Paper 256-2008

Increased Team Effectiveness through Information Visualization using ActiveX® Drill-Down Graphs Created via SAS/Graph®

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ABSTRACT

Significant research has proven that teams will produce better results then individuals in most situations. Put simply, in the words of Ken Blanchard and Sheldon Bowles, "None of us is as smart as all of us." (Blanchard [1], pg. 60) However, the main vehicle for team interaction is meetings where predefined agendas and presentations prevail. It is increasingly more important to examine data collectively in order to communicate the team's decision. Pictures are worth a thousand words. Giving the power to drill-down into the data graphically without disturbing the integrity of the original data gives the team an efficient way to communicate the decision made during data analysis. The ability to work interactively with the data during presentations or meetings only enhances the analysis. This session introduces the user to the programming techniques used to create drill-down graphs and how to use the advanced capabilities of the free SAS/Graph ActiveX plug-in provided by SAS®. These topics will enable the user to efficiently create high-powered graphics with drill down capabilities and effectively use these ActiveX graphs to facilitate information visualization within a team meeting. Using the plug-in, we will show the steps necessary to develop an interactive presentation, allowing the user to drill through predetermined graphics with embedded data effectively. During the presentation, the output created will capture and preserve the evaluation of the data. Attendees will participate in the process of 'drilling' through aggregate drug safety data to create customized graphics.

INTRODUCTION

In the pharmaceutical industry, visual and graphic displays are important analysis and presentation tools. The development of user-friendly interactive graphics would greatly enhance the usefulness of these tools. By utilizing the power of SAS, production of high-powered, presentation quality graphics is possible. More recently, data-exploration has become a desired specification. To address this, the enhanced graphs via ActiveX Control allow for this interactivity. The data analyzed for this project is in an Oracle database used for data capture and reporting. Therefore, it was not inherently functional for graphical output. By using SAS/ACCESS to Oracle, SAS can easily access the data. A subset of the data is then used to create interactive high-powered graphics, allowing the user to cut and paste the graphic into various Microsoft based programs.

Once a series of graphs and spreadsheets are created, a team can be formed to analyze the data during an interactive meeting. This is not a simple meeting with printouts and an agenda, but one with an Analyst armed with a computer and a LCD projector ready to graphically represent the discussion during the meeting. This paper will show how to create a drill-down series of graphs for better data connectivity. To afford understanding, further background on the data and the SAS ActiveX tool is provided. The paper will then discuss the drill-down capabilities of SAS, during this interactive collaborative meeting. Again, "none of us is as smart as all of us." (Blanchard [1], pg. 60)

ABBREVIATIONS

ActiveX	A component object model (COM) developed by Microsoft for Windows platforms	ODS	Output Delivery System
HTML	Hypertext Markup Language	PT	Preferred Term
MedDRA®	Medical Dictionary for Regulatory Activities	SOC	System Organ Class

THE CASE FOR TEAMWORK

To improve the safety of patients, increase the quality of an analysis, and find interesting new information from your data, an effective team should have the passion of shared vision. As Stephan R. Covey wrote, "The passion created by shared vision creates synergistic empowerment. It unleashes and combines the energy, talent, and capacities of all involved." (Covey [1], pg. 219) Also known as Quadrant II activities, the effective team spends more time on what is important and not urgent. "This is the Quadrant of Quality. Here's where we do our long range planning, anticipate and prevent problems, empower others, and increase our skills." (Covey [1], pg. 37)

Ken Blanchard, in his series of books on the power of teamwork (Blanchard [1], Blanchard [2], Blanchard [3]), highlights numerous benefits for working together. At the core of this discussion, though, is the notion that a team is much more than a collection of individuals. There are specific characteristics that define a team and its ability to be effective, the primary characteristic being that the goals of the team and the responsibilities of each team member are

clear and understood. (Blanchard [2], pg. 10) In a clinical context individuals from various backgrounds come together to make decisions on how data should be interpreted, presented and subsequently utilized. For this to be an effective and efficient process, individuals need to embrace both primary goals of teamwork. An individual must be capable and willing to represent their discipline and be diligent in their review of information. Once these personal victories have been achieved, individuals are prepared to come together and participate in the team's pursuit of its goal, in this case, the delivery of a clear, defensible interpretation of the data that a company can use to position its product in the marketplace as well make intelligent decisions on future development efforts. Stephen Covey (Covey [2], pgs. 262-263) describes this synergistic activity as the whole being greater than the sum of its parts. Ken Blanchard states that "When this happens… [you] go from being a relatively powerless individual to something far more powerful, productive and successful than [you] could have been on [your] own." (Blanchard [2], pg. 60) So, if this is clearly and abundantly documented, why is effective team review and decision making still such a hurdle in the workplace?

GROUP EVALUATION AND DECISION MAKING

Despite advances in technology and the passage of time, the prominent forum for group decision making is still the meeting, be it face-to-face, a teleconference, a web-enabled virtual or a hybrid of one or more of these types. Participants evaluate the content and context of the data prior to coming together in a meeting, developing their case for interpretation and presentation independently. Between one's individual interpretation and the formal meeting the data and its interpretation are often subject to informal caucus, water cooler banter, white-board workouts and other for a for the fleshing of ideas, the key factor being that the entire group responsible for making a decision regarding the data has not yet come together. When the meeting finally does occur, significant challenges have now been introduced that must be overcome, most of which are a product of the goals of the team being lost in the individual analysis and preparation for the team discussion.

What are some of those challenges?

- Each individual / caucus has developed its own set of assumptions regarding the data which may or may not be true
- Each individual / caucus has determined potential solutions / direction using their own nomenclature which may or may not be accurate
- The right people are not fully engaged in the same room for a sufficient amount of time
- The correct materials / sufficient quantities printed for each person attending
- Plowing through the mounts or paper to find a statistic is inefficient
- Black and white graphs may hide important data points
- Static nature of printed outputs do not allow investigation into data points
- Questions needing follow-up and answered at a later date may not be communicated to entire team

When we say increased team effectiveness in a clinical research and development setting we are speaking of a better decision reached quickly without excessive rework. Traditional SAS programming work around investigational drug studies typically involves a statistician creating output specifications, followed by a statistical programmer programming datasets, documents, and/or graphs off the specifications, and subsequently the team reviewing these outputs. The cycle continues again with the statistician updating the specifications, the programmer tweaking code or writing new code, and the team reviewing the outputs again. This optimistically has one cycle but experience has shown this depends, independently, on the quality of the specifications, outputs produced, or effectiveness and time pressures of the review. If any part of this cycle is ineffective then the whole product suffers.

Ineffectiveness does not only affect the analysis of data but can create an incredible amount of rework or future ad-hoc programming work as well. Ad-hoc programming is the bane of a programming group because it is difficult to predict and difficult to manage. This type of work spawns from the gaps in primary analysis during the normal production cycle described above. One potential advantage of visualization in this type of team setting is the creation of better specifications and the identification of gaps in the data analysis earlier in the review process. Data visualization in a team setting using a tool such as SAS/Graph produced ActiveX materials can address a number of the challenges bulleted above by securing the source data, addressing contentious individual interpretations and facilitating group exploration of the material, thus allowing the team to pursue its goal of developing a useful, sound position without distraction.

The untested, hypothetical solution proposed in this paper has the ability to address a number of these obstacles. It involves investigating data in a team setting. There are other powerful tools and systems on the market from Cognos® and Spotfire® that can be effectively used for data visualization; the authors have worked in environments that have used these in a team meeting setting with much success. Both of these systems are quite expensive and require employees with specific training and large servers with information system support. What is proposed in this paper can never mimic the exact capabilities of those two products. However, using SAS/Graph and ActiveX is a relatively inexpensive alternative or perhaps an adequate proving ground to investigate requirements for larger data visualization systems. Above all, this solution protects the source data, is graphical in nature, and is easy to manipulate yet the final product is of presentation / publication quality.

BACKGROUND AND DEFINITIONS

The data analyzed is post-marketing safety data that has been de-identified. This data represents safety information about products on the market. Although the data has numerous attributes and characteristics, an understanding of the structure behind the safety data is most important to understand the graphics, techniques, and ultimately the drill-down characteristics. The data is adverse event terms reported in conjunction with the use of a pharmaceutical product (i.e. headache, nausea etc.). These terms are part of a hierarchical architecture known as the medical dictionary MedDRA®. The dictionary itself has five levels, with each level having more granularity than the previous level and subsumed under the previous. The analysis and graphics focus on two of these levels. The highest level of MedDRA®, the System Organ Class (SOC), has 26 categories relating to major body systems (i.e. Nervous SOC, Cardiac SOC). The next level of interest is actually the fourth tier and is the Preferred Term (PT). The PT level has approximately 16000 different entries.

The data resides in a post-marketing safety database, allowing for post-marketing data to be captured and reported. This Oracle based application is a comprehensive database software package for reporting and tracking clinical adverse events. Output from this application is limited to report format only and contains virtually no graphics.

Using the programming techniques outlined in this paper drill-down graphs can be created like the one in Figure 1 on the next page. Please refer to the code following the visualization using SAS ActiveX for details on how to make this work for your organization.

VISUALIZATION USING SAS ACTIVEX

Before we move into the configuration of the drill-down code, which enables the navigation across and through levels and graphics, let us examine some sample SAS output. This section will highlight the capabilities of the SAS ActiveX tool. We will look at a 3-dimensional summarization of the database being analyzed, representing the frequency of adverse events that occur within each SOC by the corresponding product. However, the importance at this point is not in what data the graphic contains, but in the versatility and functionality of the SAS ActiveX tool. Although we will be using only one graphic to demonstrate the tool, it is important to understand that each graphic created within the drill-down code will have the same capabilities. As you drill through the data to different graphics, you are able to customize and manipulate each graphic to meet your needs.

