Answers to Exercises

Answer–Exercise 6.1 (page 352)

One reason to investigate is simply **to determine how many cases we would expect in the community**. In a large community, nine cases of a common cancer (for example, lung, breast, or colon cancer) would not be unusual. In a very small community, nine cases of even a common cancer may seem unusual. If the particular cancer is a rare type, then nine cases even in a large community may be unusual.

If the number of cancer cases turns out to be high for that community, we might pursue the investigation further. We may have a **research** motive–perhaps we will identify a new risk factor (workers exposed to a particular chemical) or predisposition (persons with a particular genetic marker) for the cancer.

Control and prevention may be a justification. If we find a risk factor, control / prevention measures could be developed. Alternatively, if the cancer is one which is generally treatable if found early, and a screening test is available, then we might investigate to determine not why these persons developed the disease, but why they died of it. If the cancer were cancer of the cervix, detectable by Pap smear and generally treatable if caught early, we might find (1) problems with access to health care, or (2) physicians not following the recommendations to screen women at the appropriate intervals, or (3) laboratory error in reading or reporting the test results. We could then develop measures to correct the problems we found (public screening clinics, education of physicians, or laboratory quality assurance.)

If new staff need to gain experience on a cluster investigation, **training** may be a reason to investigate. More commonly, cancer clusters frequently generate **public concern**, which, in turn, may generate **political pressure**. Perhaps one of the affected persons is a member of the mayor's family. A health department must be responsive to such concerns, but does not usually need to conduct a full-blown investigation. Finally, **legal concerns** may prompt an investigation, especially if a particular site (manufacturer, houses built on an old dump site, etc.) is accused of causing the cancers.

Answer–Exercise 6.2 (page 356)

Tuberculosis does not have a striking seasonal distribution. The number of cases during August could be compared with (a) the numbers reported during the preceding several months, and (b) the numbers reported during August of the preceding few years.

Aseptic meningitis is a highly seasonal disease which peaks during August-September-October. As a result, the number of cases during August is expected to be higher than the numbers reported during the preceding several months.

To determine whether the number of cases reported in August is greater than expected, we must look at the numbers reported during August of the preceding few years.

Answer–Exercise 6.3 (page 362)

Which items to include in a line listing is somewhat arbitrary.
The following categories of information are often included:

Identifying information
- Identification number or case number, usually in the leftmost column
- Names or initials as a cross-check

Information on diagnosis and clinical illness
- Physician diagnosis
- Was diagnosis confirmed? If so, how?
- Symptoms
- Laboratory results
- Was the patient hospitalized? Did the patient die?

Descriptive epidemiology–time
- Date of onset
- Time of onset

Descriptive epidemiology–person
- Age
- Sex
- Occupation, if relevant, or other seemingly relevant characteristics

Descriptive epidemiology–place
- Street, city, or county
- Worksite, school, day care center, etc., if relevant

Risk factors and possible causes

- Specific to disease and outbreak setting

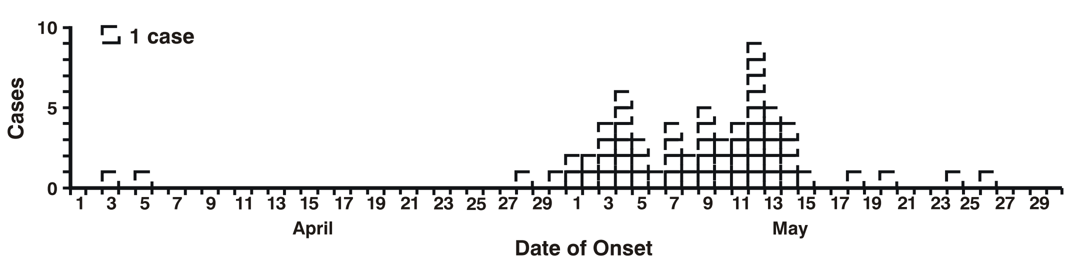
An example of a line listing from the six case report forms is shown below.

ID #	Initials	Dateof Onset	Diagnosis	How Confirmed	Age	Sex	County	Physician	Cleveland-McKay Wedding
1	KR	7/23	Probable Trichinosis	Not done	29	M	Columbia	Goodman	Yes
2	DM	7/27	Trichinosis	Biopsy	33	M	Columbia	Baker	Yes
3	JG	8/14	Probable Trichinosis	Not done	26	M	Columbia	Gibbs	Yes
4	RD	7/25	Trichinosis	Serologic	45	M	King	Webster	Yes
5	NT	8/4	Trichinosis	Not done	27	F	Columbia	Stanley	Yes
6	AM	8/11	R/O trichinosis	pending	54	F	Clayton	Mason	Yes

Answer–Exercise 6.4 (page 369)

The epidemic curve shown in Figure 6.10 suggests a common source outbreak. We can estimate time of exposure by starting at the peak of the epidemic and going back the mean incubation period, or by starting at the rise of the epidemic and going back the minimum incubation period. Going back 30 days (mean incubation period for hepatitis A) from the epidemic peak on May 9 puts the estimated exposure on April 9. Assuming the minimum incubation period (15 days) for the April 28 case, exposure would have occurred on April 13. So, we can estimate that exposure occurred between April 9 and April 13, give or take a few days on either side.

