GIS I: Organizing Principles
Displaying Data Exercise

*** Files needed for exercise: *MN_Counties_HeartMrt_over65_1214.shp,*

MN_CMSApprovedFacilities_2015.shp

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Goals: The goal of this exercise is to explore how to display and symbolize qualitative and quantitative data by creating two exploratory maps of heart disease mortality rate for senior citizen in Minnesota.

Skills: After completing this exercise, you will have a basic understanding of working with ArcMap's data view and layout view. You will be familiar with connecting to folders, adding shapefiles to an ArcMap project, symbolizing attributes, inserting map elements, and exporting a map to a PDF.

**Creating a New ArcMap Project**

1. In the Windows Explorer Start Menu, open ArcMap.
2. In the folder tree on the left side, browse to **New Maps > My Templates** and select a **Blank Map**. Click **OK**.
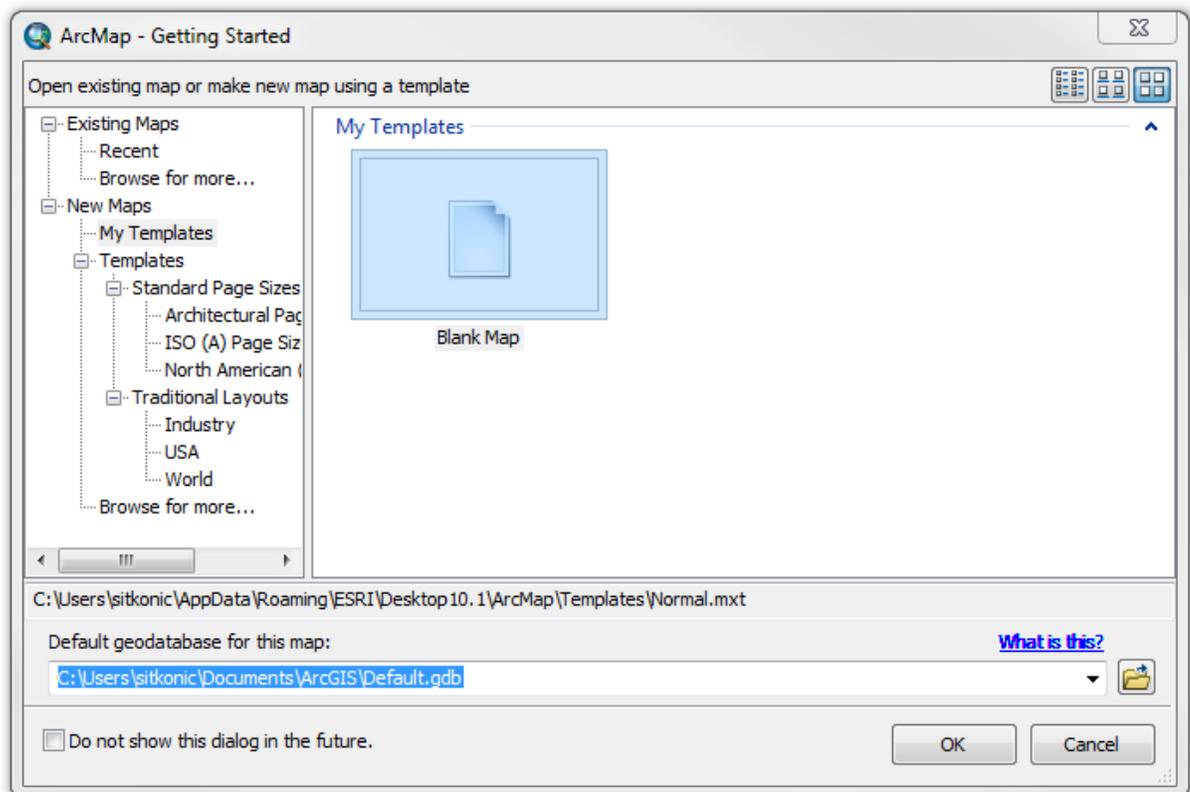
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Adding Data and Connecting to Folders

