

CD 303 Exercises

2. Disease Surveillance Case Study Exercise:

***E.coli* from where?**

E. coli O157:H7 has been recognized since the 1980s as an important pathogen that can cause serious illness. Outbreaks have been attributed to ground beef, roast beef, water, apple cider, unpasteurized milk, and contact with animals. Human infection occurs through ingestion of food or water contaminated with animal fecal material, but person-to-person transmission also occurs. The organism can survive for extended periods in water, meat stored at subfreezing temperatures, soil, and acidic environments, but can be destroyed by thorough cooking or pasteurization. Patients infected with *E. coli* O157:H7 typically present with severe abdominal cramps, bloody diarrhea, and low-grade fever after a 1 to 10-day incubation period (usually 2-5 days). Children and the elderly are at greatest risk for complications such as hemorrhagic colitis, hemolytic uremic syndrome, and death.

(This case study is loosely based on several *E. coli* O157 outbreaks at fairs. The information is not intended to be factual, but is presented for educational purposes. The format of this case follows that of one prepared by Richard Dicker, CDC.)

Surveillance

On **August 10**, the Oregon County Health Department received a report of a child with *E. coli* O157 (O157) diarrhea. This was their first O157 report in over a year. Within 24 hours Oregon County had received 3 more reports of O157 infection in children.

Question 1

If you took the information on the 4 cases, what would you want to know?

Question 2

Is this an outbreak?

What else could be going on?

Question 3

All 4 ill children that were reported to Oregon County Health Department over 24-hour period had attended the Oregon County Fair and had bloody diarrhea. The fair had been held **August 1 – 6**. Over ~120,000 people had attended this fair. However, the fair ended 3 days earlier. The fairground facilities are used for activities throughout the year.

Why is this outbreak worth investigating?

Who should know that an outbreak is suspected?

3A. Descriptive Epidemiology

The Oregon County Health Department assumed lead responsibility for the investigation. The State Office of Disease Prevention and Epidemiology was asked to assist.

Over the next several days, more and more cases of diarrhea and bloody diarrhea were reported. While the earliest 4 cases were in children, cases occurred among all age groups. The case-patients did not appear to have any consumption of food or water in common. However, they all had attended the Oregon County Fair. The investigators therefore felt comfortable focusing on the fair as the source of the outbreak.

Question 1

What might you use as a case definition?

Question 2

How are you going to look for additional cases?

Question 3

What information do you want to obtain in your questionnaire?

3B. Descriptive Epidemiology

Preliminary data showed that there were 60 cases of lab confirmed O157 infections. 46 were primary cases and 14 were secondary cases. 46/60 (77%) were < 6 years of age and 48/60 (80%) were <19 years of age. Among these culture confirmed cases, 21 were hospitalized and 11 had hemolytic uremic syndrome (HUS).

The documented onset of diarrhea is shown in the table below. To characterize the outbreak by time, the investigators decided to construct an epidemic curve.

Table 1

Onset Date	# of confirmed cases
8/5	4
8/6	6
8/7	5
8/8	16 (5 secondary)
8/9	9 (2 secondary)
8/10	7 (2 secondary)
8/11	5 (3 secondary)
8/12	2
8/13	3
8/14	3 (2 secondary)

Question 4

What is an epidemic curve? What is the value of an epidemic curve?

Question 5

Create an epi-curve by graphing the cases by time of onset of diarrhea.

Mark the fair dates on the curve.

Question 6

Based on curve and known incubation period estimate when peak exposure likely occurred.

Question 7

What can you conclude from the epidemic curve?

4. Study Design and Analytic Epidemiology

Review of Opening Scenario

On **August 10**, the Oregon County Health Department received a report of a child with *E. coli* O157 (O157) diarrhea. This was their first O157 report in over a year. Within 24 hours Oregon County had received 3 more reports of O157 infection.

All 4 ill children that were reported to Oregon County Health Department over 24-hour period had attended the Oregon County Fair and had bloody diarrhea. The fair had been held **August 1 – 6**. Over ~120,000 people had attended this fair. However, the fair ended 3 days earlier. The fairground facilities are used for activities throughout the year.