Figure 6.10
Epidemic curve for Exercise 6.4: Hepatitis A by date of onset, April-May



Answer–Exercise 6.5 (page 382)

A case-control study is the design of choice, since 17 persons with the disease of interest have already been identified. We would need to enroll these 17 persons as the case group. We would also need to determine what group might serve as an appropriate comparison or control group. Neighbors might be used for the control group, for example. In our case-control study we would determine whether each case and each control was exposed to electromagnetic fields (however we defined that exposure). Finally, we would compare the exposure experience of cases and controls.

The alternative to a case-control study is a cohort study. For a cohort study we would have to enroll a group of persons exposed to electromagnetic fields (however we defined that exposure), and a comparison group of persons not exposed. We would then have to determine how many in each group developed leukemia. Since leukemia is a relatively rare event, we would need rather large groups in order to have enough leukemia cases to make our study valid. Therefore, a cohort study is less practical than a case-control study in this setting.

Answer–Exercise 6.6 (page 383)

The appropriate measure of association for a cohort study is the relative risk, calculated as the ratio of attack rates.

Relative risk = 44.64/7.14 = 6.2

$$\text{Chi-square} = \frac{T\left[|ad - bc| - (T/2)\right]^2}{V1 \times V2 \times H1 \times H2}$$

For the table shown above, the chi-square becomes:

$$= \frac{126 \times \left[|25 \times 65 - 31 \times 5| - 126/2\right]^2}{30 \times 96 \times 56 \times 70}$$

= 249,435,774/11,289,600
= 22.09

A chi-square of 22.09 corresponds to a p-value of < 0.00001. A p-value this small indicates that the null hypothesis is highly improbable, and the investigators rejected the null hypothesis.

Answer--Exercise 6.7 (page 387)

An Outbreak of Enteritis During a Pilgrimage to Mecca

Question 1. What information do you need to decide if this is an epidemic?

Answer 1.

- Is the number of cases more than the number expected?
- Therefore, we need to know background rate.

Question 2. Is this an epidemic?

Answer 2. Yes. An epidemic can be defined as the occurrence of more cases in a place and time than expected in the population being studied. Of the 110 members without signs and symptoms of gastroenteritis prior to the pilgrimage, 64 (58%) developed such signs and symptoms during this trip. This is clearly above the expected or background rate of gastroenteritis in most populations. Gastroenteritis prevalence rates from recent surveys are approximately 5% and are consistent with this population (2/112 had such signs and symptoms at the time of the pilgrimage).

One could survey other groups of pilgrims originating from the same country to determine their rates of diarrheal illness if the existence of an outbreak was uncertain. Practically speaking, however, an attack rate of 58% is an epidemic until proven otherwise.

The term "outbreak" and "epidemic" are used interchangeably by most epidemiologists. The term "outbreak" is sometimes preferred, particularly when talking to the press or public, because it is not as frightening as "epidemic." The term "cluster" may be defined as the occurrence of a group of cases in a circumscribed place and time. In a cluster, the number of cases may or may not be greater than expected.

Question 3. Develop a preliminary case definition.

Answer 3.
Points to consider:

- As a general rule, during the initial phase of an investigation, the case definition should be broad.
- The case definition should include four components: **time, place, person,** and **diagnosis** (or signs, symptoms). Depending on the frequency of the symptoms observed and the probable etiologic agent, a more precise case definition can be developed later.

Case definition:

Clinical:	acute onset of abdominal cramps and/or diarrhea
Time:	onset after noon on October 31 and before November 2
Place/Person:	member of the Kuwaiti medical mission in route to Mecca

Note. The Kuwaiti investigators had already decided that lunch on October 31 was the responsible meal and defined an outbreak-associated case of enteritis as a person in the Kuwaiti mission who ate lunch at Arafat at 2:00 p.m. on October 31 and subsequently developed abdominal pain and/or diarrhea prior to November 2, 1979.

However, at this point in your consideration of the outbreak you have not implicated the lunch, and it would probably be premature to limit your case definition to those who ate lunch.

Question 4. List the broad categories of diseases that must be considered in the differential diagnosis of an outbreak of gastrointestinal illness.

Answer 4.