1. Click the **Add Data** icon ✦ ▾ to add new data to the map.
2. Click on the **Connect to Folder** button 🗁.
3. Browse to the data folder for this exercise (Displaying_Data_Exercise_Data) and click **OK**. You now have a permanent connection to that folder making it quicker to find and add data.
4. From the folder, click the shapefile *MN_Counties_HeartMrt_over65_1214.shp*. This file contains county-level population data and the heart disease mortality rate of senior citizens (age over 65) from the US Census and CDC.
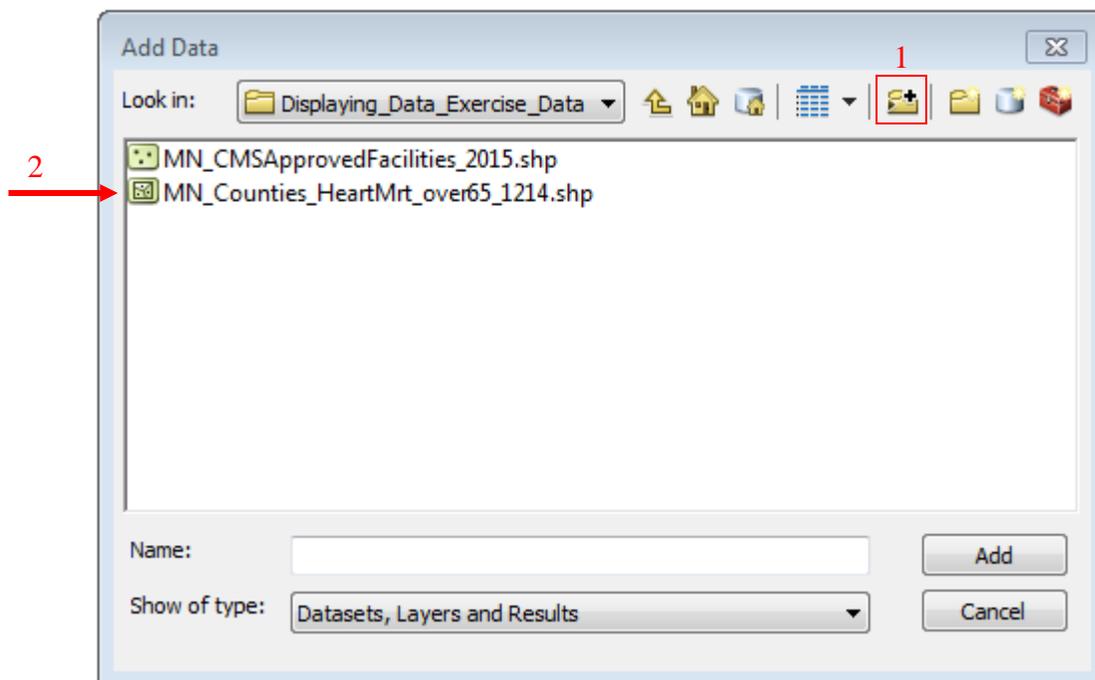

5. Once you've selected the file, click **Add** and the data will appear in the **Table of Contents** as a layer.
6. Click the **Add Data** icon again and from the same folder, select the file *MN_CMSApprovedFacilities_2015.shp.* This is a file containing point data for CMS Approved Facilities in Minnesota. This dataset extract is from the Quality Improvement Evaluation System (QIES) database which is serviced by Health Resources & Services Administration (HRSA). It includes information about provider number, name, and address and characterizes the participating institutional provider. Click **Add.** Both layers should now appear in the Table of Contents.

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Working in Data View with Qualitative Data

1. Take a look at the current symbolization of the counties of the state of Minnesota and all CMS approved facilities. The counties should all be displayed with one color corresponding to one symbol in the **Table of Contents**. The markets should also be displayed with one color corresponding to one symbol. Colors will vary from example below.
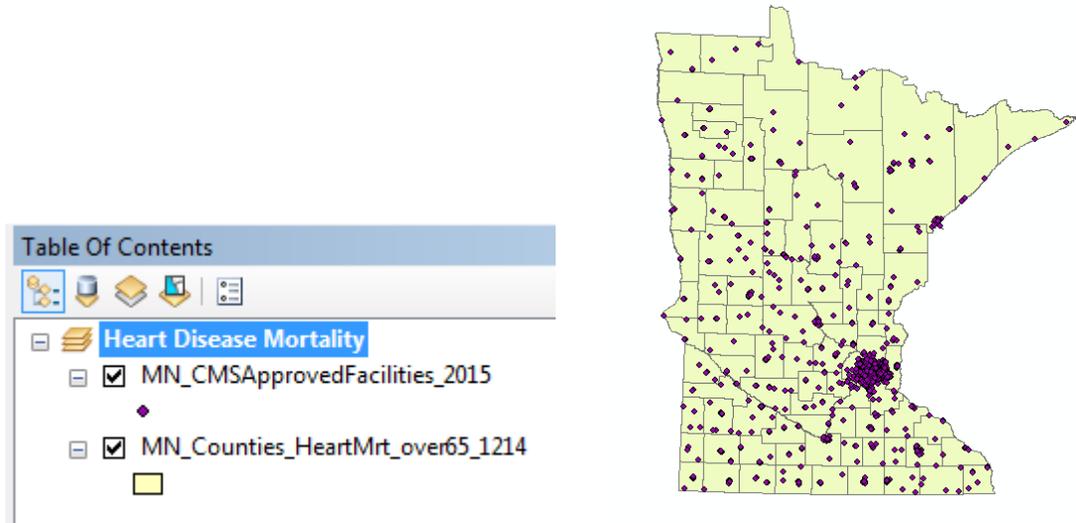

2. View the *MN_CMSApprovedFacilities_2015* layer's attribute table to see what data it contains. Right click the *MN_CMSApprovedFacilities_2015* in the **Table of Contents (TOC)** and select **Open Attribute Table**.

