

MODULE VII

AN OUTBREAK CASE STUDY

In this module, you have the opportunity to use all of the epidemiological techniques you learned in the previous modules by doing a case study. Before embarking on the case study, we'll go over some of the basic components of investigation of an outbreak of acute gastroenteritis.

Note: You will have to work through the module itself to obtain the answers to the questions asked during the investigation.

Outbreak Investigation – Acute Gastroenteritis

A. Overview

- Outbreak investigations should be a collaborative effort, since several tasks requiring different skills must be done at the same time.

- **Steps in Disease Investigation**
While every outbreak is unique, the investigative process generally follows the sequence outlined below:
 1. Obtain the initial report.
 2. Determine the extent of illness. Are there other associated cases?
 3. Learn about the suspected agent—is it transmissible from person to person? Is it transmissible through the environment, such as by food or water?
 4. Plan the investigation.
 5. Conduct the investigation.
 6. Formulate a case definition for analytical purposes.
 7. Analyze the cases and characterize by time, place, and person.
 8. Evaluate the hypothesis and formulate conclusions.
 9. Select, implement, and evaluate control measures.
 10. Prepare investigation report.
 11. Distribute the approved final report to all agencies that contributed to the investigation effort.
 12. Conduct after-action evaluation.

- This list is a summary of the things that need to be considered in any investigation. In real life, several of these steps may go on at the same time. Their order will vary, and several of the steps may occur more than once. However, all of these things are necessary to the successful resolution of an outbreak.

B. Preparations for an outbreak must begin before the outbreak occurs.

1. Each agency should establish a multidisciplinary investigative team and assign responsibilities. Members should include:
 - nursing
 - communicable disease
 - environmental
 - support staff
 - laboratory
 - public information, and
 - computer information

2. Staff should receive training, including Introduction to Epidemiology, Principles of Epidemiology and other disease specific courses on investigative procedures.
3. Assemble materials: laboratory kits, forms, reference materials, personal protective equipment such as gloves and masks.
4. Maintain a current phone directory, including e-mail and Internet addresses, home addresses and phone numbers of team participants, and key contact personnel outside the Local Public Health Agency.
5. Maintain adequate local surveillance systems for the early detection of increased disease incidence.

C. Definitions

An *outbreak or epidemic* is the occurrence in a community or region of an illness(es) of similar nature, clearly in excess of normal expectancy, and derived from a common or a propagated source (19 CSR 20-20.010).

Acute gastroenteritis is an illness with sudden onset characterized by symptoms such as diarrhea, vomiting, fever, or abdominal cramping.

NOTE: Always consider the possibility of intentional contamination when investigating an outbreak. If a bioterrorism event is suspected, notify your Regional Communicable Disease Coordinator and appropriate law enforcement officials immediately.

AN OUTBREAK CASE STUDY: Foodborne Outbreak Associated with a Wedding, Southwest Missouri, June 2002

Introduction

In this case study you will investigate a disease outbreak following the **Steps in Disease Investigation** above. For purposes of this exercise, you will be the head of the investigation team for the Washaw County Health Department (WCHD), and you will work on each of the steps in order. For each step, you will be given some information describing the current situation and then asked to describe how you would handle that step. The correct answers will be provided after each step.

STEP 1. Obtain the initial report.

Situation: On June 7, 2002, the WCHD nurse received a call from a person who had attended a wedding and reception on June 1, 2002 and soon afterward became ill with acute gastroenteritis. The caller said he knew of several other people who were also ill.

Question: What additional information should you get from the caller?

STEP 2. Determine the extent of the illness. Are there other associated cases?

Situation: You have contacted the local hospital. The Laboratory Director said they had recently sent five *Salmonella* isolates from stool cultures to the State Public Health Laboratory (SPHL) for additional testing. Within the next three days, the SPHL reported that the five isolates were all *Salmonella infantis*. One of these patients was the caller who attended the wedding.

You have telephoned the Southwest Regional Communicable Disease Coordinator, who reviewed the surveillance data in the MOHSIS computer system. No other cases of *Salmonella infantis* had been reported in the Southwest Region in all of 2002.

a. Question: Should this episode be considered an outbreak? If so, what other activities should you start?

b. Question: What definition of an outbreak related case would best serve the investigation at this point?

STEP 3. Learn about the suspected agent—is it transmissible from person to person? Through the environment (including food or water)?

Situation: Consult the Communicable Disease Investigation Reference Manual (CDIRM) or other current references such as *Control of Communicable Diseases Manual* or the *American Academy of Pediatrics Red Book* to answer the questions in Steps 3 and 4 and get other information about the natural history of the disease. In this case, the agent is known to be *Salmonella infantis*, which is transmissible from person to person and through the environment. (See CDIRM manual section on salmonellosis at <http://www.dhss.mo.gov/CDManual/Salm.pdf>)

a. Question: Considering salmonellosis is transmissible from person to person, what additional steps should be taken?

b. Question: Considering that salmonellosis is transmissible through the environment, what additional steps should be taken?

