Outbreak Investigation
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Outbreak Investigation

Acute Gastroenteritis

Overview

The purpose of this section is to provide general guidelines, including a decision tree, for the process of investigating a suspected communicable disease outbreak. Outbreak investigations should be a collaborative effort whenever possible, since several tasks requiring different skills must be done simultaneously.

Notify the District Communicable Disease (CD) Coordinator immediately when a report of a suspected outbreak is received.

While every outbreak is unique, the investigative process generally follows a series of steps that are outlined below under "Information Needed for Investigation". Although no outbreak will follow the steps in exact order, these guidelines provide a summary of the things that need to be considered in any investigation.

It is important to stress that several of these steps may occur simultaneously, that their order of occurrence will likely vary, and that several of the steps may occur more than once. However, all of these steps are necessary to the successful resolution of an outbreak.

Y Preparation for the Outbreak Before it Occurs

- Establish a multidisciplinary investigative team (i.e., nursing, communicable disease, environmental, support staff, laboratory, public information, and computer information specialists) and assign responsibilities.
- Train staff (complete Introduction to Epidemiology CD-ROM, Principles of Epidemiology and other disease specific courses on investigative procedures).
- Assemble materials (laboratory kits, forms, reference materials, personal protective equipment such as gloves and masks).
- 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.
- Maintain adequate local surveillance systems for the early detection of increased disease incidence. These systems should collect data on an ongoing basis to allow comparison of the number of new disease cases (incidence) with the historical incidence of similar cases for a similar time period.

Case Definition

An outbreak or epidemic is the occurrence in a community or region of an illness(es) similar in 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.

Information Needed for Investigation

A report of a suspected outbreak may be received in a variety of ways (e.g., active or passive surveillance systems, concerned citizens, healthcare providers, media, law enforcement, etc.). The purpose of these guidelines is to recommend procedures for investigating confirmed or suspected cases associated with an outbreak. All outbreaks or suspected outbreaks must be reported as soon as possible (by phone or e-mail) to the District CD Coordinator and/or appropriate state agency. **Always follow up the initial report to DHSS by submitting a "provisional" CD-51 Missouri Outbreak Surveillance Form and, if the outbreak is suspected to be foodborne, an initial CDC 52.13, Investigation of a Foodborne Outbreak.**

*****Always consider the possibility of intentional contamination when investigating an outbreak of acute gastroenteritis. If a bioterrorism event is suspected, notify your District CD Coordinator and appropriate law enforcement officials immediately.*****

Key Points for Smooth, Efficient Outbreak Investigation:

- Identify agency / department leaders and points of contact prior to an outbreak.
- Communicate early, often, and accurately.
- Establish regular communication among local, state, and federal agencies.
- Understand roles / responsibilities of agencies conducting investigations.
- Develop and use standard procedures / tools to allow for interagency consistency.
- Develop and maintain contact lists.

Outbreak investigation requires the collection and processing of a great deal of information. The method for collecting the initial information depends on the source of the report. When the suspected outbreak is reported by an individual (such as a physician or school nurse), then the initial information should be requested from her/him. If s/he does not have all the relevant information, ask if there is someone else who does and contact that person. When the suspected outbreak is detected through routine surveillance, then follow-up calls to several health care providers may be necessary.

1. **Obtain initial report including the following information:**
   - Identify person making report; obtain name and phone number if possible
   - Point of contact for the situation – name and phone number if different from person making report
   - Diagnosis of illness (laboratory findings or physician diagnosis)
   - Signs and symptoms of illness
   - Identify person(s) or groups ill, number ill, number potentially exposed
   - Date and hour of onset and duration of illness for the first few known cases
   - Date, time and location of any event thought to be related to the outbreak cause; potential exposures such as contact with an ill person(s) or a common gathering or facility within appropriate incubation period for illness (or within the previous 72 hours if diagnosis is unknown)
   - Location of illness in community (addresses of ill persons)
   - Reporter's hypothesis as to cause of illness
   - Suspected mode of transmission (e.g., ingestion, inhalation, or direct contact exposure)

2. **Are there other associated cases? Determine extent of illness:**
   - Review recent surveillance data. Do any other recent cases have the same diagnosis, laboratory findings, or syndrome as the currently reported case(s)?
   - Intensify surveillance in the affected area. Contact medical providers (e.g., primary care physicians, hospital emergency rooms) and other surveillance sites in the area to find out if similar cases have been identified.
     - ♦ **Yes** →
       - Expand investigation to find additional cases, persons at risk, and associations between the cases to identify exposure(s).
       - Collect basic descriptive data on all cases identified, including all the information listed above under Step 1.
       - Develop preliminary case definition based on signs, symptoms and laboratory findings.
       - Use the **"Table of Ilnesses Acquired by Ingestion of Contaminated Foods: A Condensed Classification by Symptoms, Incubation Periods, and Types of Agents"** to assist in developing a list of possible agents. If the agent is unknown, but the exposure and onset times are known, use the incubation periods listed to identify potential causative agents. If the agent and onset times are known, use the incubation period to identify possible exposure times.
       - Proceed with investigative steps outlined below.

- **No →**
  - Epidemiological investigations of single cases of illness are generally not fruitful. If no similar cases (based on diagnosis, lab findings or geographical association) have been identified, and the agent is known, follow the procedures in the appropriate disease section of this manual. **Report case utilizing CD-1 Report form, and form CD-2C, "Record of Investigation of Enteric Illness," for all enteric cases.** If the agent is unknown, maintain a record of possible exposures in case additional cases are reported.

3. **Is the suspected agent transmissible from person to person?**
   - **Yes →**
     - Investigate any suspected place of exposure to determine/identify others who may have been exposed when the identified cases were exposed.
     - Determine when the identified cases were infectious.
       - If case is currently infectious, recommend practices to prevent further transmission of the illness.
     - Identify contacts for possible secondary transmission.
       - Identify previous contacts who may be incubating the disease or may have become ill. Provide appropriate education and follow-up.
   - **No →**
     - Investigate place of exposure to find others who may have been exposed when the identified cases were exposed.
   - **Unknown →**
     - Proceed as if the agent were transmissible person-to-person.

4. **Is the suspected agent transmissible through the environment (including food or water)?**
   - **Yes →**
     - Notify environmental team members to investigate any suspected place of exposure for environmental conditions and/or contaminated food or water that may have led to exposure.
     - If a regulated public water supply is a possible source, contact the **Regional Environmental Public Health Specialist** (page 1. 2).
   - **No →**
     - Focus investigation on potential for person-to-person transmission.

- **Unknown →**
  - Proceed as if the agent were transmissible through the environment.

5. **Plan investigation.**
   - Notify team members from appropriate disciplines. Team members may also include personnel from other agencies and levels of government (DHSS, CDC, FDA, USDA, Department of Natural Resources (DNR), MO Department of Agriculture (MDA) and/or the private sector).
   - Select a team leader to coordinate the outbreak and make job assignments.
     - If outbreak encompasses multiple jurisdictions (areas/agencies), consult with District CD Coordinator to assist in determining appropriate lead agency.
   - Formulate tentative hypothesis constructed from time, place, and person associations to form the basis for the investigation. The hypothesis should be written as soon as enough information has been gathered to formulate one. It is very important not to be too restrictive in your focus, thereby excluding potentially important cases or events. By focusing too narrowly on one hypothesis you may miss pertinent cases.
   - Develop the hypothesis by interpreting available data to determine:
     - Identity of most likely agent(s)
     - Most likely source(s) of agent
     - Most likely mode or means by which agent was transmitted
   - Develop interview questions and design an outbreak investigation form (questionnaire) based on information from initial surveillance efforts (person, place, and time variables) and the hypothesized agent, source and mode of transmission.
   - Develop study design to test the hypothesis. Select an appropriate study design (e.g., cohort or case-control) based on the circumstances. The design should specify how a comparison group of non-ill persons will be selected and what statistical analyses will be performed. Seek consultation from the Distri CD Coordinator regarding study design, to minimize lost time and rework.

6. **Conduct investigation.**
   - For all **ill** cases that meet the preliminary case definition, obtain appropriate information:
     - Complete outbreak investigation form/questionnaire for each person. Do not vary questions asked on questionnaire to prevent compromising your analysis and overall conclusions.
       - **Submit completed CD-1 Case Report on all confirmed / probable cases** (see case definitions for specific diseases).

- If agent is transmissible person-to-person, complete appropriate outbreak investigation form/questionnaire on contacts of cases.
- Implement appropriate control measures for all ill persons (see the following references).
  - Appropriate Communicable Disease Investigation Reference Manual (CDIRM) section for specific diseases
  - **Control Measures** in this manual section
  - **Guidelines for Screening and Management of Food Service and Other High Risk Workers During Foodborne Outbreaks**

- For the selected comparison group of **non-ill** persons, obtain information using the outbreak investigation form/questionnaire.
  - Statistical analysis of outbreak data cannot be performed without information from an appropriate non-ill comparison group.
  - Instruct well persons who had the relevant exposure (to point source or ill person) in appropriate control measures. Whether exposed or not, educate interviewed well persons about the illness and alert them to contact their health care provider if they become ill.
- Collect clinical specimens.
  - Determine what clinical specimens have been collected by health care providers and obtain results. **As soon as an outbreak is apparent, request that the laboratory save the specimens for further specialized testing by the Missouri State Public Health Laboratory (SPHL).**
  - Consult with the District CD Coordinator and SPHL regarding what additional specimens may be necessary.
  - Refer to the **"Guidelines for Submitting Clinical Laboratory Specimens".** This also includes a protocol to use when the causative agent in a gastrointestinal outbreak has not been identified.
- Conduct environmental assessment and collect specimens.
  - When a suspect establishment, event, and/or means of transmission (e.g., food) is identified, the Environmental Public Health Specialist should inspect the site and collect the appropriate specimens.
    - Refer to **"Guidelines for Submission of Food Samples for Bacteriological Analysis During Outbreaks"** .
- Coordinate analysis of both clinical and environmental specimens with the SPHL.

7. Formulate a case definition for analytical purposes.

1. Combine clinical characteristics, laboratory test results, and epidemiological information into criteria for the categorization of cases.
   See **"Guidelines for Confirmation of Foodborne Disease Outbreaks**". If the agent is known, see appropriate CDIRM section.

- Prepare a line list of relevant case information that has been gathered (see **Sample Line List**; categories on line list may be expanded as necessary).
- Categorize the cases according to the case definition.
    - Confirmed case – implement appropriate control measures
    - Probable / Suspect case – implement appropriate control measures
    - Presumptive case – implement appropriate control measures
    - Ill, but does not meet case definition – monitor to see whether individual develops signs and symptoms characteristic of the agent; if so, refer to health care provider for testing and (if appropriate) treatment.

8. Analyze the cases and characterize by time, place, and person.

- Prepare a frequency distribution of cases by location and by personal characteristics. If appropriate to the situation, obtain denominator data to calculate attack rates. Identify potential associations and risk factors. Update this information at least daily.
- Create epi curve (histogram) that reflects onset times and incubation period for the organism. Update this information at least daily.
- Select the categories to be analyzed for risk factors and/or associations using Epi Info or other suitable statistical computer software such as SAS.
- Analyze the data to identify differences in exposure frequencies between the ill and well groups (if case/control study), or differences in illness rates between exposed and non-exposed (if cohort study), to confirm or refute the hypothesis. As data from the interviews is analyzed, it may be necessary to modify the direction of the investigation or to formulate a new hypothesis.
- Statistical expertise is available through the District CD Coordinator.

