

SAS/GRAPH Blues? {:^(SAS/FRAME to the Rescue }:^)

Kathy Shelley, Iowa State University, Ames, Iowa

ABSTRACT

This paper shows how SAS/FRAME can be used to automate repetitive graph production, thus enabling users to produce well-designed graphs without writing SAS/GRAPH programs. Sample Frame screens and excerpted Screen Control Language Code (SCL) are taken from EpiSTATION, a SAS/FRAME application which is an interactive data analysis package with special applications in Small Area Analysis for zip code based data. Currently, this software is being used on UNIX Workstations and on PC's running Windows 3.11 or Windows 95.

INTRODUCTION

SAS/GRAPH is one of the most difficult components to program in the SAS software suite. Yet with today's high speed desktop computers, color printers, and SAS' annotate facility, it is capable of producing any type of graph which the end-user needs. However, this usually takes a considerable programming effort. Most end-users do not have time to become expert SAS/GRAPH programmers. SAS/ASSIST is a SAS Frame application which allows users to produce graphs without writing code. EpiSTATION improves ASSIST's interface by consistently using a top-down button structure (Galitz 1993), dynamic sample on-screen graphs to aid in button selection, easier to use option customization screens, and better default graphs. Default graphs were constructed adhering to design recommendations made by William Cleveland (1985), Edward Tufte (1983,1990), Michael Friendly (1991), and LeRoy Bessler (1993). An additional innovation was achieved by combining statistical modeling results from PROC REG at the bottom of a regression plot in PROC GPLOT. This idea can be extended to other statistical applications.

PAPER HIGHLIGHTS

- CONSISTENT BUTTON LAYOUT DESIGN
- DYNAMIC ON-SCREEN SAMPLE GRAPHS
- EASY-TO-USE OPTION SCREENS
- STATISTICS COMBINED WITH GRAPHICS

CONSISTENT BUTTON LAYOUT DESIGN

Screens which require an input dataset have been constructed to have a top-down order with required fields shown in **red** and all other buttons displayed in **blue**. The **OPEN FILE** button is always at the top and is a required field. The main screens are designed in such a way that a graph will be guaranteed to be produced if the user

merely chooses the required fields and clicks on the **EXECUTE** button at the bottom of the screen. By clicking on the **OPTIONS** button, the user will be given choices which will refine and give a more professional appearance to the graph. The options are displayed in successive screens activated by the push buttons. This consistent look-and-feel from each main task frame enables the user to quickly produce graphs and reports because the interface becomes second nature. **Figure 1** is the default screen for Bar Charts and **Figure 2** is the default screen for Small Area (zip code based) maps. Notice that the two screens have the same look and feel.

DYNAMIC ON-SCREEN SAMPLE GRAPHS

Because there are eighteen possible Bar Chart types and four X-Y Plot types, we placed dynamically changing sample graphs on the right side of the main menu. When the user clicks on "Select Bar Chart Type" or "Select Plot Type", a drop-down pop list of graph types is displayed. As the user clicks on each separate graph type, the contents of the SAS/GRAPH Object dynamically changes to reflect the selected graph type. In addition to the sample SAS/GRAPH Object, Bar Charts have dynamically changing on-line instructions which appear directly below the sample graph. This is especially helpful in Bar Charts because SAS/GRAPH's "GROUP" and "SUBGROUP" variables are hardly intuitive in making selections for stacked vs. grouped bar charts. By providing matching sample graphs and instructions, the user can easily mimic the on-screen examples to achieve the desired visual display. **Figure 3** shows the default screen for grouped bar charts and **Figure 4** shows the default screen for stacked bar charts. Following is a small excerpt of sample Screen Control Language code which shows how the graph choice pop list, sample graphs and sample button choices change according to user button selections.

These lines create the pop list selections:

```
plotlist=makelist();  
rc=insertc(plotlist,"Vertical Stacked");  
rc=insertc(plotlist,"Vertical Grouped");  
rc=insertc(plotlist,"Vertical Simple");  
rc=insertc(plotlist,"Horizontal Stacked");
```

...

