



**Educator Guide:  
Case Studies in STEM - Epidemiology**

## Case Studies in STEM – Epidemiology Educator Guide

**Overview:** Students will explore a case study on epidemiology by role playing investigators and individuals affected by an outbreak. Students will be collecting information on the disease outbreak and formulating a hypothesis about the source of the outbreak and mode of transmission.

### **Envision Platform & National Standards Alignment:**

- CCSS ELA Alignment
  - RST. 11-12.8
- Next Generation Science Standards
  - HS-ETS1-1
- Envision Education Platform
  - Dimension 1: Core Skills – Standard 1B, Collaboration Standard 1D, Critical Thinking

### **Expected Outcomes & Desired Results:**

- Apply the process of an outbreak investigation to a realistic case study
- Practice communication skills by performing interviews generate hypotheses about the source of an outbreak and mode of transmission
- Collect information that can be used to identify the source of the outbreak
- Recognize the challenges experienced by health professionals who conduct epidemiological studies
- Employ team-building skills to successfully complete an outbreak investigation

Epidemiology is the scientific and medical study of the causes and transmission of disease within a population. A critical component of public health, as well as clinical practice, the study of epidemiology results in data and information that allows healthcare professionals to make important decisions. We see epidemiology in action through the news every day. From the 2010 recall of nearly 380 million eggs due to Salmonella to the close monitoring of Ebola cases, epidemiology is a prevalent form of health science that will continue to impact our health and livelihood.

The *Epidemiology Case Study* challenges students to apply the framework of an outbreak investigation to a true-to-life case study in an effort to identify the source of a disease before the health of more individuals is impacted.

Students will be collecting information on the disease outbreak and formulating a hypothesis about the source of the outbreak and mode of transmission. Students will be divided into two groups – Case Individuals and Investigators. Case Individuals will role play a student, teacher, school staff, doctor or lab technician throughout the investigation. There are 11 case individual roles. Investigators will be interviewing the Case Individuals to learn more about the outbreak and to synthesize a hypothesis.

### Facilitating the Lesson:

1. Introduce the topic of epidemiology and the activity by going over the following points.
  - *Epidemiology – the branch of medicine that deals with the incidence, distribution and possible control of diseases and other factors relating to health*
  - *Let students know they will be role playing to learn more about epidemiology and how scientists gather information if an outbreak has occurred.*
  - *Some students will be role playing an individual who has been effected by this outbreak, while others will be role playing the investigators.*
2. Pass out the Outbreak Investigation Introductory Information sheet to all students and have them individually read the background information.
  - After students have had time to read, review the key points of information
    - 73 students visited the school nurse complaining of blueness to the lips & fingers and the students were taken to the hospital
    - Students were diagnosed with methemoglobinemia (MetHb)
    - All students are expected to recover
    - Methemoglobinemia is a blood disorder that can be caused by inheriting it or through exposure to certain drugs, chemicals or foods.
3. Divide students into 2 groups, investigators or case study roles. There are 11 case study roles, so make sure you have enough students to play the case study roles. Once students have been divided into two groups pass out the information for the group.
  - Case Study Individuals - Role Specific Information along with 1 role card. You will need to cut the role information and role cards sheets.
  - Investigators - Outbreak Investigation Questionnaire.
  - Depending on the number of investigators it might be helpful to divide them into 2-3 groups and have different investigation teams to develop their own questions and hypothesis.
4. Have each group meet to discuss their roles for 10 minutes.
  - Investigators should be thinking of questions they want to ask the individuals and depending on the number of investigators assigning individuals to question. Remind them to ask questions that will generate responses beyond 'Yes' or 'No'
  - Case Individuals will learn their role and think about how they want to portray that person. Remind them to stay in character and provide information only if directly asked.
5. After 10 minutes of planning investigators will interview the case individuals. There will be 15 minutes for interviews. During this time students will be:
  - Investigators will develop questions and interview at least one case individual.
  - Case individuals will answer any questions and reveal information to the investigators (but don't show them the role card!)
6. After 15 minutes, the investigators will be meet to discuss evidence and to develop a hypothesis. The individuals are available and listening to their discussion, but not able

to volunteer any additional information. If an individual is asked a follow up question from an investigator they are allowed to respond. The investigators will have 7 minutes to discuss and create a hypothesis. If there are more than 1 group of investigators, each group should be developing their own hypothesis.

- Investigators will be presenting their hypothesis to the class as well as sharing their questioning technique and what information supports their hypothesis.
7. After 7 minutes have the investigators present their hypothesis to the entire class. After all groups have shared their hypothesis, pass out the Summary of Agent sheet and give students time to read it. This sheet has what happened to cause the outbreak.
- After students have read it debrief the activity with the following questions:
    - Did you collect enough information from the individuals to come to a supported hypothesis?
    - What information did you miss?
    - What was the hardest part of being an investigator?
    - What was the hardest part of being your role as an individual?
    - How did you work together to create a hypothesis or in your role?

### Using Case Studies in Your Classroom

- Case studies are a great tool to introduce literacy to your STEM classroom
  - Open discussion around a relevant topic
  - Engage in collaborative thought
  - Debate opposing viewpoints
  - Support learning standards
  - Prepare for the college classroom
- What makes a great case study
  - Why – Content, Context, Relevance
    - Story-based
    - Applicable Knowledge
    - How can students relate as 21<sup>st</sup> century learners
  - How - Case Study Checklist
    - Key elements to support the *Why*
    - Example sources
    - Set the playing field, provide tools, implement
- Sources for FREE science and health-based case studies:
  - Centers for Disease Control and Prevention (CDC)
  - <http://www.cdc.gov/eis/casestudies/>
  - National Center for Case Study Teaching in Science – supported by NSF
  - <http://sciencecases.lib.buffalo.edu/cs/>
- Sources for high school appropriate research articles:
  - American Journal of Epidemiology
  - PubMed Central
    - [www.ncbi.nlm.nih.gov/pmc](http://www.ncbi.nlm.nih.gov/pmc)

This curriculum piece is adopted from Envision's NYLF: Advanced Medicine & Healthcare for high school students and a presentation at NSTA Orlando 2014 on Science Literacy in the Classroom.