Broad categories: Bacterial
Viral
Parasitic
Toxins

More specifically:

Differential Diagnosis of Acute Foodborne Enteric Illness

Bacteria and bacterial toxins
*Bacillus cereus**
Campylobacter *jejuni*
Clostridium botulinum (initial symptoms)
*Clostridium perfringens**
*Escherichia coli**
Salmonella, non-typhoid
Salmonella typhi
Shigella
Staphylococcus aureus
Vibrio cholerae O1
Vibrio cholerae non-O1
Vibrio parahemolyticus
Yersinia enterocolitica

Viruses
Norwalk-like agents (i.e., 27 nm viruses)
Rotavirus*

Toxins
Heavy metals (especially cadmium, copper, tin, zinc)
Mushrooms
Fish & shellfish (e.g., scombroid, ciguatera)
Insecticides

Parasites
Cryptosporidium
Entamoeba histolytica
Giardia lamblia

*These agents are most compatible with the following characteristics of this outbreak:
- acute onset
- lower GI signs and symptoms
- no fever
- appreciable proportion seeking medical advice
- no mention of non-enteric (dermatologic, neurologic) manifestations

However, you have not yet reached the point in your investigation to consider the most likely etiologic possibilities for the illness.

Question 5. What clinical and epidemiologic information might be helpful in determining the etiologic agent(s)?

Answer 5.
Incubation period
Symptom complex
Duration of symptoms
Severity of symptoms
Seasonality
Geographic location
Biologic plausibility of pathogens

Question 6. The Kuwaiti investigators distributed a questionnaire to the persons who ate the implicated lunch. What information would you solicit on this questionnaire?

Answer 6.

- **Identifying information**
- **Demographics (age, sex, race)**
- **Clinical information**
  - Symptoms
  - Date & time of onset of symptoms
  - Duration of symptoms
  - Medical intervention, if required
- **Information on possible causes**
  - Exposure information regarding foods consumed, including amounts
  - Other potential exposures
  - Other factors that may modify risk of diarrhea (e.g., antacids, antibiotics)

Question 7. Calculate the attack rate for those who ate lunch and those who did not. What do you conclude?

Answer 7.

112 members of the mission
-15 members who didn't eat lunch
- 2 members sick before pilgrimage
95 *at risk of developing illness*
64 became ill among those who ate lunch
0 *became ill among those who didn't eat lunch*

Attack rate for those who ate lunch:
64 ill/95 at risk = 67%

Attack rate for those not eating lunch:
0 ill/15 at risk = 0%

Conclusion: Lunch is strongly associated with disease.

Question 8. Using appropriate time periods, draw an epidemic curve.

Answer 8.
Points for consideration about epi curves:

1. The epi curve is a basic tool of epidemiologists to
   a. establish existence of epidemic vs. endemic illness
   b. delineate time course and magnitude of an epidemic
   c. develop inferences about transmission, e.g., common source, person to person, intermittent exposure. Note that changing the interval on the *x*-axis can significantly alter the shape of an epi curve.
   d. predict future course of an epidemic: when it will end, that a second wave is underway, that secondary cases are occurring, etc.
2. With common source outbreaks, the width of the curve is determined by the incubation period, varying doses, and host susceptibility.
3. Often a few cases don't fit into the body of an epi curve. Such exceptions may be quite important--as index cases or other special situations.
4. A rule of thumb: When the incubation period is known, the maximum time period on the *x*-axis should not usually exceed 1/4 - 1/3 of the incubation period.

Summary of the temporal distribution (see Figure 6.11a).

a. Onsets of cases occurred over a period of 31 hours extending from 5 p.m. on October 31 to 11 p.m. on November 1.

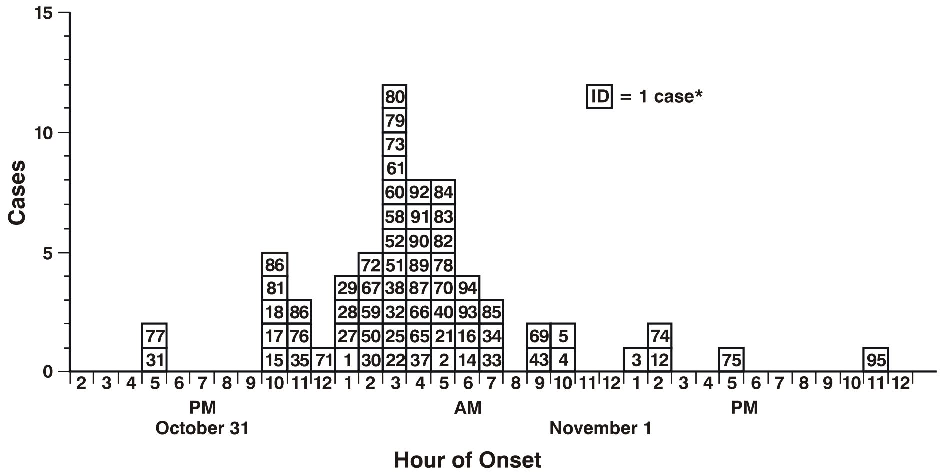
b. Onsets of 53 (82.8%) of the cases occurred throughout the 10 hour interval from 10 p.m. on October 31 through 7 a.m. on November 1.

c. The peak (12 cases) occurred at 3 a.m. on November 1.

d. The median hour of onset = 3:30 a.m. November 1 (actual middle rank = 32.5 which falls between the 3 and 4 a.m. measurement intervals).

e. It is likely that the way the questionnaire was designed forced the interviewees to give a rounded time for onset of symptoms.