The following SCL lines show how the sample graphs and instructions are dynamically allocated after the user chooses one of the graph types from the pop list. Note that we needed to create a graph catalogue which permanently contained the sample graphs and sample PROC GSLIDE instructions graphs:

```
rc=popmenu(plotlist,9);  
call notify('sampgraf','_unhide_');  
call notify('samptext','_unhide_');  
if rc=1 then do; *horizontal simple graph;
```

```

radio1a='simple';
radio1b='horizontal';
btype='hbar';
barcolor='onecolor';
end;
if rc=2 then do;
...

GRAFTYPE:
if radio1a='simple' and radio1b='horizontal' and
radio1c='frequencies' then do;
    call notify('sampgraf', '_set_graph_',
    'system.windows.hgraph1.grseg');
    call notify('samptext', '_set_graph_',
    'system.windows.htext1.grseg');
end;
if radio1a='simple' and radio1b='horizontal' and
radio1c='means/sums' then do;
    call notify('sampgraf', '_set_graph_',
    'system.windows.hgraph1m.grseg');
    call notify('samptext', '_set_graph_',
    'system.windows.htext1m.grseg');
end;

```

EASY-TO-USE OPTIONS SCREENS

When the user presses the Options button, an appropriate options frame is displayed. This frame gives the user customized choices depending on which graph procedure is run: Bar Charts, X-Y Plots, or Maps. A sample options frame for a grouped bar chart is displayed in **Figure 5** and the resultant graph is displayed in **Figure 6**. The options in **Figure 5** produced the two columns of statistics to the right of the graph. Because SAS horizontal bar charts allow means, counts, cumulative counts, and percentage figures to be displayed the SCL code displays the appropriate check boxes in the Options screen. If the user had chosen a vertical graph, only the means check box would have been displayed because only one number can be displayed at the top of each vertical bar. The other check boxes would be hidden for bar statistics. Note that the **analysis** object allows displaying of the mean or sum by the bars.

The following SCL code excerpt illustrates the hiding of these buttons:

```

if btype='vbar' then do;
    call notify('cfreq', '_HIDE_');
    call notify('percent', '_HIDE_');
    call notify('cpercent', '_HIDE_');
    if radio1c ne 'frequencies' then do;
        call notify('freq', '_HIDE_');
        call notify('analysis', '_UNHIDE_');
    end;
    if radio1a='stacked' and radio1c='frequencies'
    then do;
        call notify('freq', '_HIDE_');
    end;
    if radio1c='frequencies' then do;
        call notify('analysis', '_HIDE_');
    end;
end;

```

STATISTICS COMBINED WITH GRAPHICS

One of the X-Y Plot choices is a simple linear regression plot which is created in PROC GPLOT using an optional SYMBOL statement which draws the fitted regression line and 95% confidence bands for either the conditional mean response or for the actual predicted response. An additional option is to display regression statistics computed in PROC REG which include R^2 , slope and intercept estimates and accompanying T values for the parameters. This was accomplished by using PROC PRINTTO and capturing the appropriate output lines into a data set. Then these statistic values were saved as macro variables and inserted into footnotes in the PROC GPLOT graph with a uniform graph font to line up the parameter statistics below the graph. **Figure 7** shows a regression plot which includes the 95% confidence bands and corresponding regression parameter estimates with T-values below the graph. Note that PROC INSIGHT also annexes statistics to its plots for some of the graphs. However, with SAS/FRAME we have the freedom to construct our own graphs and corresponding statistical output. SAS' flexibility of PROC PRINTTO and the ability to draw any type of graph with SAS' annotate facility give us unlimited freedom in developing our own displays.