9. Evaluate hypothesis

Use the information from the statistical analysis, along with laboratory data, environmental inspection findings, and any other relevant information, to evaluate the hypothesis and formulate conclusions. If the hypothesis does not appear to be confirmed, it may be necessary to modify the direction of the investigation or to formulate a new hypothesis.

10. Select and implement control measures.

Implement the control measures that are indicated by the statistical, environmental, laboratory and other findings to prevent further spread of the agent. For additional information, see **Control Measures.**

11. Evaluate the control measures for efficacy.

Determine if solution(s) specified in control plan are being achieved.

- **Yes, control measures are being carried out →**
  - Consider solution(s) have been achieved if additional cases are prevented.
  - If more than two incubation periods have passed and new cases are still occurring, then the outbreak is not under control. New cases may represent continuing exposure from a common source, a new common source, or person-to-person transmission from old cases. Consult with the District CD Coordinator to identify next steps.
- **No, control measures are not being carried out →**
  - Identify problem(s), develop new solution(s), implement and evaluate.

12. Prepare report of investigation.

The final report is an important document that summarizes the outbreak. Reliable, complete information about outbreaks contributes to understanding the trends and causal factors in disease incidence, and to detecting and evaluating new diseases and risks.

The outbreak report should contain the following components:

- Summary (similar to an abstract)
- Introduction
- Background information
- Methods
- Results
- Analysis or interpretations
- Conclusions (optional)
- Control measures
- Recommendations

The final outbreak report may also be used to justify resources that were expended and/or to identify a need for additional resources for future incidents. The final report is a public document and may serve as evidence in legal proceedings (see **Guidelines for Release of Information About an Outbreak**). When the final report is completed and submitted, interim documents and working notes and other materials that are not specifically medical records can be discarded.

The final reports should be completed and submitted to the District CD Coordinator within 90 days of the conclusion of the outbreak investigation. (See **Reporting Requirements)**

13. **Distribute approved final report to all agencies that contributed to the investigation effort.**

14. **Conduct after-action evaluation.**
    Include all team members in the evaluation process. (See **Prompts for After-Action Evaluation)**

15. **Special circumstances.**

Release of Information and Public Notification:

See **Guidelines for Release of Information About an Outbreak** for situations in which either:

- it may be advisable to release information to the public because there is a continuing risk of exposure, or
- the public or the press request details of the investigation before it has been completed.

Exclusion of Food Service and Other High Risk Workers:

For guidance regarding testing and exclusion from work during outbreaks, see **Guidelines for Screening and Management of Food Service Workers and Other High Risk Workers During Foodborne Outbreaks**

Multistate Outbreaks:

Because food distribution may occur over a wide geographical area, outbreaks may affect multiple states. **Guidelines for Foodborne Disease Outbreak Response - Council to Improve Foodborne Outbreak Response,** publication was supported by Cooperative Agreement Number 1U38Hm000414 from CDC.
It may be accessed at
http://www.cifor.us/CIFORGuidelinesProjectMore.cfm

Notification

- Contact the District CD Coordinator, or the Department of Health and Senior Services' Situation Room (24/7 DSR) at 800-392-0272 immediately upon learning of a suspected outbreak of acute gastroenteritis.
- Contact the Section for Child Care Regulation at (573 / 751-2450) if cases are associated with a child care facility.
- Contact the Section for Long Term Care Regulation (573 / 526-8505) if cases are associated with a long-term care facility.

- Contact the Bureau of Health Facility Regulation (573 / 751-6303) if cases are associated with a hospital or hospital-based long-term care facility.

Control Measures

Appropriate control measures depend upon the situation. Consideration should be given to the agent, the mode(s) of transmission, the specific vehicle and setting, and any other relevant findings from the investigation. Consultation is available from the District CD Coordinator. Control measures may include any or all of the following:

- providing vaccine or immune globulin to contacts of known cases
- recalling, embargoing, or destroying food
- correcting a contaminated water source or supply system
- making a public announcement of the outbreak
- improving sanitation, foodhandling or infection control practices
- closing a restaurant until corrections can be made
- recommending antibiotic treatment and/or exclusion (from work, child care etc.)
- use of barrier precautions such as masks and gloves, or
- other measures

Control measures should be implemented as soon as there is sufficient information. Some basic control measures (good infection control practices, environmental sanitation) are generic to almost every acute gastrointestinal illness (AGI) outbreak. Control measures should be continuously evaluated as new information comes in, and changed as necessary.

See the following references for assistance:

- **Guidelines for Screening and Management of Food Service Workers in Foodborne Outbreaks**
- **Guidelines for Release of Information About an Outbreak**
- **Heymann, David L., ed. Control of Communicable Diseases Manual, 19th ed. Washington, DC: APHA, 2008.**
- **Pickering, Larry K., ed. Red Book: 2012 Report of the Committee on Infectious Diseases. 29th ed. Elk Grove Village, IL: AAP, 2012.**

Laboratory Procedures

Laboratory procedures depend upon the suspected agent(s). The following sources may be helpful in identifying the suspected agent(s): **Table of Illnesses Acquired by Ingestion of Contaminated Foods** and CDC's **Guidelines for Confirmation of Foodborne Disease Outbreaks.**

- For information about submitting clinical specimens to the SPHL, see **Guidelines for Submitting Clinical Laboratory Specimens.**

- For submission of food samples to the SPHL, see **Guidelines for Submitting Food Samples for Bacteriological Analysis During Outbreaks.**
- For water or other types of samples, consult with the District CD Coordinator and the SPHL.

More information about laboratory testing is available at the SPHL website at **www.health.mo.gov/Lab/index.html**

Reporting Requirements

Outbreaks are a Category I disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services (DHSS) **within 24 hours** of first knowledge or suspicion by telephone, facsimile or other rapid communication.

1. **Missouri Outbreak Surveillance Form (CD-51):** All outbreaks or suspected outbreaks must be reported as soon as possible (by phone, fax or e-mail) to the District CD Coordinator. In addition, a Missouri Outbreak Surveillance Form (CD-51) must be submitted to the Bureau of Communicable Disease Control and Prevention in Jefferson City within 24 hours. The report category on the second page should be checked as "Provisional".

2. **CDC Form 52.13, Investigation of a Foodborne Outbreak:** If an outbreak is suspected to be foodborne, then the form **Investigation of a Foodborne Outbreak (CDC 52.13)** must be submitted to the Bureau of Communicable Disease Control and Prevention in Jefferson City within 24 hours. Complete as much information as you can at that time, and mark the form "Provisional".

3. **Final Outbreak Reports:** Within 90 days from the conclusion of an outbreak, the following final reports must be submitted to the District CD Coordinator, who in turn forwards the report to the Bureau of Communicable Disease Control and Prevention in Jefferson City:

    a. **An epidemiological narrative report** is to be written and submitted for all investigated outbreaks. The report will address, at a minimum, the headings outlined in #12 of this section. For investigations of suspected outbreaks, submit a brief narrative summary and reasoning/conclusions as to why it was not an outbreak.

    b. **A final CD-51 report** is to be submitted, which provides final outbreak numbers of ill and at risk population projections or changes that have occurred in the status of the report. The District Office will indicate

if the outbreak investigation was "administratively closed" or "final."

c. **A final CDC 52.13 report** is to be submitted if the outbreak meets the CDC foodborne outbreak definition: "The occurrence of two or more cases of a similar illness resulting from the ingestion of a common food in the U.S." Complete and submit the form to the Bureau of Communicable Disease Control and Prevention in Jefferson City at the same time as the above final reports. Mark the form "Final" under Item #1. See **Guidelines for Completing the Form CDC 52.13**.

4. **Disease Case Report (CD-1):** The CD-1 may be used as an information-gathering tool and in many instances may be our initial notification of an outbreak.

5. **Record of Investigation of Enteric Illness (CD-2C):** The CD-2C may be used as an information-gathering tool in an outbreak resulting from an intermittent common source or propagated source to assist with determining the specific source.

6. **CDC Form 52.12, Waterborne Diseases Outbreak Report:** If an outbreak of illness is associated with the consumption or use of water for drinking, or with ingestion, contact or inhalation of recreational water, the Waterborne Disease Outbreak report (CDC 52.12) is to be completed and submitted to the Bureau of Communicable Disease Control and Prevention in Jefferson City.

References

1. Heyman, David L., ed. Control of Communicable Diseases Manual, 19th ed. Washington, DC: APHA, 2008.
2. Pickering, Larry K., ed. Red Book: 2012 Report of the Committee on Infectious Diseases. 29th ed. Elk Grove Village, IL: AAP, 2012.
3. Mandell, Gerald L., ed. Principles and Practice of Infectious Diseases, 6th ed. Philadelphia, PA: Elsevier Churchill Livingstone, 2005.
4. International Association of Milk, Food and Environmental Sanitarians, Inc. Procedures to Investigate Foodborne Illness, 5th ed. Des Moines, IA: IAMFES, 1999.

Other Sources of Information

1. Centers for Disease Control and Prevention. Diagnosis and Management of Foodborne Illnesses: A Primer for Physicians and Other Health Care Professionals. MMWR 2004; 53 (No. RR-4). www.cdc.gov/mmwr/preview/mmwrhtml/rr5304a1.htm

2. Centers for Disease Control and Prevention. Foodborne Outbreak Response and Surveillance Unit website. www.cdc.gov/foodborneoutbreaks/
3. Centers for Disease Control and Prevention. Guidelines for Confirmation of Foodborne Disease Outbreaks. MMWR 2000; 49 (No. SS01); 54-62. www.cdc.gov/mmwr/preview/mmwrhtml/SS4901a3.htm
4. Missouri Department of Health and Senior Services, State Public Health Laboratory website. www.health.mo.gov/Lab/index.html
5. Council to Improve Foodborne Outbreak Response (CIFOR). Guidelines for Foodborne Disease Outbreak Response. Atlanta: Council of State and Territorial Epidemiologist, 2009. **http://www.cifor.us/CIFORGuidelinesProjectMore.cfm**

Guidelines for Submitting Clinical Laboratory Specimens

Summary of Clinical Specimen Transport

Organism	Specimen	Transport Conditions **
Bacillus cereus	feces	Cold, no transport media
Bacillus cereus	vomitus	Cold, no transport media
Campylobacter	feces	Cold, enteric transport media (Cary-Blair)
Clostridium perfringens	feces	Cold, no transport media
Cryptosporidium	feces	Room temp, PVA & Formalin preservative
E. coli O157:H7	feces	Cold, enteric transport media (Cary-Blair)
Giardia	feces	Room temp, PVA & formalin preservative
Norovirus/ Norwalk-like	feces (preferred)/ vomitus	Cold, no transport media
Salmonella	feces	Cold, enteric transport media (Cary-Blair)
Shigella	feces	Cold, enteric transport media (Cary-Blair)
Staphylococcus	feces	Cold, enteric transport media (Cary-Blair)
Staphylococcus	vomitus	Cold, no transport media
Vibrio	feces	Cold, enteric transport media (Cary-Blair)
Viruses	feces	Cold, no transport media
Yersinia	feces	Cold, enteric transport media (Cary-Blair)

Requests for isolation of more than one organism from a single clinical specimen can be made if transport conditions are appropriate. However, local personnel should make every effort to determine probable causative organisms before laboratory work is requested. Culture and isolation cannot be performed on specimens submitted in PVA and formalin, and parasitology and virus isolation examinations cannot be performed on specimens submitted in enteric transport media. Submit specimens in transport media, unless it is a bacteria or virus that requires no transport media (see table at top of page).

