Creating Health Maps Using SAS

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ABSTRACT

There are many different programs that have been developed to map data. However, SAS® users do not need to always go outside of their SAS® installation to map data. SAS® has many built-in options for mapping that, with a bit of knowledge, can be just as good as advanced external programs. This paper will give an introduction on how to generate health maps using PROC GMAP and compare the results to maps created in ArcGIS. This paper is designed to teach users how to create simple choropleth and prism maps using numeric response data.

INTRODUCTION

This paper discusses how some basic capabilities of PROC GMAP can be used to map health data. This paper will demonstrate how to generate different types of maps. In addition to creating maps including choropleth maps, this paper will also show how different color ramps can be used to display data. Additionally this paper will demonstrate how to import shape files directly into SAS®. This paper is designed to introduce some features of SAS/GRAPH.

Stroke is a leading cause of disability and the fifth leading cause of death in Florida[1]. The burden of stroke varies by geographical region. Identifying areas and populations with higher stroke burden is important for informing public health intervention and prevention efforts. Age-adjusted stroke mortality data have been mapped historically in Florida using ArcGIS. The objective of this demonstration is to show how SAS® can be used to as a tool for mapping health data.

IMPORTING MAPS

SAS® provides certain maps within the software. However, SAS® may not provide the map you need. The PROC MAPIMPORT allows you to import Esri shapefiles into SAS® to create maps. For example, if you were examining a health condition and you wanted to look at the distribution of the disease across the state at the county level and the map was not available in SAS®[2]. The U.S. Census provides shapefiles at the different demographic levels (county, contract, etc.). Shapefiles can be downloaded from http://www.census.gov/cgi-bin/geo/shapefiles2010/layers.cgi.

A Florida county shapefile with mortality data joined to it was imported into SAS®. The data represents stroke mortality data from the Florida Department of Health for the years 2010-2012 and a shapefile from the U.S. Census. PROC MAPIMPORT will need to be run twice. First, the procedure needs to be run to import the shapefile into SAS®. Then again to specify the actual variable so that SAS® can generate the map. See below for the code for the first iteration:

```
proc mapimport datafile="C:\Shapefiles\New_mortality.shp"
out=my_map;
run;
```

There are many variables in this file. In order to identify the names of variables a PROC CONTENT can be used to examine the variables in a shapefile. Please see code below:

```
proc contents
data=my_map;
run;
```

Output 1

```
Alphabetic List of Variables and Attributes
#   Variable Type Len
11  County   Char 3
4   Count01  Num  8
5   Count04  Num  8
```

Output 1. Output from a PROC CONTENT statement

This output can be used to learn the names of actual variables in the dataset that will be used for mapping.

Run the PROC MAPIMPORT again, this time specifying FIPS as the ID variable. This will allow SAS® to know which variable is the ID, and can group the areas correctly. See code below:

```
proc mapimport datafile=" C:\Shapefiles\New_mortality.shp"
out=my_map;
id FIPS;
run;
```

CREATING CHOROPLETH MAPS

The next procedure will demonstrate how to make the actual maps. The map below shows the age-adjusted stroke mortality rates for the years of 2010-2012. The color used in this map was chosen so that geographical areas with higher burden are depicted with darker colors (Figure 1). The TITLE statement can be used to add a title to the map. The PATTERN statement is used for determining the color scheme of the map. The ID statement is used to specify the variable to be mapped. The CHORO statement is used to make choropleth maps. See example code below:

```
title1 ls=1.5 "Florida Age-Adjusted Stroke Mortality 2010-2012";
pattern1 v=s color=vlig;
proc gmap data=my_map map=my_map;
id Rate10;
choro Rate10 / coutline=blue;
levels=1 nolegend;
run;
```