FUTURE GRAPHICS DEVELOPMENT WORK AND CONCLUSIONS

Very few statistical software packages combine both analytic report statistics and graphic displays on the same graph as we did in the regression plot. We are planning to attach statistics from one-way and two-way Analysis of Variance runs (PROC GLM) to the bottom of the bar charts which involve analysis variables where simple bar charts would display statistics from the one-way ANOVA and grouped/stacked bar charts would display statistics from two-way ANOVAs.

Additional graph frames which would be interesting to add could include box plots, dot plots and stem-and-leaf plots using the annotate facility as Michael Friendly has done (1991).

A third feature which would be desirable would be to use the hotspotting feature in SAS/FRAME graphic objects to enable a user to click on a map small area region and to have the screen display demographic information regarding that region in much the same way as GIS applications currently work.

In summary, our development team has used the flexibility of SAS software guided by recommended screen and graph design concepts to create an easy-to-use and flexible software system. It is this author's hope that the next version of SAS/ASSIST will be as easy to use as our software, particularly in the area of graph production and enhancement.

ACKNOWLEDGMENTS

The primary development team of EpiSTATION included the following people: Scott McCracken, Susan Osmand, Tom Bubolz, Pete Anderson and Kathy Shelley. Many other people have worked on documentation and product testing.

SAS, SAS/AF, SAS/FRAME, SAS/ASSIST, SAS/GRAPH, SAS/STAT, SAS/BASE, SAS/INSIGHT are registered trademarks of trademarks of SAS Institute Inc. in the USA and other countries.

The EpiSTATION logo is a registered trademark of the ISYS Group Inc.

The author may be contacted at the following address:
 Kathy Shelley
 Iowa State University
 117 Snedecor Hall
 Ames, IA 50011
 email: kathy@iastate.edu
 http://www.public.iastate.edu/~kathy/homepage.html

REFERENCES

(1) "Chart Smart: Designing Graphs and Tables for Effective Communication", Proceedings of MWSUG '93, by Le Roy Bessler, 1993.

(2) The Elements of Graphing Data by William S. Cleveland, Wadsworth Advanced Book Program, 1985.

(3) SAS System for Statistical Graphics First Edition by Michael Friendly, SAS Institute Inc. 1991.

(4) User Interface Screen Design, by Wilbert O. Galitz John Wiley & Sons, Inc., 1993.

(5) SAS/AF Software: FRAME Entry Usage and Reference Version 6 First Edition, SAS Institute Inc. 1993.

(6) SAS/GRAPH Software Volumes 1 and 2, Reference Version 6 First Edition, SAS Institute Inc., 1990.

(7) SAS Screen Control Language Reference, Version 6, Second Edition, SAS Institute Inc.

(8) SAS/STAT User's Guide Volumes 1 and 2, Version 6 Fourth Edition, SAS Institute Inc., 1990.

(9) Envisioning Information by Edward R. Tufte Graphics Press, 1990.

(10) The Visual Display of Quantitative Information by Edward R. Tufte, Graphics Press, 1983.