All forms must be properly and completely filled out, including collection date. All specimen vials must be labeled with patient name. Unlabeled specimen vials will **NOT BE TESTED**. Labeling the mailer box with the patient name is not acceptable; the specimen vials must have patient name on them.

If norovirus is confirmed from any gastroenteritis outbreak, two separate samples from the outbreak will be sent to the Centers for Disease Control and Prevention (CDC) for molecular characterization. The Local Public Health Agency will be requested to complete the "Report

of Outbreak of Suspected Viral Gastroenteritis" form and submit it to the Missouri State Public Health Laboratory (SPHL) to mail with the samples.

Guidelines for Investigation of Gastrointestinal Illness of Unknown Etiology

Following the initial contact concerning an outbreak of gastrointestinal illness, the health professional will be faced with a myriad of tasks to be performed before definite decisions can be made as to what laboratory test to request. The following protocol should be followed.

If norovirus testing is being considered, please refer to the instruction sheet on the SPHL web site at http://www.dhss.mo.gov/Lab/Virology/NorovirusInstructions.pdf. It is important to note that norovirus testing will be performed only in outbreak situations, and that collection of specimens from a minimum of three and a maximum of ten different individuals is required.

Stool samples will be collected from all symptomatic individuals (no more than 72 hours from onset). Two samples will be collected; one with transport media (for bacterial testing) and one without transport (for viral and certain bacterial testing). If initial collections must be made before outbreak supplies are available, the regular enteric outfits may be used by pouring the transport media out of one vial and marking that vial with a large X on top. No bloods will be collected at this point for norovirus (Norwalk-like virus). The SPHL will provide an outbreak kit that will include the following per patient:

1. One set of collection vials (one with and one without transport media).
2. Two patient forms (one for viral testing and one for bacterial testing).
3. Small diagnostic canister.
4. Patient instructions/institutional instructions.
5. Individual/multi mailer with cold packs and labels.

After specimens are received at the SPHL, the following approach will be taken:

1. Symptoms and epidemiological data indicate illness of viral origin: all raw specimens (without transport media) will be tested for norovirus, rotavirus, and adenovirus. Adenovirus and rotavirus may be requested separately if norovirus testing is not indicated (raw stool specimens only). Specimens for viral testing must be collected within 72 hours of onset. (Bacterial/viral testing is determined at time of consult.)

2. Symptoms and epidemiological data indicate illness of bacterial origin: all specimens (in transport media) will be tested for Salmonella, Shigella, Campylobacter, and E. coli O157:H7, unless possible causative organisms can be narrowed by symptoms.

Specimens in bacteriological transport media are not suitable for viral testing.

If the field person is unable to determine if the suspected causative agent is bacterial or viral, the SPHL will run the specimens for both viral and bacterial agents in consultation with the Bureau of Communicable Disease Control and Prevention. (If the number of specimens is very large, the Bureau of Communicable Disease Control and Prevention and the SPHL may decide a certain percentage to be screened initially.)

A form of molecular subtyping, Pulsed Field Gel Electrophoresis (PFGE) is done routinely on Salmonella, Shigella, and Toxigenic E. coli isolated at or sent to the SPHL. This provides further information as to the relatedness of different isolates in an investigation and may assist in tracking the original source. Information regarding specific isolates and their relatedness may be obtained by calling the Bureau of Communicable Disease Control and Prevention of the DHSS.

NOTE*: Additional information regarding specific organisms can be found throughout the Communicable Disease Investigation Reference Manual.*

Information on collection and transport of food samples

See **"Guidelines for Submitting Food Samples for Bacteriological Analysis During Outbreaks"**

For further information regarding the submission of clinical specimens, please contact the SPHL at (573 / 751-3334).

Free courier service is available statewide to facilitate overnight specimen shipment. Contact the SPHL – Central Services Unit at (573 / 751-3334) for the location in your area.

Guidelines for Submitting Food Samples for Bacteriological Analysis During Outbreaks

Laboratory results and their interpretation are only as valid as the sample submitted for examination. Inappropriate samples, samples that have been improperly collected or mishandled, and unrepresentative samples will yield meaningless results. Not only must the health and welfare of the public be considered, but there is also the distinct possibility that legal action may arise from virtually any consumer complaint requiring laboratory personnel to testify concerning the results of their examinations. If the record of the sample collection is incomplete, or if samples are received in nonsterile containers or in a partially decomposed state, the laboratory results may be of little or no value.

Adequate precautions should be taken to preclude microbial contamination of samples from external sources, the air environment, sample containers, sampling devices, and improper handling, especially at temperatures that may alter significantly the microflora present. Ample refrigeration must be provided to prevent destruction or growth of organisms in the sample.

The Missouri State Public Health Laboratory (SPHL) recommends these general points for obtaining acceptable food samples.

1. Samples of freshly prepared foods, perishable foods or leftovers from meals implicated in an outbreak should be collected as soon as possible after report of the incident.

2. Notify the Environmental Bacteriology Unit (573 / 751-3334) in advance regarding the number of samples collected, when they should arrive and the tests desired. This is necessary to assure adequate quantities of the appropriate media. Some media require several hours of preparation.

3. Whenever possible, an unopened container from the same production lot as the suspected food should be submitted.

4. If the products are in bulk form or in containers of a size impractical for submission, aseptically transfer a representative sample portion (at least 100 grams, 100 ml, or 4 ounces) to a sterile container. For large solid food samples (frozen or unfrozen), test portions should be taken aseptically from several areas using sterile knives and forceps, then mixed as a composite, so that a sample more representative of the food can be evaluated. Sterile water bottles may be used to collect food samples.

5. Aseptic techniques should always be used to obtain samples even if the foods have been grossly mishandled.

6. Seal samples securely so they will not spill or open in transit to the laboratory. If the sample is to be examined for a regulatory purpose, the sample container must be sealed so that it cannot be opened without breaking the seal.

7. Cool samples in ice to 0^{o}- 4^{o} C and transport them in a sample chest with suitable refrigerant capable of maintaining the sample at 0^{o}- 4^{o} C until arrival at the laboratory. Collect frozen samples in pre-chilled containers. **DO NOT THAW SAMPLES THAT ARE ALREADY FROZEN: KEEP THEM FROZEN.**

8. Samples should be delivered to the laboratory as rapidly as possible. When it is not possible to hand-deliver samples to the laboratory; they should be shipped by the most rapid method.

9. A separate Food and Drug Specimen Information and Flow Sheet (Lab-52) must be properly and completely filled out for <u>each sample</u>. One completed reverse side is sufficient for each series of samples.

10. The District Communicable Disease Coordinator can assist in facilitating shipment of food samples for bacteriological analysis if needed.

If there is a question as to the integrity of the leftover food from the suspect meal(s), samples may be collected and the situation discussed with the Environmental Bacteriology Unit. Compromised samples may be analyzed for a specific organism only if that organism has already been isolated from clinical specimens collected in an outbreak investigation.

The SPHL's testing protocol has included a standard plate count in addition to specific bacterial analyses for food samples. However, for foods prepared with cultured products, cheese, sour cream, etc., a standard plate count and direct microscopic examination will not be performed. Presence of coliform organisms and/or yeast and mold would be appropriate indicators of mishandling.

Samples submitted directly to us by the public will not be accepted for analysis.

For further information regarding the submission of food samples, please contact the Environmental Bacteriology Unit (573 / 751-3334).

Guidelines for Screening and Management of Food Service and Other High Risk Workers During Foodborne Outbreaks

General Recommendations – Agent Identified or Unknown

Exclusion. All foodhandlers in an implicated establishment who have symptoms similar to the outbreak cases should be immediately excluded from foodhandling duties. In a health care or child care setting, workers with symptoms similar to the outbreak cases should be immediately excluded from direct patient or child care. They should not return to foodhandling or direct patient or child care until their symptoms resolve, or if the causative organism is identified, until the disease-specific guidelines below are met.

It should be the general practice of all food establishments, child care centers, and health care facilities to exclude all persons with poor hygiene from working in these facilities. It is also expected that all staff working in these settings who have skin lesions, boils, abscesses, and other purulent conditions be excluded from work until the condition is properly treated and is resolved. For additional guidance for foodhandlers, please see the Missouri Food Code (19 CSR 20-1.025).

Epidemiologic investigation. Conduct a thorough investigation [see **Outbreak Investigation** section in the Communicable Disease Investigation Reference Manual (CDIRM)]. Determine the predominant symptoms, their duration and the incubation period. Develop a hypothesis regarding the causative organism. Then follow the disease-specific guidelines below. For more detailed information on the submission of laboratory specimens, see **Guidelines for Submitting Clinical Laboratory Specimens** and **Guidelines for Submitting Food Samples for Bacteriological Analysis During Outbreaks.**

Bacillus Cereus
Clostridium Perfringens
Vibrio Parahemolyticus

Transmission. Not usually transmitted from person-to-person.

Exclusion. Exclude ill persons from handling food while symptomatic.

Screening. Collect one fecal specimen from each ill worker within the appropriate time frame (24 hours for *V. parahemolyticus*, 3 days for *B. cereus* and *C. perfringens*). No screening of asymptomatic foodhandlers is necessary.

Management. Employees may return to work when no longer symptomatic. No follow-up culturing is necessary.

Campylobacter Enteritis (Campylobacteriosis)

Transmission. Person-to-person transmission is possible but infrequent.

Exclusion. Exclude ill persons immediately from handling food or providing direct patient or child care, until diarrhea ceases.

Screening. Collect one stool specimen from each foodhandler, patient care or child care worker for case finding purposes. Rectal swabs are not recommended.

Management. Employees may return to work when diarrhea ceases. No follow-up culturing is necessary. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Information. For additional information, go to the **Campylobacteriosis** section in the CDIRM

Cryptosporidiosis

Transmission. May be transmitted from infected foodhandlers, health care and child care workers, with or without symptoms.

Exclusion. Exclude ill persons immediately from handling food or providing direct patient or child care, until asymptomatic.

Screening. Collect one stool specimen from each symptomatic foodhandler or child care worker for case finding purposes. If the first stool is negative by microscopic examination for ova and parasites (O&P), examine two additional specimens collected 24 hours apart.(1) If the initial specimen is negative by immunodiagnostic testing of the stool, no additional specimens need to be tested.(2)

Management: Employees may return to work when asymptomatic. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

If a food service employee no longer has diarrhea, but is being treated, they should not work handling foods that will not be subsequently cooked or heated (salad bar duties, preparing sandwiches, etc.) until therapy has been completed.

Information. For additional information, go to the **Cryptosporidiosis** section in the CDIRM

Cyclosporiasis

Transmission. Not transmitted from person-to-person.

Exclusion. Exclude ill persons immediately from handling food until diarrhea ceases.

