward and rightward pointing arrow to depict the overall symbol normally included in Forest Plot output. The Unicode hexa-decimal value was retired from the character map shown in the next figure

CHARACTER MAP TO ADD ANY FONT SYMBOL TO A GRAPHIC DISPLAY

Figure 27.



Font : Arial Unicode MS

Characters to copy :

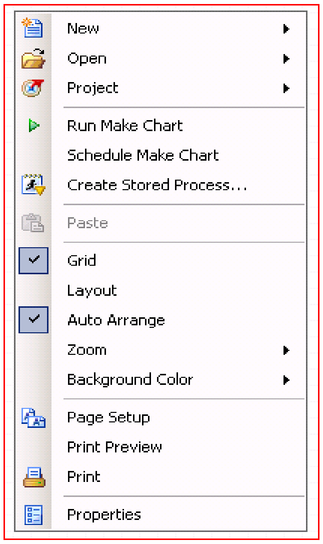
□ Advanced view

U+25C4: Black Left-Pointing Pointer

Any character from a Unicode font can be added to a graphic display at any x and y coordinate location via a drawtext statement. The character map can be accessed by going to Start➔Programs➔ Accessories➔ System Tools➔Character Map.

INITIAL STEP TO CREATE STORED PROCESS FROM APPLICATION PROGRAM

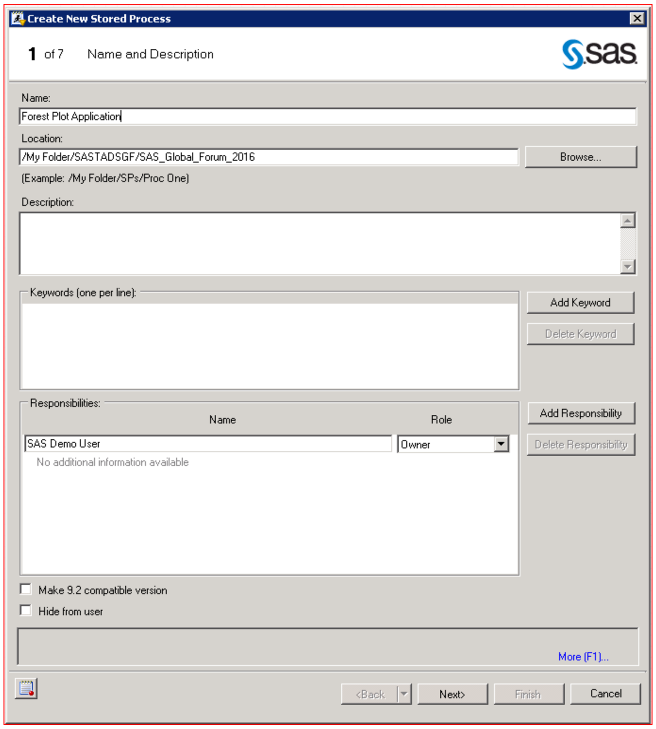
Figure 28.



If an Enterprise Guide User whose organization has the Business Analytics Architecture installed, right-clicks on a program entry in either the process flow diagram or project tree, a menu will appear that brings up a point and click stored process wizard. This wizard will define the metadata, or information needed to allow the Forest Plot application to execute from any computer on an organization's intranet and surface the results in Microsoft Tools like Word, PowerPoint and Excel.

STORAGE LOCATION AND FORMAL NAME OF STORED PROCESS

Figure 29.



1 of 7 Name and Description

Name: Forest Plot Application

Location: /My Folder/SASTADSGF/SAS_Global_Forum_2016

(Example: /My Folder/SPs/Proc One)

Description:

Keywords (one per line):

Responsibilities:

