MODULE 1

1. An outbreak is an increase in the number of cases of a particular disease greater than is expected for a given time and place.
   A. True
   B. False

   ANSWER: B. False. An outbreak is two or more cases of a similar illness among individuals who have had a common exposure. A cluster is the occurrence of more cases of a particular disease than expected for a given place and time.

2. Which of the following causative agents is the most common cause of foodborne disease outbreaks in the United States?
   A. Viruses
   B. Bacteria
   C. Parasites
   D. Chemicals

   ANSWER: A. Viruses. Viruses are the most common causative agent identified in foodborne outbreaks reported to the Centers for Disease Control Foodborne Outbreak Reporting System, accounting for over 50% of the outbreaks that have a confirmed or suspected etiology.

3. Some foodborne pathogens can also be spread by water, from person-to-person, and from animal-to-person.
   A. True
   B. False

   ANSWER: A. True. Pathogens associated with food can also be spread through other modes including by water (drinking or recreational), person-to-person, and animal-to-person.

4. Which of the following is a primary goal for undertaking foodborne disease outbreak investigations?
   A. To study the natural history of the causative agent
   B. To train staff
   C. To stop the current outbreak by implementing effective control measures
   D. To respond to public concerns

   ANSWER: C. To stop the current outbreak by implementing effective control measures. The primary goals for undertaking foodborne disease outbreak investigations are to stop the current outbreak as soon as possible by implementing effective control measures and prevent similar outbreaks in future.
5. Knowledge and skills from all of the following disciplines should be represented on every foodborne outbreak investigation team EXCEPT
   A. Environmental health
   B. Epidemiology
   C. Laboratory
   D. Veterinary medicine

   ANSWER: D. Veterinary medicine. The knowledge and skills represented on an outbreak investigation team are configured to meet the needs of the particular outbreaks. However, the team always needs knowledge and skills in environmental health, epidemiology, laboratory, food regulations, public health education, and communications.

   MODULE 2
   1. Common exposures are used to detect outbreaks through a foodborne illness notification/complaint systems whereas a common pathogen is used to detect outbreaks through pathogen-specific surveillance systems
      A. True
      B. False

      ANSWER: A. True. Because illness complaints typically are not laboratory-confirmed, an outbreak detected through foodborne illness complaints usually is signaled by common exposures among ill people. Detection of outbreaks through pathogen-specific surveillance is based on an increase in number of cases of a specific pathogen over what is expected.

   2. Investigation of a restaurant named in a food-borne illness complaint is most likely to identify a food safety problem for which of the following?
      A. One person reported becoming ill after eating at the restaurant.
      B. Family members ate at the restaurant and developed diarrhea 6 hours later.
      C. Three friends became ill with vomiting within 4 hours of eating fried rice at the restaurant.
      D. Two people became ill (one with a migraine headache and one with diarrhea) after eating at the restaurant.

      ANSWER: C. Three friends became ill with vomiting within 4 hours of eating fried rice at the restaurant. Investigation of a restaurant named in a foodborne illness complaint is most likely to identify a food safety problem in the following situations
      • The complainant observed specific food preparation or serving procedures likely to lead to a food-safety problem at the establishment
      • Two or more persons report a similar illness and shared a food or meal at the establishment and had no other shared exposure. The illness should be consistent with the foods eaten and the incubation period.
The only scenario meeting these criteria is the three friends who developed a similar illness after eating fried rice at a restaurant.

3. Which of the following can improve the accuracy of a food history solicited during a foodborne illness complaint?
   A. Have case look at a calendar and identify key events to jog memory.
   B. Have case review credit card or cash register receipts to identify where or what they ate.
   C. Enlist help of dining partners.
   D. All of the above

   ANSWER: D. All of the above. To improve the completeness and accuracy of food histories obtained during foodborne illness complaints have the complainant:
   - Look at a calendar
   - Describe each meal in time period
   - Identify key events to jog memory
   - Review receipts or menus
   - Enlist help of dining partners
   - Consider a list of foods
   - Think about food preferences
   - Rule out or rule in specific foods

4. All of the following are true of pathogen-specific surveillance EXCEPT
   A. Detects all types of foodborne illness.
   B. Relies on reports from physicians and clinical laboratory staff.
   C. Is the primary means to detect widespread outbreaks such as multistate outbreaks.
   D. Has an inherent lag in reporting due to time necessary to confirm pathogen through laboratory testing.