The following figures will briefly demonstrate the graphic's properties, the ActiveX toolbar and how to effectively customize and manipulate the data. These properties and toolbar are inherent in the ActiveX application and there is no additional programming needed. Once the drill-down graphics are complete, the manipulation can be performed during the team's meeting on a 'live' basis as needed. And, the graphics are very conveniently created in html format. Perhaps, during a review, the team decides that a customized graphic is needed. Using the ActiveX tool we can quickly create the customization for the team. Once complete, it is a simple cut and paste into a Microsoft application to preserve or present the result. The only necessity is the SAS ActiveX plug-in. On the next several pages, you will find accompanying each figure is a brief paragraph explaining the function being demonstrated.

Figure 1: The data values and labels are available by simply using your mouse pointer and 'hovering' over the desired data point. A pop-up screen will display the underlying data.

Figure 1

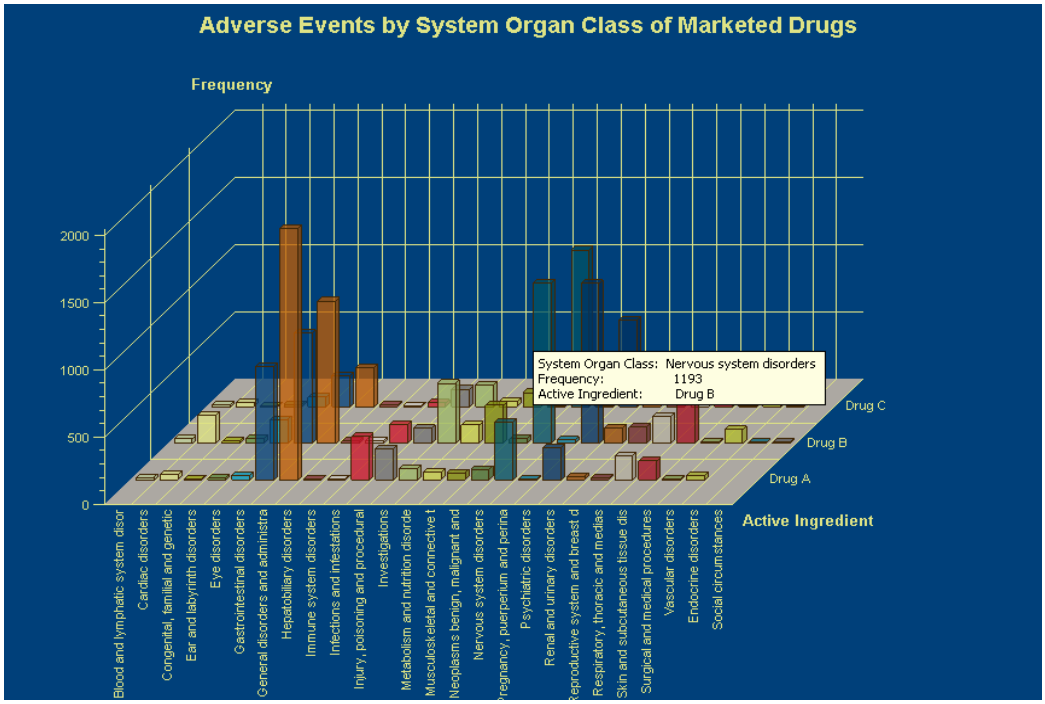


Figure 2: With a 'right click' on your mouse, you are able to access the in depth graphic menu. It is through this menu that you will be able to perform numerous functions including viewing and editing your data as well as manipulation and customization of the graphic.

Figure 2

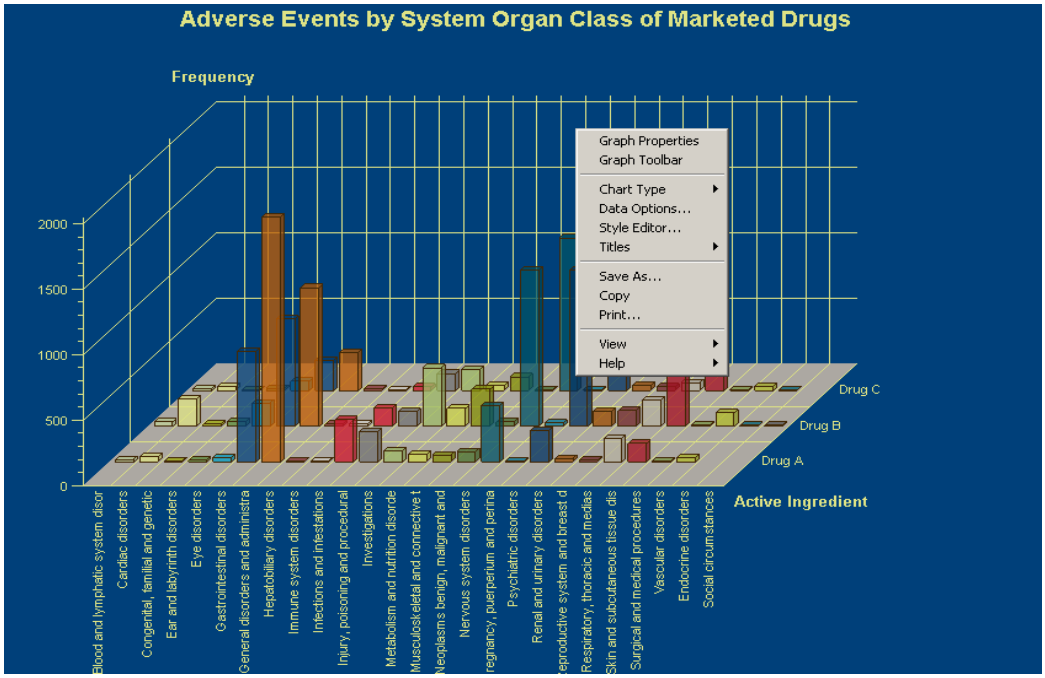


Figure 3: The first tab within the Properties option allows you to customize the style and colors of the graphic as well as grid line patterns. You are also able to convert the graphic from 3 dimensional to 2 dimensional. SAS has numerous default styles to choose, or you can design a custom style of your own.

Figure 3

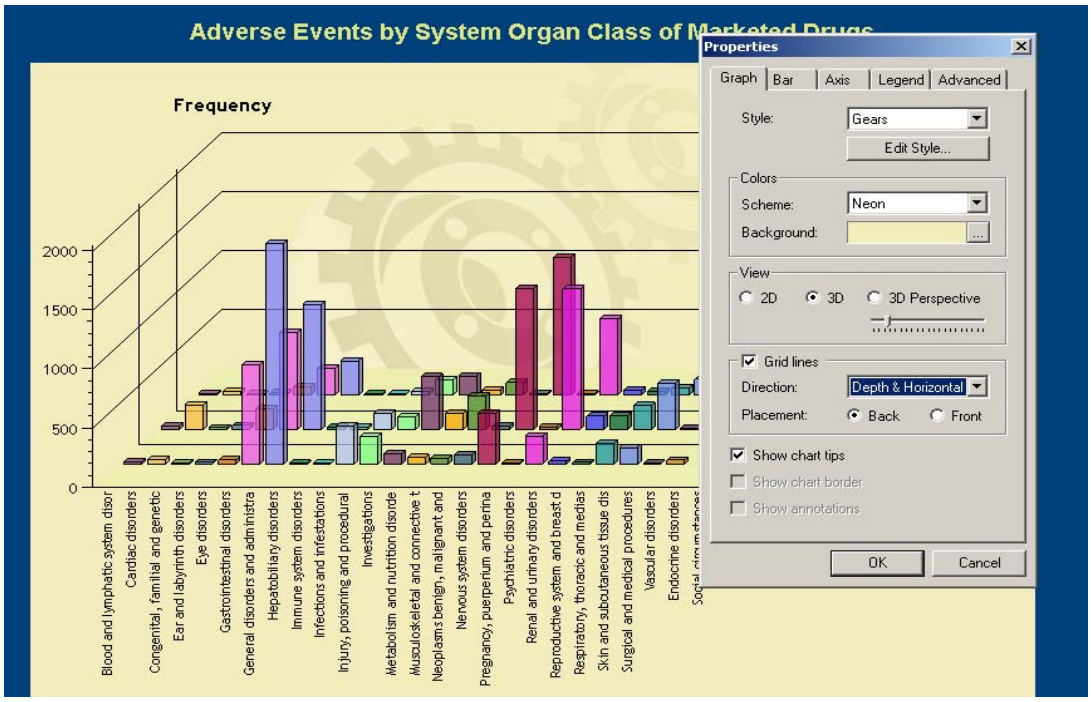


Figure 4: The second tab within the Properties option allows you to customize the coloring category, bar shape and outline color. There are numerous default categories that you can choose. Data labels can be toggled on and off at this point. By default, the labels are toggled off, however, they are still visible when the mouse cursor is over a data point.