Name	Role
SAS Demo User	Owner

No additional information available

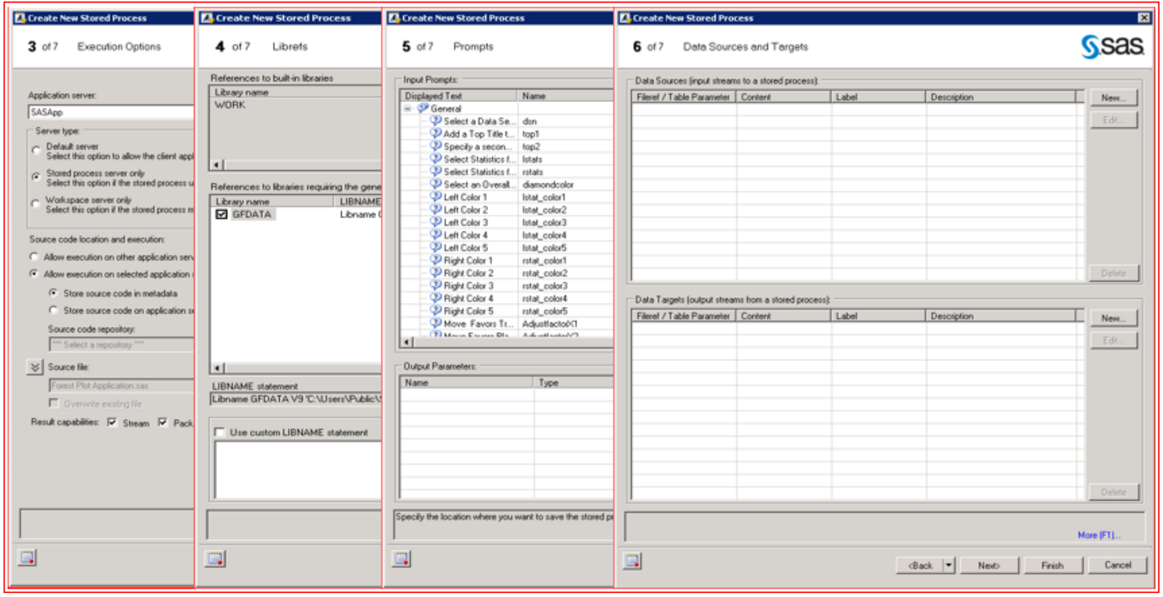
□ Make 9.2 compatible version

□ Hide from user

In the first wizard window the developer defines a formal name for the stored process and a storage folder, which should ultimately allow the application to be accessed from any Business Analytics Tool.

STORED PROCESS CONFIGURATION WIZARD WINDOWS

Figure 30.



3 of 7 Execution Options

Application server: SASApp

Server type:

○ Default server
Select this option to allow the client appl

● Stored process server only
Select this option if the stored process u

○ Workspace server only
Select this option if the stored process m

Source code location and execution:

○ Allow execution on other application serv

● Allow execution on selected application

● Store source code in metadata

○ Store source code on application s

Source code repository: *** Select a repository ***

Source file: Forest Plot Application.sas

□ Overwrite existing file

Result capabilities: ☑ Stream ☑ Pack

4 of 7 Librefs

References to built-in libraries

Library name
WORK

References to libraries requiring the gene

Library name	LIBNAME
☑ GFDATA	Libname (

LIBNAME statement: Libname GFDATA V9 'C:\Users\Public\

□ Use custom LIBNAME statement

5 of 7 Prompts

Input Prompts:

Displayed Text	Name
General	
Select a Data Se...	dsn
Add a Top Title t...	top1
Specify a secon...	top2
Select Statistics f...	lstats
Select Statistics f...	rstats
Select an Overall...	diamondcolor
Left Color 1	lstat_color1
Left Color 2	lstat_color2
Left Color 3	lstat_color3
Left Color 4	lstat_color4
Left Color 5	lstat_color5
Right Color 1	rstat_color1
Right Color 2	rstat_color2
Right Color 3	rstat_color3
Right Color 4	rstat_color4
Right Color 5	rstat_color5
Move Favors Tr...	AdjustfactorX1
Move Favors Pla...	AdjustfactorX2

Output Parameters:

Name	Type

Specify the location where you want to save the stored pr

6 of 7 Data Sources and Targets

Data Sources (input streams to a stored process):

Fileref / Table Parameter	Content	Label	Description

Data Targets (output streams from a stored process):