STEP 4. Plan the investigation.

Situation: By carrying out the activities in the previous steps, the following information was obtained:

- There were three meals associated with the wedding celebration:

May 31, 2002	Rehearsal Dinner
June 01, 2002	Bridal Brunch (morning)
June 01, 2002	Wedding Reception (7:00 p.m.)
- The bridal brunch was held at a private residence, and was attended by 12 women.
- The rehearsal dinner and the wedding reception were catered by a local catering firm and held at a convention center. The catering firm is operated out of a home with a separate kitchen devoted to the business.
- About 30 people attended the rehearsal dinner and 300 attended the wedding reception.
- All of the first five identified cases attended the reception, but only one was at the rehearsal dinner and none attended the bridal brunch.

a. Question: At this early stage, what would be a reasonable tentative hypothesis about what may have caused the outbreak?

Clues:

- Formulate a tentative hypothesis based on the time, place, and person associations you have found so far. This hypothesis will form a basis for the investigation. It is very

important not to be too narrow in your focus, thereby excluding potentially important cases or events.

- Develop the hypothesis by interpreting available data to determine:
 - Identity of most likely agent(s)
 - Most likely source(s) of agent
 - Most likely mode by which agent was transmitted.

b. Question: The purpose of the detailed investigation is to gather the information needed to test your tentative hypothesis. What are the required tests of each component of the hypothesis, and what information is needed for each?

c. Question: You have developed your hypothesis and determined what information you will need to gather. How will you gather the information and test your hypothesis?

STEP 5. Conduct the investigation

Situation: Your team is assembled and the questionnaires are developed.

Question: How will you proceed with the investigation?

STEP 6. Formulate a case definition for analytical purposes.

Situation: You've gathered a lot of information. Now you need to develop a more refined case definition so you can clearly identify the relevant cases and analyze the data. The goal is to create a case definition that is sufficiently "tight" to include only the people whom you are reasonably sure had *Salmonella* infections related to the outbreak.

Question: What elements will you use to formulate your case definition? What is your new, refined case definition?

STEP 7. Analyze the cases and characterize by time, place, and person.

Situation: The investigation was carried out as planned. With the assistance of the Regional Communicable Disease Coordinator, the following steps were taken:

- The case definition was used to identify which people were considered to be "cases."
- An epidemiologic curve (histogram) was created.
- A case-control study was conducted and attack rates were calculated.

Following are the major findings, grouped again by the three major parts of the hypothesis.

1. "This is an outbreak of *Salmonella infantis*..."

- Ten stool specimens from outbreak-related cases were confirmed positive for *Salmonella infantis*. The earliest specimen was collected on 6/4/02 and the last one on 7/2/02. No other enteric pathogens were isolated.
- One person with a stool specimen positive for *Salmonella infantis* did not meet the case definition and was excluded from the analysis. She was the mother of the bride (who did not handle the food). Her symptoms started on 5/31/02 (the day before the wedding) and therefore she did not meet the definition. It is possible that she had

“nervous diarrhea” before the wedding, and her *Salmonella* infection actually began later.

- Sadly, the bride and groom were also reported to be ill. They were not included in the study because they had left on their honeymoon anyway.
- The common signs and symptoms were diarrhea (100%), cramps (84%), nausea (52%), fever (52%), chills (44%), and headache (36%).
- There were 24 cases who reported onset time. The mean onset time was 23 hours after the wedding reception began; the range was 6 to 63 hours.

2. “...caused by the ingestion of contaminated foods (or beverages)...”

- Exposure histories of ill and well attendees:
 - The case-control study began on June 12, 2002. Fifty-one persons were interviewed, all of whom ate at the reception. Twenty-five of the 51 were ill and met the case definition. Three more ill people were interviewed but did not meet the case definition and so were excluded from the analysis. The controls were 23 well guests identified during interviews with wedding attendees.
 - All cases interviewed were over 18 years old. The mean age of the cases was 36 and the mean age of the controls was 29.
 - The menu consisted of: turkey, ham, roast beef, potato salad, pasta salad, raw vegetables and dip, raw fruit and sauce, chips, bread, condiments, a variety of cakes, iced tea, soda and beer.
 - Two-by-two tables were constructed for each menu item served at the wedding reception. Two foods were found to be statistically significantly associated with illness:

Food Item	Odds Ratio	95% Confidence Interval	Uncorrected “p” Value
Turkey	5.45	1.19 – 26.99	0.01
Potato Salad	5.2	1.22 – 23.52	0.01