Figure 6.11a
Outbreak associated cases of enteritis by hour of onset of illness, Kuwaiti Mission, Arafat, Saudi Arabia, October 31 – November 1, 1979



*ID# included for reference only.

Question 9. Are there any cases for which the times of onset seem inconsistent? How might they be explained?

Answer 9.

1. The two cases (#31 and 77) with onsets at 5 p.m. on October 31
   a. Illnesses unrelated to the outbreak?
   b. Earlier exposures to food items? Cooks?
   c. Short incubation periods? Large doses? Enhanced susceptibility?
   d. Times of onset incorrect?

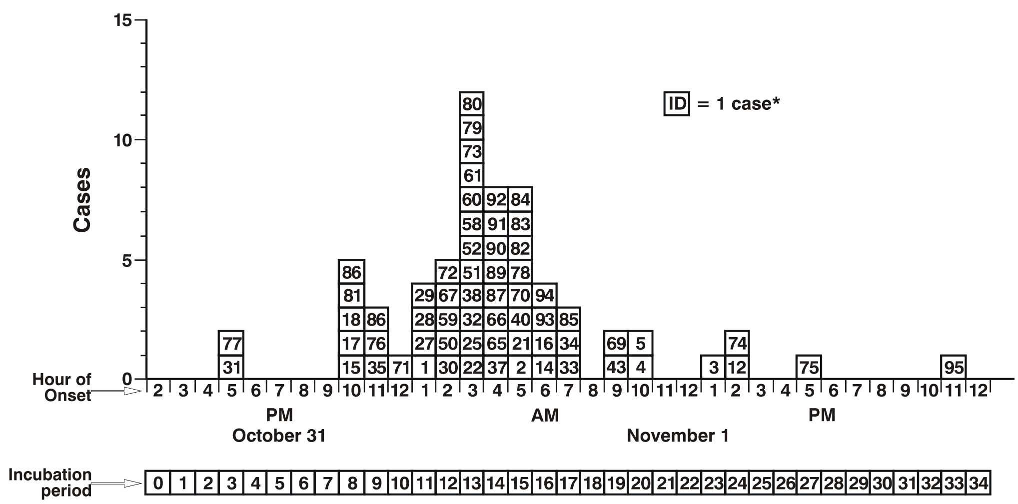
2. The two cases (#75 and 95) occurring late on November 1
   a. Illnesses unrelated to the outbreak?
   b. Foods eaten at later time?
   c. Secondary cases?
   d. Times of onset incorrect?
   e. Long incubation periods? Small doses? Enhanced resistance?

Question 10. Modify the graph you have drawn (Question 8) to illustrate the distribution of incubation periods.

Answer 10.

Since all meal participants were served at 2:00 p.m. the distribution of onsets and incubation periods is the same. Therefore, to illustrate the distribution of incubation periods, you need only to show a second label for the *x*-axis, as in Figure 6.11b.

Figure 6.11b
Outbreak associated cases of enteritis by hour of onset of illness and incubation period, Kuwaiti Mission, Arafat, Saudi Arabia, October 31 – November 1, 1979



*ID# included for reference only.

Question 11. Determine or calculate the minimum, maximum, mean, median, mode, range, and standard deviation of the incubation periods.

Answer 11.

Minimum = 3 hours

Maximum = 33 hours

Mean = 14 hours

Median = 13.5 hours (middle rank = 64 + 1)/2 = 32.5, which falls between the intervals for 13 and 14 hours.)

Mode = 13 hours

Range = maximum - minimum = 30 hours

Standard deviation = 5 hours

Note: The range in which roughly 95% of the observations fall = $\bar{x}$ ± 1.96 (rounded to 2) standard deviations = 4 to 24 hours (see Lesson 3 for calculation steps).

Comment

The incubation period (though not necessarily the clinical features) are about right for *Clostridium perfringens*, *Salmonella*, *Vibrio parahemolyticus*, and *Bacillus cereus*. The incubation period is a bit short for enterotoxigenic E. Coli and *Vibrio cholerae* non-O1. Too long for staph enterotoxin, heavy metals, chemicals, and most toxins produced by fish, shellfish, and mushrooms. Illnesses that have upper GI signs and symptoms, such as nausea and vomiting, and intoxications due to chemicals, metals, etc., usually have short incubation periods, while illnesses with predominately lower GI signs and symptoms, such as diarrhea, have longer incubation periods.