Screening. Collect one fecal specimen from each ill worker for case finding purposes. If the first stool is negative by microscopic examination, then two additional specimens, collected 2-3 days apart, should be submitted. No screening of asymptomatic foodhandlers is necessary.

Management. Employees may return to work when no longer symptomatic. No follow-up culturing is necessary.

Information. For additional information, go to the **Cyclosporiasis** section in the CDIRM

E. coli O157:H7 and other Shiga toxin-producing E. coli (STEC)

Transmission. May be transmitted from infected foodhandlers, health care and child care workers, with or without symptoms.

Exclusion. Exclude ill persons immediately from handling food, patient care, child care or other jobs that pose significant risk of transmission. This also applies to ill contacts of cases. Exclude asymptomatic persons with positive stool cultures immediately. **(CCDM)**

Screening. Collect two stool specimens, at least 24 hours apart, from each foodhandler, patient care or child care worker for screening. Rectal swabs are not recommended.

Management. Both cultures negative: No additional culturing is necessary. If symptomatic, continue to exclude from foodhandling, patient care or child care until diarrhea ceases. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Culture positive (one or both): Continue to exclude from foodhandling, patient care or child care until follow-up cultures indicate worker is no longer infected.

Follow-up cultures should be done as follows: if not treated with antibiotics, wait one week after initial specimens. If treated with antibiotics, wait at least 48 hours after last dose is taken.
NOTE: Some antibiotics have a longer half-life; and any specimen submitted too early may have an unsatisfactory result. Take stool specimens at least 24 hours apart. If both are negative, worker may return to foodhandling, patient care or child care duties. If one or both stools are positive, wait one week and take two more specimens, 24

hours apart. Repeat this procedure weekly until both specimens are negative.

Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Information. For additional information, go to the **E. coli O157:H7 and other Shiga toxin-producing E. coli (STEC)** section in the CDIRM

Giardiasis

Transmission. May be transmitted from infected foodhandlers, health care and child care workers, with or without symptoms.

Exclusion. Exclude ill persons immediately from handling food or providing direct patient or child care, until diarrhea ceases.

Screening. Collect one stool specimen from each symptomatic foodhandler or child care worker for case finding purposes. If the first stool is negative by microscopic examination for ova and parasites (O&P), examine two additional specimens collected 24 hours apart. [(1)] If the initial specimen is negative by immunodiagnostic testing of the stool, no additional specimens need to be tested. [(2)]

Management. Employees may return to work when diarrhea ceases. No follow-up culturing is necessary. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

If a food service employee no longer has diarrhea, but is being treated, they should not work handling foods that will not be subsequently cooked or heated (salad bar duties, preparing sandwiches, etc.) until therapy has been completed.

Information. For additional information, go to the **Giardiasis** section in the CDIRM

Hepatitis A

Transmission. May be transmitted from infected foodhandlers, health care and child care workers, with or without symptoms.

Exclusion. Exclude ill persons immediately from handling food, providing patient care or child care.

Screening. Workers with any symptoms consistent with hepatitis should be screened. Collect one serological specimen for testing.

Management. Exclude infected foodhandlers, patient care and child care workers from work for 7 days after onset of jaundice.[3] This also applies to ill contacts of cases. In the absence of jaundice, exclude infected foodhandlers, patient care and child care workers from work for 14 days after onset of symptoms. No follow-up testing is necessary.

If a worker has symptoms consistent with hepatitis, but the initial HAV-IgM test is negative, it may be advisable to request liver enzyme testing. Refer to **Hepatitis A** manual section for more information.

Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Information. For additional information, including other control measures, go to **Hepatitis A** section in the CDIRM

Norovirus [Norwalk–like viruses, Caliciviruses, Small round structured viruses (SRSV)]

Transmission. May be transmitted by infected foodhandlers, health care and child care workers.

Exclusion. Exclude ill persons immediately from handling food, patient care, or child care until diarrhea ceases.

Screening. Collect one stool or vomitus specimen within 48-72 hours of onset from each symptomatic foodhandler, patient care or child care worker for

testing. Collect no fewer than 3 and no more than 10 specimens from ill persons during any one outbreak.

Management. Employees may return to work when diarrhea ceases. No follow-up testing is necessary. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Salmonella

Transmission. May be transmitted from infected foodhandlers, health care and child care workers, with or without symptoms.

Exclusion. Exclude ill persons immediately from handling food, patient care, child care. This also applies to ill contacts of cases. Exclude asymptomatic persons with positive stool cultures if their work involves touching unwrapped foods that are consumed raw or served without further cooking. (6)

Screening. Collect two stool specimens, at least 24 hours apart, from each foodhandler for case finding purposes. Rectal swabs are not recommended.

Management. Both cultures negative: No additional culturing is necessary. If symptomatic, continue to exclude from foodhandling until diarrhea ceases. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Culture positive (one or both): For most infected workers, continue to exclude from foodhandling, patient care, or child care until diarrhea ceases. Antibiotic therapy is not usually recommended, as it may prolong the period of excretion and may lead to resistant strains. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Culture positive (one or both): If their work involves touching unwrapped foods that are consumed raw or served without further cooking, continue to exclude until follow-up cultures indicate worker is

no longer infected. After diarrhea ceases, worker may be assigned to non-foodhandling duties. This should be encouraged, since excretion may last up to several months. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Follow-up cultures should be done only for workers specified above, as follows: Wait one week after initial specimens. Take two stool specimens, at least 24 hours apart. If both are negative, worker may return to foodhandling duties. If one or both stools are positive, wait one week and take two more specimens, 24 hours apart. Repeat this procedure weekly until both specimens are negative.

Information. For additional information, go to the **Salmonellosis** section in the CDIRM

Shigella

Transmission. May be transmitted from infected foodhandlers, health care and child care workers, with or without symptoms.

Exclusion. Exclude ill persons immediately from handling food, patient care, child care or other jobs that pose significant risk of transmission. This also applies to ill contacts of cases. Exclude asymptomatic persons with positive stool cultures immediately.

Screening. Collect two stool specimens, at least 24 hours apart, from each foodhandler, patient care or child care worker for screening. Rectal swabs are not recommended.

Management. Both cultures negative: No additional culturing is necessary. If symptomatic, continue to exclude from foodhandling, patient care or child care until diarrhea ceases. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Culture positive (one or both): Continue to exclude from foodhandling, patient care or child care until follow-up cultures indicate worker is no longer infected. Appropriate antibiotic treatment can shorten the

duration of illness and of positive cultures. Sensitivity testing should be done in order to prescribe appropriately. (6)

Follow-up cultures should be done as follows: if not treated with antibiotics, wait one week after initial specimens. If treated with antibiotics, wait at least 48 hours after last dose is taken.
NOTE: Some antibiotics have a longer half-life; and any specimen submitted too early may have an unsatisfactory result. Take stool specimens at least 24 hours apart. If both are negative, worker may return to foodhandling, patient care or child care duties. If one or both stools are positive, wait one week and take two more specimens, 24 hours apart. Repeat this procedure weekly until both specimens are negative.

Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Information. For additional information, go to the **Shigellosis** section in the CDIRM

Staphylococcal Food Poisoning

Transmission. May be transmitted by infected or colonized foodhandlers.

Exclusion. Exclude ill persons from handling food while symptomatic. Exclude foodhandlers with boils, abscesses and other purulent lesions of the hands, face or nose until lesions are healed.

Screening. Collect one feces or vomitus specimen from each foodhandler with gastrointestinal symptoms within 24 hours of onset. Specimens should also be obtained from any purulent lesions, using culturettes.

If fecal specimens from cases and samples of implicated foods are not available, nasal cultures of foodhandlers may be considered. This should be done only after consultation with the Bureau of Communicable Disease Control and Prevention and the SPHL Microbiology Unit.

Management. Employees may return to work when no longer symptomatic. No follow-up culturing is necessary. Give instructions regarding proper infection

control procedures, including good handwashing after defecation and proper foodhandling. Proper personal hygiene should be stressed.

Typhoid Fever (*Salmonella* Typhi)

Transmission. May be transmitted from infected foodhandlers, health care and child care workers, with or without symptoms.

Exclusion. Exclude ill persons immediately from handling food, patient care, or child care until released from supervision (see Management, below). This also applies to ill contacts of cases. Exclude typhoid carriers and chronic typhoid carriers from handling food, patient care, child care until released from supervision (see Management, below).

Screening. Collect three stool specimens, at least 24 hours apart, from each foodhandler, patient care or child care worker.

Management. All cultures negative: No additional culturing is necessary. If symptomatic, continue to exclude from foodhandling, patient care, or child care until diarrhea ceases. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

At least one culture positive: Continue to exclude from foodhandling, patient care, or child care until released from supervision. Antibiotic therapy is not recommended in the absence of complications. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Release from supervision (acute case): Follow-up cultures must be collected at least one month after onset of illness. If treated with antibiotics, wait at least 48 hours after last dose is taken.
NOTE: Some antibiotics have a longer half-life; and any specimen submitted too early may have an unsatisfactory result. Collect three (3) stool specimens at least 24 hours apart. If any one of the stool cultures is positive, wait one month and take three more specimens, 24 hours apart. Repeat this procedure monthly until three consecutive negative cultures are obtained. [5]

Refer to the **Typhoid Fever** section of this manual for management of typhoid carriers and chronic typhoid carriers. A typhoid carrier is defined as any person whose feces or urine contains typhoid bacilli and who is not ill. If a typhoid carrier has had typhoid fever within the past 12 months, s/he is considered a convalescent typhoid carrier. If a typhoid carrier continues to have typhoid bacilli in his/her feces or urine for more than 12 months after illness, or in the absence of a history of fever, s/he shall be considered a chronic typhoid carrier.

Information. For additional information, go to the **Typhoid Fever** section in the CDIRM

Yersiniosis

Transmission. Person-to-person transmission is possible but infrequent.

Exclusion. Exclude ill persons immediately from handling food or providing direct patient or child care, until diarrhea ceases. **(CCDM)**

Screening. Collect one stool specimen from each foodhandler, patient care or child care worker for case finding purposes. Rectal swabs are not recommended.

Management. Employees may return to work when diarrhea ceases, usually 2-3 weeks after onset. No follow-up culturing is necessary. Give instructions regarding proper infection control procedures, including good handwashing after defecation and proper foodhandling.

Information. For additional information, go to the **Yersiniosis** section in the CDIRM

References

1. NCCLS Document M28-P, 1993: Procedures for the recovery and identification of parasites from the intestinal tract; proposed guidelines. National Committee for Clinical Laboratory Standards, Villanova, PA. (June 2005)
2. Evaluation of nine immunoassay kits (enzyme immunoassay and direct fluorescence) for detection of Giardia lamblia and Cryptosporidium *parvum* in human fecal specimens: Garcia LS; Shimizu RY: J Clin Microbiol. 1997 Jun;35(6):1526-9.
3. Pickering, Larry K., ed. Red Book: 2012 Report of the Committee on Infectious Diseases. 29th ed. Elk Grove Village, IL: AAP, 2012.
4. American Society for Microbiology. Diagnostic Medical Parasitology, 3rd ed. Washington, DC. 1997: 570.
5. Heyman, David L., ed. Control of Communicable Diseases Manual, 19th ed. Washington, DC: APHA, 2008.
6. Mandell, Gerald L., ed. Principles and Practice of Infectious Diseases, 6th ed. Philadelphia, PA: Elsevier Churchill Livingstone, 2005.

