John Snow's Cholera Map

Lesson Overview

Dr. John Snow is regarded as one of the founding fathers of modern epidemiology. During a major cholera epidemic in 1854 London, he collected and mapped data on the locations (street addresses) where cholera deaths occurred. His process was laborious and slow, but ultimately informative. His painstaking and detailed analysis led to the identification of the epidemic's source—a contaminated public water source. Today, John Snow's data has been geocoded, making it accessible in a GIS. In this lesson, you will create a heat map showing the locations that experienced the highest number of cholera deaths in the epidemic. You will share this heat map as a basic story map.

As part of a pre-med curriculum, you are taking a course in the history of epidemiology. Your first assignment is to prepare a presentation about Dr. John Snow's investigation of cholera during an 1854 outbreak in London. Luckily for you, John Snow's 19th century data has been georeferenced and can be explored in a GIS. You have decided to include a story map in your presentation that reflects Dr. Snow's conclusion that contaminated public water pumps were responsible for the outbreak.

Builds skills in

➢ Opening a map
➢ Changing the style of point data to create a heat map
➢ Creating a story map

Software requirements

➢ ArcGIS Online account (get a free trial)

Estimated time

➢ 30 minutes

Exercise

Step 1: Open and save the map

1. Open Disease Investigations: Cholera map.

2. At the top of the page, Click **Sign In** and sign into your ArcGIS account.

3. On the ribbon, click **Save** and **Save As**.

4. In the **Save Map** window, change the **Title** to *Disease Investigations: Cholera - yourInitials*.

5. Click **Save Map**.

As you work and modify the map, it's good practice to save it often.

6. On the side panel, click **Content** to see the map's layers.

7. Zoom in on the map until you can see the little hash marks at points along the streets.
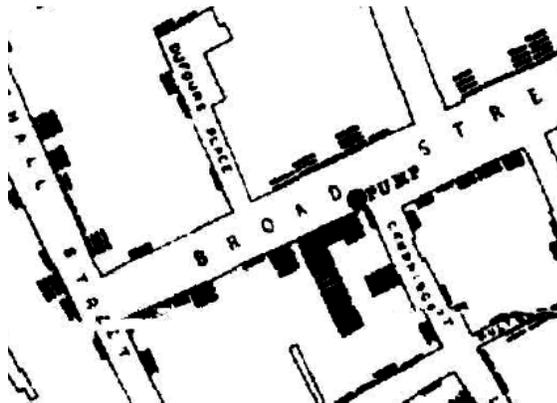
These marks indicate the number of cholera cases at an address. As you can see, some addresses had only one or two cases, but many address had more.

8. On the top ribbon, click **Bookmarks** and click **Soho**.

9. In the **Contents** pane, check the **Cholera cases by address** layer to turn it on.

These are the same addresses Snow mapped, but they have been geocoded to be accessible in a GIS. One of the attributes for this point layer is num_cases. This is the number of cholera cases that Snow recorded at each address with his hand-drawn hash marks.

10. Click any red dot to see its attributes in a pop-up window. The pop-up provides the address and the number of cases at that address.

11. Close the pop-up and save the map.

Step 2: Create a heat map

Snow collected data and recorded it on his map so he could determine where the greatest number of cholera cases and deaths occurred. This was a laborious process for Snow, but GIS provides tools that help us answer this question quickly. Geocoding the addresses and cholera data opens the door to many analysis processes in GIS. We will employ only one of these analysis processes today. We will analyze the location of cholera cases by creating a heat map. Heat maps use point layer data to calculate and display relative density. The colors are most intense where the most points are concentrated together. Here, we do not want to locate where the greatest number of dots is but rather the greatest number of cases.