Figure 4

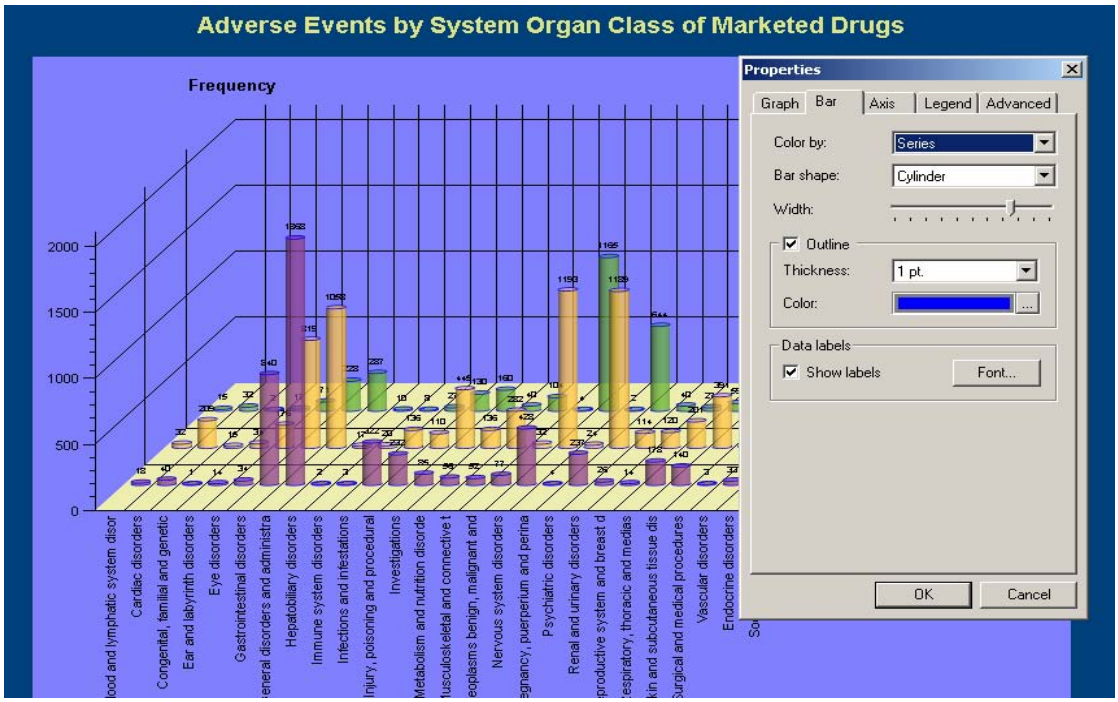


Figure 5: The third tab within the Properties option allows you to customize each axis separately, including color, order, tick marks and labels. The font, size and location of the labels can be customized.

Figure 5

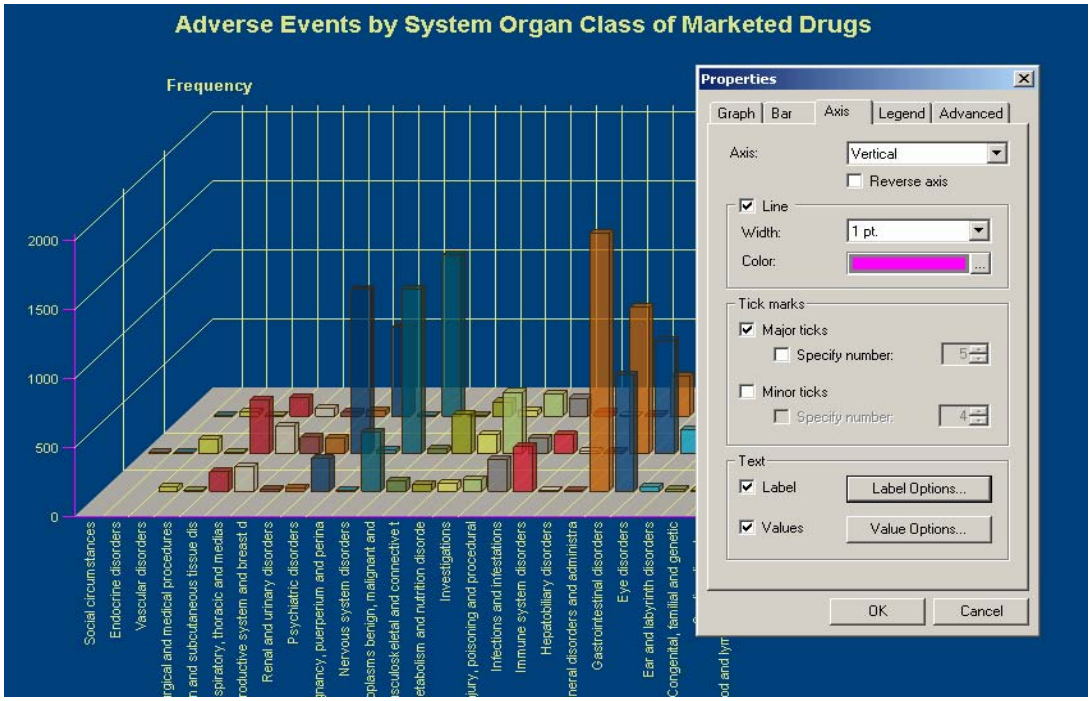


Figure 6: The fourth tab within the Properties option gives you the ability to display and customize the legend including color, font, size and location. The legend title and background can be customized as well.

Figure 6

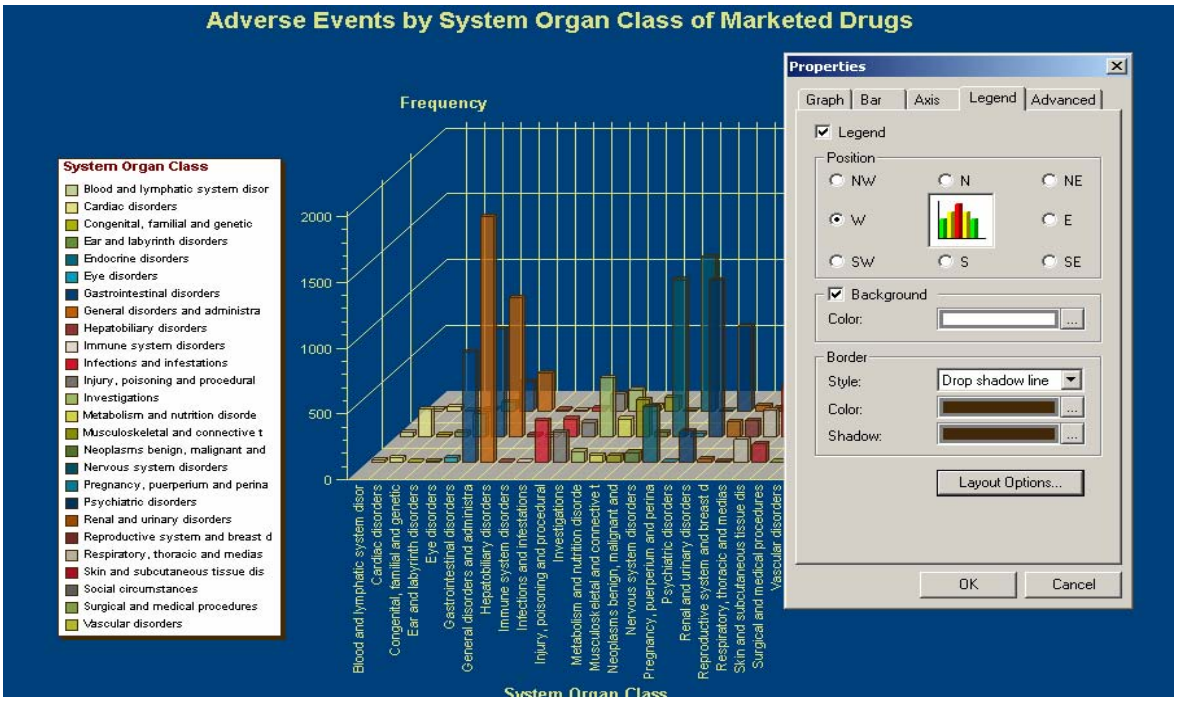


Figure 7: The final tab within the Properties option gives you the ability to customize lighting, zoom and rotation effects. The zoom and rotation effects are available on the graphic toolbar. Experience will guide you through the best options for your graphic.

Figure 7

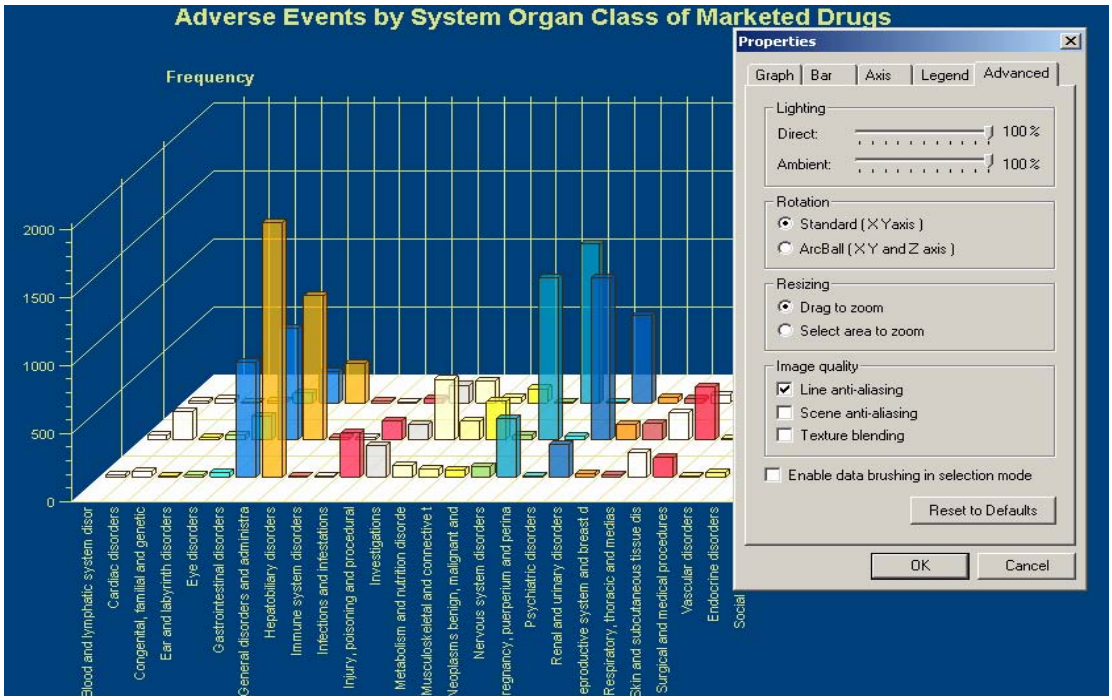


Figure 8: You are able to easily manipulate the chart type to create horizontal and vertical bar charts as well as pie charts. Bars and axis labels are automatically corrected. This offers you the ability to quickly adjust the graphic depending on what the reviewing group prefers.