3. A new window will appear with the attributes of *MN_CMSApprovedFacilities_2015.* Look at the fields. The table has the address as well as other information about the CMS approved facilities. Which fields seem qualitative? The fields that differentiate types of approved facilities are qualitative: Nursing Facilities, Hospital, etc. Close the attribute table by clicking the 'x' in the top right corner.

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4. Now you will change the symbolization of the facilities approved by CMS. Right click the *MN_CMSApprovedFacilities_2015* layer in the TOC, select **Properties.**

5. The **Layer Properties** window should appear. Navigate to the **Symbology** tab. This tab shows the current symbolization of the facilities layer.

6. You will display your qualitative data by categories. Select **Categories > Unique values** from the **Show** menu. In the **Value Field** drop-down menu, choose the field "Category". Click the **Add All Values** button. The unique categories of your data will appear. Uncheck the box for <all other values> since there are no other values. We want to examine the impact of nursing facilities and hospitals on heart disease mortality rate. So we want to remove all other categories but nursing facilities and hospitals from the map. Click on Ambulatory Surgical Centers and click remove; do the same thing for other irrelevant categories.
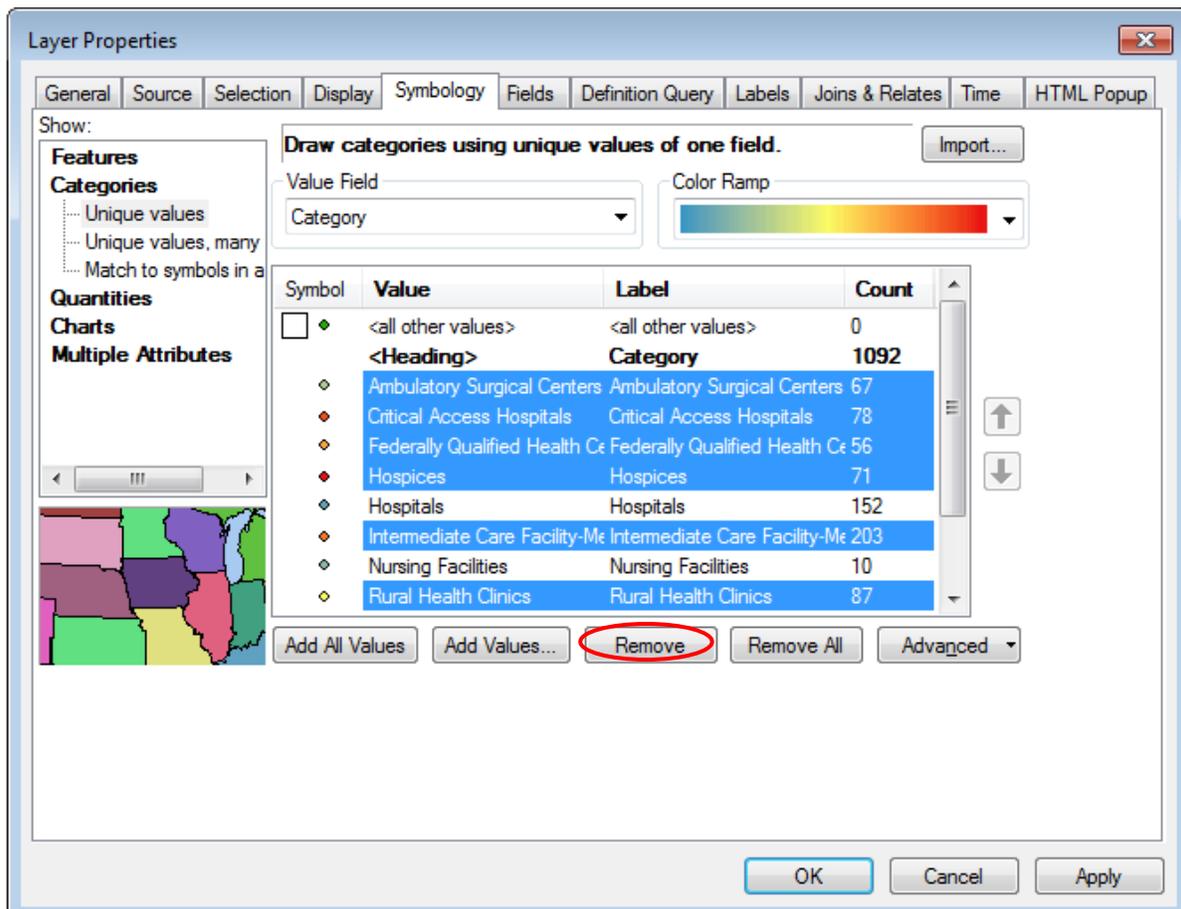
7. There are detailed types of nursing facilities in our dataset. You may not be interested in those detailed categories right now. You can group them up. Click *Nursing Facilities* and hold