Table of Illnesses Acquired by Ingestion of Contaminated Foods: A Condensed Classification by Symptoms, Incubation Periods, and Types of Agents

Note: Although this document is very useful, some of the information about specific organisms may conflict with more recent references. Always consult the current publications listed as references for this CDIRM manual section.

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
UPPER GASTROINTESTINAL TRACT SIGNS AND SYMPTOMS [NAUSEA, VOMITING] PREDOMINATE Incubation (latency) period usually less than 1 hour						
			Fungi			
Gastrointestinal irritating group mushroom poisoning	Possibly resin-like substances in some mushrooms (mushroom species are different from those cited on pages 5 and 15)	30 min to 2 h	Nausea, vomiting retching, diarrhea, abdominal pain	Many varieties of wild mushrooms	Vomitus	Eating unknown varieties of wild mushrooms; mistaking toxic mushrooms for edible varieties
			Chemicals			
Antimony poisoning	Antimony in gray enamelware	Few min to 1 h	Vomiting, abdominal pain, diarrhea	High-acid foods and beverages	Vomitus, stools, urine	Purchasing/using antimony-containing utensils; storing high-acid foods in chipped gray enamelware

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Cadmium poisoning	Cadmium in plated utensils	15-30 min	Nausea, vomiting abdominal cramps, diarrhea, shock	High-acid foods and beverages; metal-colored cake decorations	Vomitus, stools, urine, blood	Purchasing/using cadmium-containing utensils; storing high-acid beverages in cadmium containers
Copper poisoning	Copper in pipes and utensils; old ice cream machines; old dairy white metal	Few min to few h	Metallic taste, nausea, vomiting (green vomitus), abdominal pain diarrhea, chills	High-acid foods and ice cream (ices) and beverages	Vomitus, gastric washings, urine, blood	Faulty backflow preventors in vending machines or soda fountains; storing or vending high-acid (low pH) beverages from copper containers, pipe lines, or old equipment containing copper
Fluoride poisoning	Sodium fluoride in insecticides and rodenticides	Few min to 2 h	Salty or soapy taste, numbness of mouth, vomiting, diarrhea, dilated pupils, spasms, pallor, shock, collapse	Any accidentally-contaminated foods, particularly dry foods (such as dry milk, flour, baking powder, cake mixes)	Vomitus, gastric washing	Storing insecticides in same area as foods, mistaking pesticides for powdered foods

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Lead poisoning	Lead in earthenware vessels; pesticides, paint, plaster, putty, soldered joints	30 min or longer	Metallic taste, burning of mouth, abdominal pain, milky vomitus, bloody or black stools, foul breath, blue gum line, shock	High-acid foods and beverages stored in lead-containing vessels; any accidentally contaminated food	Vomitus, gastric washing, stools, blood, urine	Purchasing or using lead-containing vessels; storing high-acid foods including wine in lead-containing vessels; storing pesticides in same area as food
Tin poisoning	Tin in tinned cans or containers	30 min to 2 h	Bloating, nausea, vomiting, abdominal cramps, diarrhea, headache	High-acid foods and beverages	Vomitus, gastric washing, urine, blood, stools	Storing high-acid foods in tinned cans or containers in which there is no lacquer or the lacquer had peeled. Very high concentrations are required to cause illness
Zinc poisoning	Zinc in galvanized containers	Few min to few h	Pain in mouth and abdomen, nausea, vomiting, dizziness	High-acid foods and beverages	Vomitus, gastric washing, urine, blood, stools	Storing high-acid foods in galvanized cans

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Incubation (latency) period usually between 1 and 6 h						
Bacteria						
Bacillus cereus gastro-enteritis	Exo-enterotoxin of *B. cereus*; organism in soil (strains dif-fer from those cited on page 7)	½ to 5 h	Nausea, vomiting, occasionally diar-rhea	Boiled or fried rice, cooked corn-meal dishes, porridge, pasta	Vomitus, stool	Storing cooked foods at room temperature; storing cooked foods in large containers in re-frigerator; preparing foods sev-eral hours before serving
Staphylococcal intoxi-cation	Exoenterotoxins A, B, C, D, E, F, or H of *Staphylococcus aureus*. Staphylo-cocci from nose, skin and lesions of human beings and other animals and from udders of cows	1 to 8 h, typically 2 to 4 h	Nausea, vomiting retching, abdominal pain, diarrhea, pros-tration	Ham, meat and poultry products; cream-filled pastries; whipped but-ter; cheese; dry milk; food mixtures; high protein leftover foods	Ill: vomitus stools, rectal swabs. Food handlers: na-sal swabs, swabs of le-sions	Storing cooked foods at room temperature; storing cooked foods in large containers in re-frigerator; touching cooked foods; preparing foods several hours before serving; holding foods at warm bacterial-incubation temperatures; fermentation of abnormally low-acid foods; handling foods by persons with pus-containing infections

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			Chemicals			
Nitrite poisoning[c]	Nitrites or nitrates used as meat curing compounds	1 to 2 h	Nausea, vomiting, cyanosis, headache, dizziness, weakness; loss of consciousness; chocolate-brown colored blood[c]	Cured meats; any accidentally-contaminated food; spinach excessive nitrification	Blood	Using excessive amounts of nitrites or nitrates in foods for curing or for covering up spoilage; mistaking nitrites for common salt and other condiments; improper refrigeration of fresh produce; excessive nitrification of fertilized foods
Diarrhetic shellfish poisoning	Okadaic acid and other toxins produced by dinoflagellates *Dinophysis* spp.	½ to 12 h, usually 4 h	Diarrhea, nausea, vomiting, abdominal cramps, chills	Mussels, clams, scallops	Gastric washing	Harvesting shellfish from waters with higher than usual concentration of *Dinophysis* spp.
			Incubation (latency) period usually between 7 and 12 h			
			Fungi			
Cyclopeptide and gyromitrin groups of mushroom poisoning	Cyclopeptides and gyromitrin in some mushrooms (mushroom species are different from those cited on pages 1 and 15)	6 to 12 h	Abdominal pain, feeling of fullness, vomiting, protracted diarrhea, loss of strength, thirst, muscle cramps, collapse, jaundice, drowsiness, dilated	*Amanita phalloides, A.verna, Galerina autumnalis, Gyromitra esculenta* (false morels) and similar spe-	Urine, blood, vomitus	Eating certain species of *Amanita, Galerina,* and *Gyromitra* mushrooms; eating unknown varieties of mushrooms; mistaking toxic mushrooms for edible varieties

			pupils, coma; death	cies of mush-rooms		
Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			Incubation (latency) period between 13 and 72 h			
			Viruses			
Small round structured virus gastroenteritis	Norwalk, Hawaii, Snow Mountain, Taunton Viruses: Caliciviruses	½ to 3 days, typi-cally 36 hours	Nausea, vomiting, diarrhea, abdominal pain, myalgia, headache, malaise, low-grade fever; duration 36 hours	Human feces	Stools, acute and convales-cent blood	Infected persons touching ready-to-eat foods; harvesting shellfish from sewage polluted waters; inadequate sewage disposal; us-ing contaminated water
			BURNING MOUTH, SORE THROAT AND/OR RESPIRATORY SYMPTOMS AND SIGNS OCCUR			
			Incubation period less than 1 h			
			Chemicals			
Calcium chloride poi-soning	Calcium chloride freezing mixture for frozen dessert bars	Few min	Burning lips, mouth, throat; vomiting	Frozen dessert bars	Vomitus	Splashing of freezing mixture onto popsicles while freezing; cracks in molds allowing $CaCl_2$ to penetrate popsicle syrup
Sodium hydroxide poisoning	Sodium hydroxide in bottle-washing compounds, deter-gents, drain cleaners, or hair straighteners	Few min	Burning of lips, mouth and throat; vomiting, abdomi-nal pain, diarrhea	Bottled beverages, pretzels	Vomitus	Inadequate rinsing of bottles cleaned with caustic soda; inad-equate baking of pretzels

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Incubation (latency) period usually between 18 and 72 h						
Bacteria						
Beta-hemolytic streptococcal infections	*Streptococcus pyogenes* from throat and lesions of infected humans	1 to 3 days	Sore throat, fever, nausea, vomiting, rhinorrhea; sometimes a rash. Sequela: rheumatic fever	Raw milk, egg-containing salads	Throat swabs, vomitus	Persons touching cooked foods; touching of foods by persons with pus-containing infections; room-temperature storage; storing cooked foods in large containers in refrigerator; inadequate cooking or reheating; preparing foods several hours before serving
LOWER GASTROINTESTINAL TRACT SIGNS AND SYMPTOMS [ABDOMINAL CRAMPS, DIARRHEA] PREDOMINATE						
Incubation (latency) period usually between 7 and 17 h						
Bacteria						
Bacillus cereus enteritis	Enterotoxins of *B. cereus.* Organisms in soil (strains differ from those cited in page 4)	8 to 16 h, mean 12 h	Nausea, abdominal pain, watery diarrhea	Cereal products, soups, custards and sauces, meatloaf, sausage, cooked vegetables, reconstituted dried potatoes, refried beans	Stools	Storing cooked foods at room temperature; storing cooked foods in large containers in refrigerator; holding foods at warm (bacterial-incubating) temperatures; preparing foods several hours before serving; inadequate reheating of leftovers

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Clostridium perfringens enteritis	Endoenterotoxin formed during sporulation of *C. perfringens* in intestines; organism in feces of humans, other animals, and in soil	8 to 22 h, typically 10 h	Abdominal pain, diarrhea	Cooked meat, poultry, gravy, sauces, meat-containing soups, refried beans	Stools	Storing cooked foods at room temperature; storing cooked foods in large containers in refrigerators; holding foods at warm (bacterial-incubating) temperatures; preparing foods several hours before serving; inadequate reheating of leftovers
Incubation (latency) period usually between 18 and 72 h						
Bacteria						
Aeromonas diarrhea	*Aeromonas hydrophila*	1 to 2 days	Water diarrhea, abdominal pain, nausea, chills, headache	Fish, shellfish, snails, water	Stools	Contamination of foods by sea or surface water
Campylobacteriosis	*Campylobacter jejuni*	2 to 7 days, usually 3 to 5 days	Abdominal cramps, diarrhea (blood and mucus frequently in stools), malaise, headache, myalgia, fever, anorexia, nausea, vomiting. Sequela: Guillain-Barre syndrome	Raw milk, poultry, beef liver, raw clams, water	Stools, rectal swabs, blood	Drinking raw milk; handling raw poultry; eating raw or rare meat or poultry; inadequate cooking or pasteurization; cross contamination from raw meat