The second example of a choropleth map shows an option of creating a map that discretely shows different colors of every numerical value in the map (Figure 2). There are different options that you can use on the CHORO statement in PROC GMAP. If you want to control the number of colors you can use the LEVELS option with the CHORO statement or the DISCRETE option. See the code below:

```
title1 ls=1.5 "Florida Age-Adjusted Stroke Mortality 2010-2012";
pattern1 v=s color=vlig;
proc gmap data=my_map map=my_map;
id Rate10;
choro Rate10 / discrete;
run;
```
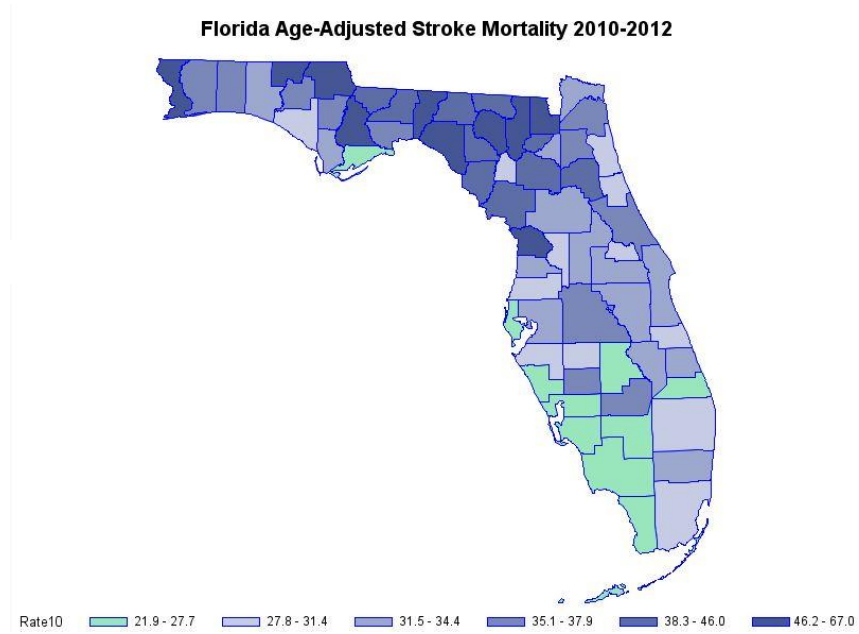
Figure 1

Florida Age-Adjusted Stroke Mortality 2010-2012

Rate10 | 21.9 - 27.7 | 27.8 - 31.4 | 31.5 - 34.4 | 35.1 - 37.9 | 38.3 - 46.0 | 46.2 - 67.0

Figure 1. Stroke Age-adjusted Stroke Mortality SAS® map 2010-2012

This example produces a choropleth map that shows the age-adjusted mortality rates of stroke in Florida for 2010-2012. The legend shows the range of values for each level.
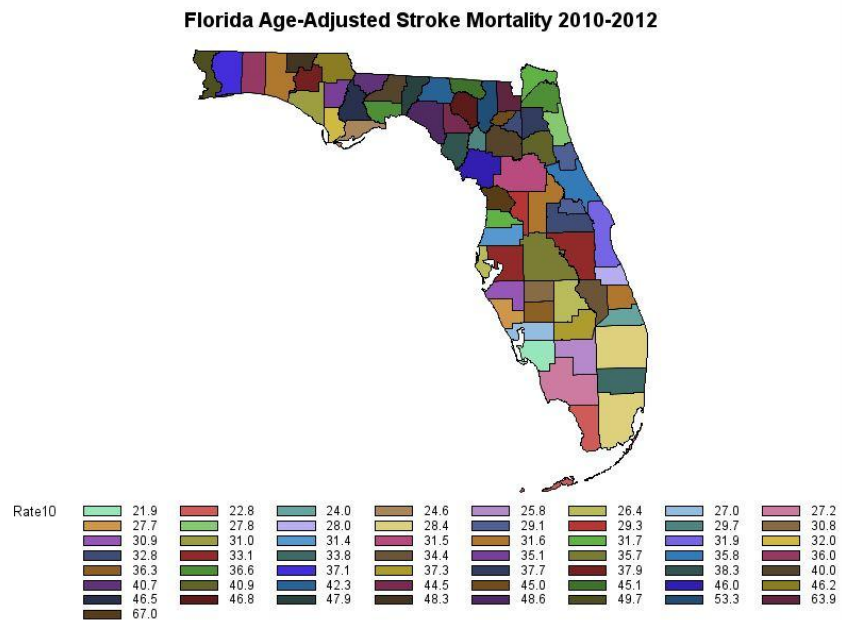
Figure 2

Florida Age-Adjusted Stroke Mortality 2010-2012

| Rate10							
21.9	22.8	24.0	24.6	25.8	26.4	27.0	27.2
27.7	27.8	28.0	28.4	29.1	29.3	29.7	30.8
30.9	31.0	31.4	31.5	31.6	31.7	31.9	32.0
32.8	33.1	33.8	34.4	35.1	35.7	35.8	36.0
36.3	36.6	37.1	37.3	37.7	37.9	38.3	40.0
40.7	40.9	42.3	44.5	45.0	45.1	46.0	46.2
46.5	46.8	47.9	48.3	48.6	49.7	53.3	63.9
67.0							

Figure 2. Stroke Age-adjusted Stroke Mortality SAS® map 2010-2012

This example produces a choropleth map that shows the age-adjusted mortality rates of stroke in Florida for 2010-2012. The legend shows the stroke mortality rate for each county.