Question 12a. Calculate the frequency of each clinical symptom among the cases.

Answer 12a.

Frequency distribution of signs and symptoms among outbreak-associated cases of enteritis, Kuwaiti Mission, Arafat, Saudi Arabia, October 31 – November 1, 1979 (N = 64)

Sign or Symptom	Number of Cases	Percent
Diarrhea	62	96.9
Abdominal Pain	52	81.3
(Diarrhea + abdominal pain)	(50)	(78.1)
Blood in stool	8	12.5
(Diarrhea + blood in stool)	(5)	(7.8)
(Diarrhea + abdominal pain + blood in stool	(3)	(4.7)
Nausea	2	3.1
Vomiting	2	3.1
Fever	0	0

The distribution of signs and symptoms are given in the table above. Diarrhea occurred among all but two of the cases, with 78.1% experiencing both diarrhea and abdominal pain.

Blood in the stool was reported by 8 (12.5%) of the cases. Symptoms of upper GI distress occurred among 4 (6.3%) of the cases (2 persons experienced nausea while two others reported vomiting). No temperature elevations were recorded.

Question 12b. How does the information on the symptoms and incubation period help you to narrow the differential diagnosis? (You may refer to the attached compendium in Appendix F, which describes a number of acute foodborne gastrointestinal diseases.)

Answer 12b.

The clinical findings, including an apparent absence of malaise, myalgias, chills, and fever, are more consistent with an intoxication resulting from the presence of toxin in the lower GI tract than with an invasive infectious agent. The recovery of all cases within 24 hours is also consistent with such an intoxication. The absence of dermatologic and neurologic signs and symptoms in conjunction with the incubation period (the median was 13.5 hours and the mean was 14 hours) would lessen the likelihood of heavy metals, organic and inorganic chemicals, and toxins produced by fish, shellfish and mushrooms. The incubation period and clinical features help narrow the list to the following: *Clostridium perfringens*, *Bacillus cereus*, *Vibrio parahemolyticus*, and, less likely, *Vibrio cholerae* non-O1, and enterotoxin producing *E. coli.*

Question 13a. Using the food consumption histories in Table 6.8, complete item 7 of the "Investigation of a Foodborne Outbreak" report form in Appendix F.

Answer 13a.

	# persons who ATE specified food				# who DID NOT EAT specified food			
	Ill	**Well**	**Total**	**Attack Rate**	**Ill**	**Well**	**Total**	**Attack Rate**
Rice	62	31	93	66.7%	2	0	2	100.0%
Meat	63	25	88	71.6 %	1	6	7	14.3%
T.S.	50	26	76	65.8%	14	5	19	73.7%

You may analyze these data with 2 x 2 tables:

		ILL	WELL	TOTAL	Attack Rate	
Exposed?	Yes	a	b	a + b	AR1 = a/a + b	RR = AR1/AR2
	No	c	d	c + d	AR2 = c/c + d	
		a + c	b + d	T = a + b + c + d		

		ILL	WELL	TOTAL	Attack Rate	
Ate	Yes	62	31	93	62/93 = 66.7%	RR = 66.7/100
Rice	No	2	0	2	2/2 = 100.0%	= 0.67

		ILL	WELL	TOTAL	Attack Rate	
Ate	Yes	63	25	88	63/88 = 71.6%	RR = 72.6/14.3
Meat	No	1	6	7	1/7 = 14.3%	= 5.0
		64	31			

		ILL	WELL	TOTAL	Attack Rate	
Ate	Yes	50	26	76	50/76 = 65.8%	RR = 65.8/73.7
Tomato	No	14	5	19	14/19 = 73.7%	0.89
Sauce		64	31			

Question 13b. Do these calculations help you to determine which food(s) served at the lunch may have been responsible for the outbreak?

Answer 13b. Attack rates were high for those who ate rice, meat, and tomato sauce. However, meat is the likely culprit because it was the only food associated with a high attack rate among those who ate it, but a low attack rate among those who did not. Almost all (63/64) who ate meat also ate the other items, which probably accounts for the high attack rates for those items, too.

One of the cases did not admit to eating meat and could be explained in any number of ways:

- Unrelated illness
- Cross-contamination, e.g., common server, spoon, dish, counter, etc., or from meat to rice
- Reporting error (e.g., forgot or purposely denied eating meat)
- Transcription error (e.g., misrecorded response)

NOTE: Epidemiologic evidence shows an association between exposure and subsequent disease but **does not prove causal relationship.**

Question 14. Outline further investigations which should be pursued. List one or more factors that could have led to the contamination of the implicated food.

Answer 14.