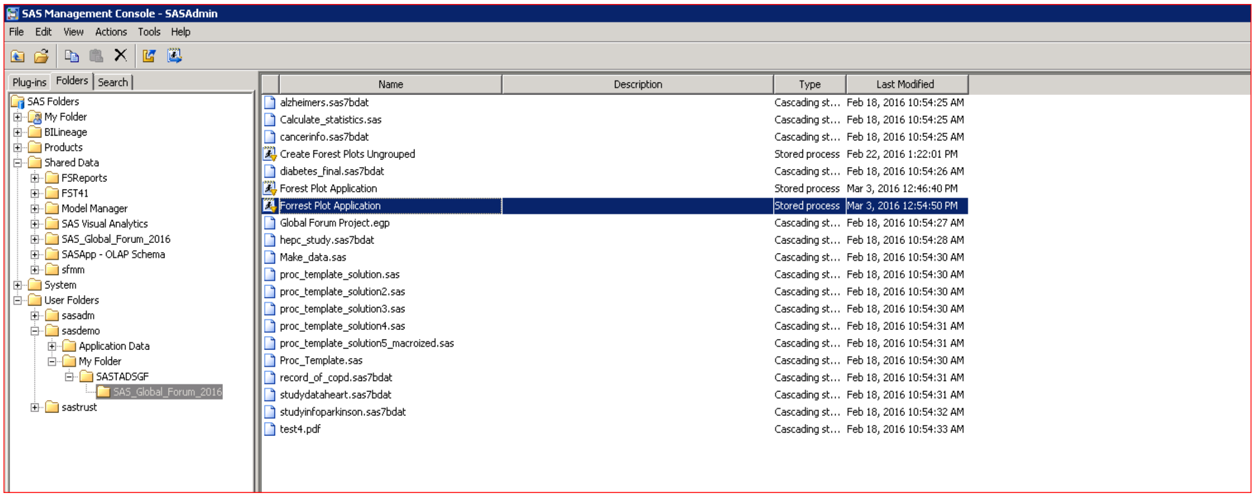
Fileref / Table Parameter	Content	Label	Description

Additional configurations, particularly in wizard windows 3 and 5 are required to define how the program code will be accessed and where it will be executed. In wizard 5, every prompt created in Enterprise

Guide is automatically registered to the stored process. Additional functionality can be added to the application here like cascading prompts, and nested prompts not available in Enterprise Guide.

SETTING ACCESS PERMISSIONS FOR A STORED PROCESS

Figure 31.