CREATING PRISM MAPS

This example will use the same variable and data to create a prism map, a map that uses color as well a raised area to display stroke death counts. See code below:

```
title 'Stroke Mortality Rates, 2010-2012';
proc gmap data=my_map map=my_map;
id Rate10;
prism Count10;
run;
quit;
title;
footnote;
```

The only difference in code for creating a prism map as compared to a choropleth map is the change of the word CHORO to PRISM in the GMAP procedure. The SAS code can be modified to change the viewing angle of the map.

Figure 3
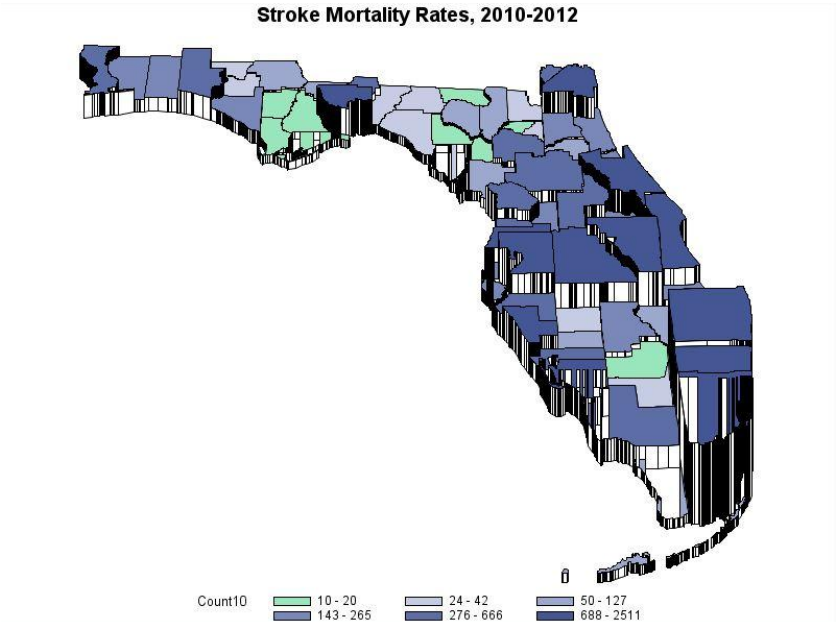
Figure 3. Stroke Age-adjusted Stroke Mortality SAS PRISM map 2010-2012

This example produces a prism map that shows the age-adjusted mortality rates with the mortality counts raised in Florida for 2010-2012. The legend shows the range of values for each level.
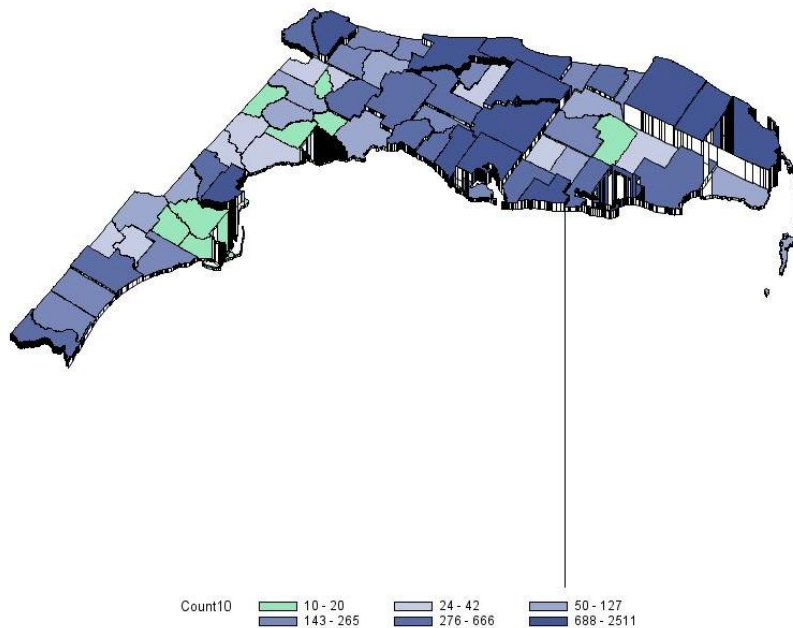
Figure 4