Figure 8

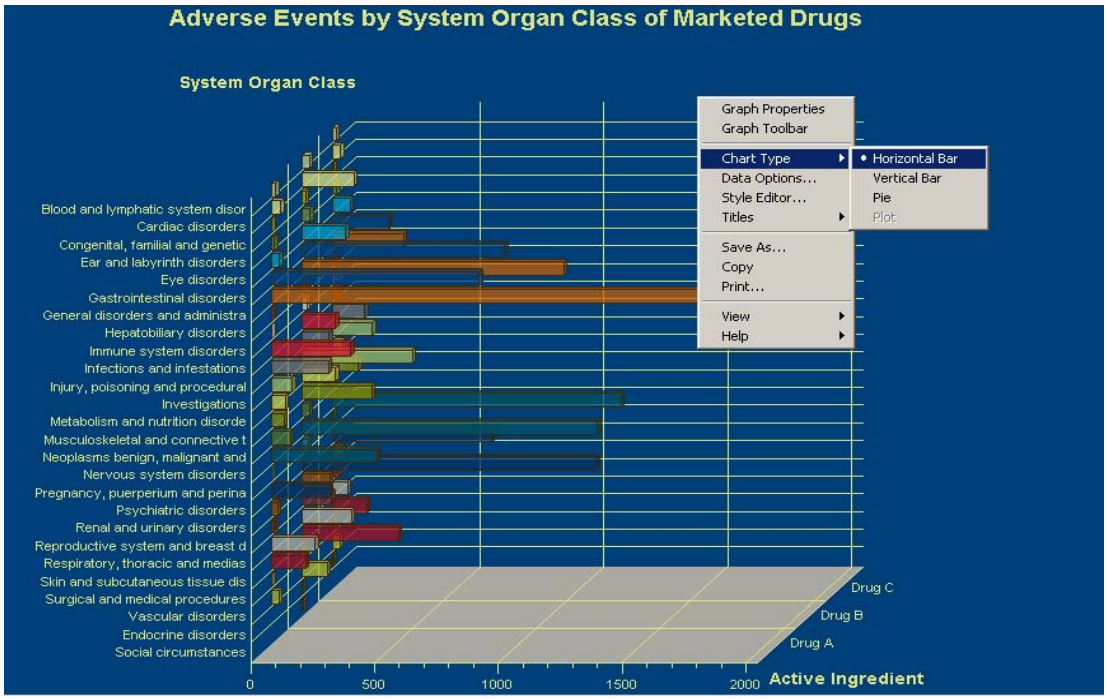


Figure 9: Choosing a pie chart offers the group a very specific and unique way to interpret the data. Common coloring across pies makes comparison efficient and effortless. Toggling between the different types of charts enables easier interpretation of the data, depending on the needs of the group.

Figure 9

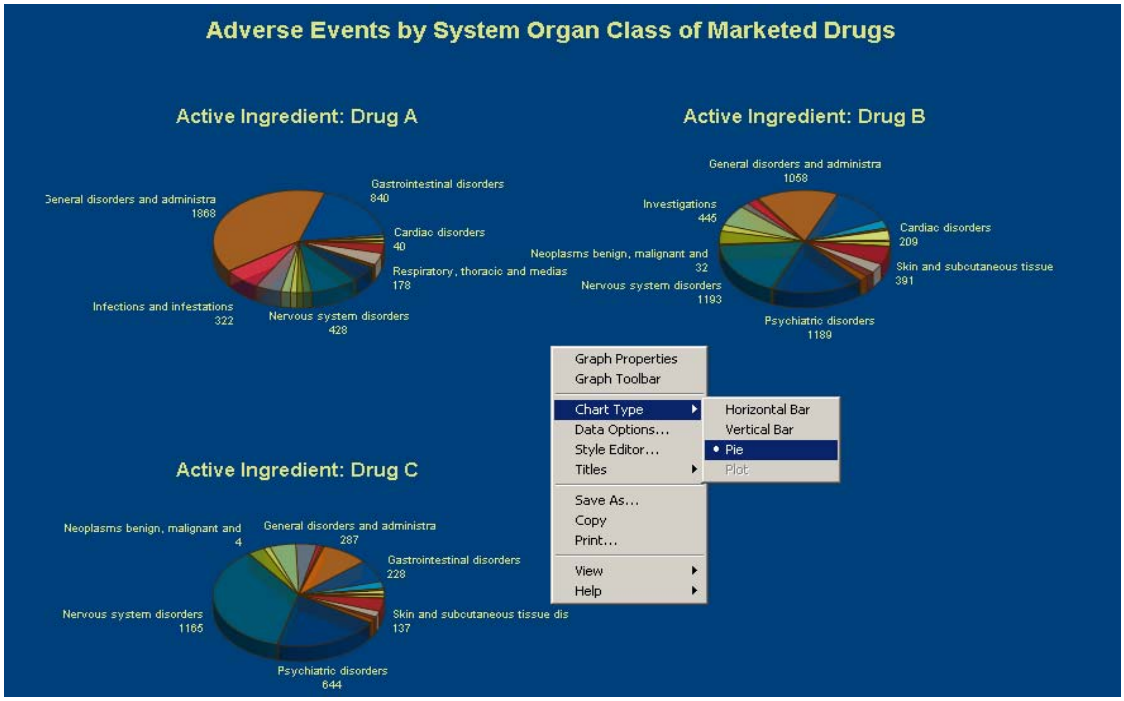


Figure 10: Under the Data Options tab, you are able to view and edit the chart data. This allows the group to view the actual data in tabular form as well as graphically. Customization of the bars and the statistic being calculated is also possible within this tab.

Figure 10

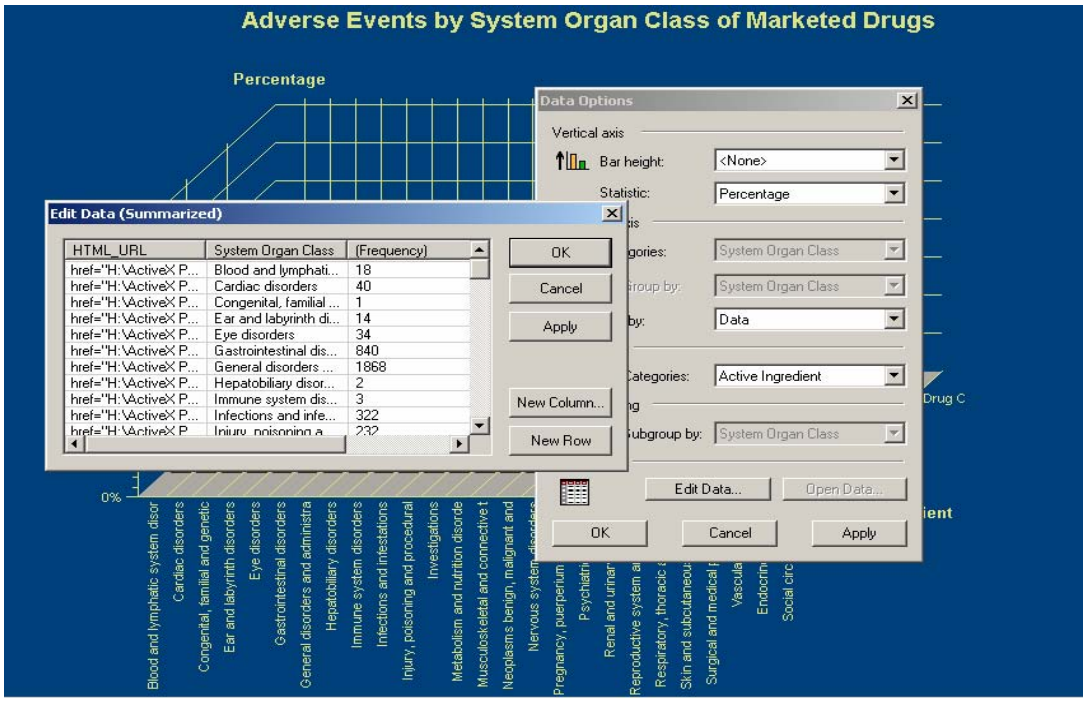


Figure 11: The Style Editor allows you to highly customize the chart appearance. It is here that user defined pictures or graphics can be chosen to serve as background images. It is important to note that all functions of the graphic remain intact.