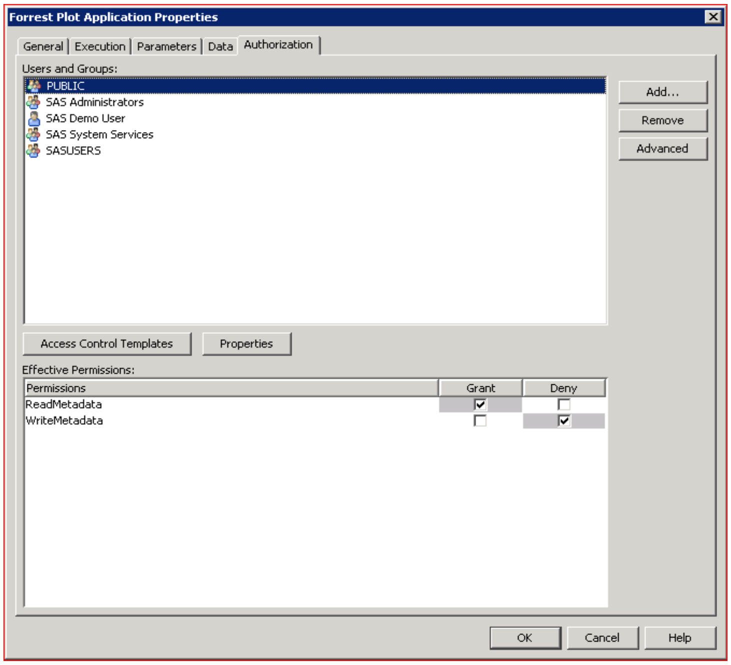


Name	Description	Type	Last Modified
alzheimers.sas7bdat		Cascading st...	Feb 18, 2016 10:54:25 AM
Calculate_statistics.sas		Cascading st...	Feb 18, 2016 10:54:25 AM
cancerinfo.sas7bdat		Cascading st...	Feb 18, 2016 10:54:25 AM
Create Forest Plots Ungrouped		Stored process	Feb 22, 2016 1:22:01 PM
diabetes_final.sas7bdat		Cascading st...	Feb 18, 2016 10:54:26 AM
Forest Plot Application		Stored process	Mar 3, 2016 12:46:40 PM
Forrest Plot Application		Stored process	Mar 3, 2016 12:54:50 PM
Global Forum Project.egp		Cascading st...	Feb 18, 2016 10:54:27 AM
hepc_study.sas7bdat		Cascading st...	Feb 18, 2016 10:54:28 AM
Make_data.sas		Cascading st...	Feb 18, 2016 10:54:30 AM
proc_template_solution.sas		Cascading st...	Feb 18, 2016 10:54:30 AM
proc_template_solution2.sas		Cascading st...	Feb 18, 2016 10:54:30 AM
proc_template_solution3.sas		Cascading st...	Feb 18, 2016 10:54:30 AM
proc_template_solution4.sas		Cascading st...	Feb 18, 2016 10:54:31 AM
proc_template_solution5_macroized.sas		Cascading st...	Feb 18, 2016 10:54:31 AM
Proc_Template.sas		Cascading st...	Feb 18, 2016 10:54:30 AM
record_of_copd.sas7bdat		Cascading st...	Feb 18, 2016 10:54:31 AM
studydataheart.sas7bdat		Cascading st...	Feb 18, 2016 10:54:31 AM
studyinfoparkinson.sas7bdat		Cascading st...	Feb 18, 2016 10:54:32 AM
test4.pdf		Cascading st...	Feb 18, 2016 10:54:33 AM

Once the Stored Process has been configured from the wizard, a user should go over to the SAS Management Console and insure the routine has the right permission for different uses and groups to access. The application developer or SAS Business Analytics administrator will navigate to the folder selected in the previous stored process wizard 1 and set the permissions.

PERMISSIONS FOR A STORED PROCESS

Figure 32



Users and Groups:

PUBLIC
SAS Administrators
SAS Demo User
SAS System Services
SASUSERS

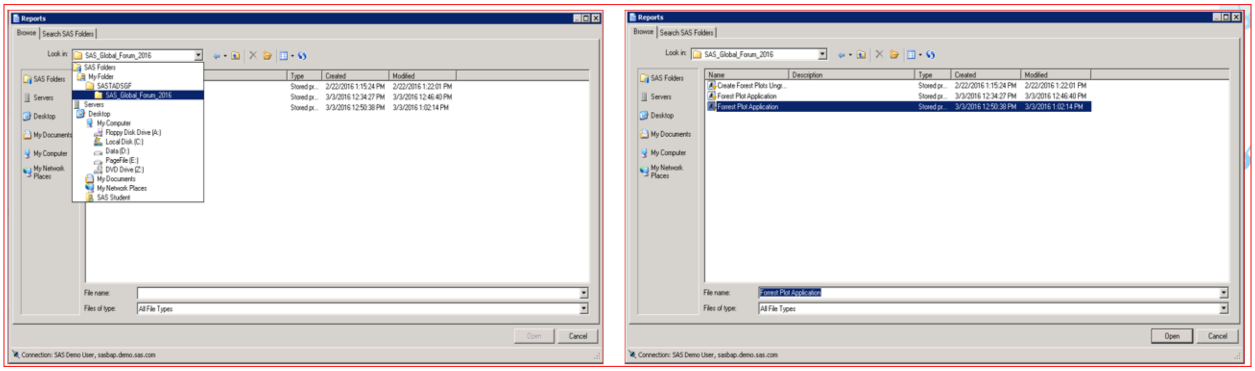
Effective Permissions:

Permissions	Grant	Deny
ReadMetadata	☑	☐
WriteMetadata	☐	☑

Comprehensive security can be defined from the SAS Management Console to the users and groups obtaining access to the application. The console is part of the office analytics environment.