Figure 4. Stroke Age-adjusted Stroke Mortality SAS® PRISM map 2010-2012

This example produces a prism map that shows the age-adjusted mortality rates with the mortality counts raised for Florida 2010-2012. The legend shows the range of values for each level. This map has a different viewing angle as compared with the previous map.

SIMILAR ARC GIS MAP

Features that have numerical attributes can be mapped using ArcGIS. There are different types of maps that can be made. I will demonstrate components to create a simple choropleth map. First, I will show how create a county level map similar to the map made in SAS®. First add the shape file, see demonstration below:
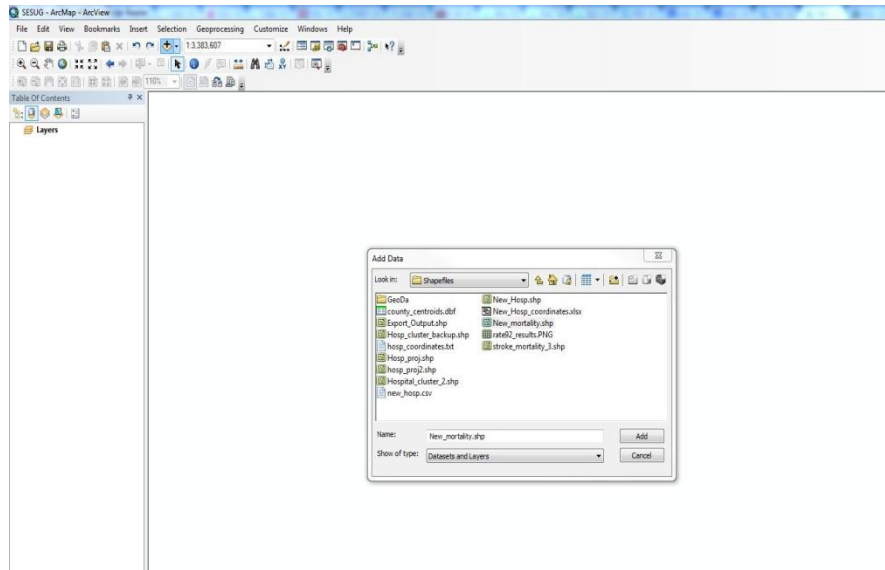
Figure 5

Figure 5. Adding Stroke Mortality data 2010-2012

This example demonstrates how to add a shapefile using SAS®.
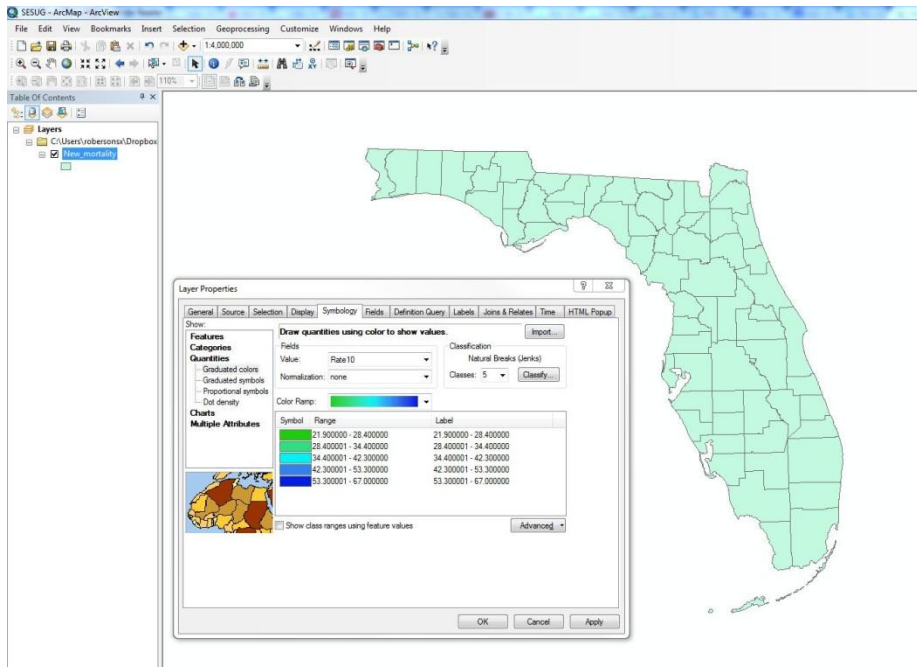
Figure 6