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SHIFT key and click *Skilled Nursing Facility_Dual* to select all types of nursing facilities. Right click the selected categories and select *Group Values*. A new group of nursing facilities will be generated. Single click on the Label in newly created group and change the name from "*Nursing Facilities; Skilled Nursing Facilities; Skilled Nursing Facility_Distinct; Skilled Nursing Facility_Dually*" to *Nursing Facilities*.
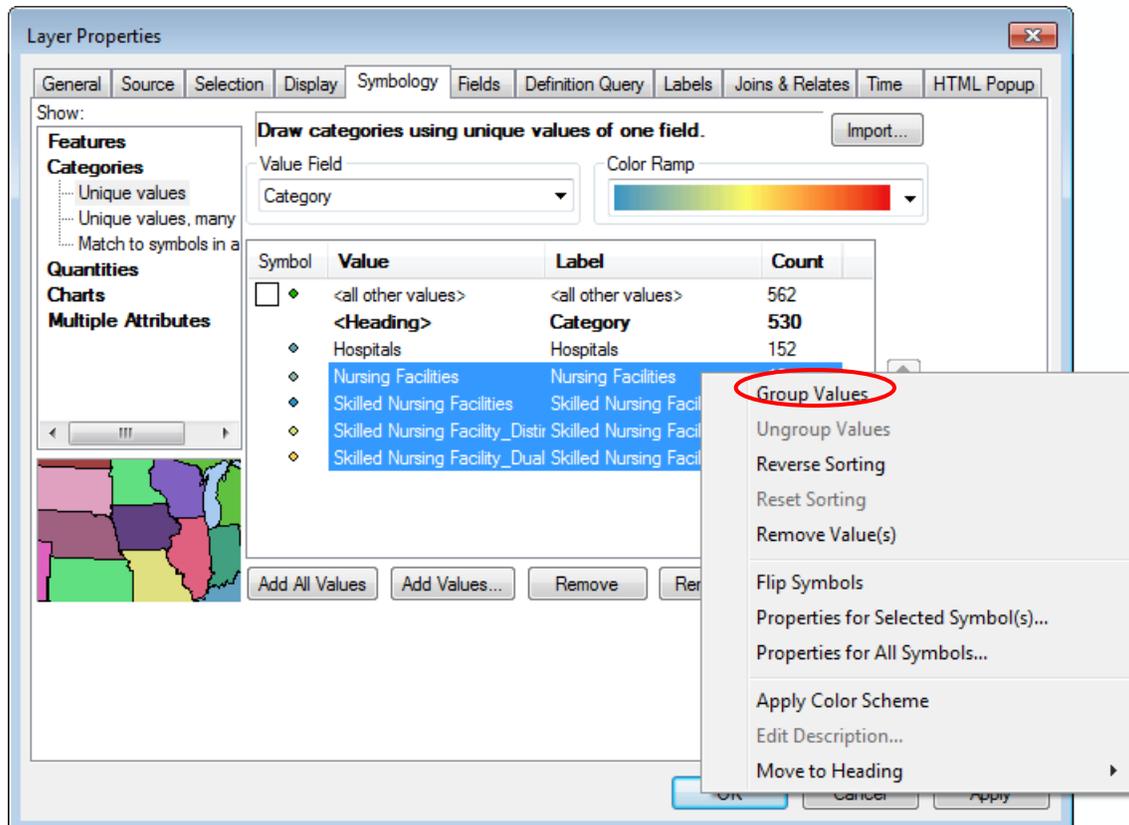
8. Change the symbols to distinguish the categories of facilities. You can do this multiple ways. Click the **Symbol** heading and select **Properties for All Symbols** to change the shape, size, and color of *all* your symbols at once. Alternatively, double click on each symbol to change the shape and color separately. Change the shape and color as you wish, and then click **OK**.

9. Examine the map with your new symbols. Are the symbols an appropriate size and shape? Are colors easily distinguished? If not, return to the **Symbology** tab in **Layer Properties** and adjust the size, shape or color. You can preview your changes without closing the layer properties box by clicking **Apply**. When you're satisfied, click **OK**.