Figure 1

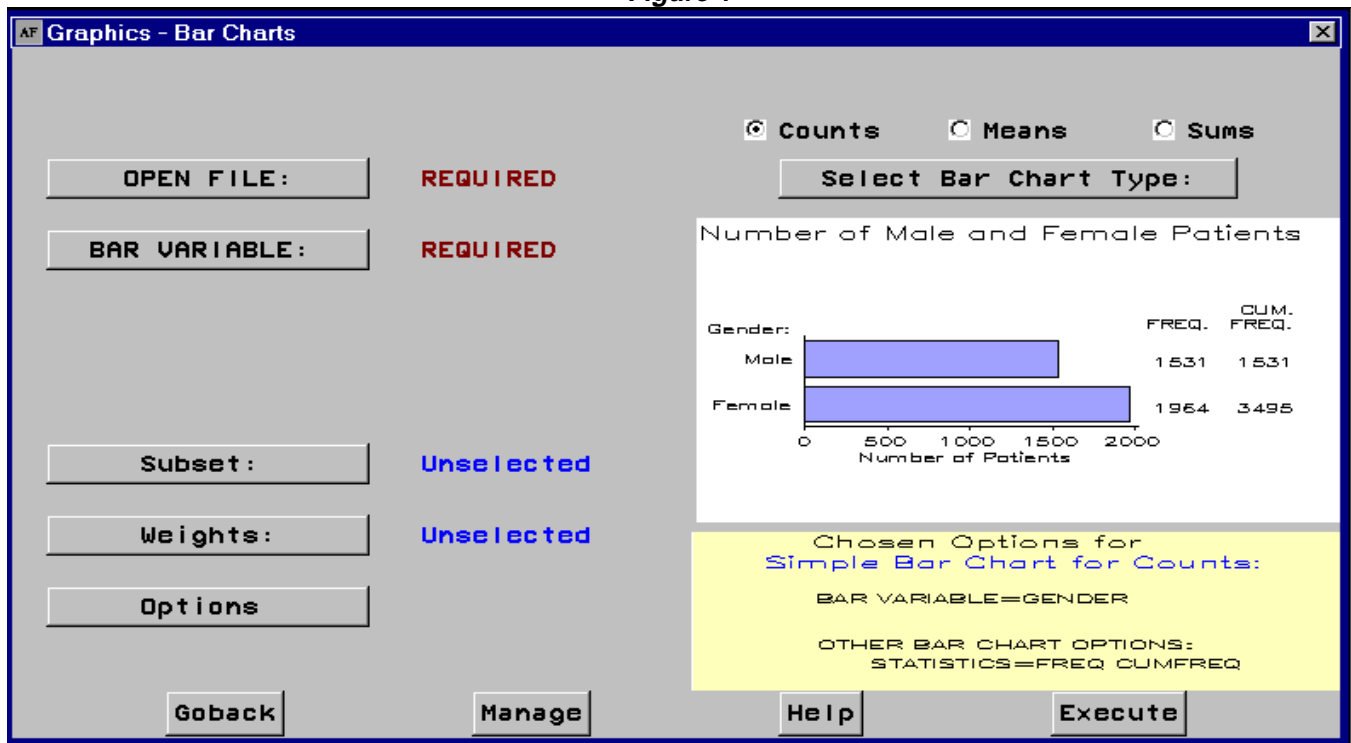


Figure 2