- Environmental evaluation
 - No food remained for testing.
 - On June 10, 2002, the convention center in which the reception was held was inspected and revealed the following:
 - The tables used for serving food had no cold holding capacity.
 - Serving tables were not provided with sneeze shields.
 - The kitchen area was adequately equipped and clean.
 - The inspection and evaluation of the caterer’s facility on June 10 revealed the following:
 - Foodhandling equipment appeared to be in good working order.
 - The operation did not have a three-vat sink for proper dishwashing.
 - All foods served at the wedding reception were to be served cold.
 - The caterer received uncooked boneless turkey breasts at approximately 10:00 p.m., Wednesday, May 29. They were delivered frozen by the bride’s family from Smallville, individually vacuum packaged. The caterer immediately placed the breasts in a tub of water. The caterer could not remember if the breasts were placed in refrigeration or left on the counter at room temperature to thaw. The thawed breasts were cooked in the original vacuum packaging Thursday afternoon, May 30,

to a temperature of 170°F using a meat thermometer to check cooking temperature. They were removed from the electric roaster oven and cooled at room temperature for 1½ to 2 hours. The breasts were then placed in refrigeration. They were sliced at the caterer's on a commercial meat slicer Friday afternoon, May 31. Old food debris was found on the slicer on June 10, the day of inspection.

- The potato salad was prepared on Thursday, May 30, at the caterer's with the following ingredients: potatoes, Miracle Whip salad dressing, mustard, commercially prepared pickle relish, celery, sugar, salt and pepper.
- The pasta salad was prepared at the caterer's on Thursday, May 30, with the following ingredients: commercially prepackaged noodles, oil, vinegar and mustard.
- Pre-cooked boneless hams were served, which were shaved and packaged at two large grocery stores in a nearby town. Unannounced visits to both stores on June 11, 2002 revealed that the hams were sliced in the meat cutting departments. Only a single meat slicer was present in each meat department. During the day, raw and cooked products were being sliced. The meat slicers were not thoroughly cleaned and sanitized between the slicing of raw and cooked products. Raw beef particles were present on both slicers at the time of inspection. The ambient air temperatures in the meat cutting rooms were in the mid to upper 70s.
- Pre-cooked Hormel brand roast beef was sliced and packaged at a grocery in a small town in the southern part of the county. The roast beef was picked up the morning of the dinner and delivered in coolers to the convention center where the dinner was served. A visit to the grocery on June 11, 2002, revealed the following: The meat slicer was used only for precooked prepackaged deli meats. The meat slicer was clean. The walk-in meat cooler used for storage was 40°F and also clean.
- On June 10, 2002, a sample of the water supply at the catering establishment was obtained and analyzed based on Department of Health and Senior Services standards for drinking water. The water was determined to be unsatisfactory, with bacteria too numerous to count with coliforms. It was also noted that the well that supplies the water was located within 50 feet of a hog lot.

3. "... served at the wedding reception on June 1."

- Thorough questioning of the ill and well persons included in the case-control study revealed no other activities or food or beverage sources in common in the week preceding the outbreak.

a. Question: Was the planned investigation adequately conducted?

b. Question: Referring to the epidemic curve (the histogram you previously downloaded), is the distribution of the cases compatible with a common exposure at the wedding reception? Describe how you arrived at your conclusion.

c. Question: Will the information obtained allow an adequate test of each element of the hypothesis?

STEP 8. Evaluate the hypothesis and formulate conclusions.

Situation: You now have all available information from the statistical analysis, along with laboratory data, environmental inspection findings, and other relevant information with which to evaluate the hypothesis and formulate conclusions.

a. Question: Is the first part of the hypothesis (“This is an outbreak of *Salmonella infantis*. . .”) supported well enough by the data that you accept it as true?

b. Question: Is the second part of the hypothesis (“ . . . caused by the ingestion of contaminated foods (or beverages)...”) supported well enough by the data that you accept it as true?

c. Question: Is the third part of the hypothesis (“ . . . served at the wedding reception on June 1”) supported well enough by the data that you accept it as true?

STEP 9. Select, implement, and evaluate control measures.

Situation: The outbreak was caused by an organism, *Salmonella infantis*, which causes gastrointestinal symptoms.

a. Question: What control measures have you selected and implemented?

b. Question: How can you determine whether the control measures were effective?

STEP 10. Prepare the report

You will learn how to prepare an outbreak report in Module VIII and you will be able to view a report for this outbreak of *Salmonella infantis*.

STEP 11. Distribute the report

The outbreak report should be submitted to the WCHD Administrator and to DHSS for approval. Once approved, it should be distributed according to agency guidelines. At a minimum, it should be shared with each agency involved in the investigation, and with any other entities who have made a formal request for it.

STEP 12. Conduct after-action evaluation

Every outbreak investigation provides an opportunity for learning. The team(s) involved in the investigation should be pulled together and a discussion held about what went well, what did not go so well, and what changes can be put in place to make it easier and better the next time.