10. You may want to change your county layer to a neutral color so the markets are more easily viewed. Do this by right-clicking on the color swatch for the county layer in the TOC and adjusting the color.
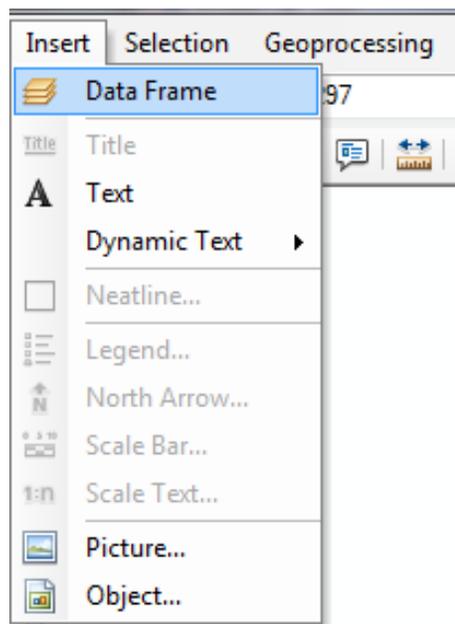
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☐ ☑ MN_Counties_HeartMrt_over65_1214

→   ☐▌
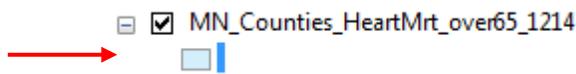
11. You now hav**e** a map of MN CMS approved facilities symbolized by their categories. This could be very useful information.

Adding a New Data Frame

1. Next, you'll work on a second map with the heart disease mortality rate data. From the **Insert** menu. Select **Data Frame** to add a new data frame to your Table of Contents. Note that the default name for the original/old Data Frame is "Layers" and the default name for a new Data Frame is "New Data Frame".

Insert	Selection	Geoprocessing
🗐 Data Frame	97	
Title Title		
A Text	🖭 ⬌	
Dynamic Text ▶		
☐ Neatline...		
⬚ Legend...		
⬆N North Arrow...		
⬚ Scale Bar...		
1:n Scale Text...		
🖼 Picture...		
🖼 Object...		

2. Rename the *old* Data Frame "Heart Disease Mortality" by clicking on the data frame name and then clicking again (slow double click). Next, rename the *new* Data Frame "CMS approved facilities".

3. Copy the *MN_Counties_HeartMrt_over65_1214* layer from the CMS approved facilities Data Frame to the Heart Disease Mortality Data Frame. Right click on the layer, select **Copy**, and then right click on the new data frame and select **Paste Layers**. Your Table of Contents should look like the image below.

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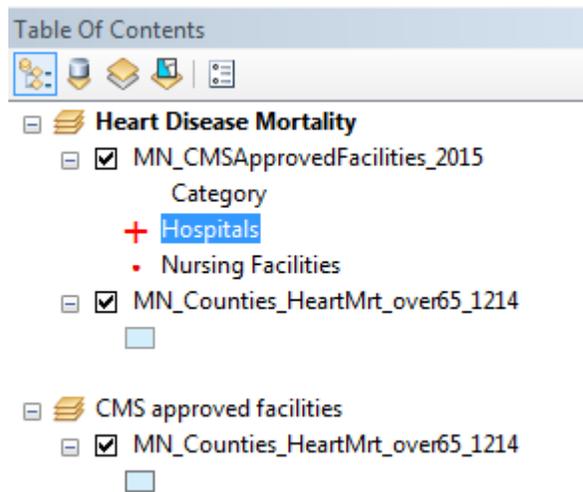
4. Remember, the **bolded** data frame is the one that is activated and will appear in Data View.

Working in Data View with Quantitative Data

1. View the *MN_Counties_HeartMrt_over65_1214* layer's attribute table in Heart Disease Mortality data frame to see what data it contains. Right click the layer in the TOC and select **Open Attribute Table**.

2. A new window will appear with the attributes of *MN_Counties_HeartMrt_over65_1214.* Which fields are quantitative? There are only one quantitative fields. HrtMrt_65p is the heart disease mortality rate for people in year 65 and over from 2012 to 2014. Close the table.

3. You will symbolize counties by heart disease mortality rate. Right click the *MN_Counties_HeartMrt_over65_1214* layer in the TOC, select **Properties**. Navigate to the **Symbology** tab.

4. Modify the selections to show quantities using a color gradation. In the **Show** menu, select **Quantities > Graduated colors**. Under **Fields > Value**, select "HrtMrt_65p".

5. Change the classification. Click the **Classify** button. A new window will appear showing a histogram of your data. Use the **Method** drop-down menu to select a method and see how the break values change. Click **OK** to close the window and **Apply** to view the changes on the map. Apply a few methods and consider how they change the map display. Which seems to be the most appropriate classification method for this particular data distribution?