A. Detailed review of ingredients, preparation, and storage of incriminated food. For bacterial food poisoning need:

1) initial contamination (point of origin vs point of consumption)

2) improper time-temperature relationships with respect to preparation, cooking, serving, and storage

B. Specific things about which one might inquire:

1) Origin of the meat – some sources may be at higher risk than others. Animal meats are often contaminated at time of slaughter. This aspect is usually quite difficult to control.

2) Storage of meat to time of cooking (should be kept frozen or refrigerated). This usually doesn't pose problems and since most meat is **not** eaten raw, subsequent cooking would considerably lessen the risk of disease.

3) Cooking procedures – often difficult to control both in public/private sectors. Temperatures attained and duration of optimum cooking temperatures poorly monitored. Failure to reach adequate cooking temperatures associated with diseases other than *C. perfringens* for the most part.

4) Cross-contamination – a factor difficult to control since knives, counter space, cutting boards, and pots or pans, are often used for both raw foods and cooked foods without interim cleansing.

5) Inadequate refrigeration of cooked foods – common in *C. perfringens* outbreaks. Cooked foods essentially allowed to incubate for several hours during cooling process. Not easy to correct as may involve expenditures for additional refrigeration appliances and use of shallow pans.

6) Inadequate reheating of cooked foods – as with 3).

7) Improper holding temperatures while serving – Here again, difficult to control, but commonly associated with disease outbreaks including *C. perfringens*. The food was essentially held at temperatures that permitted the growth of contaminating organisms rather than at 140 degrees Fahrenheit or above which would have prevented their multiplication.

Question 15. In the context of this outbreak, what control measures would you recommend?

Answer 15.

1. After collecting appropriate specimens for laboratory analysis, destroy remaining foods to prevent their consumption.

2. Prevent recurrence of similar event in the future.

   a. Educate food handlers in proper techniques, stressing importance of time-temperature relationships.

   b. Acquire necessary equipment for properly cooking, cooling, serving, and storing foods.

   c. When applicable, eliminate sources of contaminated food.

3. Basic principles in prevention of *C. perfringens*.

   a. Cook all foods to minimum internal temperature of 165 degrees Fahrenheit.

   b. Serve immediately or hold at > 140 degrees Fahrenheit.

   c. Any leftovers should be discarded or immediately chilled and held at < 40 degrees Fahrenheit using shallow pans.

   d. All leftovers should be reheated and held at temperatures given above for cooked foods.

Question 16. Was it important to work up this outbreak?

Answer 16.

Reasons why it was important:

1. To identify factors associated with its occurrence in order to institute the necessary measures to prevent future recurrences.

2. To provide reassurance that a deliberate act of poisoning was not involved.

3. To demonstrate that public health officials can react promptly to a problem and identify causative factors utilizing epidemiologic methods.

Self-Assessment Quiz 6

Now that you have read Lesson 6 and have completed the exercises, you should be ready to take the self-assessment quiz. This quiz is designed to help you assess how well you have learned the content of this lesson. You may refer to the lesson text whenever you are unsure of the answer, but keep in mind that the final is a closed book examination. Circle ALL correct choices in each question.

1. The most common way(s) that a local health department uncovers outbreaks is/are by: (Circle ALL that apply.)

A. receiving calls from affected residents

B. receiving calls from health care providers

C. reviewing all case reports received each week to detect common features

D. performing descriptive analysis of surveillance data each week

E. performing time series analysis to detect deviations from expected values based on the previous few weeks and comparable time periods during the previous few years

2. In an ongoing outbreak of a disease with *no* known source and mode of transmission, the primary reason for an investigation relates to:

A. prevention and control

B. training of staff

C. learning more about the disease

D. being responsive to the concerns of the community

E. legal responsibility

1. Analyze data by time, place, and person
2. Conduct a case-control study
3. Generate hypotheses
4. Conduct active surveillance for additional cases
5. Verify the diagnosis
6. Confirm that the number of cases exceeds the expected number
7. Coordinate who will talk to the press about the investigation

3. For an investigation of an outbreak, what is the logical order of the activities listed above?

   A. 1-2-3-4-5-6-7
   B. 5-6-4-1-2-3-7
   C. 6-5-1-3-2-4-7
   D. 7-6-5-4-1-3-2
   E. 5-6-1-3-2-4-7

4. If you were a state employee, the first step in the investigation of an outbreak of meningococcal meningitis 200 miles away might include: (Circle ALL that apply)

   A. talking with someone knowledgeable about meningococcal meningitis
   B. talking with someone knowledgeable about field investigations
   C. talking with a couple of the initial case-patients
   D. discussing the feasibility of mass vaccination
   E. stopping your mail

5. The appropriate role for an epidemiologist from the CDC in the investigation of a local outbreak of botulism (possibly foodborne):

   A. is to lead the investigation in consultation with CDC experts
   B. is to provide consultation to the local staff who will conduct the investigation
   C. is to lend a hand to the local staff
   D. is whatever is negotiated in advance with the local health department