   Answer: A. Detects all types of foodborne illness. For pathogen-specific surveillance, cases of interest are specific laboratory-confirmed diseases or well-defined syndromes selected by the state or local health department.

5. All of the following are important roles for local health departments in national pathogen-specific surveillance EXCEPT
   A. Collect information on local cases in a format consistent with other investigators.
   B. Share case reports with state health department in a timely fashion.
   C. Be alert to outbreaks in other jurisdictions.
   D. Submit all patient isolates directly to CDC.
ANSWER: D. Submit all patient isolates directly to CDC. In national pathogen-specific surveillance, state public health laboratories test patient isolates and submit findings to CDC or upload the results to a national database. For NARMS, state public health laboratories submit specified isolates to CDC. Local health departments still submit isolates to the state laboratory.

MODULE 3
1. Why is it important to identify as many cases associated with an outbreak as possible?
   A. Determine true magnitude of outbreak
   B. Characterize outbreak accurately
   C. Increase the ability of epidemiologic studies to link illness with true cause of outbreak
   D. All of the above

   ANSWER: D. All of the above. It is important to actively search for additional cases associated with each outbreak to
   • Get a sense of the true magnitude of the outbreak.
   • Characterize the outbreak (and its cause) accurately.
   • Have sufficient power (statistically speaking) to make inferences from epidemiologic studies.

2. A case definition might include all of the following EXCEPT:
   A. Symptoms of the illness
   B. Laboratory test results
   C. Food that is the suspected source of the outbreak
   D. Date of illness onset

   ANSWER: C. Food that is the suspected source of the outbreak. Never include the suspected source of an outbreak in the case definition. If you include the suspected source in the case definition, all of your cases will have exposure to that source AND you will not be able to test your hypothesis

3. Development of a hypothesis early in an outbreak helps direct subsequent steps of an outbreak investigation and should involve all investigation team members.
   A. True
   B. False

   ANSWER: A. True. The purpose of hypothesis generation is three-fold: to direct immediate control measures, to narrow the focus of subsequent studies, and to determine if others need to be involved in the investigation.
4. A cluster of *E. coli* O157:H7 infections is detected through PulseNet with cases from 30 states. Among cases, 66% were under 19 years of age and 71% were female. What is the most likely mode of transmission in this outbreak?

A. Person-to-person  
B. Public water supply  
C. Recreational water  
D. Food

**ANSWER:** D. Food. The descriptive epidemiology of cases can often suggest the mode of transmission in an outbreak. Cases being spread over 30 states and the high percentage of cases in a particular age group/sex is suspicious of a foodborne illness. These case characteristics were actually from an outbreak of *E. coli* O157:H7 associated with frozen cookie dough and reflected the common practice among young women of eating raw cookie dough.

5. Which of the following characteristics would make an outbreak the highest priority for further investigation?

A. It has been 3 months since onset of illness for the last case.  
B. Affected persons are staff who attended an office potluck.  
C. Listeria is the causative agent.  
D. A total of 8 cases of campylobacteriosis were identified after searching for additional cases.

**ANSWER:** C. *Listeria* is the causative agent. The most critical outbreaks to investigate are those that are a severe threat to the public’s health or where a timely control response is critical. Listeriosis is serious. Although healthy persons with listeriosis usually have only fever and muscle aches, sometimes preceded by GI symptoms, infections during pregnancy can lead to miscarriage, stillbirth, premature delivery, or life-threatening infection of the newborn.

**MODULE 4**

1. Which of the following statements is true about contributing factors.

A. An outbreak will occur if a contributing factor is present.  
B. The three major categories of contributing factors are contamination, survival (lack of inactivation), and proliferation.  
C. Contributing factors in an outbreak depend on the causative agent but not the food vehicle or processing method.  
D. Correction of the contributing factor will correct the food safety problem and prevent it from occurring again.

**ANSWER:** B. The three major categories of contributing factors are contamination, survival (lack of inactivation), and proliferation. Contributing factors can be classified into three major categories: Contamination, survival (or failure to inactivate), and
proliferation. Presence of a contributing factor alone is not sufficient to cause foodborne illness. Not all contributing factors have relevance with all causative agents, foods, or settings. Correction of contributing factors alone will not prevent the food safety problem from occurring again. Identification (and correction) of underlying factors that led to the occurrence of contributing factors is necessary.