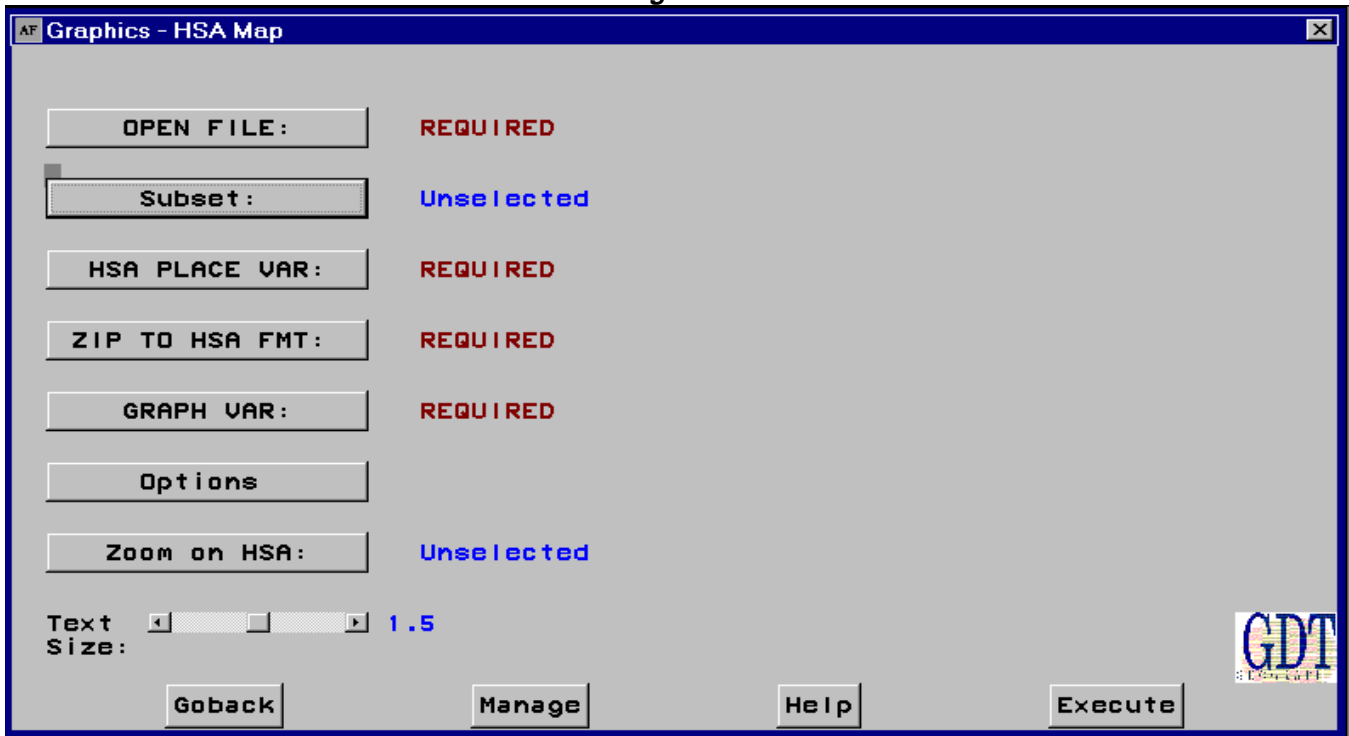


Figure 3