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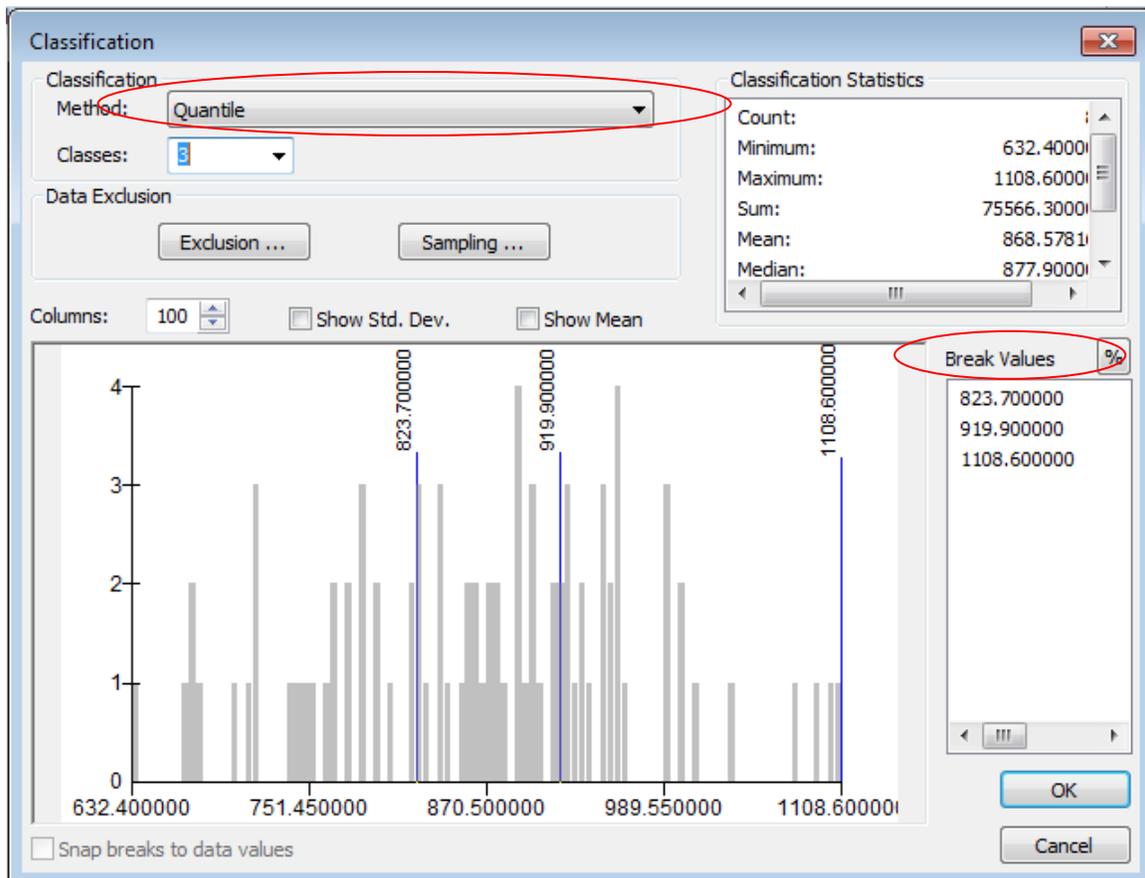
6. Quantiles seem to make sense for this data since we want to know the rank of the county. Return to the **Classify** screen and select **Method > Quantile**. In the **Classes** drop-down menu, select **3**. Click **OK** to close the window.

7. Change the **Color Ramp** to the color of your choice. For legibility, it's a best practice to use a monochromatic (single hue) color ramp for data that is increasing or decreasing in value.

8. Change the **Label** format. Click on the **Label** heading and select **Format Labels…** There are many different format categories depending on what type of data you are displaying. Since the data you are displaying is a percent, change the category to **Percentage** and then adjust the **Numeric Options…** so that you only have one decimal place. Click **OK.**