Figure 11

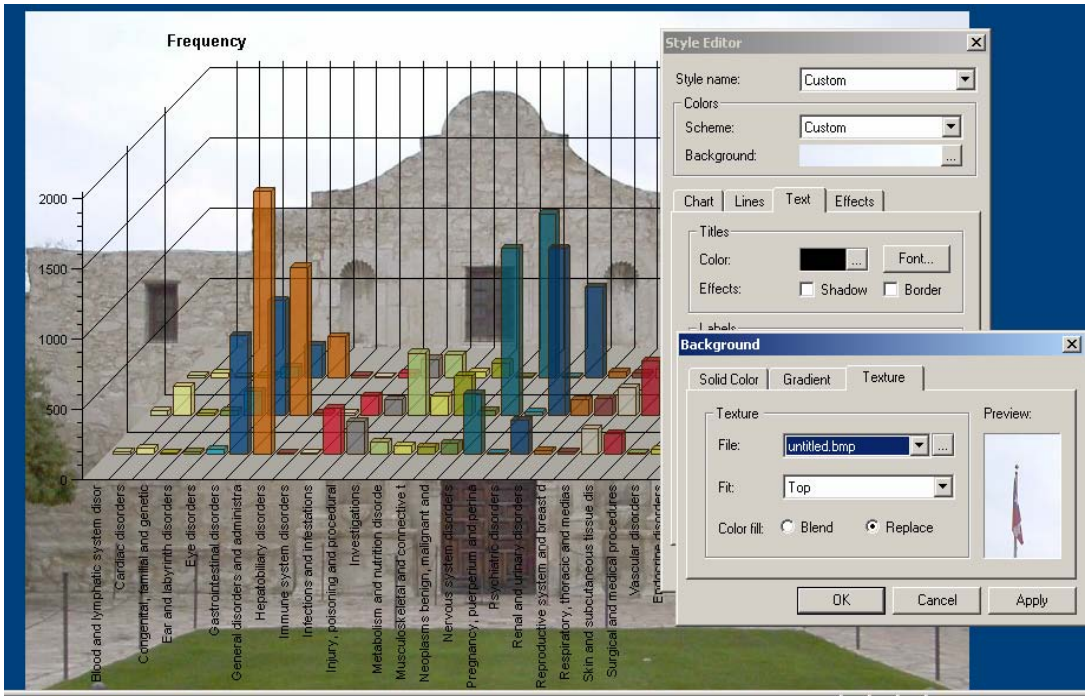
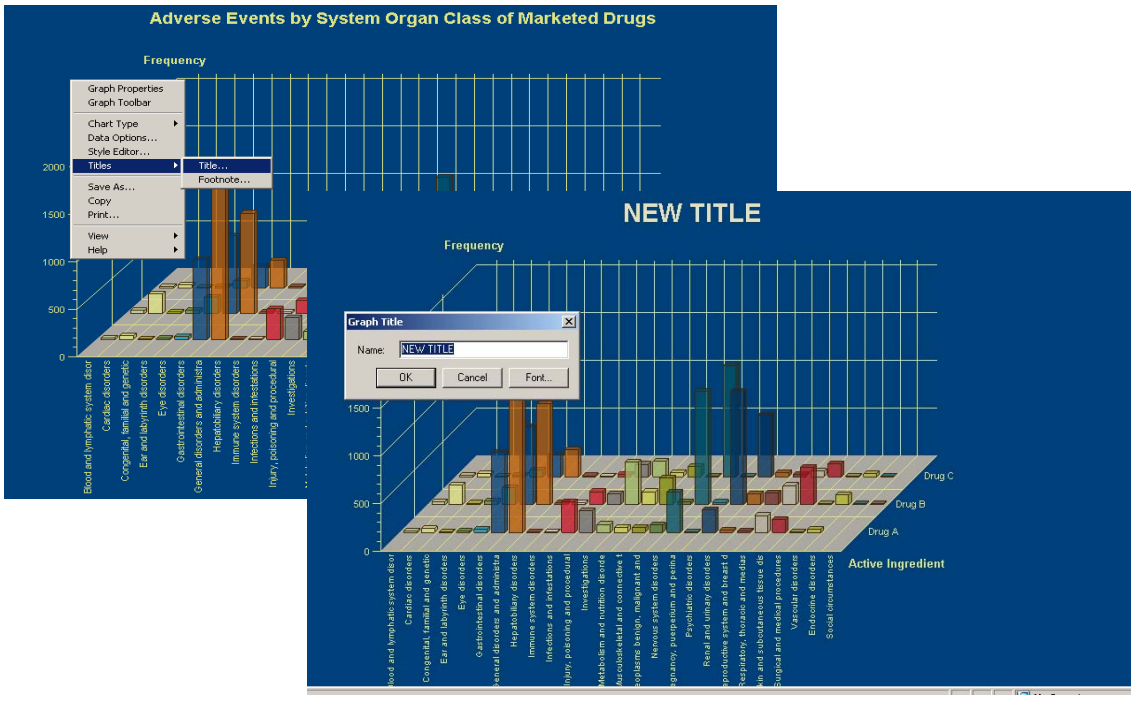


Figure 12: Often the group may like to change the title while reviewing the data. This is an easy task within the graphic menu. You are able to edit the title instantly.

Figure 12



GRAPHIC TOOL AND FUNCTIONS AVAILABLE

Perhaps the most powerful and useful tool for the group within the menu is the Graph Toolbar. This toolbar includes seven tools which allow you to interact with the data and manipulate the chart as needed for the group.
Seven individual tools appear on the toolbar. From left to right these tools are the following:

a typical mouse pointer

a rotational tool with the ability to rotate the graph in all directions

a tool allowing the user to move the graph within the window

a zoom tool manipulating the entire graph

a precise zooming tool allowing the user to choose a specific area to enlarge

a tool that allows the user to highlight specific areas

a tool which enables the user to return the graphic to its original form.

The remaining figures demonstrate the use of the Graphic Toolbar tools and how they can effectively manipulate, subset and examine the data that is embedded within the graphic.

Figure 13: By right clicking and choosing 'Graph Toolbar', the interactive toolbar appears. The seven tools outlined above are seen on the toolbar.

Figure 13

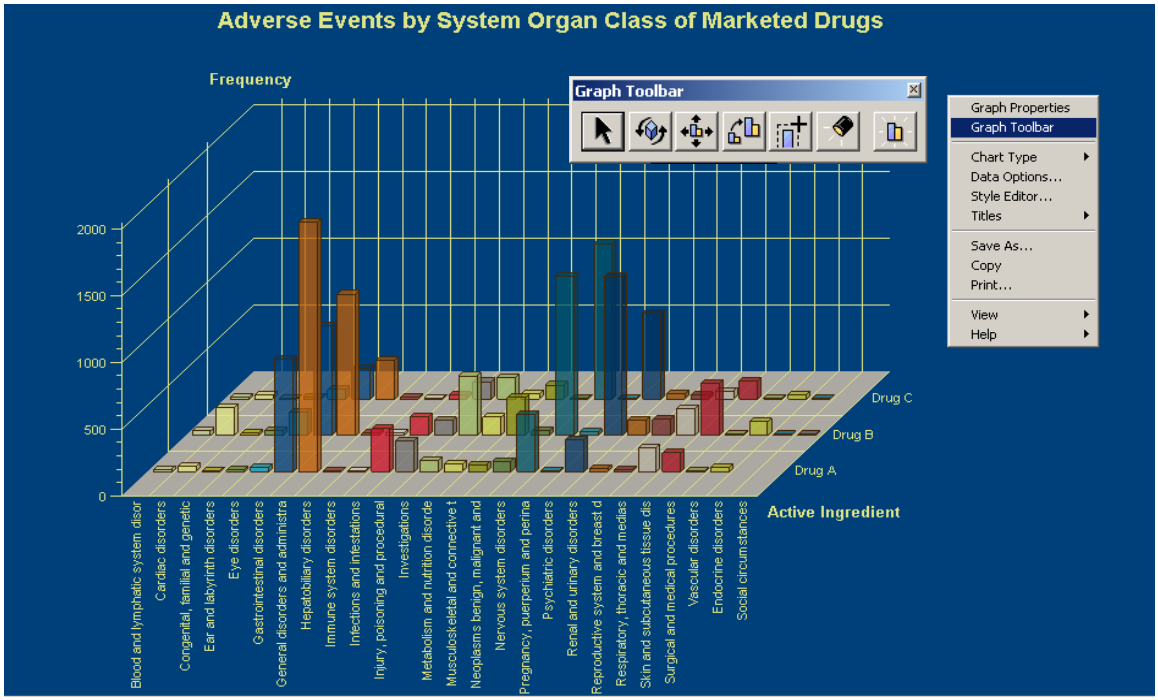


Figure 14: The Rotation tool allows you to rotate the graphic through 360 degrees. Note that the axis labels are automatically corrected during the rotation. This enables you to view bars and data that may be obscured in the original output.

Figure 14

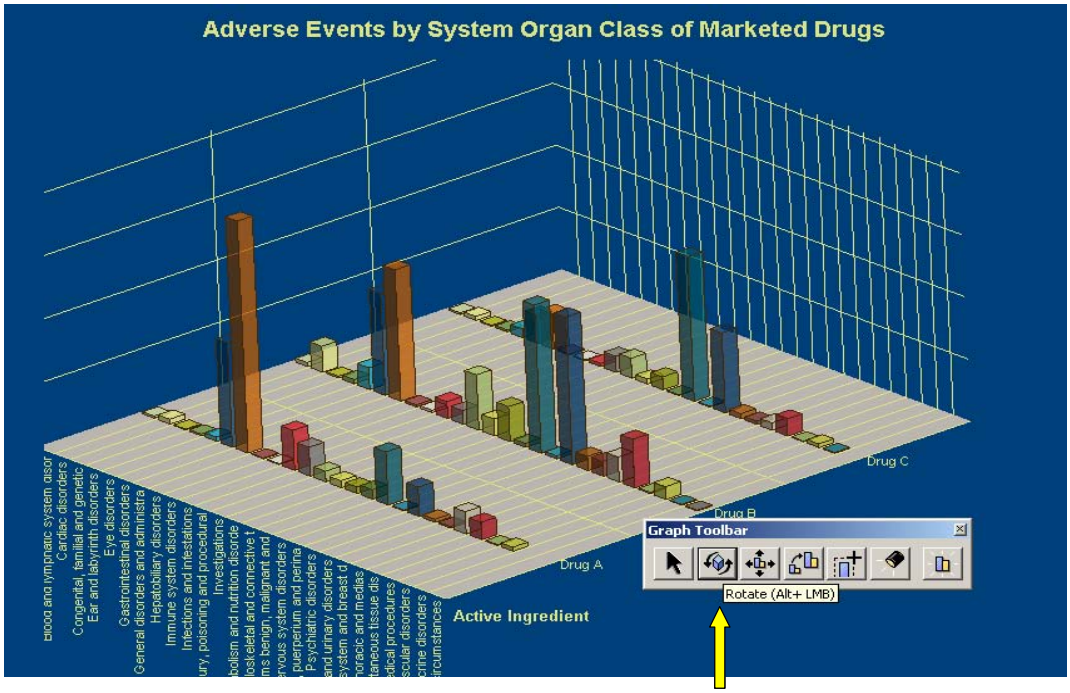


Figure 15: The Zoom tool allows you to highlight specific areas of the graphic to zoom for the group. All functionality remains intact in the new graphic and you can easily reset the view to the original.