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Cholera	*Vibrio cholerae* serogroup O1 classical and El Tor biotypes; serogroup O139	1 to 5 days, usually 2 to 3 days	Profuse watery diarrhea (rice-water stools), vomiting, abdominal pain, rapid dehydration, thirst, collapse, reduced skin turgor, wrinkled fingers, sunken eyes, acidosis	Raw fish, raw shellfish, crustacea; foods washed or prepared with contaminated water; water	Stools, rectal swabs	Obtaining fish and shellfish from sewage-contaminated waters in endemic areas, poor personal hygiene, infected persons touching foods, inadequate cooking, using contaminated water to wash or freshen foods, improper sewage disposal, using night soil as fertilizer
Cholera-like vibrio gastroenteritis	Non O-1/O139 *V. cholerae* and related spp. (e.g., *V. mimicus, V. fluvialus, V. hollisae*)	1 to 5 days	Watery diarrhea (varies from loose stools to cholera-like diarrhea)	Shellfish, fish	Stools, rectal swabs	Obtaining fish and shellfish from sewage-contaminated waters; inadequate cooking; cross contamination
Enterohemorrhagic or verotoxigenic *Escherichia coli* diarrhea	*E. coli* O157:H7, O26, O111, O115, O113	1 to 10 days, typically 2 to 5 days	Watery diarrhea, followed by bloody diarrhea; severe abdominal pain; blood in urine. Sequela: hemolytic uremic syndrome	Hamburgers, raw milk, roast beef, sausages, apple cider, yogurt, sprouts, lettuce, water	Stools, rectal swabs	Ground beef made from meat from infected cattle; ingesting raw meat or milk; inadequate cooking; cross contamination; infected persons touching ready-to-eat food; inadequately drying and fermenting meats

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Enteroinvasive *Escherichia coli* diarrhea	Enteroinvasive-*E. coli* strains	½ to 3 days	Severe abdominal cramps, fever, watery diarrhea (blood and mucus usually present), tenesmus, malaise	Salads and other foods that are not subsequently heated; soft cheeses, water	Stools, rectal swabs	Inadequate cooking; infected persons touching ready-to-eat foods; not washing hands after defecation; storing cooked foods at room temperature; storing cooked foods in large containers in refrigerators; holding foods at warm (bacterial-incubating) temperatures; preparing foods several hours before serving; inadequate reheating of leftovers
Enterotoxigenic *Escherichia coli* diarrhea	Enterotoxigenic-*E. coli* strains	½ to 3 days	Profuse watery diarrhea (blood and mucus absent), abdominal pain, vomiting, prostration, dehydration, low-grade fever	Salads and other foods that are not subsequently heated; soft cheeses, water	Stools, rectal swabs	Inadequate cooking; infected persons touching ready-to-eat foods; not washing hands after defecation; storing cooked foods at room temperature; storing cooked foods in large containers in refrigerators; holding foods at warm (bacterial-incubating) temperatures; preparing foods several hours before serving; inadequate reheating of leftovers; using raw milk for cheese making

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Plesiomonas enteritis	*Plesiomonas shigelloides*	1 to 2 days	Diarrhea (blood and mucus in stools), abdominal pain, nausea, chills, fever, headache, vomiting	Water	Stools, rectal swabs	Inadequate cooking
Salmonellosis	*Salmonella* (>2,000 serovars.) from feces of infected animals	6-72 hours, typically 18-36 h	Abdominal pain, diarrhea, chills, fever, nausea, vomiting, malaise	Poultry, eggs and meat and their products, raw milk and dairy products, other foods contaminated by salmonellae (e.g., sprouts, melons, chocolate, cereal)	Stools, rectal swabs	Storing cooked foods at room temperature; storing cooked foods in large containers in refrigerators; holding foods (including sliced melons) at warm (bacterial-incubating) temperature; inadequate cooking and reheating; preparing foods several hours before serving; cross contamination; improper cleaning of equipment; obtaining foods from contaminated sources; occasionally infected persons touching ready-to-eat foods
Shigellosis	*Shigella dysenteriae,*	½ to 7	Abdominal pain,	Any ready-to-	Stools,	Infected person touching ready-

	S. flexneri, S. boydii, S. sonnei	days, typically 1 to 3 days	diarrhea (stools may contain blood, pus, and mucus), tenesmus, fever, vomiting	eat food contaminated by infected person; frequently salads, poi, water	rectal swabs	to-eat foods, improper refrigeration, inadequate cooking and reheating

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Vibrio parahaemolyticus gastroenteritis	*Vibrio parahaemolyticus*	4 to 96 h, typically 12 h	Abdominal pain, diarrhea, nausea, vomiting, fever, chills, headache	Marine fish, molluscan shellfish, crustacea (raw or recontaminated)	Stool, rectal swabs	Eating raw fin fish and shellfish; inadequate cooking; improper refrigeration; cross contamination; improper cleaning of equipment; using sea water in food preparation or to cool cooked foods
Yersiniosis	*Yersinia enterocolitica, Y. pseudotuberculosis*	1 to 7 days	Abdominal pain (may simulate acute appendicitis); low-grade fever, headache, malaise, anorexia, chills, diarrhea, nausea, vomiting	Raw milk, tofu, water	Stools, rectal swabs	Inadequate cooking or pasteurization; contamination after cooking; surface or spring water as ingredients or for packing foods; cross contamination

			Viruses			
Astrovirus gastroenteritis	Astroviruses from human feces	1 to 2 days	Diarrhea, sometimes accompanied by one or more enteric signs or symptoms	Ready-to-eat foods	Stools, acute and convalescent blood	Failure to wash hands after defecation; infected person touching ready-to-eat foods; inadequate cooking or reheating
Norwalk and small round structured viral gastroenteritis	(See entry under *Upper gastrointestinal signs and symptoms predominate*, page 6)					

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			Incubation Periods from a Few Days to a Few Weeks			
			Parasites			
Amebiasis	*Entamoeba histolytica*	Few days to several months, typically 2 to 4 wk	Mild to severe gastroenteritis; abdominal pain, constipation or diarrhea (stools contain blood and mucus), fever, chills, skin ulcers	Raw fruit, vegetable or seafood salads	Stools, blood	Poor personal hygiene, infected persons touching ready-to-eat foods; inadequate cooking and reheating

Anisakiasis	*Anisakis, pseudoterranova*	4 to 6 wk	Stomach pain, nausea, vomiting abdominal pain, diarrhea, fever	Rock fish, herring, cod, salmon, squid, sushi	Stools	Ingestion of raw fish, inadequate cooking
Beef tapeworm infection (Taeniasis)	*Taenia saginata* from flesh of infected cattle	8 to 14 wk	Vague discomfort, hunger pains, loss of weight, abdominal pain	Raw or insufficiently cooked beef	Stools	Lack of or proper meat inspection; inadequate cooking; inadequate sewage disposal, contaminated pastures
Cyclosporosis	*Cyclospora cayetanensis*	1-11 days, typically 7 days	Prolonged watery diarrhea, weight loss, fatigue, nausea, anorexia, abdominal cramps	Raspberries, lettuce, basil, water	Stools	Sewage contaminated irrigation or spraying water suspected; washing fruits with contaminated water; possibly, handling foods that are not subsequently heated

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Cryptosporidium	*Cryptosporidium parvum*	1-12 days, usually 7 days	Profuse watery diarrhea, abdominal pain, anorexia, vomiting, low-grade fever	Apple cider, water	Stools, intestinal biopsy	Inadequate sewage or animal waste disposal; contamination by animal manure; contaminated water; inadequate filtration of water

Fish tapeworm infection (Diphyllobothriasis)	*Diphyllobothrium latum* from fresh of infested fish	5 to 6 wk	Vague gastrointestinal discomfort, anemia may occur	Raw or insufficiently cooked freshwater fish (perch, pike, turbot, trout, salmon)	Stools	Inadequate cooking; improper sewage disposal; sewage-contaminated lakes
Giardiasis	*Giardia lamblia*	5 to 25 days, typically 7 to 10 days	Diarrhea (pale, greasy, malodorous stools), abdominal pain, bloating, nausea, weakness, vomiting, dehydration, fatigue, weight loss, fever	Salmon, salads, water	Stools	No or inadequate hand washing after defecation; infected persons handling ready-to-eat foods; inadequate sewage disposal; using untreated surface water supplies as ingredient or for processing
Pork tapeworm infection (Taeniasis)	*Taenia solium* from flesh of infected swine	8 to 14 wk	Vague discomfort, hunger pains, weight loss	Raw or insufficiently cooked pork	Stools	Lack of improper meat inspection; inadequate cooking; improper sewage disposal; contaminated pastures

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
NEUROLOGICAL SYMPTOMS AND SIGNS (VISUAL DISTURBANCES, TINGLING, AND/OR PARALYSIS) OCCUR[c]						
Incubation (latency) period usually less than 1 h						
Fungi						
Ibotenic acid group of mushroom poisoning	Ibotenic acid and muscinol in some mushrooms (mushroom strains are different from those cited on pages 1 and 5)	30 to 60 min	Drowsiness and state of intoxication, confusion, muscular spasms, delirium, visual disturbances	*Amanita muscaria, A. pantherina* and related species of mushrooms		Eating *A. muscaria* and related species of mushrooms; eating unknown varieties of mushrooms; mistaking toxic mushrooms for edible varieties; seeking hallucinogenic effects
Muscarine group of mushroom poisoning	Muscarine in some mushrooms (mushroom strains are different from those cited on pages 1 and 5)	15 min to few h	Excessive salivation, perspiration, tearing, reduced pressure, irregular pulse, constricted pupils, blurred vision, asthmatic breathing	*Clitocybe dealbata, C. rivulosa* and many species of *Inocybe* and *Boletus* mushrooms		Eating muscarine group of mushrooms; eating unknown varieties of mushrooms; mistaking toxic mushrooms for edible mushrooms
Chemicals						
Organophosphorous poisoning	Organic phosphorous insecticides (such as parathion, TEPP, diazinon, malathion)	Few min to few h	Nausea, vomiting, abdominal cramps, diarrhea, headache, nervousness, blurred vision, chest pain, cyanosis, confusion,	Any accidentally-contaminated food	Blood, urine, fat biopsy	Spraying foods just before harvesting, storing insecticides in same area as foods; mistaking pesticides for dried foods

			twitching, convulsions			
Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Carbamate poisoning	Carbamyl (sevin), Temik (aldicarb)	½ h	Epigastric pain, vomiting, abnormal salivation, sweating, twitching, fasciculations, contractions of pupils, muscular incoordination	Watermelons, cucumbers, any accidentally-contaminated food	Blood, urine	Inappropriate application for vine foods; storing insecticides in same area as foods; mistaking pesticides for powdered foods
Paralytic/neurologic shellfish poisoning	Saxitoxin and similar toxins from dinoflagellates *Alexandrium* and *Gymnodinium* species	Few min to 30 min	Tingling, burning, numbness around lips and finger tips, giddiness, incoherent speech, difficulty standing, respiratory paralysis	Mussels, clams, scallops	Gastric washing	Harvesting shellfish from waters with high concentration of *Alexandrium* or *Gymnodinium* species (Red tides)
Tetrodotoxin (Fugu/Puffer) poisoning	Tetrodotoxin from intestines and gonads of puffer-type fish	10 min to 3 h	Tingling sensation of fingers and toes; dizziness, pallor, numbness of mouth and extremities, gastrointestinal symptoms,	Puffer-type fish		Eating puffer-type fish; failure to effectively remove intestines and gonads from puffer-type fish if they are to be eaten