ACCESSING STORED PROCESS IN MS-WORD WITH ADD-IN FOR MICROSOFT OFFICE

Figure 33.



Reports

Look in: SAS_Global_Forum_2016

SAS Folders
My Folder
SASTADSGF
SAS_Global_Forum_2016
Servers
Desktop
My Computer
Floppy Disk Drive (A:)
Local Disk (C:)
Data (D:)
PageFile (E:)
DVD Drive (Z:)
My Documents
My Network Places
SAS Student

Name	Description	Type	Created	Modified
Create Forest Plots Ungr...		Stored pr...	2/22/2016 1:15:24 PM	2/22/2016 1:22:01 PM
Forest Plot Application		Stored pr...	3/3/2016 12:34:27 PM	3/3/2016 12:46:40 PM
Forest Plot Application		Stored pr...	3/3/2016 12:50:38 PM	3/3/2016 1:02:14 PM

File name: Forest Plot Application

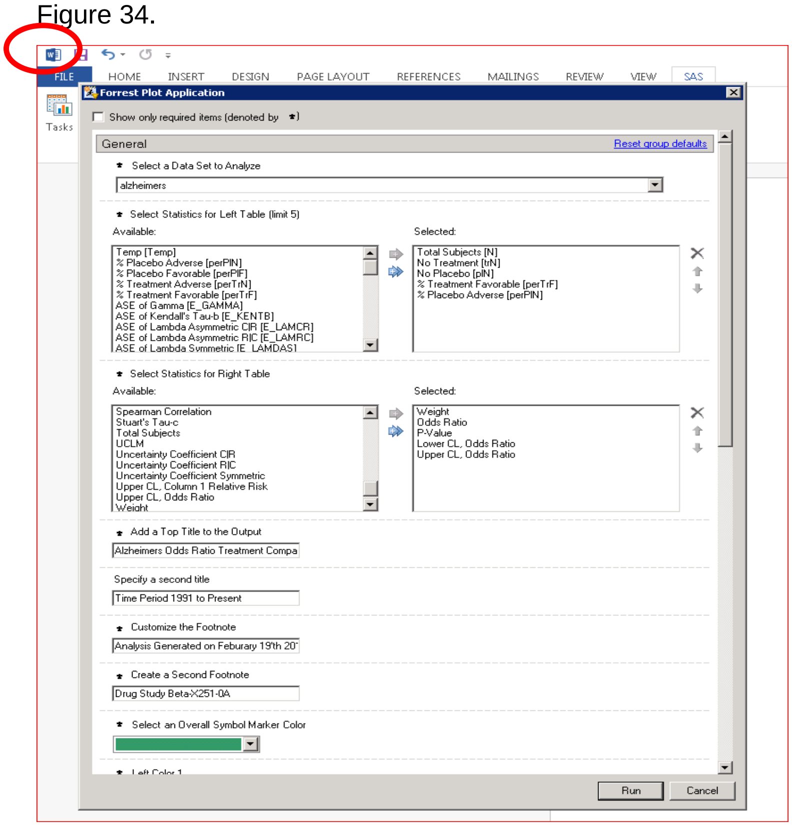
Files of type: All File Types

Connection: SAS Demo User, sasbap.demo.sas.com

Once the stored process has been registered in the SAS Management Console, a user can go over to Microsoft Word, PowerPoint, or Excel access the SAS Add-In and select the Report Icon from the SAS Ribbon. Then a SAS Folder Window will appear, and the application user can navigate to the location where the stored process was stored, click on the entry and run the point-and-click application.

OPENING AND RUNNING APPLICATION IN MS-WORD

Figure 34.