Figure 6. Choosing the variable of interest

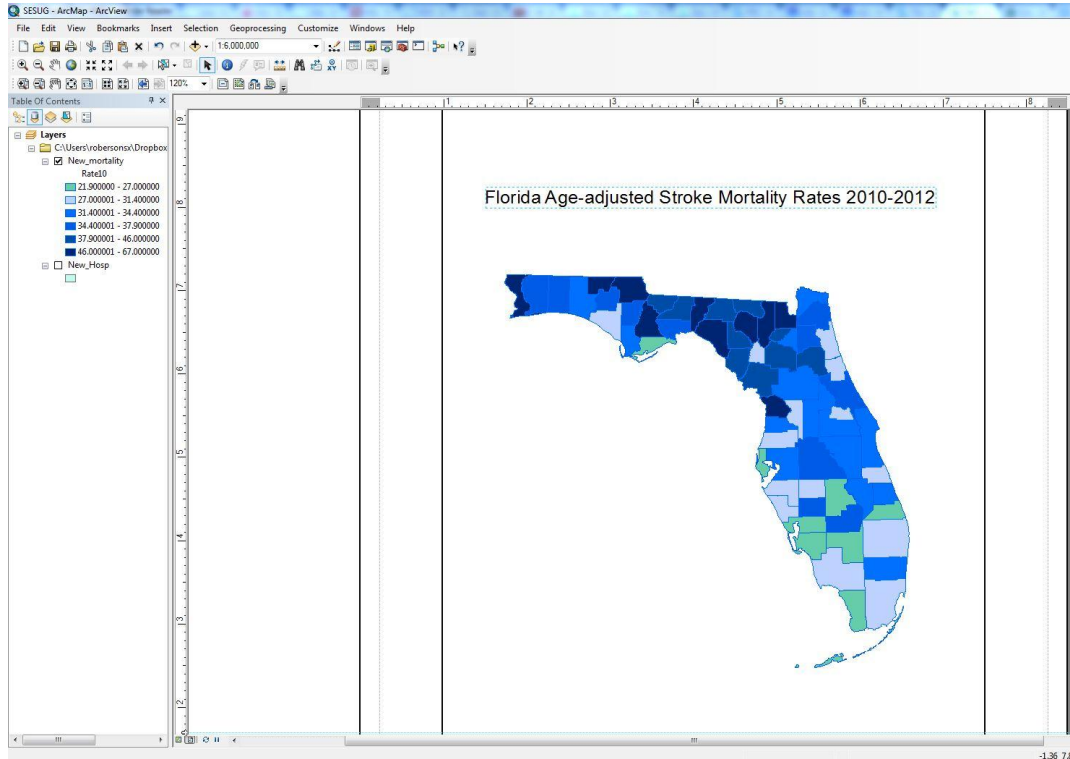This example demonstrates how to choose the variable of interest

Figure 7

Figure 7.

Next Create and title the final map. There are options to change the color ramps as well as other features of the map.

CONCLUSION

This paper shows examples of how to create health maps using Esri shapefiles. Instead of moving between software when working in SAS® there are procedures to create different maps such as choropleth and prism maps. These maps can be used to identify geographical disparities associated with health conditions. Public health officials can use these maps to document burden of disease and inform data-driven decisions, to ultimately lead to interventions aimed at reducing disparities.

REFERENCES

1. Florida Department of Health. Florida Community Health Assessment Resource Tool Set. 2013; Available from: http://www.floridacharts.com/charts/SpecReport.aspx?RepID=7226&tn=33.

2. Allison, R. SAS/GRAPH. 2013; Available from: http://robslink.com/SAS/book1/Chapter_05_Maps.pdf.

RECOMMENDED READING

- *SAS/GRAPH Beyond the Basics*

CONTACT INFORMATION

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