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			hemorrhage, desquamation of skin, fixed eyes, twitching, paralysis, cyanosis; fatalities occur			
			Plant toxicants			
Jimson weed	Tropane alkaloids	Less than 1 h	Abnormal thirst, photophobia, distorted sight, difficulty speaking, flushing, delirium, coma, rapid heart beat	Any part of jimson weed; tomatoes grafted to jimson weed stock	Urine	Eating any part of jimson weed or eating tomatoes from tomato plant grafted to jimson weed stock
Water hemlock poisoning	Resin and cicutoxin in hemlock root *Cicuta virosa, C. masculate,* and *C. douglasii*	15 to 60 min	Excessive salivation, nausea, vomiting, stomach pain, frothing at mouth, irregular breathing, convulsions, respiratory paralysis	Root of water hemlock	Urine	Eating water hemlock; mistaking water hemlock root for wild parsnip, sweet potato, or carrot
			Incubation (latency) period usually between 1-6 h			
			Chemicals			
Chlorinated hydrocarbon poisoning	Chlorinated hydrocarbon insecticides	30 min to 6 h	Nausea, vomiting, parasthesia, dizziness, muscular	Any accidentally-contami-	Blood, urine, stools, gastric	Storing insecticides in same area as food; mistaking pesticides for dried foods

			weakness, anorexia, weight loss, confusion	nated food	washing	

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			Marine Plankton			
Ciguatera poisoning	Ciguatoxin in fatty tissues in head and flesh of tropical marine fish. From marine plankton	3 to 5 h, sometimes longer	Gastrointestinal symptoms which disappear in a few days; tingling and numbness of mouth and limbs, muscular and joint pain, dizziness, cold-hot sensations, rash, weakness, slow heartbeat, prostration, paralysis; neurological problems may last several days; deaths occur	Numerous varieties of tropical fish, e.g., barracuda, grouper, red snapper, amber jack, goat-fish, skipjack, parrotfish		Eating fatty tissues in head flesh of tropical reef fishes; usually large reef fish are more commonly toxic. (The more toxic regions are in the South Pacific and Indian Oceans and the Caribbean Sea.)

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Incubation (latency) period usually between 12 to 72 h						
Bacteria						
Botulism	Neurotoxins A, B, E, and F of *Clostridium botulinum*; spores found in soil, fresh-water mud and animals	2 h to 8 days, typically 18 to 36 h	Gastrointestinal symptoms may precede neurological symptoms. Vertigo, double or blurred vision, dryness of mouth, difficult swallowing, speaking and breathing; descending muscular weakness, constipation, dilated or fixed pupils, respiratory paralysis; fatalities occur	Canned low-acid foods (usually home canned); smoked fish; cooked potatoes; onions, garlic in oil, frozen pot pies, meat loaf, stew left overnight in ovens without heat; fermented fish eggs, fish, marine mammals, muskrat tails, seal flippers, uneviscerated fish	Blood, stool, gastric washing	Inadequate heat processing of canned foods and smoked fish; post-processing contamination, uncontrolled fermentations; improper curing of hams and fish; holding foods at room and warm temperatures

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Incubation (latency) period usually greater than 72 h						
Chemicals						
Mercury poisoning	Methyl and ethyl mercury compounds from industrial waste and organic mercury in fungicides	1 wk or longer	Numbness, weakness of legs, spastic paralysis, impaired vision, blindness, coma	Grains treated with mercury-containing fungicide; pork, fish and shellfish exposed to mercury compounds	Urine, blood, hair	Fish harvested from water polluted with mercury compounds; feeding animals grains treated with mercury fungicides; eating mercury-treated grains or meat from animals fed such grains
Triorthocresyl phosphate poisoning	Triorthocresyl phosphate used as extracts or as oil substitute	5 to 21 days, mean 10 days	Gastrointestinal symptoms, leg pain, ungainly high-stepping gait, foot and wrist drop	Cooking oils, extracts and other foods contaminated with triorthocresyl phosphate	Biopsy of gastronemisus muscle	Using compounds as food extractant or as cooking or salad oil
GENERALIZED INFECTION SIGNS AND SYMPTOMS (FEVER, CHILLS, AND/OR MALAISE) OCCUR						
Incubation period usually between 12-72 h						
Bacteria						
Vibrio vulnificus infection	*Vibrio vulnificus*	16 h	Septicemia, fever, chills, malaise,	Raw oysters and clams	Blood	Persons with liver ailments eating raw shellfish

			prostration; pre-existing liver disease in cases typical			
Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			Incubation (latency) period usually greater than 1 week			
			Bacteria			
Brucellosis	*Brucella abortus, B. melitensis* and *B. suis* from tissues and milk of infected animals	7 to 21 days	Fever, chills, sweating, weakness, malaise, headache, muscle and joint pain, loss of weight	Raw milk, goat cheese made from unpasteurized milk	Blood	Failure to pasteurize milk, livestock infected with brucellae
Listeriosis	*Listeria monocytogenes*	3 to 70 days, usually 4 to 21 days	Fever, headache, nausea, vomiting, stillbirths, meningitis, encephalitis, sepsis	Coleslaw, milk, soft cheese, pate, turkey franks, processed meats	Blood, urine	Inadequate cooking; failure to properly pasteurize milk; prolonged refrigeration
Typhoid or paratyphoid fevers	*Salmonella typhi* for typhoid from feces of infected humans; other serovars. (e.g., *paratyphi A, choleraesuis, enteritidis*) for paratyphoid from infected	7 to 28 days, usually 14 days	Continued fever, malaise, headache, cough, nausea, vomiting, anorexia, abdominal pain, chills, rose spots, constipation or bloody diarrhea.	Shellfish; any food contaminated by infected person, raw milk, post-process-con-	Stools, rectal swabs, blood in incubatory and early acute phase, urine in acute phase	Infected persons touching foods; failure to wash hands after defecation; inadequate cooking; improper refrigeration; improper sewage disposal; obtaining foods from unsafe sources; harvesting shellfish from sewage-contaminated waters

	humans or other animals		Sequela: reactive arthritis	taminated meat, cheese, watercress, water		

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			Viruses			
Hepatitis A	Hepatitis A virus	15 to 50 days, usually 25-30	Fever, malaise, lassitude, anorexia, nausea, abdominal pain, jaundice, dark urine, light-colored stools	Raw shellfish, any food contaminated by infected person	Stools, urine, blood	Infected persons touching foods; failure to wash hands after defecation; inadequate cooking; harvesting shellfish from sewage-contaminated waters; improper sewage disposal
Hepatitis E	Hepatitis E virus	15 to 65 days, usually 35-40	Similar to above (high mortality for pregnant women)	Raw shellfish, any food contaminated by infected person	Stools, urine, blood	Infected persons touching foods; failure to wash hands after defecation; inadequate cooking; harvesting shellfish from sewage-contaminated waters; improper sewage disposal

			Parasites			
Angiostrongyliasis (eosinophilic meningo-encephalitis)	*Angiostrongylus cantonensis* (rat lung worm) from rodent feces and soil	14 to 16 days	Gastroenteritis, headache, stiff neck and back, low-grade fever	Raw crabs, slugs, prawns, shrimp, snails	Blood	Ingesting raw foods, inadequate cooking
Toxoplasmosis	*Toxoplasma gondii* from tissue and animal	10 to 13 days	Fever, headache, myalgia, rash	Raw or insuf-ficiently-cooked beef, lamb, wild pig, venison	Biopsy of lymph nodes, blood	Ingesting raw meat, inadequate cooking

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
Trichinosis	*Trichinella spiralis* (roundworm) from flesh of infected swine, bear, walrus	4 to 28 days, mean 9 days	Gastroenteritis, fe-ver, edema about eyes, muscular pain, chills, pro-stration, labored breathing	Pork, bear meat, walrus flesh; cross contaminated ground beef and lamb, often in grinders	Blood, muscle biopsy, skin test	Eating raw or inadequately cooked pork or bear meat; inadequate cooking or heat processing; feeding uncooked or inadequately heat-processed garbage to swine; failure to clean grinders between grinding pork and other meats

ALLERGIC-TYPE SYMPTOMS AND SIGNS (FACIAL FLUSHING AND/OR ITCHING) OCCUR
Incubation (latency) period usually less than 1 h
Bacterial (and animal) agents

Histamine poisoning (scombroid poisoning)	Histamine-like substance produced by *Proteus* spp. and other bacteria	Few min to 1 h	Headache, dizziness, nausea, vomiting, peppery taste, burning throat, facial swelling and flushing, stomach pain, diarrhea, itching skin	Tuna, mackerel, Pacific dolphin (mahi mahi), blue-fish, cheese		Inadequate cooling; improper refrigeration of fish; improper curing of cheese

Illness	Etiologic agent and source	Incubation or latency period[a]	Signs and symptoms[a]	Foods usually involved[b]	Specimen to collect	Factors contributing to food-borne outbreaks
			Chemicals			
Monosodium glutamate poisoning	Excessive amounts of monosodium glutamate (MSG)	Few min to 1 h	Burning sensation in back of neck, forearms, chest; feeling of tightness in chest, tingling, flushing, dizziness, headache, nausea	Foods seasoned with MSG		Using excessive amounts of MSG as flavor intensifier. ONLY certain individuals are sensitive to MSG

Nicotinic acid (niacin) poisoning	Vitamin, sodium nicotinate used as color preservative	Few min to 1 h	Flushing, sensation of warmth, itching, abdominal pain, puffing of face and knees	Meat or other food in which sodium nicotinate has been added, including baby food and baked goods	Using sodium nicotinate as color preservative, improper mixing

[a] Symptoms and incubation periods will vary with the individual and group exposed because of resistance, age and nutritional status of individuals, number of organisms or concentration of poison ingested, amount of food eaten, and pathogenicity and virulence of strain of microorganism or toxicity of chemical involved. Several of the illnesses exhibit additional symptoms and have incubation periods that are shorter or longer than stated.
[b] Collect sample foods suspected as being the vehicle or contaminated with foodborne pathogens.
[c] Carbon monoxide poisoning may simulate this condition. Patients who have been in closed cars with motors running or have been in rooms with improperly vented heaters are subject to exposure to carbon monoxide.

Guidelines for Release of Information About an Outbreak

Public Announcement of Exposure During a Disease Outbreak

It is important to remember that a public announcement of an outbreak will have several immediate and significant consequences.

1. It will cause concern, both rational and irrational, in the public.

2. It will cause a possibly catastrophic impact to any establishment specifically named as associated with the outbreak.

3. It will adversely impact any business establishments that are even tangentially linked with the announcement (i.e., other restaurants from the same franchise or with similar sounding names).

4. It may result in a loss of cooperation from some of the principals involved in the outbreak (i.e., restaurant owners, cases who have been contacted by lawyers, etc.).

5. It will increase the flow of inquiries from the public, thereby absorbing valuable resources that could otherwise be directed at combating the outbreak.

Regardless of those consequences, it is sometimes necessary to make a public announcement of an outbreak situation. Following are guidelines, adapted from the Centers for Disease Control and Prevention (CDC) guidelines for announcing a public clinic, which can be used to help decide if a public announcement is appropriate.

All of the following criteria should be met when considering a public announcement.

1. Does the possibility exist that the public has been exposed?

   Did an infectious person handle food, without gloves, that did not receive further cooking before consumption? Examples are:

   - Lettuce, tomatoes or other garnishes on sandwiches that receive no further heating
   - Salads, vegetables and fruits at salad bars
   - Sliced, cooked foods, such as ham or roast beef, that may be contaminated during slicing or boning procedures
   - Cold cuts
   - Cake icing
   - Ice that is scooped by hand or with a glass or contaminated scoop
   - Condiments or garnishes for drinks (olives, cherries, lime wedges, etc.)