2. An environmental health assessment of a food establishment undertaken during an outbreak investigation is similar to a regulatory inspection except it focuses on the past.
   A. True
   B. False

ANSWER: B. False. Regulatory inspections address food safety problems occurring at the establishment on the day of the inspection. They focus on the most common food safety problems likely to occur at that type of facility. Environmental health assessments address food safety problems that occurred in the past. They are conducted when information suggests food safety problems are not adequately controlled. The environmental health assessment focuses on the vehicle implicated in an outbreak, if known, during the period in which the outbreak exposure occurred.

3. To prepare for an environmental health assessment, the investigator might consult which of the following?
   A. Team epidemiologist
   B. Laboratory staff
   C. Regulatory inspector for facility
   D. All of the above

ANSWER: D. All of the above. To prepare for an environmental health assessment the investigator needs to review available outbreak information, what is known about the implicated food establishment through existing records, and information on the causative agent. This information can be obtained by consulting the team epidemiologist, the regulatory food inspector, and laboratory staff.

4. All of the following activities might be performed during an environmental health assessment of the implicated facility in an outbreak EXCEPT
   A. Interview of the manager of the implicated facility
   B. Walk through of the facility
   C. Collection of information from ill food workers
   D. Observation of all food preparation processes undertaken at the facility

ANSWER: D. Observation of all food preparation processes undertaken at the facility. The environmental health assessment will focus on the food vehicle implicated in an outbreak. The investigator will observe procedures used to make the implicated food during the period of interest, not all food preparation processes undertaken at the facility.
5. Staff from local health departments are likely to be responsible for all of the following activities during a traceback investigation EXCEPT
   A. Interview of cases for product details
   B. Determining whether end user contamination is the source of the outbreak
   C. Collection of paperwork from the implicated food establishment
   D. Detailed analysis of receipts and invoices

   ANSWER: D. Detailed analysis of receipts and invoices. Formal regulatory traceback investigations require detailed review invoices and shipping and receiving documents and analysis of mountains of information. They require knowledge of the involved industry and food distribution patterns and chain of custody. As a result, USDA and FDA staff usually take the lead in the analysis of receipts and invoices.

MODULE 5
1. A case series includes a comparison group.
   A. True
   B. False

   ANSWER: B. False. A case series includes only cases. It does not include a comparison group.

2. What is the measure of association for a case-control study?
   A. Odds ratio
   B. Relative risk
   C. p-value
   D. Confidence interval

   ANSWER: A. Odds ratio. The odds ratio is the measure of association for a case-control study. The relative risk is the measure of association for a cohort study. The p-value and the confidence interval indicate the role that chance plays in the study findings. (The confidence interval also reflects the precision of the measure of association.)

3. In a cohort study, the relative risk for drinking apple cider is 4.9. Which interpretation is correct?
   A. Apple cider is the cause of the outbreak.
   B. People who drank apple cider were almost 5 times more likely to become ill than those who did not.
   C. Apple cider is protective.
   D. The association between apple cider and illness is statistically significant.

   ANSWER: B. People who drank apple cider were almost 5 times more likely to become ill than those who did not. A cohort study compares the attack rate among people exposed to a particular food with the attack rate of people not exposed to the food and tells us how much more likely it is for people exposed to the food to become ill than those not exposure to the food.
4. Which of the following is a true statement about the p-value?
   A. The p-value cut-off for statistical significance is always 0.05.
   B. The p-value helps you determine the public health significance of an association between a food and an illness.
   C. The p-value is not affected by study size.
   D. A p-value of 0.05 means that there is a 5 in 100 probability that the observed association between the food and illness is due to chance alone.

   **ANSWER:** D. A p-value of 0.05 means that there is a 5 in 100 probability that the association between the food and illness that was observed in the epidemiologic study is due to chance alone. The p-value indicates the role that chance plays in the study findings. It is the probability of finding an association between an exposure and a disease (as strong as the one observed) due to chance alone.

5. Only epidemiologists should interpret results from epidemiologic studies.
   A. True
   B. False

   **ANSWER:** B. False. All outbreak investigation team members should be able to interpret measures of association and p-values. They should also routinely scrutinize (and question) the results of epidemiologic studies.

