

RESOURCE LIBRARY | ACTIVITY : 50 MINS

Analyzing Disease Outbreaks

Students explore how mapping can be used to identify the source of an outbreak and for disease control and prevention. After reading the story of John Snow and how he used mapping to locate the source of a cholera outbreak to a single water pump in London, students then use the four-level analysis method to analyze disease outbreak maps. In small groups, they discuss sample outbreak maps from the CDC or WHO using this method.

GRADES

6, 7, 8

SUBJECTS

Biology, Health, Geography, Geographic Information Systems (GIS), Human Geography, Physical Geography, Social Studies

CONTENTS

7 Links, 1 PDF, 1 Activity

OVERVIEW

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For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/analyzing-disease-outbreaks/>

In collaboration with

DIRECTIONS

Menacing Microbes Unit Driving Question: *How does a community get ready for an outbreak?*

There's an Outbreak! Lesson Driving Question: *How do diseases spread?*

1. Introduce students to the practice of using four-level analysis to interpret patterns in a map.

- Tell students that one of the ways that people solve problems is to look for patterns of data in maps. A useful technique for this is called four-level analysis.
- Draw a large version of the Four-Level Analysis Tool on the board. This should mirror the image on the student handout—a four-square table, each square labeled with a Roman Numeral (I–IV).
- Display the NASA map of the Earth at night.
- Guide the students through a Think-Pair-Share discussion about the projected map using the following four-level analysis questions:
 - *What are you looking at? Where is this? When is this?*
 - *What patterns do you see?*
 - *Why does the map look like this? What are some possible explanations for these patterns?*
 - *Why is this important? What will you remember?*
- Record student responses in the appropriate squares on the large version of the tool.
- Tell students that maps can be a useful tool for identifying the source of a disease outbreak.

2. Use the case of John Snow to learn how maps can locate the source of an outbreak.

- Introduce students to John Snow by having them watch 06:06–7:55 of the Geospatial Revolution video.
- Complete the epidemic Mapping a London Epidemic activity to identify what patterns John Snow might have noticed in order to find the location of the source of the epidemic. This is a stand-alone activity that can either be used in its entirety or by having students complete the following three exercises:

- Mapping a London epidemic
 - Cholera deaths in Soho
 - Water pumps in Soho
- After completing the activity, have students share what they notice about the different maps.

3. Analyze disease maps to identify patterns in the data.

- There are six maps that students can explore. In pairs, have students access one of the following six maps for their analysis:
 - Flu
 - Measles
 - E-coli
 - Lyme
 - Ebola
 - Varicella
- With their selected map in front of them, distribute the Four-Level Analysis Tool to each pair of students. Have students respond to the following on their Four-Level Analysis Tool:
 - Level I: *What are you looking at? Where is this? When is this?*
 - Level II: *What patterns do you see?*
 - Level III: *Why does the map look like this? What are some possible explanations for these patterns?*
 - Level IV: *Why is this important? What will you remember?*

4. Share the analysis with others to compare information on the maps.

Have each pair of students share their analysis with another pair of students.

- If pairs are comparing the analysis of the same map, have students discuss what was different about their analyses (e.g., explanations for the patterns, reasons why this is important).
- If pairs are comparing an analysis of different maps, ask them to discuss what was different about the maps (e.g., location, scale, interactivity).

Tip

If using the [John Snow Story Map](#), and are not familiar with the GIS technology, walk through the directions in advance so that you can help students when they get stuck. You may want to do this together as a whole class.

Modification

If you need to keep this activity in one class period, show the video of John Snow and then focus class time on the four-level analysis. This is method emphasized in high school advanced geography classes.

Modification

Step 2: In the Geospatial Revolution video, from 7:55 - 10:40 is also about using maps for disease control, but not specific to Jon Snow. If there is time for students to watch it, the Mecca segment makes connections to current contexts and provides a strong connection to Step 3 of this activity.

Modification

Step 2: Mapping a London Epidemic does not require students to use computers. If students do not have computer access, this activity can be shortened to only include the Mapping a London Epidemic resource and printing hard copies of the maps for the four-level analysis.

Informal Assessment

Collect the [Four-Level Analysis Tool](#) to assess students' understanding of the method, and the depth of their analysis.