2. Are the hygienic practices of the food handler known to be deficient, or did the infected person work while having diarrhea?

   A subjective evaluation of the infected person's hygiene may consider such things as:
   - Appearance of the person's home and living conditions
   - Personal cleanliness, especially the hands and fingernails
   - Personal history of handwashing, especially after bowel movements (may be unreliable)
   - Personal recall of handwashing facilities (color of soap, hot/cold water availability, location of towel dispenser)
   - Availability of toilet paper, disposable towels, soap, warm water, and unobstructed access to handwashing facilities in the restroom facilities and food preparation area
   - History of diarrhea while working

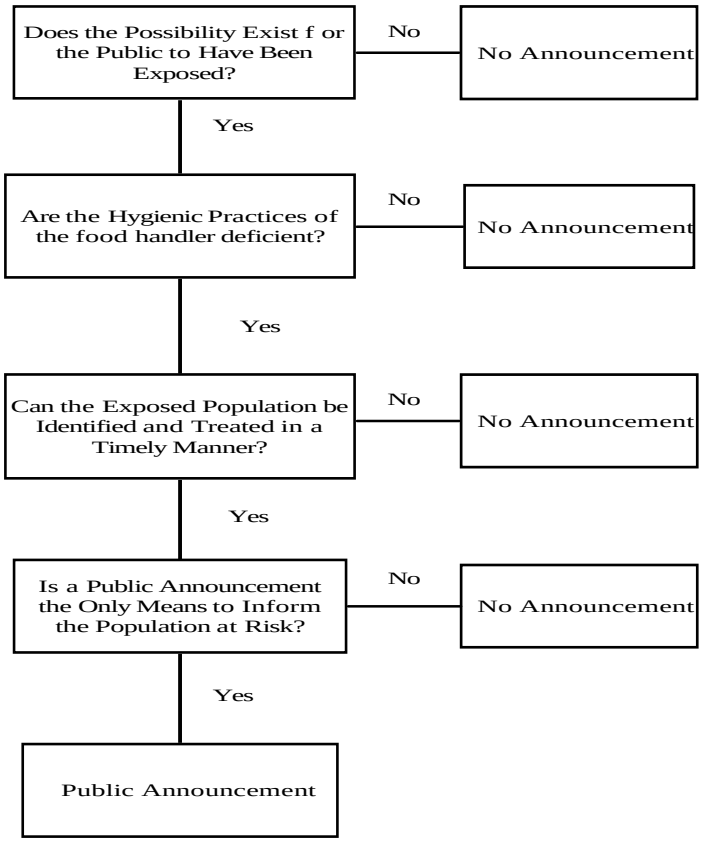
3. Can the exposed population be identified and treated in a timely manner?
   - Is there an effective preventive treatment for the illness? (Including education regarding the means of transmission and prevention of spread to secondary cases.)
   - Can such a treatment be administered during the time period for which it would be effective (i.e., within 2 weeks of exposure for IG, etc.)?
   - Are sufficient resources available to administer the prophylactic treatment?

4. Is a public announcement the only means available to inform the population at risk?
   - Is the entire population at risk known?
   - If so, is there another *practical* means to contact them in a timely manner?

Note: If a public announcement is deemed necessary, good risk communication is essential. Contact the District Communicable Disease Coordinator to request technical assistance from public information staff.

Response to Requests for Release of Information Regarding a Disease Outbreak

After an outbreak investigation has been completed, information about the outbreak and its source will be released by the Section for Disease Control and Environmental Epidemiology upon request, in accordance with state and federal laws governing the release of government information. Individual patients may request their personal records, but individuals will not be identified in any other release of information.


Does the Possibility Exist f or the Public to Have Been Exposed?
No
No Announcement
Yes
Are the Hygienic Practices of the food handler deficient?
No
No Announcement
Yes
Can the Exposed Population be Identified and Treated in a Timely Manner?
No
No Announcement
Yes
Is a Public Announcement the Only Means to Inform the Population at Risk?
No
No Announcement
Yes
Public Announcement

Prompts For After-Action Evaluation

The outbreak response should be evaluated soon after the outbreak is over. All units/agencies that were involved in the investigation should be represented in the discussion.

Pre-Outbreak Preparation:

- Was an outbreak investigation team established in advance?
- How well were staff prepared for their duties?
- How accessible were the materials needed to work the outbreak, including a telephone contact directory?
- What was learned about the local surveillance system during the outbreak?
- Discuss any barriers or problems; identify and implement needed improvements.

Initial Outbreak Detection:

- Was the outbreak detected in a timely manner?
- Was appropriate information gathered at the time of notification, or upon initial detection via surveillance data?
- Discuss any barriers or problems; identify and implement needed improvements.

Determining Extent of Illness:

- Was surveillance broadened appropriately and if so how?
- How cooperative were potential reporters?
- How efficient was the system set up for reporting of additional cases? (easy to access, timely, fast)
- How complete and appropriate was the information gathered for each case?
- Discuss any barriers or problems; identify and implement needed improvements.

Determining Transmissibility of Agent:

- Was the correct determination made regarding person-to-person and/or environmental transmissibility of agent?
- Were appropriate actions initiated?
- Discuss any barriers or problems; identify and implement needed improvements.

Investigation Planning:

- Were all the appropriate team members included?
- How clear were roles and responsibilities?
- How good was communication between team members?
- Review the process of hypothesis development.
- How timely was the outbreak investigation form (questionnaire) development? Were all the necessary questions included?

- How appropriate was the investigation design, given what you know now? How were necessary refinements made as the investigation proceeded?
- Discuss any barriers or problems; identify and implement needed improvements.

Investigation Process:

- How prompt and efficient was the investigation?
- Were adequate resources assigned to the investigation tasks?
- Were all the appropriate team members included?
- Evaluate the quality and timeliness of the information collected, including interviews, laboratory testing and environmental inspection results.
- Evaluate the appropriateness and timeliness of laboratory specimen collection and testing.
- How were well persons (controls) recruited for the comparison group?
- Discuss any barriers or problems; identify and implement needed improvements.

Case Definition and Data Analysis:

- How well did the case definition serve in the analysis? How was it refined?
- How timely was the process of data analysis?
- Was appropriate technical assistance/consultation sought? If so, how readily available and helpful was it?
- How much "re-work" was needed to get the data in shape for analysis?
- Were the necessary tools (computer software, etc.) readily available?
- Discuss any barriers or problems; identify and implement needed improvements.

Evaluation of Hypothesis:

- Was sufficient data available to properly evaluate the hypothesis?
- Was the hypothesis refined as a result of the analysis?
- If the initial hypothesis was not confirmed, what action was taken?
- Discuss any barriers or problems; identify and implement needed improvements.

Control Measures and Evaluation:

- How appropriate were the selected control measures?
- How effectively were they implemented?
- Was their efficacy evaluated promptly and thoroughly?
- Were appropriate corrections made as a result of the evaluation?
- Discuss any barriers or problems; identify and implement needed improvements.

Report Preparation and Distribution:

- Was the final report timely, thorough and professionally written?
- Was consultation needed? Was it sought? Was it readily available?

- Who received copies of the report? Was anyone overlooked?
- Discuss any barriers or problems; identify and implement needed improvements.

Special Circumstances:

- If a public disclosure of the outbreak was made, how was that handled?
- If this was a multi-state outbreak, were the appropriate procedures followed?
- Discuss any barriers or problems; identify and implement needed improvements.

Protocol for Conducting Multiple, Simultaneous Communicable Disease Investigations

In Missouri, local public health agencies (LPHAs) hold the primary responsibility for conducting communicable disease investigations in their jurisdictions. The Missouri Department of Health and Senior Services (DHSS), Bureau of Communicable Disease Control and Prevention (BCDCP) staff provide guidance, recommendations, and support to LPHAs as requested during investigations of communicable diseases. The State of Missouri is divided into five districts for the purposes of communicable disease investigations, tuberculosis control, and bioterrorism preparedness and response. BCDCP epidemiology specialists located in each district are the primary point of contact and support for the LPHAs. For a map of these districts, please see the following: BCDCP District Map. In addition, the BCDCP epidemiology specialists provide epidemiologic support for local investigations if the scope of the investigation exceeds the LPHAs capacity to respond. BCDCP support is made available to LPHAs, medical providers, and other public health partners 24 hours per day / 7 days per week, including weekends and holidays, through the DHSS Emergency Response Center by calling (800/392-0272).

BCDCP staff is often more directly involved in the investigations pertaining to special circumstances such as healthcare-associated infections and emerging or exotic diseases. When disease investigations span multiple local jurisdictions or states, BCDCP staff generally serves in a coordinating role to lead the investigation in coordination with other public health partners including, but not limited to, LPHAs, other state health departments, and federal partners at the Centers for Disease Control and Prevention and U.S. Food and Drug Administration (FDA). DHSS maintains the capacity to conduct multiple, simultaneous infectious disease case and/or outbreak investigations. BCDCP is staffed by 12 epidemiology specialists who are assigned responsibility for investigations occurring in their respective districts. The BCDCP epidemiology specialists all have the capacity and tools needed to work remotely in support of investigations occurring in other jurisdictions. Additional epidemiology support is provided from other BCDCP epidemiology specialists, management, and the Missouri State Epidemiologist.

In the event of a large scale event exceeding a program area's capacity to respond, additional support and resources from other program areas within DHSS will be made available. The incident command system (ICS) has been used to ensure resources are available in a streamlined and coordinated response to large events in Missouri, such as the tornado in Joplin and other natural disasters. The ICS can be utilized when multiple, simultaneous investigations arise to streamline the capacity to conduct these investigations. Training in ICS is required for all BCDCP epidemiology specialists and management. In addition, Missouri is one of 19 states to receive a FDA grant to develop a Rapid Response Team to assist in the multi-disciplinary response required for large, complex outbreaks of foodborne illnesses. The Missouri Rapid Response Team functions through the activation of ICS in accordance with established policies and procedures.

DHSS in collaboration with the LPHAs in Missouri have consistently maintained and demonstrated the capacity to investigate multiple simultaneous communicable disease events. During the 10 year period of 2007 – 2016, approximately 84 communicable disease outbreaks were investigated annually in Missouri. Many of these investigations occurred simultaneously and concurrent with the responses to emergent, high-priority public health threats, such as influenza A H1N1, Ebola, and Zika. DHSS will continue to maintain and enhance the capacity to conduct multiple, simultaneous communicable disease investigations.

Sample Line List

Unit _____ **Month** _____

Resident Name	Age	Sex		Room #	Infection Site					Date*/Lab Pathogen	Date/ Symptoms	Predisposing Factors	Date/ Treatment	Approp**		Resolved	
		M	F		URI	LRI	UTI	Skin	Other					Yes	No	Yes	No
Totals																	

Total Resident Days for Month _____

* Date of Specimen Collection

** Appropriate = Yes, Organism Sensitive to Antibiotic

REPORT OF OUTBREAK OF SUSPECTED VIRAL GASTROENTERITIS

NOTE: This form is no longer being used by the SPHL - 11/29/2012.