**MODULE 6**
1. Which of the following causative agents tend to have the longest incubation period?
   A. Preformed toxins
   B. Viruses
   C. Bacteria
   D. Parasites

   **ANSWER:** D. Parasites. Illnesses due to preformed toxins have short incubation periods, often measured in terms of minutes or hours. Illnesses due to infections have incubation periods that are relatively long, often measured in terms of days as compared to hours or minutes for intoxications. Gastrointestinal illnesses due to parasites, in general, have the longest incubation periods, ranging from 1-4 weeks.

2. Most foods can be associated with a variety of causative agents.
   A. True
   B. False

   **ANSWER:** A. True. Certain causative agents are associated with certain foods because the foods provide adequate conditions for contamination, survival, and proliferation of the microorganism. Most foods, however, can be contaminated with a variety of different causative agents and more than one food can transmit most causative agents.
3. The following are true statements about stool specimens collected during a foodborne disease outbreak EXCEPT
   A. Stool is the specimen of choice for most causative agents.
   B. Routine stool cultures cover the most common foodborne disease causative agents.
   C. The method of collection and handling depend on the suspected causative agent.
   D. Freezing of stool specimens can interfere with detection of some causative agents.

   ANSWER:  B. Routine stool cultures cover the most common foodborne disease causative agents. In most laboratories, “routine stool cultures” are limited to screening for *Salmonella* and *Shigella* species and *Campylobacter jejuni/coli*. Some laboratories now routinely test for Shiga toxin-producing *E. coli* (STEC). Routine stool cultures do not cover viruses (the most common cause of outbreaks of foodborne illness), selected bacteria, or parasites.

4. Which of the following is a possible interpretation of a negative result on a routine stool culture?
   A. The patient’s illness was not caused by agents detected through routine cultures.
   B. The specimen was collected too late in the course of illness.
   C. The specimen was handled improperly, killing any causative agents present.
   D. All of the above

   ANSWER:  D. All of the above. A negative result on a routine stool culture may have alternative explanations beyond the obvious (i.e., the patient’s illness is not due to the causative agents tested for). The specimen may have been collected too late in the course of the illness, when the patient was no longer excreting the pathogen in adequate numbers for detection. In addition, the specimen may have been improperly collected or mishandled leading to the death of any microorganisms present.

5. Subtyping of isolates from cases of the same disease can be used for all of the following EXCEPT
   A. Link cases together
   B. Link outbreaks in different geographic locations
   C. Link foods with cases
   D. As sole proof of an outbreak

   ANSWER:  D. As sole proof of an outbreak. In a foodborne outbreak, subtyping of isolates from cases and food can be used to link cases together, link outbreaks in different geographic locations, link foods with outbreaks, and refine the case definition. Matching of subtypes, however, should not be considered proof of a common exposure among cases, merely that the isolates share a common ancestry. An epidemiologic investigation is necessary to demonstrate that there is a common source of exposure.
MODULE 7

1. Which of the following is a likely reason for the increase in multijurisdictional outbreaks in recent years?
   A. Food produced in the United States less safe than it used to be
   B. Improved ability to link cases of foodborne illness due to subtyping efforts
   C. Antibiotic use in livestock
   D. Increased interest in locally produced foods sold through farmer’s markets

   ANSWER: B. Improved ability to link cases of foodborne illness due to subtyping efforts

   The occurrence of multijurisdictional outbreaks (i.e., cases residing in more than one jurisdiction) has increased over time. Several reasons explain the increase including centralized production and wide distribution of food products, globalization of the food supply, and improved detection as a result of active laboratory surveillance, automated algorithms for detecting increases in infection rates, and molecular subtyping.

2. All of the following characteristics suggest that cases associated with an outbreak might reside in multiple jurisdictions EXCEPT
   A. Implicated food was widely distributed.
   B. Contributing factors were found at the implicated restaurant during the environmental health assessment.
   C. Illness among cases was linked to multiple restaurants.
   D. Outbreak was linked to an event that drew participants from many states.

   ANSWER: B. Contributing factors were found at the food service establishment during the environmental health assessment. The following characteristics are good indicators that cases associated with an outbreak are likely to reside in multiple jurisdictions: widespread geographic distribution of cases, implicated food widely distributed with evidence suggesting food product contaminated before point of service, or the setting of outbreak involved exposure of persons who have subsequently dispersed. Finding contributing factors at the restaurant supports end-user contamination and is not an indicator that cases are likely to reside in multiple jurisdictions.