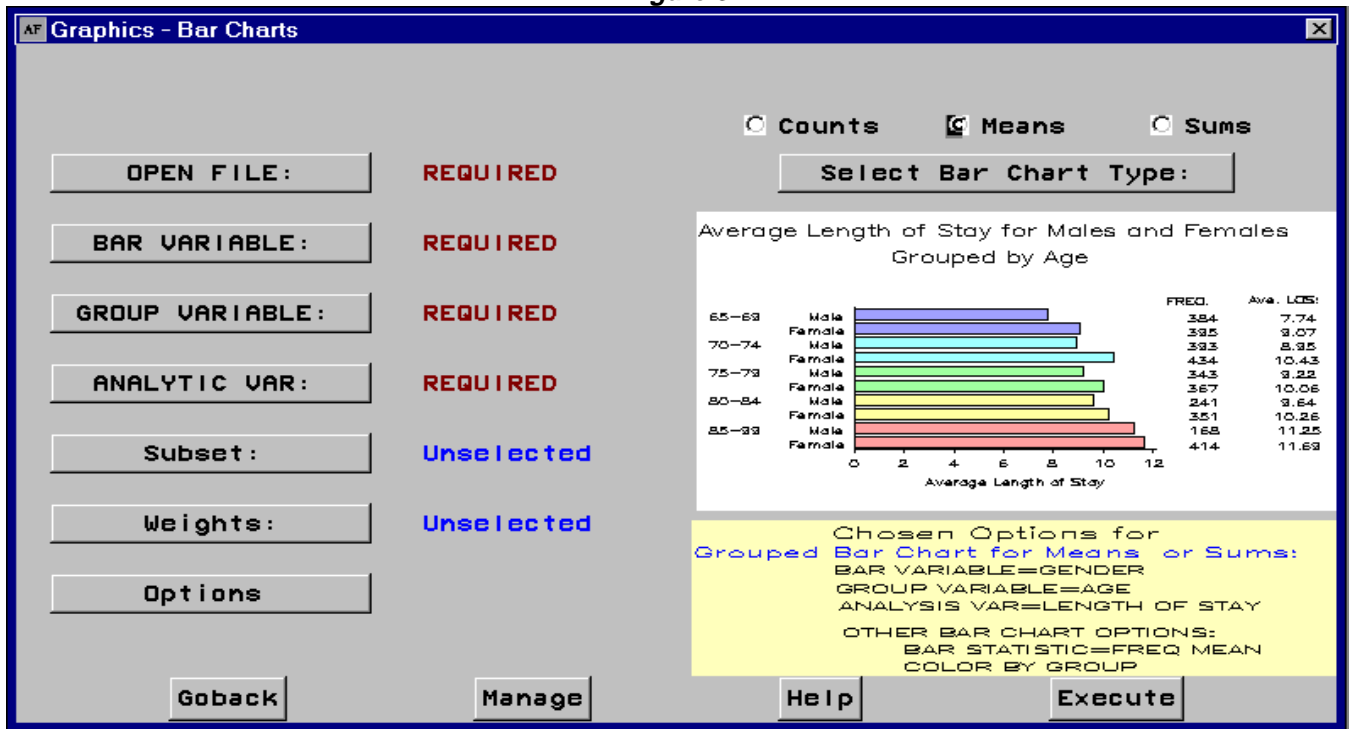


Figure 4

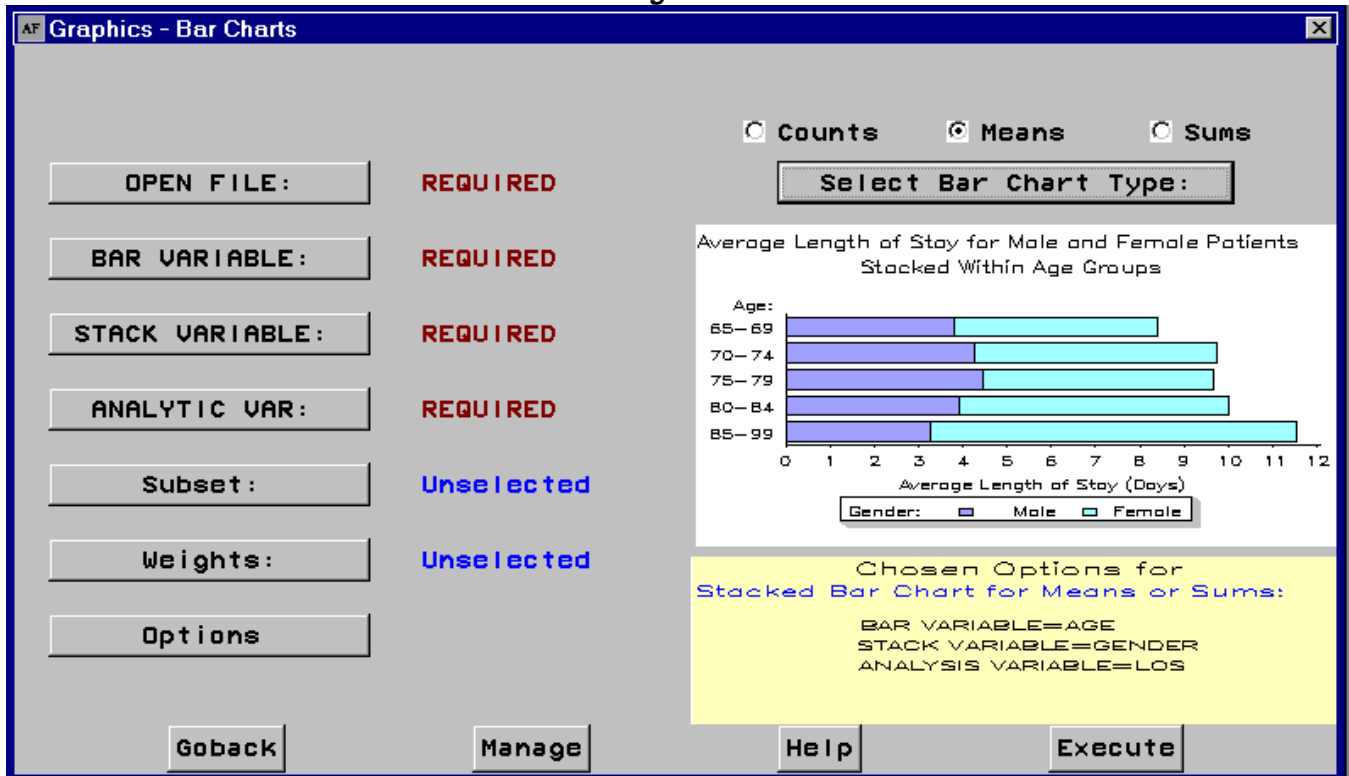