1. Turn on the **Public water pumps** layer

2. Point to the **Cholera cases by address** layer. When you do this, you will see a series of buttons appear beneath the layer name. If you hover over a button, you will see what it does. Click the **Change Style** button.
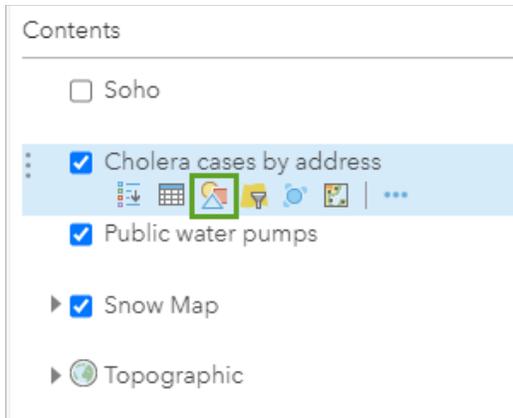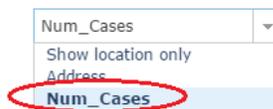
The **Change Style** pane appears. Next you will change the style of the map to heat map.

3. For **Choose an attribute to show**, choose **Num_cases**. In other words, you don't want to just map the locations, you want to map the number of cases at each location.
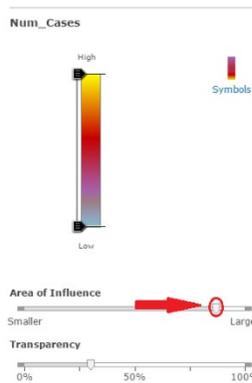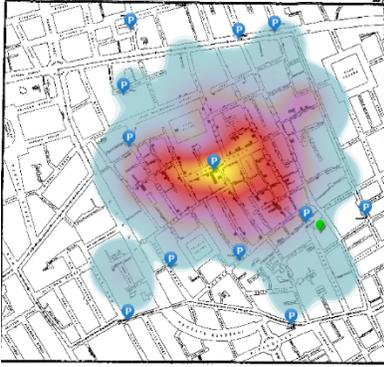

4. For **Select a drawing style**, select **Heat Map**, then click **Options**.

5. Move the Area of Influence slider slightly to the right to enlarge the area of highest density on the map.

6. Click **OK**, then click **Done**.

The yellow area on your map indicates the part of Soho where the greatest number of cholera deaths occurred. As you move through orange, red, and purple to blue areas, the density of cholera cases drops off.

7. Click on the pump symbol in the center of the yellow area to learn its name.

This is the Broad Street Pump, made famous by John Snow's discovery. (Broad Street has since been renamed Broadwick Street.) Snow's painstaking analysis of the same data led him to the conclusion that the Broad Street pump was the source of the Soho epidemic. When the pump handle was removed, preventing people from using it, the epidemic came to an end. Through spatial analysis, many lives were saved, and cholera was confirmed as a water-borne disease.

8. Save the map.

Step 3: Create a story map

1. In the upper-right corner, click **Home** and click **Content**.

2. On the top ribbon, next to your username, click the App launcher button (nine dots) and choose **StoryMaps**.

3. Click **Create a new story**.

4. Title the map *London Cholera Epidemic 1854*. Also add a subtitle.

London Cholera Epidemic 1854

Heat map of Cholera cases in the Soho District of London 1854

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5. Scroll down and click the **+** button next to the **Tell your story** text.

6. Click **Map** and choose your cholera map.

7. Position your map at the scale that you like and click **Place Map**.

8. Under the map, click the **+** button and choose **Paragraph**. Insert the following text:

John Snow's map of cholera outbreaks from nineteenth century London was viewed by many as the start of disease mapping. It is also credited for being one of the first examples of analyzing locational data.

9. At the top, click **Design**.

10. In the **Design** pane, under **Cover**, click the third option (**Minimal**). Close the **Design** pane.

11. click **Publish** and choose the appropriate sharing option. Click **Publish Story**.

In this exercise you explored historical data, created a heat map from point data, and created a simple story map.

Assessment

From the Living Atlas, search for the **COVID-19 Cases US** layer owned by CSSE_GISandData. The data sources for this layer are the WHO, CDC, ECDE, and many others. Add the layer to a map and draw it as a heat map. Add the **USA States (Generalized)** layer. Write a description of the spatial distribution of the virus within the United States.

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About the author

This lesson was written by a K-12 educator with support from the Learn ArcGIS team at Esri.

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