Additional information:

The Oregon County Fair is a major annual event in Oregon each August. It is a large agricultural fair with hundreds of animal exhibits, food vendors, and amusement rides. More than 170,000 visits were recorded this year.

The fairgrounds are supplied by shallow wells approximately 20-feet deep. Since the fairgrounds are only in operation 42 days of year, the fairground water supply is not considered a community water system; it is considered an alternative water source and is regulated under the food code. This type of well must be tested within 60 days of an event. Testing for coliforms was performed on June 20th and was negative.

Question 1

What hypotheses do you want to evaluate?

(answer question before proceeding to next section)

Additional information:

An environmental investigation of the fairground revealed that much of the fair was supplied by chlorinated water. However, in one area of the fairground, a shallow well (well #6) provided unchlorinated water to several vendors who used the water to make beverages and ice. This area was close to the large animal barn.

Question 2

Do we need a study, if so what type of study? (answer question before proceeding to next section)

Additional information:

Cases eligible for inclusion in case control study were people who had attended the Fair and who had stool culture positive for *E. coli* O157 and were the first case in a household (primary cases).

Question 3

Whom might you get for controls? How do you find them? (answer question before proceeding to next section)

Additional information:

For the Oregon County Fair, controls were obtained from credit card receipts of attendees and from persons entered in photography exhibit and children's art exhibit. Controls were selected who had a similar age distribution as the cases.

Results

Investigators identified 32 cases and 84 controls. All cases had attended the fair during the last 4 days. Analysis included only controls who attended the fair at least once during the final 4 days (32 cases and 57 controls).

Hypothesis 1: Water from well #6

Among cases, 26 were exposed to well #6 and 6 were not exposed. Among controls, 9 were exposed to well #6 and 48 were not exposed.

Hypothesis 2: Vendor A chicken

Among cases, 14 were exposed to Vendor A chicken and 18 were not exposed. Among controls, 5 were exposed to Vendor A chicken and 52 were not exposed.

Table 1: Fill in 2X2 table for exposure to water from well #6, Fair outbreak

	Cases (ill)	Controls (not ill)	Row Total
Yes exposed	(a)	(b)	a+b
No, not exposed	(c)	(d)	c+d
Column Total	a+c	b+d	a+b+c+d

Table 2: Fill in 2X2 table for exposure to Vendor A chicken, Fair outbreak

	Cases (ill)	Controls (not ill)	Row Total
Yes exposed	(a)	(b)	a+b
No, not exposed	(c)	(d)	c+d
Column Total	a+c	b+d	a+b+c+d

Question 4

What is an appropriate measure of association for a case-control study?

Calculate the measures of association for the data in Tables 1 and 2.

Water from well #6

Vendor A chicken

5. Questionnaires and Interviewing Tips

Ten Cardinal Rules for Conducting Interviews

- 1. Do a practice run until you're comfortable with the questionnaire**
- 2. Find a quiet place to conduct your interviews**
- 3. Be nonjudgmental**
- 4. Avoid leading the interviewee**
- 5. Accurately record what people say**
- 6. Ensure confidentiality, beginning with conducting interviews in a private location**
- 7. Gently redirect, as needed**
- 8. Probe if answers are vague, particularly about time of symptom onset**
- 9. Work with epidemiology staff to provide language interpretation, if needed**
- 10. Thank interviewee at closing and explain how info will be used**

Interviewer Training: “The Good, the Bad, and the Ugly”

Scene One	Scene Two
<i>What went well?</i>	<i>What went well?</i>
<i>What went <u>not</u> so well?</i>	<i>What went <u>not</u> so well?</i>

7. Taking Action

On further analysis, only one factor remained statistically significant: drinking beverages from vendors who were supplied by water from well #6. As part of the environmental investigation, samples of water were tested from well #6, from the distribution pipe to the vendor area, and from the outlet pipe at the vendor area. Although *E. coli* O157 is not often isolated from water supplies, all 3 sites at the fairgrounds yielded *E. coli* O157:H7.

Question 1

What control measures might you recommend for control of this outbreak?

Question 2

a. Who needs to know what you recommend? Why?

b. How will you communicate your findings?

Conclusion

To prevent future similar outbreaks, the public health authorities issued summary orders to prohibit the use of untreated water at certain agricultural fairs and to require daily testing and disinfection of water supplies during public events.