6. As described in this lesson, the primary distinction between the terms “outbreak” and “epidemic” is:

A. “outbreak” does not imply that the cases are all related

B. “outbreak” implies a grouping of cases but not necessarily more than expected

C. “outbreak” is limited to fewer than 20 cases, epidemic to more than 20

D. “outbreak” does not generate as much anxiety among the public

Number of cases of Disease X reported to the state health department by Counties A-D

	Week Ending					
County	12/13	12/20	12/27	1/3	1/10	1/17
A	4	3	2	2	3	1
B	12	9	0	0	24	15
C	1	0	1	2	7	9
D	1	1	0	1	0	0

7. Explanations most consistent with the pattern of case reports received from County B include: (Circle ALL that apply.)

A. changes in the case definition

B. change in the denominator

C. new physician in the county

D. change in diagnostic procedures

E. batch processing

8. Why should an investigator who has no clinical background nonetheless talk to a patient or two as an early step in the outbreak investigation? (Circle ALL that apply.)

A. To verify the clinical findings as part of verifying the diagnosis

B. To verify the laboratory findings as part of verifying the diagnosis

C. To learn more about the clinical manifestations of the disease

D. To develop hypotheses about the cause of the outbreak

E. To advise the patient about the common risk factors and usual course of the illness, after reviewing *Control of Communicable Diseases in Man*

9. A case definition during an outbreak investigation should specify: (Circle ALL that apply.)
   A. clinical criteria
   B. time
   C. place
   D. person
   E. hypothesized exposure

10. A characteristic of a well conducted outbreak investigation is that:
    A. every case is laboratory confirmed
    B. a few cases are laboratory confirmed and the rest meet the case definition
    C. a "loose" case definition is used during the analytic epidemiology phase
    D. the case definition includes three categories: definite, probable, and possible

11. Common methods of identifying additional cases (expanding surveillance) as part of an outbreak investigation include: (Circle ALL that apply.)
    A. sending a letter to physicians
    B. telephoning the infection control nurse at the local hospital
    C. advising the public through newspapers, TV, and radio to contact the local health department
    D. asking case-patients who they were with at the time of exposure (if known)
    E. reviewing morbidity and mortality data for the local area from the National Center for Health Statistics

12. The ultimate purpose for characterizing an outbreak by time, place, and person is to:
    A. identify errors and miscodes in the data
    B. provide a comprehensive description of an outbreak by portraying its time course, geographic extent, and populations most affected by the disease
    C. ensure that all true cases are captured by the surveillance system
    D. generate hypotheses
    E. test hypotheses

13. For a disease of unknown etiology and incubation period, an epidemic curve can be used to derive which of the following? (Circle ALL that apply.)

A. Peak dates of onset of the illness

B. Peak dates of reporting of the cases to the health department

C. Probable period of exposure

D. Future direction of the epidemic

14. Which of the following apply to drawing an epidemic curve? (Circle ALL that apply.)

A. The *y*-axis is dates of onset of the illness

B. The time interval should be less than one-eighth the minimum incubation period of the disease

C. The type of graph should be a histogram

D. The graph should begin with the first case of the epidemic

15. For *Clostridium perfringens* food poisoning, the minimum incubation period is 8 hours, and the average incubation period is 10 to 12 hours. Based on the graph shown below, when is the probable period of exposure?

A. October 6, periods 1-2 (12:01 A.M. to 8:00 A.M.)

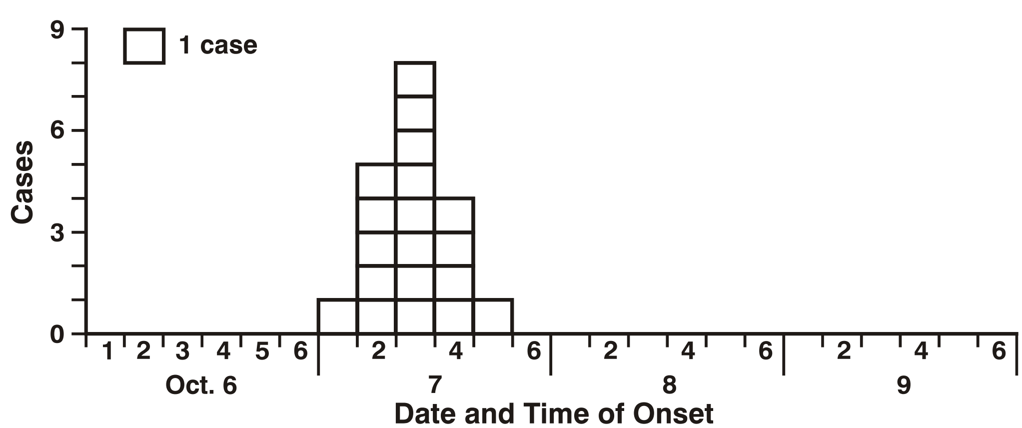
B. October 6, periods 2-3 (4:01 A.M. to noon)