9. Leave all other values and menus at their default settings. If needed, use the image below for guidance. When all the symbology fields are complete, click **OK**.
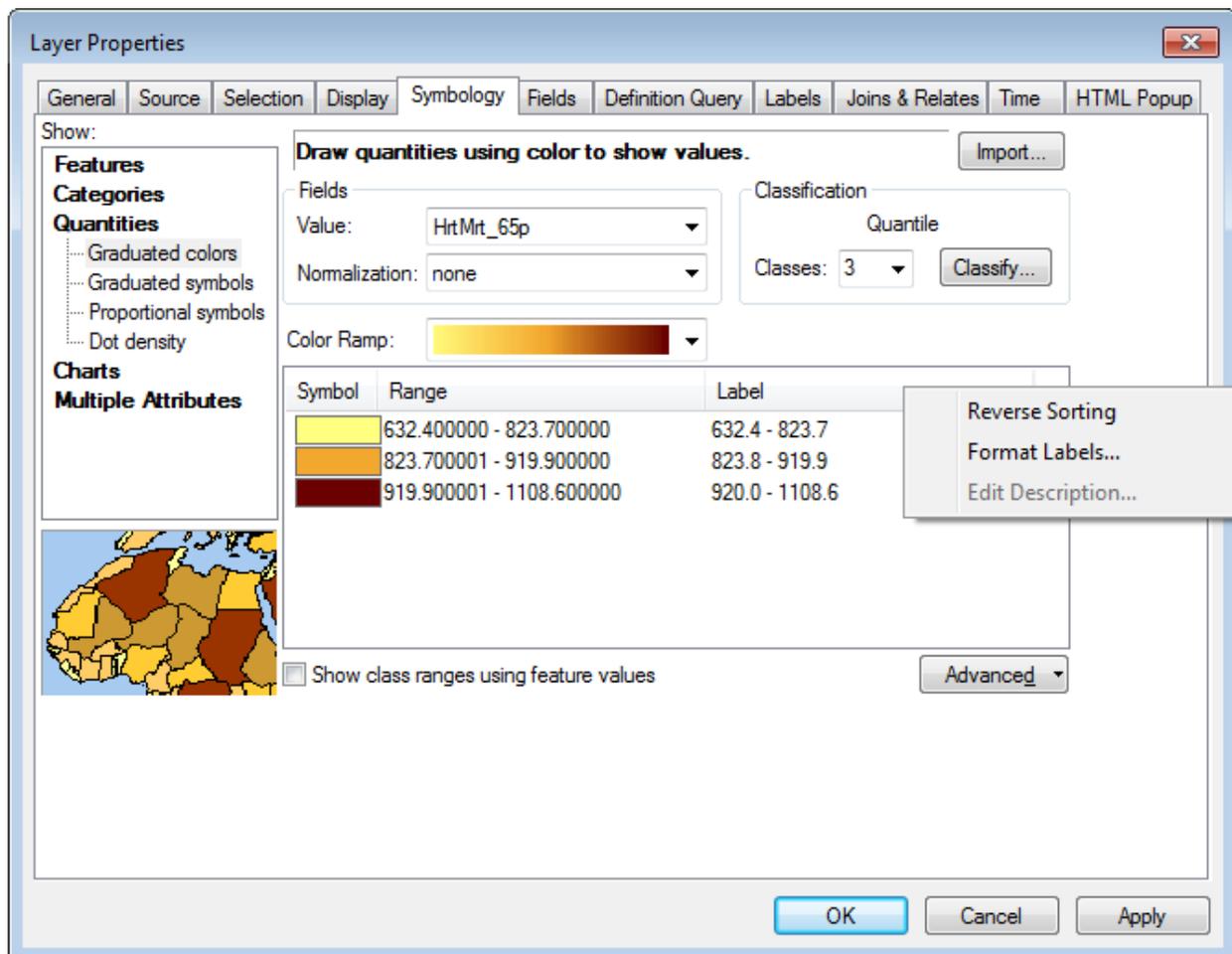
10. On your map, the *MN_Counties_HeartMrt_over65_1214* layer should now have different colors for each county depending on the heart disease mortality rate for people over 65. Notice also that the percent ranges (in quartiles) should be listed under the *MN_Counties_HeartMrt_over65_1214* layer in the TOC.

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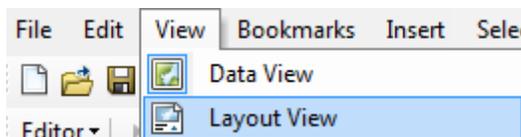**Displaying Data Exercise**
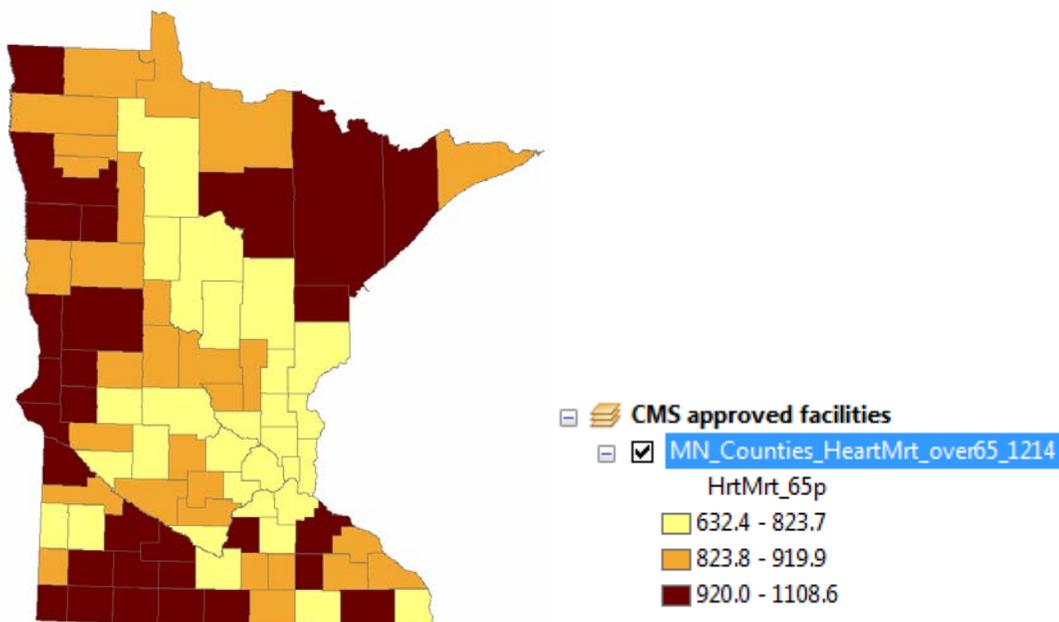
11. Take some time to look at the map display. Use tools to **Zoom/Pan** and see which areas of the state have higher and lower percentages.