Figure 15

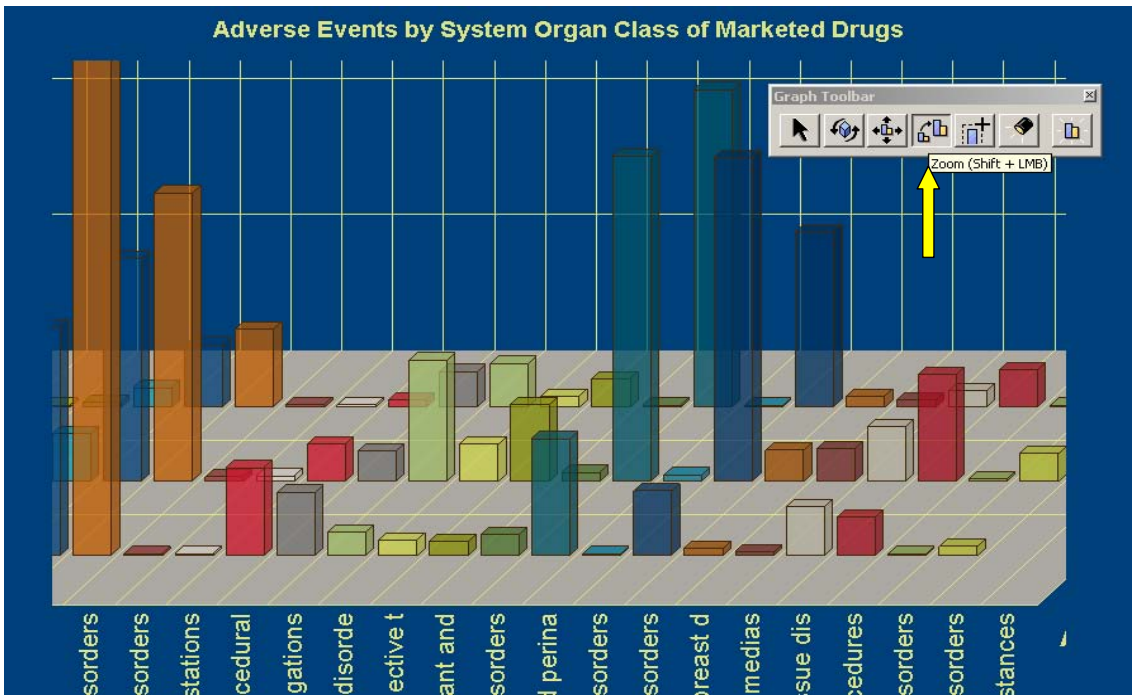


Figure 16: The Move tool allows you to move the graphic within the window. This is very useful when using the Zoom function, when some axis names or data become difficult to view.

Figure 16

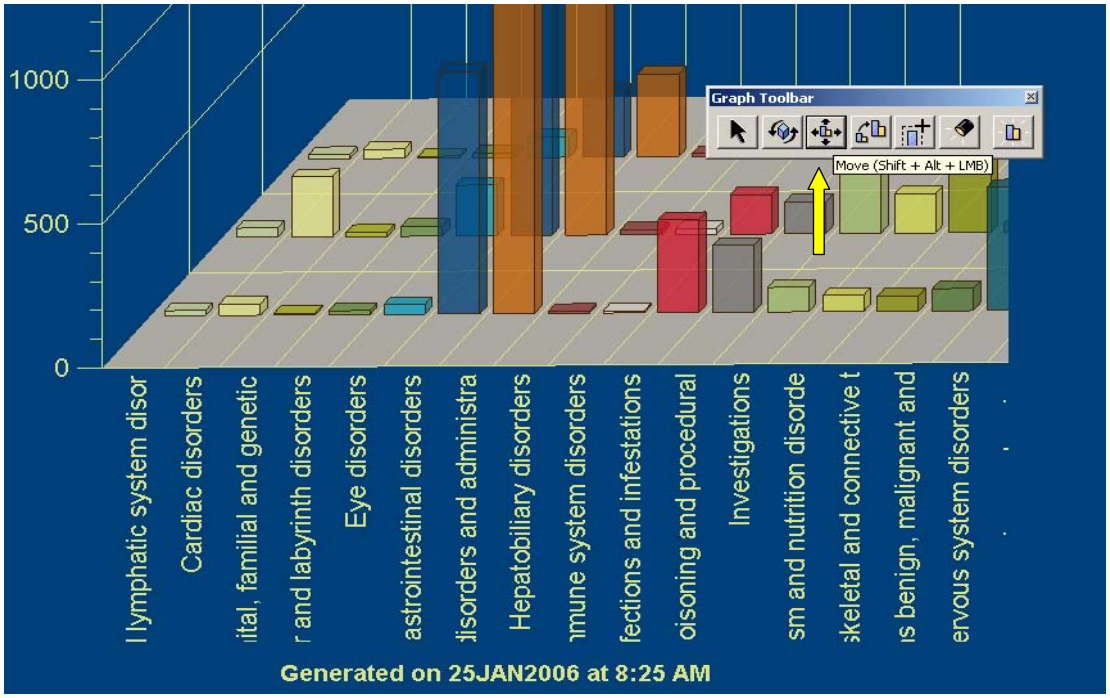


Figure 17: The Subset Data tool allows you to choose specific data to subset. Once chosen, SAS automatically zooms in on the data. Again, it is important to note that all functionality remains intact in the new graphic.

Figure 17

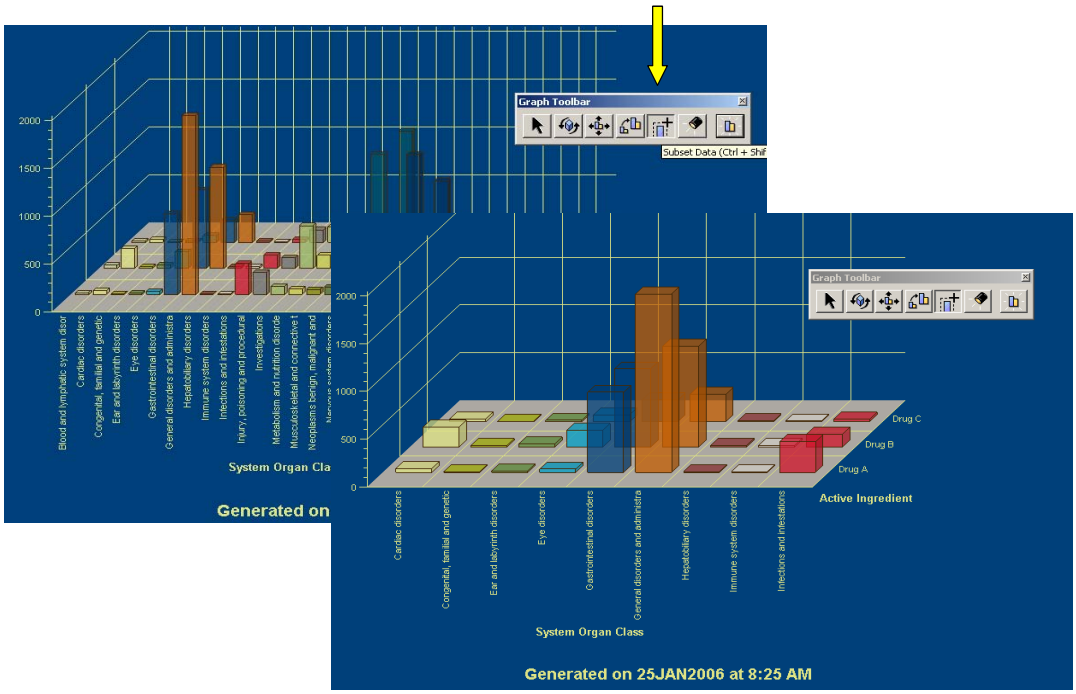


Figure 18: The Position Light tool allows you to change the lighting effect on the floor and bars of the graphic.