C. October 6, periods 3-4 (8:01 A.M. to 4 P.M.)

D. October 6, periods 4-5 (12:01 P.M. to 8:00 P.M.)

E. October 6, periods 5-6 (4:01 P.M. to midnight)

Figure 6.12
Data and time of onset (by 4 hour periods starting at 12:01 A.M. each day)



16. The geographic distribution of cases should be tabulated or mapped according to:

A. residence of each case

B. place of usual occupation, school, or other primary daytime exposure

C. health care facility where diagnosis was made

D. location where disease onset occurred

E. variable of "place" that produces a meaningful pattern

17. Reasonable ways of generating hypotheses in an outbreak investigation include: (Circle ALL that apply.)

A. asking the local health officer what he/she thinks is the cause

B. asking the case-patients what they think is the cause

C. reviewing a textbook about the disease under investigation

D. postulating explanations for the patterns seen in the descriptive epidemiology

E. focusing on the patients who do not fit the general patterns seen in the descriptive epidemiology

18. During an investigation of an outbreak of gastroenteritis on a small college campus, the investigators confirmed the diagnosis, searched for additional cases, and characterized the cases by time, place, and person. No obvious hypotheses regarding source or mode of transmission came to mind. The investigators should next:

A. interview a few cases in depth

B. conduct a case-control study

C. conduct a cohort study

D. sample and test foods from the school dining hall for the incriminated agent

E. interview and test the dining hall foodhandlers for the incriminated agent

19. In an epidemiologic study, investigators enrolled 100 children with Kawasaki syndrome and 100 children *without* Kawasaki syndrome. Among children with Kawasaki syndrome, 50 had been exposed to compound C in the previous 3 weeks. Among those without Kawasaki syndrome, 25 had been exposed to compound C. In this study, the best estimate of the relative risk of Kawasaki syndrome associated with exposure to compound C is:

A. 1.0

B. 1.5

C. 2.0

D. 3.0

E. not calculable from the information provided

20. In the epidemiologic study of Kawasaki syndrome described in the previous question, the mean serum porcelain levels of children with Kawasaki syndrome was lower than the mean serum porcelain levels of children without Kawasaki syndrome. The difference was statistically significant at the 5% level ($p < 0.05$). This means that:

A. elevated serum porcelain causes Kawasaki syndrome

B. deficiency of serum porcelain causes Kawasaki syndrome

C. the difference between mean serum porcelain levels is unlikely to have occurred by chance alone

D. the difference between mean serum porcelain levels is likely to have occurred by chance alone

21. The report of an epidemiologic study described the association between a particular exposure and a particular disease as "a weakly positive association, but not statistically significant at the 0.05 level." The data most consistent with this statement is:

A. odds ratio = 10.0, p-value = 0.20

B. odds ratio = 1.5, p-value = 0.03

C. relative risk = 1.8, p-value = 0.01

D. relative risk = 10.0, p-value = 0.10

E. risk ratio = 1.8, p-value = 0.20

Use the data in this table for questions 22 and 23.

	Ate specified food			Did not eat specified food		
Food item	**Ill**	**Well**	**Total**	**Ill**	**Well**	**Total**
Macaroni salad	25	15	40	20	39	59
Potato salad	17	38	55	28	16	44
Three-bean salad	43	47	90	2	7	9
Punch	40	52	92	5	4	7
Ice cream	20	1	21	25	53	78

22. After attending a retirement party for the agency director, many of the health department staff developed gastroenteritis. All attendees were interviewed by the public health nurse who had recently completed the CDC *Principles of Epidemiology* self study course. Calculate the appropriate measure of association for each of the home-made food items shown in the table above. For which food is the measure of association largest?

A. Macaroni salad

B. Potato salad

C. Three-bean salad

D. Punch

E. Ice cream

23. Which of the food items do you think is most likely to have caused this outbreak?

A. Macaroni salad

B. Potato salad

C. Three-bean salad

D. Punch

E. Ice cream

24. Control and prevention measures should be implemented:

A. as early as possible after verifying the diagnosis

B. as early as possible after performing the descriptive epidemiology

C. as early as possible after performing the analytic epidemiology (testing hypotheses)

D. as early as possible after refining the hypotheses and executing additional studies

25. For a federal investigator, which of the following communication modes should be used first to announce the findings of an outbreak investigation?

A. Written report for local authorities

B. Written report for state newsletter

C. Written report for the *Morbidity and Mortality Weekly Report*

D. Oral report for the local authorities

E. Press conference to explain findings the public

Answers in Appendix J

If you answered at least 20 questions correctly, you understand Lesson 6 well enough to begin to prepare for the final examination.

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