3. Which of the following is a likely contribution of federal public health agencies to a multi-jurisdictional foodborne outbreak investigation.
   A. Expertise and experience
   B. Resources such as laboratory testing
   C. Leadership and coordination
   D. All of the above

   ANSWER: D. All of the above. Federal public health agencies often provide leadership and coordination in outbreaks that involve multiple states. However, their contributions to multijurisdictional outbreak investigations are much broader and include providing subject matter expertise and investigational resources and authority to recall implicated food items.
4. If the causative agent in a foodborne outbreak is a common foodborne disease, the outbreak is unlikely to be intentional.
   A. True
   B. False

   ANSWER: B. False. Determining whether an outbreak is intentional or not can be challenging. Intentional food contamination events may involve common diseases, mimic characteristics of common diseases, or be hard to recognize as unusual.

5. Which of the following statements about the incident command system (ICS) is correct?
   A. The health department should not activate the ICS until the situation reaches a crisis.
   B. ICS operating rules and processes can help multiple agencies work together efficiently and effectively.
   C. It is recommended that the local ICS be activated in all foodborne outbreaks.
   D. Involved agencies will be familiar with public health and foodborne diseases.

   ANSWER: B. ICS operating rules and processes help multiple agencies work together efficiently and effectively. ICS is a structure that helps multiple agencies work together in order to efficiently and effectively address a shared problem. ICS helps agencies that do not normally work together coordinate responses to an emergency by providing a structure to support and coordinate activities and communications.

MODULE 8
1. Which of the following would be reasonable to include on a local agency’s list of stakeholders to be contacted in the event of a foodborne outbreak?
   A. Public health laboratory
   B. Key health-care providers in the community
   C. Primary media contacts
   D. All of the above

   ANSWER: D. All of the above. It would be reasonable to include all of the following on the agency’s list of stakeholders to be contacted in the event of a foodborne outbreak: members of the outbreak investigation team, supervisors and other officials inside agency, state health department, public health laboratory, surrounding local jurisdictions, critical contacts in other government agencies, food industry contacts, key health-care providers in community, and primary media contacts. The specific people/agencies contacted will vary depending on the characteristics and circumstances surrounding the particular outbreak.

2. Which of the following should be undertaken during an outbreak investigation to improve communication between team members?
   A. Introduce team members to each other
   B. Hold regular meetings
C. Create a list of persons and agencies who should be contacted in the event of an outbreak
D. Develop formal communication processes for team member agencies

ANSWER: B. Hold regular meetings. To improve communications among team members, the team should hold regular meetings to share information, interpret findings, and decide on activities. The other activities in this question should be undertaken before an outbreak occurs.

3. Information collected by each investigator on an outbreak investigation team is only useful to that investigator.
   A. True
   B. False

ANSWER: B. False. Close collaboration between team members is important because information generated by one investigator may be pertinent to other team members.

4. The purpose of writing a final report from an outbreak investigation include all of the following EXCEPT
   A. Facilitates implementation of prevention and control measures
   B. Identifies team members who did not complete the tasks assigned to them
   C. Allows investigators to learn from the experience
   D. Justifies program resources

ANSWER: B. Identifies team members who did not complete the tasks assigned to them.

The purpose of the final report includes the following:
- Documents what actually happened during the investigation and the results
- Records and clarifies recommended control and prevention measures
- Documents health department activities and performance and as such can help justify necessary staffing and other resources for the future.
- Acts as a public record that documents information in writing
- Allows investigators and others to learn from the experience.

Although identifying what went well and what didn’t go well allows investigators to learn from the experience, there are better ways to deal with individual team members who did not complete their assigned tasks than identifying them in a public document.

5. Which of the following would be reasonable to include in the final report from a foodborne outbreak investigation?
   A. Notes from interviews with food workers at implicated establishment
   B. Individual laboratory reports
   C. Summary of findings from case-control or cohort studies
   D. Names of patients
Answer: C. Summary of findings from case-control or cohort studies. The report should be concise, but include the information necessary for the reader to draw the same conclusions as the investigators. Include summaries of the various investigations and both positive and negative findings, as appropriate. Do not include detailed data analyses, transcripts of interviews, or technical reports. If appropriate, they may be included as appendices.