12. Add county name labels to the map if you wish. To do this, right click on the layer in the TOC, select **Properties**, and open the **Labels** tab. Check the box to "Label features in this layer" and select "NAME10" from the Label Field dropdown menu. There are many other formatting options available, but for now you can keep all other defaults.

Working in Layout View

1. When working with your data layers and tables, you must be in **Data View** for many of the tools and functions of ArcMap to work. When you are done with data manipulation, management and analysis tasks, you should switch to **Layout View** to design a map product. To switch views from data to layout view, click the **View** menu and select **Layout View**.


2. Notice that a new toolbar, the Layout toolbar, becomes active.

3. In the **File** menu, select **Page and Print Setup** and change the orientation to **Landscape**. Click **OK** to apply the orientation.

4. Both data frames exist in the layout; however they will initially be overlapping, so you will have to move one data frame to the side in order to see the one beneath it. Resize both data frames to the same size by dragging the small blue boxes at the edges of the data frame. Remove the border around each data frame by right clicking on the data frame, selecting **Properties**, navigating to the **Frame** tab and adjusting the **Border** drop down menu.

5. Once you resize your data frames, click the Full Extent button 🌐 in the toolbar to zoom and center your layers in the data frame. Do this for each data frame.

6. Insert map elements to your project. Click **Insert** to add a **Title**, **Text**, **Legend**, **Neatline**, **North Arrow**, and **Scale Bar or Scale Text**. The "Text" you insert should include metadata such as the data source, date, and map author. *Note: You will have to click on each data frame individually and insert two legends separately. Do you need two legends? Two north arrows? Two scale bars? A sample layout is shown below.

7. You should change the name of your layers in the Table of Contents so that they are easier to understand in your legend. After you've added a legend, you can right click on it and select **Properties** to adjust the settings that control how the labels, swatches, and items appear.

8. After adding all desired map elements, export the map as a PDF (for printing later, for emailing, adding to a document). Click **File**, select **Export Map**. In the Export Map window, navigate to where you would like to save the file and use the **Save as type** drop-down menu to select **PDF (*.pdf).** Keep all other options default and click **Save**.

9. ***Note**: By default, ArcMap will export georeference information – this means that someone can open your PDF, and without much trouble, retrieve X/Y coordinate information for all the data in your map. This can be a data security issue. To disable this, uncheck the box "**Export Map Georeference Information**" in the **Advanced Options tab** when exporting.
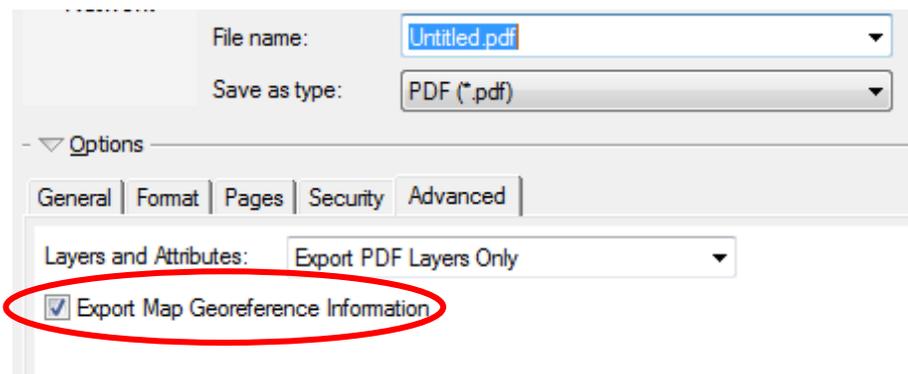
10. **Reflect**: What insights might be gained by overlaying these two data types on one map?

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For further reference see CDC's Cartographic Guidelines for Public Health (on the CDC Division for Heart Disease and Stroke Prevention website: https://www.cdc.gov/dhdsp/maps/gisx/

Minnesota Heart Disease Mortality Rate for Age 65+ and CMS Facilities Location

CMS Facilities
+ Hospitals
• Nursing Facilities

Heart Mortality
Rate for 65+
632.4 - 823.7
823.8 - 919.9
920.0 - 1108.6

0 25 50 100 Miles

Date: Dec.15th.2016
Author: Ruiyang Li
Source: Census Bureau, 2010. CDC, 2016