Figure 18

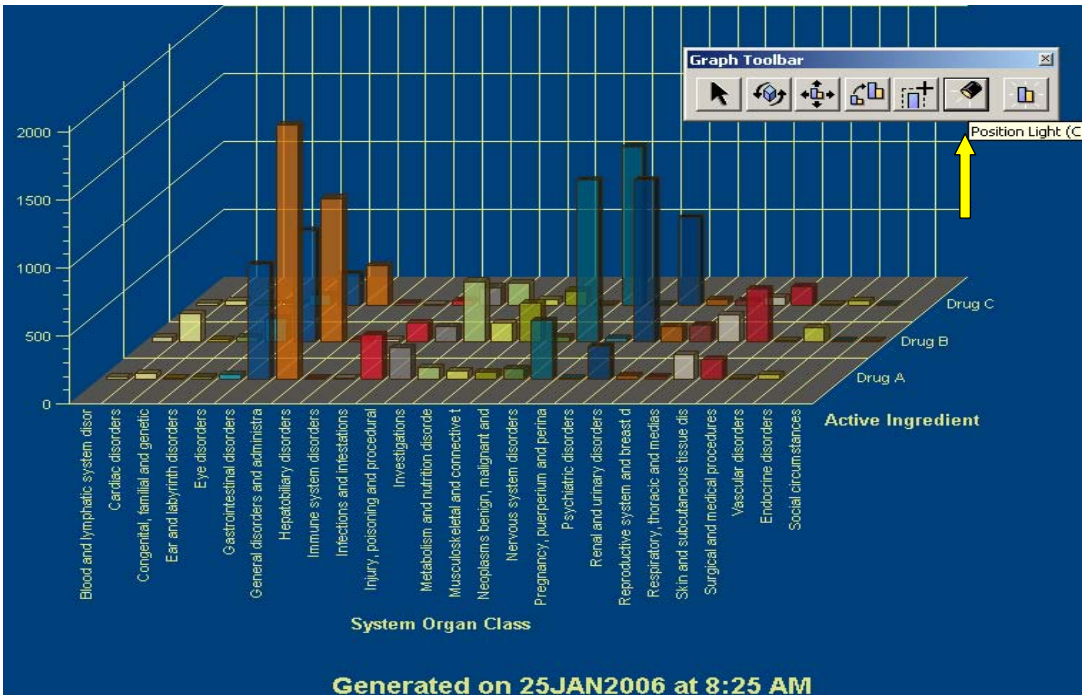
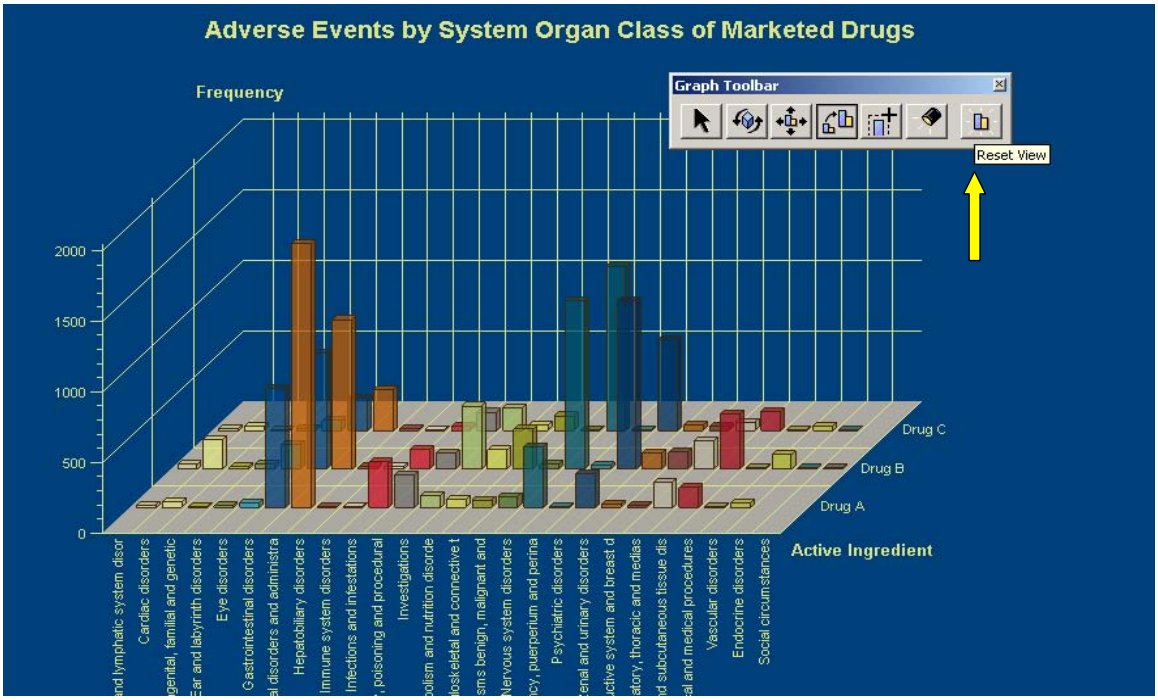


Figure 19: The Reset View tool resets the graphic to its original view. This is very useful after manipulation of the graphic, allowing you to display the original graphic easily and quickly. This does not change any customization performed within the chart properties or Style Editor.

Figure 19



CONFIGURING THE DRILL-DOWN MODE

How can hyperlinks between graphs and spreadsheets be created? The use of the SAS Macro language should be considered do to the number of hyperlinks and documents created. SAS OnlineDoc explains that the URL drill-down mode uses the HTML= option to name a link variable that provides drill-down URLs. This mode is implemented in a similar manner to the type of drill-down that is available for the GIF, JPEG, and PNG device drivers, except that in this case, the ActiveX control associates drill-down URLs with graph elements without using an image map. The six basic steps to create a set of drill-down graphs that are hyperlinked to each other follow.

STEP 1 – SETUP GOPTIONS

Specify the device driver by choosing ActiveX as the device. Set any other global options. In this example, the GOPTIONS statement resets the GOPTIONS, sets the device driver to ActiveX and specifies the size of the graphs created.

```
goptions reset=global device=activex ypixels=600 xpixels=800;
```

STEP 2 – CLOSE ODS LISTING DESTINATION

As per SAS OnlineDoc, close the ODS Listing destination to conserve resources.

```
ods listing close;
```

STEP 3 – START ODS HTML WITH URL DRILL-DOWN MODE

Open an HTML output file in ODS, choose a style, and specify URL drill-down mode. See the section Custom Style Using PROC TEMPLATE in this paper for PROC TEMPLATE code examples.

```
ods html body=drugs path=urldrill style=Custom parameters=("drilldown"="url");
```

Note the applet parameter DRILLDOWN=URL does not need to be specified. This drill-down mode is invoked by default when the HTML= options is used in the SAS/GRAPH procedure used to generate the graph.

STEP 4 – CREATE THE HYPERLINKS

Specify drill-down URLs by adding a link variable to the dataset. Add links to the graph with the HTML= option. Create variables in the dataset containing the Adverse Event data variables with the directory and name of the HTML file to link. It is important that this link will become the actual name and location of the HTML document produced. In the following example, the variable DRUGLINK containing the hyperlink is created which will link the bar in the overall graph to the chart showing all the different SOCs for that particular drug.

```
data aelinks;
     set allae;
     druglink='href="C:\Drug\'||trim(drug)||' AEs by SOC.html"';
     soclink='href="C:\Drug\'||trim(drug)||'\'||propcase(trim(soc))||
             ' AEs by Preferred Term.html"';
     ptlink='href="C:\Drug\'||trim(drug)||'\xls\'||propcase(trim(pt))||'.xls"';
run;
```

The graphs and spreadsheets are placed in the appropriate directories as shown below. The overall drug AEs by SOC graphs go into the C:\DRUG subdirectory. The particular drug's AEs by preferred term go into the subdirectory for that drug, for example C:\DRUG\DRUG A subdirectory. Finally, individual spreadsheets listing the AE data for each drug's preferred term go into XLS subdirectory, for example C:\DRUG\DRUG A\XLS subdirectory

```
C:.
├──Drug          <---- Graphs of AEs by Drugs and SOCs go here
│   ├──Drug A        <---- Graphs of AEs by Preferred Term go here
│   │   └──xls           <---- Spreadsheets listings of individual AEs go here
│   ├──Drug B
│   │   └──xls
│   ├──Drug C
│   │   └──xls
```

STEP 5 – SPECIFY SAS/GRAPH PROCEDURE WITH HTML= OPTION AND CREATE SPREADSHEETS

Specify a SAS/GRAPH procedure to generate the graphs. Specify the statement option HTML= to identify the link variable. The example code that follows uses the GCHART procedure. Notice the procedure uses the variable DRUGLINK created earlier with the HTML= option to construct the hyperlink.

```
title1 "Total Adverse Events by Drug";
footnote1 "Generated on %SYSFUNC(DATE(), EURDFDE9.) at %SYSFUNC(TIME(), TIMEAMPM8.)";

proc gchart data=allae;
     hbar3d drug / frame descending freq cfreq percent autoref clipref
                   patternid=midpoint html=druglink;
run;
```

Specify a procedure like PROC REPORT or PROC PRINT to generate a spreadsheet. Since ODS HTML is the ODS destination, it is easy to create the spreadsheets too. SAS 9.0 and above provide direct, transparent access to Microsoft Excel. The following code produces a spreadsheet through PROC REPORT and ODS HTML.

```
ods html body="Drug\Drug A\xls" path=urldrill style=Gears
         parameters=("drilldown"="url");

title1 j=left color=black height=16pt "&drugname Adverse Events of";
title2 j=left color=black height=16pt "&ptname";

proc report data=drill nowd headline headskip split="\"
     style(report)=[cellspacing=2 borderwidth=2 bordercolor=cx737373]
     style(header)=[foreground=cx00407A font_size=12pt borderwidth=4]
     style(column)=[foreground=cx00407A font_face=Arial font_size=10pt]
     style(lines)=[foreground=black background=black font_size=10pt];

     column event frd source gender age serious narrate;
     define event   / display "Case Number" width=30;
     define frd     / display "Case First\Received Date";
     define source  / display "Source\of Case";
     define gender  / display "Gender";
     define age     / display "Age";
     define serious / display "Serious";
     define narrate / display "Narrative" width=100 flow
style(column)=[cellwidth=6in];
run;
```

STEP 6 – CLOSE ODS

Close the HTML output file and reopen the ODS listing destination.

```
ods html close;
ods listing;
```

CUSTOM STYLE USING PROC TEMPLATE

To produce publication or presentation quality graphs, a custom style should be created. This paper will not show how to use PROC TEMPLATE, because there are many excellent papers on customizing and using templates. The code that follows will simply show some of the customizations used to make this graph standout.