Figure 5

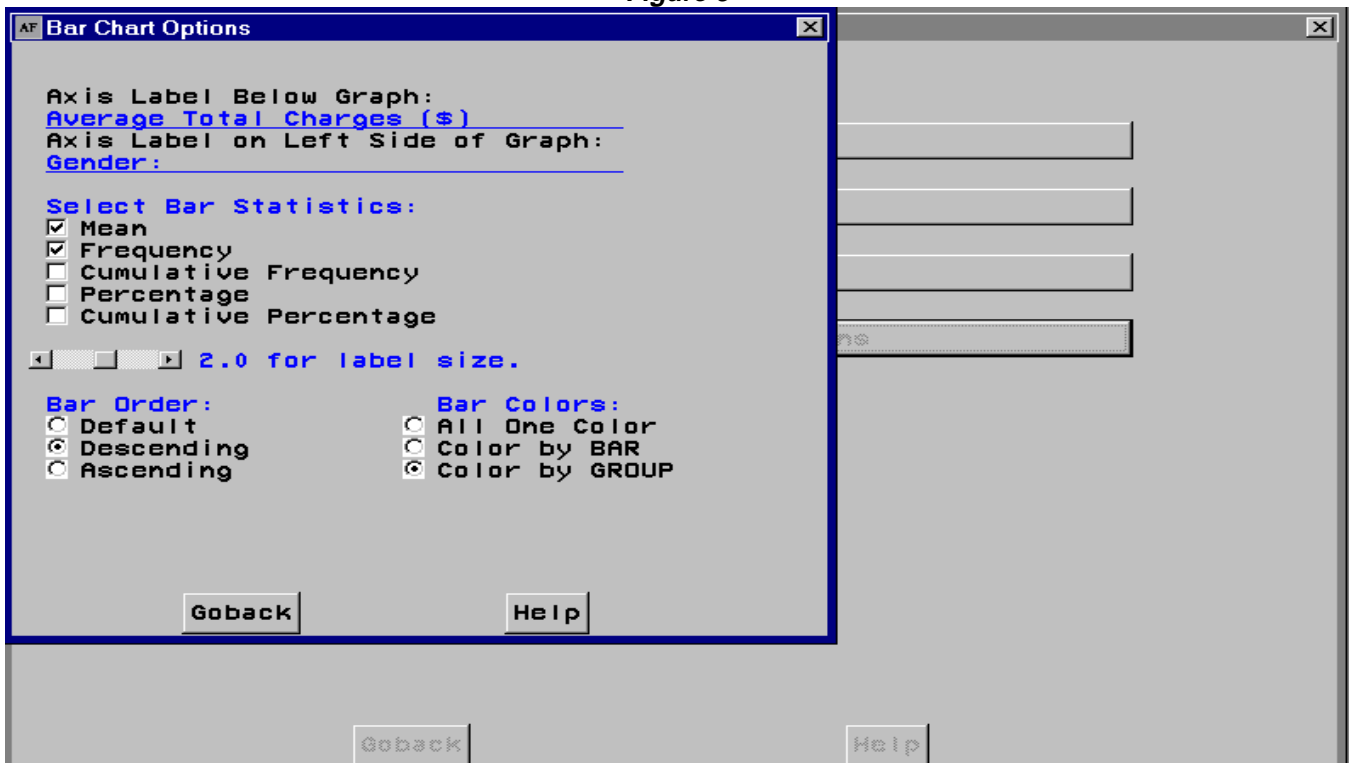