Extending the Learning

If technology is available, [The John Snow Story Map](#) uses a GIS heat mapping technique.

OBJECTIVES

Subjects & Disciplines

Biology

- Health

Geography

- Geographic Information Systems (GIS)
- Human Geography
- Physical Geography

Social Studies

Learning Objectives

Students will:

- Identify patterns in disease outbreak maps.

Teaching Approach

- Project-based learning

Teaching Methods

- Discussions
- Multimedia instruction
- Reading

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Information, Media, and Technology Skills
 - Media Literacy
- Geographic Skills
 - Acquiring Geographic Information
 - Analyzing Geographic Information
 - Answering Geographic Questions

- [Asking Geographic Questions](#)
- [Organizing Geographic Information](#)
- Science and Engineering Practices
 - Analyzing and interpreting data

National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- [Reading Standards for Literacy in History/Social Studies 6-12:](#)

Key Ideas and Details, RH.6-8.2

- [Reading Standards for Literacy in History/Social Studies 6-12:](#)

Integration of Knowledge and Ideas, RH.6-8.7

THE COLLEGE, CAREER & CIVIC LIFE (C3) FRAMEWORK FOR SOCIAL STUDIES STATE STANDARDS

- [D1.His.14.6-8:](#)

Explain multiple causes and effects of events and developments in the past.

- [D2.His.16.6-8:](#)

Organize applicable evidence into a coherent argument about the past.

- [D2.His.1.6-8:](#)

Analyze connections among events and developments in broader historical contexts.

Preparation

What You'll Need

REQUIRED TECHNOLOGY

- Tech Setup: 1 computer per classroom, 1 computer per pair, Projector

PHYSICAL SPACE

- Classroom

GROUPING

- Heterogeneous grouping
- Homogeneous grouping
- Jigsaw grouping
- Large-group instruction
- Large-group learning
- Small-group instruction
- Small-group learning
- Small-group work

RESOURCES PROVIDED: UNDEFINED

- Penn State: Geospatial Revolution Episode Four

RESOURCES PROVIDED: HANDOUTS & WORKSHEETS

- [Four-Level Analysis](#)

RESOURCES PROVIDED: MAPS

- CDC: Weekly U.S. Map - Influenza Summary Update
- CDC: Measles Cases and Outbreaks
- CDC: Map of Reported Cases

RESOURCES PROVIDED: INTERACTIVES

- Outbreaks

RESOURCES PROVIDED: INSTRUCTIONAL CONTENT

- Mapping A London Epidemic

RESOURCES PROVIDED: ARTICLES & PROFILES

- NASA: Earth at Night
- WHO: Ebola Virus Disease - Democratic Republic of the Congo

BACKGROUND & VOCABULARY

Background Information

Once a disease outbreak has been reported, it is important to identify the source of the outbreak so that a response team can stop the spread of the disease. Epidemiologists often use map data to find the source of outbreaks. There are many different modern techniques for this such as GIS mapping. A historical example of this kind of mapping is the case of John Snow, an epidemiologist who used maps to trace the source of a cholera outbreak to a single water pump.

A method that people use for analyzing maps is called four-level analysis. This is a method that seeks to understand not only what patterns exist on a map, but why they are happening and what might happen next. Geographic patterns and processes are emphasized in advanced high school geography courses. Learning this method can be a valuable skill in preparation for this kind of course work.

Prior Knowledge

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Recommended Prior Activities

- [Getting Sick: How Diseases Spread](#)
- [Investigating Infectious Diseases](#)

Vocabulary

Term	Part of Speech	Definition
cholera	<i>noun</i>	infectious, sometimes fatal disease that harms the intestines.
contagion	<i>noun</i>	disease-producing agent, like a virus or bacteria; can also refer to the disease itself or the transmission of the disease.
contaminate	<i>verb</i>	to poison or make hazardous.
disease	<i>noun</i>	harmful condition of a body part or organ.
epidemic	<i>noun</i>	outbreak of an infectious disease able to spread rapidly.
outbreak	<i>noun</i>	sudden occurrence or rapid increase.

For Further Exploration

Instructional Content

- [Mapping the Cholera Epidemic of 1854](#)

Video

- [PBS: John Snow - Pioneer of Epidemiology](#)



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