Forrest Plot Application

□ Show only required items (denoted by *)

General

* Select a Data Set to Analyze: alzheimers

* Select Statistics for Left Table (limit 5)

Available:
Temp [Temp]
% Placebo Adverse [perPIN]
% Placebo Favorable [perPIF]
% Treatment Adverse [perTrN]
% Treatment Favorable [perTrF]
ASE of Gamma [E_GAMMA]
ASE of Kendall's Tau-b [E_KENTB]
ASE of Lambda Asymmetric C|R [E_LAMCR]
ASE of Lambda Asymmetric R|C [E_LAMRC]
ASE of Lambda Symmetric [E_LAMDAS]

Selected:
Total Subjects [N]
No Treatment [trN]
No Placebo [plN]
% Treatment Favorable [perTrF]
% Placebo Adverse [perPIN]

* Select Statistics for Right Table

Available:
Spearman Correlation
Stuart's Tau-c
Total Subjects
UCLM
Uncertainty Coefficient C|R
Uncertainty Coefficient R|C
Uncertainty Coefficient Symmetric
Upper CL, Column 1 Relative Risk
Upper CL, Odds Ratio
Weight

Selected:
Weight
Odds Ratio
P-Value
Lower CL, Odds Ratio
Upper CL, Odds Ratio

* Add a Top Title to the Output: Alzheimers Odds Ratio Treatment Compa

Specify a second title: Time Period 1991 to Present

* Customize the Footnote: Analysis Generated on Feburary 19th 20

* Create a Second Footnote: Drug Study Beta-X251-0A

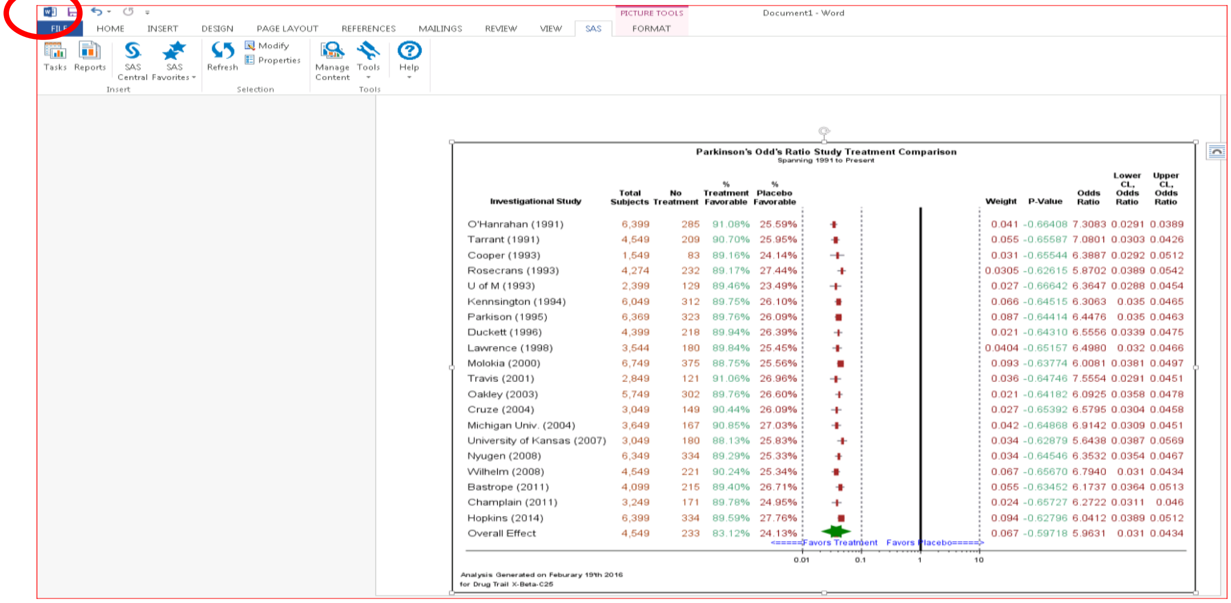
* Select an Overall Symbol Marker Color: 🟩

* Left Color 1

Same application shown earlier in the paper will appear. The user can select and define the particular attributes of the Forest Plot, hit the RUN button, and display the output.

FINAL RESULTS IN WORD

Figure 35.