Figure 6

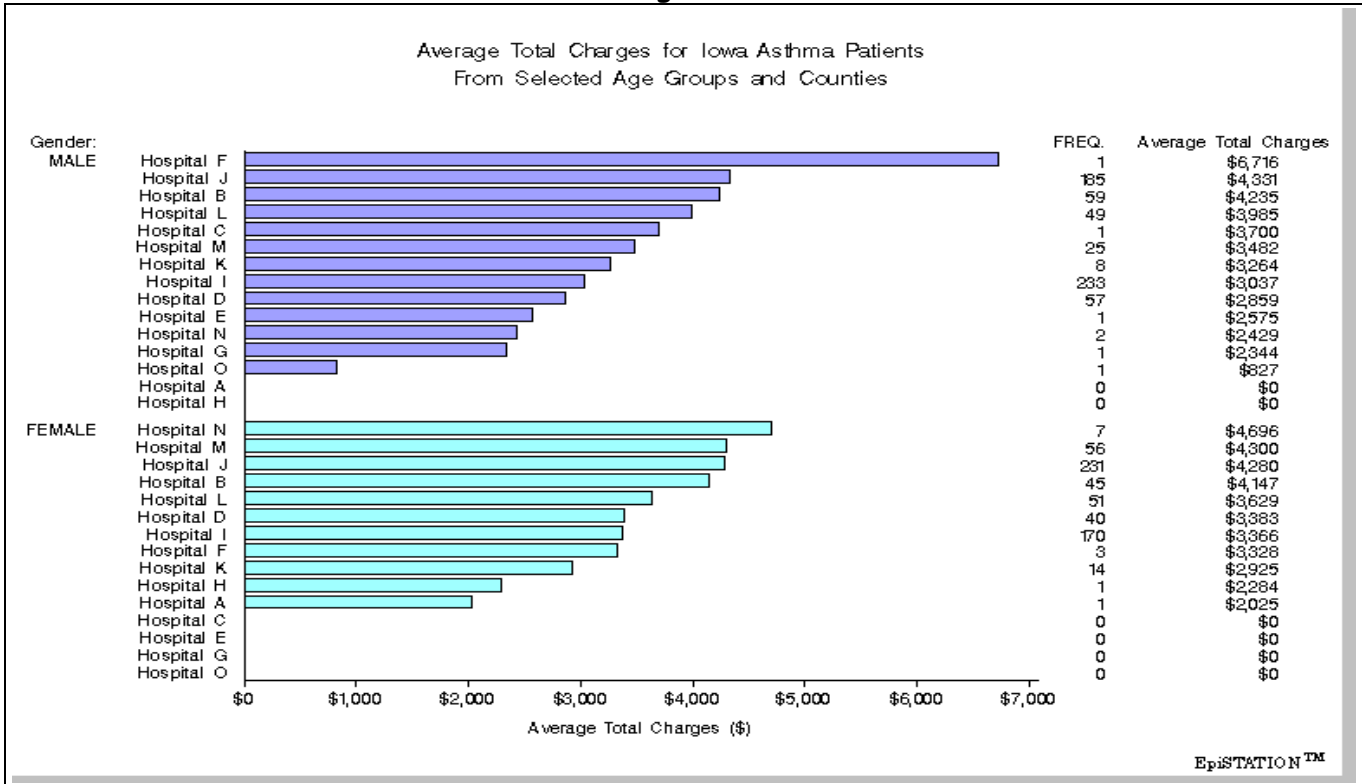


Figure 7