START WITH AN EXISTING STYLE

The TEMPLATE procedure is a difficult one to understand, so start with an existing template and modify. This code creates a new template called Custom based off the provided SAS template Gears.

```
proc template;
   define style Custom;
      parent = styles.Gears;
```

MAKE FONT CHANGES

Change the template to use the font best suited for the graph. Some companies have corporate standards regarding font usage, put that font here. The size of the font and font face can be specified.

```
      replace fonts /
         'TitleFont2' = ("News Gothic BT Roman, Arial, sans-serif",12pt,Bold)
         'TitleFont' = ("News Gothic BT Bold, Arial, sans-serif",14pt,Bold)
         'StrongFont' = ("News Gothic BT Roman, Arial, sans-serif",12pt,Bold)
         'EmphasisFont' = ("News Gothic BT Light, Arial, sans-serif",8pt,Italic)
        Etc...
      replace GraphFonts /
         'GraphDataFont' = ("News Gothic BT Condensed, Arial, sans-serif",6pt)
         'GraphFootnoteFont' = ("News Gothic BT Condensed, Arial, sans-serif",6pt)
        Etc...
```

MAKE COLOR CHANGES

Change the template to use the colors again best suited for the graph. Companies have corporate standards regarding color usage; the corporate communications department can provide a list. There are multiple ways to define what color to use via color-naming schemes. Some valid color-naming schemes include RGB, CMYK, HLS, HSV and Gray-Scale color codes; the example code below uses RGB color codes. The RGB color-naming scheme specifies color in terms of its red, green, and blue components. Color names are of the form CXrrggbb.

```
      replace colors /
         'headerfgemph' = cxDEE385
         'headerbgemph' = cxCF142B
         'headerfgstrong' = cxDEE385
         'headerbgstrong' = cxCF142B
         'headerfg' = cxDEE385
         'headerbg' = cxCF142B
        Etc...
      replace GraphColors /
         'gcerror' = cx000000
         'gerror' = cxB0C4AE
         'gcpredictlim' = cx2E522D
         'gpredictlim' = cxB0C4AE
         'gcpredict' = cx2E522D
         'gpredict' = cx2E522D
         'gcdata3' = CXA8B508
         'gcdata2' = CXDEE385
         'gcdata1' = CXDEE385
        Etc...
```

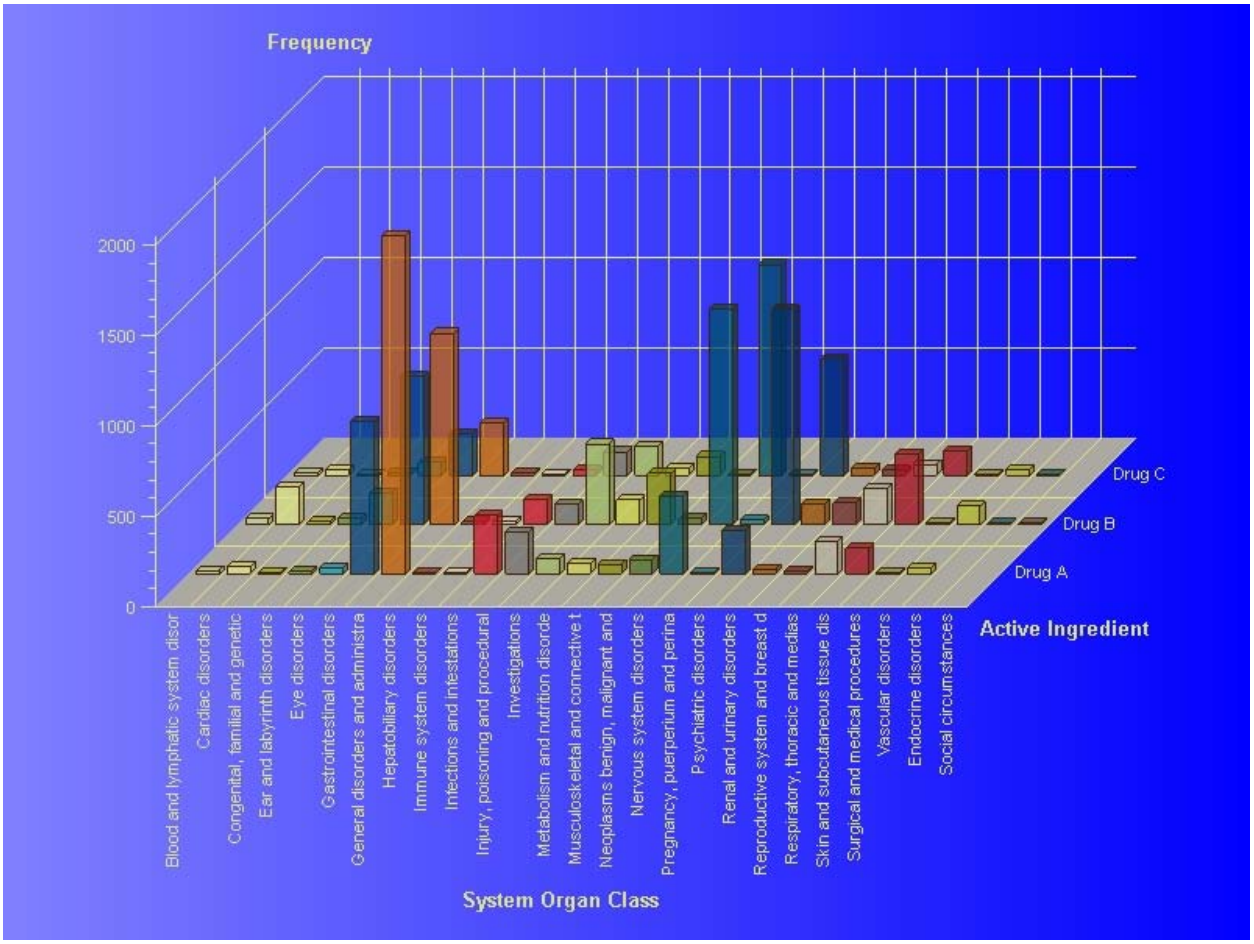
FINAL TOUCHES – TRANSPARENCY AND BACKGROUND IMAGE

When making a 3-D graph with multiple items as the Z-axis, bars that are in front can hide the bars displayed in the back. By making the bars somewhat transparent, these other bars are then visible. In the code below, adjustments to the GraphCharts attribute changes the transparency of the bars. Adding a background image is simple to do, just point to the image within the GraphBackground attribute like shown below. Now, there is a great image behind the graph but the graph's grids cover the image up too much. To remedy this situation, use the GraphWalls attribute and set transparency to one. The 1.0 has the meaning of 100% transparent.

```
      style GraphCharts from GraphCharts
         "Chart Attributes" /
         transparency = 0.25;
      replace GraphBackground
         "Graph background attributes" /
         background = colors('docbg')
         image = "X:\BACKGROUND\PICTURE.JPG"
         vjust = T;
      style GraphWalls from GraphWalls
         "Wall Attributes" /
         transparency = 1.0;
   end;
run;
```

THE FINAL RESULT

The final result below is informative, interesting, flexible, and portable. The graph is more than just a pretty picture; it is a presentation and information conveyance tool.



CONCLUSIONS

Throughout this paper, we have reiterated the importance of efficient and effective meetings, enabling the group to be productive and proactive in their decision making. Current processes can be ineffective, essentially waiting for output and data that may or may not be available at the follow up meeting. We have shown how the SAS ActiveX tool allows the analyst to visually display data in a real-time environment to the group. We feel this is a very innovative and effective means to perform the analysis, accomplishing much more within the meeting environment. The SAS ActiveX plug-in is a simple tool which affords the group the ability to examine and interpret the data without having to wait for output. The questions asked can be explored during the meeting with the group. There are other, more powerful solutions which exist in the market. However, in this cost conscious environment, SAS offers a very capable tool which is virtually free to the SAS end user.

REFERENCES

Blanchard, Ken, Sheldon Bowles, Don Carew, and Eunice Parisi-Carew. 2001. *High Five! The Magic of Working Together.* New York, New York: William Morrow/HarperCollins. [1]

Blanchard, Ken, Don Carew and Eunice Parisi-Carew. 2000. *The One Minute Manager Builds High Performing Teams.* New York, New York: William Morrow [2]

Blanchard, Ken and Sheldon Bowles. 1997. *Gung Ho! Turn on the People in Any Organization.* New York, New York: William Morrow [3]

Bruns, Dan. 2005. "An Introduction to the Simplicity and Power of SAS/Graph", *Tutorials of the Thirtieth Annual SAS Users Group International Conference.* Cary, NC: SAS Institute

Covey, Stephen R., Roger A. Merrill, and Rebecca R. Merrill. 1989. *First Things First.* New York, New York: Simon & Schuster [1]

Covey, Stephen R. 1989. *The Seven Habits of Highly Effective People.* New York, New Your: Fireside/Simon & Schuster [2]

Northrop Grumman Health Solutions. 2007. Northrop Grumman Health Solutions white paper. "Medical Dictionary for Regulatory Activities (MedDRA) - Maintenance and Support Services Organization (MSSO)" http://www.it.northropgrumman.com/MMPDFs/MedDRA%20MSSO%20white%20form%20v2.pdf

Ravenna, Andy & Syphus, Stacey (2005). "Querying and Reporting Using SAS Enterprise Guide Course Notes", Cary, NC: SAS Institute

SAS Institute Inc. (2003), "SAS/GRAPH Colors and Images: Specifying Colors in SAS/GRAPH Programs", Cary, NC: SAS Institute

SAS Institute Inc. (2003), "Summary of ActiveX and Java Support: PROC GCHART", Cary, NC: SAS Institute

SAS Institute Inc. (2003), "Creating Interactive Output for Java: Configuring Drill-Down Links for Java and ActiveX", Cary, NC: SAS Institute

SAS Institute Inc. (2003), "Creating Interactive Output for Java: Examples of Interactive Java Output", Cary, NC: SAS Institute

SAS Institute Inc. (2003), "SAS/GRAPH Statements: Example 10. Creating a Bar Chart with Drill-down for the Web", Cary, NC: SAS Institute

SAS Institute Inc. (2003), "SAS/GRAPH Statements: AXIS Statement", Cary, NC: SAS Institute

ACKNOWLEDGEMENTS

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