Parkinson's Odd's Ratio Study Treatment Comparison
Spanning 1991 to Present

Investigational Study	Total Subjects	No Treatment	% Treatment Favorable	% Placebo Favorable	Weight	P-Value	Odds Ratio	Lower CL, Odds Ratio	Upper CL, Odds Ratio
O'Hanrahan (1991)	6,399	285	91.08%	25.59%	0.041	-0.66408	7.3083	0.0291	0.0389
Tarrant (1991)	4,549	209	90.70%	25.95%	0.055	-0.65587	7.0801	0.0303	0.0426
Cooper (1993)	1,549	83	89.16%	24.14%	0.031	-0.65544	6.3887	0.0292	0.0512
Rosecrans (1993)	4,274	232	89.17%	27.44%	0.0305	-0.62615	5.8702	0.0389	0.0542
U of M (1993)	2,399	129	89.46%	23.49%	0.027	-0.66642	6.3647	0.0288	0.0454
Kennsington (1994)	6,049	312	89.75%	26.10%	0.066	-0.64515	6.3063	0.035	0.0465
Parkison (1995)	6,369	323	89.76%	26.09%	0.087	-0.64414	6.4476	0.035	0.0463
Duckett (1996)	4,399	218	89.94%	26.39%	0.021	-0.64310	6.5556	0.0339	0.0475
Lawrence (1998)	3,544	180	89.84%	25.45%	0.0404	-0.65157	6.4980	0.032	0.0466
Molokia (2000)	6,749	375	88.75%	25.56%	0.093	-0.63774	6.0081	0.0381	0.0497
Travis (2001)	2,849	121	91.06%	26.96%	0.036	-0.64746	7.5554	0.0291	0.0451
Oakley (2003)	5,749	302	89.76%	26.60%	0.021	-0.64182	6.0925	0.0358	0.0478
Cruze (2004)	3,049	149	90.44%	26.09%	0.027	-0.65392	6.5795	0.0304	0.0458
Michigan Univ. (2004)	3,649	167	90.85%	27.03%	0.042	-0.64868	6.9142	0.0309	0.0451
University of Kansas (2007)	3,049	180	88.13%	25.83%	0.034	-0.62879	5.6438	0.0387	0.0569
Nyugen (2008)	6,349	334	89.29%	25.33%	0.034	-0.64546	6.3532	0.0354	0.0467
Wilhelm (2008)	4,549	221	90.24%	25.34%	0.067	-0.65670	6.7940	0.031	0.0434
Bastrope (2011)	4,099	215	89.40%	26.71%	0.055	-0.63452	6.1737	0.0364	0.0513
Champlain (2011)	3,249	171	89.78%	24.95%	0.024	-0.65727	6.2722	0.0311	0.046
Hopkins (2014)	6,399	334	89.59%	27.76%	0.094	-0.62796	6.0412	0.0389	0.0512
Overall Effect	4,549	233	83.12%	24.13%	0.067	-0.59718	5.9631	0.031	0.0434

Analysis Generated on Feburary 19th 2016
for Drug Trail X-Beta-C25

The output from the application is automatically inserted into a word document which is being used as documentation for health care studies being sub-mitted to the FDA.

CONCLUSION

As the paper demonstrates creating Forest Plots using a point and click prompted stored process is definitely feasible. The basic application presented can be modified further to incorporate additional customization features. Knowledge from several SAS disciplines and products is required to build and deploy an application like this one. If your organization frequently creates graphic output of this form, then in addition to base SAS software, the SAS Office Analytics environment will have to be licensed.

REFERENCES

Sanjay Mantange 0/02/2014. Global Forum **Paper SAS096-2014** “Up Your Game with Graph Template Language Layouts” SAS Institute Inc., Cary, NC .

CONTACT INFORMATION

If you would like a copy of the Enterprise Guide Application and SAS Program used to generate the output contact the writer via the information below. In addition another solution to the Forrest Plot problem was explored and somewhat developed using proc report, proc sgplot, and ODS Layout. This application showed real promise to extend the capabilities of the current application, but was not specifically related to the abstract.

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

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