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.

➢ 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 Illnesses 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 12).
   - No →
     - Focus investigation on potential for person-to-person transmission.
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 District 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.
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- 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.

   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**

**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**


**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](http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5304a1.htm)

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](http://www.cdc.gov/mmwr/preview/mmwrhtml/SS4901a3.htm)


Guidelines for Submitting Clinical Laboratory Specimens

Summary of Clinical Specimen Transport

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

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](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°- 4° C and transport them in a sample chest with suitable refrigerant capable of maintaining the sample at 0°- 4° 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 each sample. 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. If the initial specimen is negative by immunodiagnostic testing of the stool, no additional specimens need to be tested.

**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 food handlers, 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 food handlers, patient care and child care workers from work for 7 days after onset of jaundice. This also applies to ill contacts of cases. In the absence of jaundice, exclude infected food handlers, 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 food handling.

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 food handlers, 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 food handler, 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 food handling, 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 food handling.

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

**Staphylococcal Food Poisoning**

Transmission. May be transmitted by infected or colonized food handlers.

Exclusion. Exclude ill persons from handling food while symptomatic. Exclude food handlers 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 food handler 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 food handlers 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
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.
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.

**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


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

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**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.

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<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
<th>Incubation or latency period</th>
<th>Signs and symptoms</th>
<th>Foods usually involved</th>
<th>Specimen to collect</th>
<th>Factors contributing to foodborne outbreaks</th>
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</thead>
<tbody>
<tr>
<td><strong>UPPER GASTROINTESTINAL TRACT SIGNS AND SYMPTOMS [NAUSEA, VOMITING] PREDOMINATE</strong></td>
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<tr>
<td>Incubation (latency) period usually less than 1 hour</td>
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<tr>
<td>Gastrointestinal irritating group mushroom poisoning</td>
<td>Possibly resin-like substances in some mushrooms (mushroom species are different from those cited on pages 5 and 15)</td>
<td>Few min to 1 h</td>
<td>Nausea, vomiting, retching, diarrhea, abdominal pain</td>
<td>Many varieties of wild mushrooms</td>
<td>Vomit</td>
<td>Eating unknown varieties of wild mushrooms; mistaking toxic mushrooms for edible varieties</td>
</tr>
<tr>
<td>Antimony poisoning</td>
<td>Antimony in gray enamelware</td>
<td>Few min to 1 h</td>
<td>Vomiting, abdominal pain, diarrhea</td>
<td>High-acid foods and beverages</td>
<td>Vomit, stools, urine</td>
<td>Purchasing/using antimony-containing utensils; storing high-acid foods in chipped gray enamelware</td>
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<tr>
<td>Illness</td>
<td>Etiologic agent and source</td>
<td>Incubation or latency period</td>
<td>Signs and symptoms</td>
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<td>Factors contributing to food-borne outbreaks</td>
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<tr>
<td>Cadmium poisoning</td>
<td>Cadmium in plated utensils</td>
<td>15-30 min</td>
<td>Nausea, vomiting, abdominal cramps, diarrhea, shock</td>
<td>High-acid foods and beverages; metal-colored cake decorations</td>
<td>Vomitus, stools, urine, blood</td>
<td>Purchasing/using cadmium-containing utensils; storing high-acid beverages in cadmium containers</td>
</tr>
<tr>
<td>Copper poisoning</td>
<td>Copper in pipes and utensils; old ice cream machines; old dairy white metal</td>
<td>Few min to few h</td>
<td>Metallic taste, nausea, vomiting (green vomitus), abdominal pain diarrhea, chills</td>
<td>High-acid foods and ice cream (ices) and beverages</td>
<td>Vomitus, gastric washings, urine, blood</td>
<td>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</td>
</tr>
<tr>
<td>Fluoride poisoning</td>
<td>Sodium fluoride in insecticides and rodenticides</td>
<td>Few min to 2 h</td>
<td>Salty or soapy taste, numbness of mouth, vomiting, diarrhea, dilated pupils, spasms, pallor, shock, collapse</td>
<td>Any accidentally-contaminated foods, particularly dry foods (such as dry milk, flour, baking powder, cake mixes)</td>
<td>Vomitus, gastric washing</td>
<td>Storing insecticides in same area as foods, mistaking pesticides for powdered foods</td>
</tr>
<tr>
<td>Illness</td>
<td>Etiologic agent and source</td>
<td>Incubation or latency period</td>
<td>Signs and symptoms</td>
<td>Foods usually involved</td>
<td>Specimen to collect</td>
<td>Factors contributing to food-borne outbreaks</td>
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<tr>
<td>Lead poisoning</td>
<td>Lead in earthenware vessels; pesticides, paint, plaster, putty, soldered joints</td>
<td>30 min or longer</td>
<td>Metallic taste, burning of mouth, abdominal pain, bloody or black stools, foul breath, blue gum line, shock</td>
<td>High-acid foods and beverages stored in lead-containing vessels; any accidentally contaminated food</td>
<td>Vomitus, gastric washing, stools, blood, urine</td>
<td>Purchasing or using lead-containing vessels; storing high-acid foods including wine in lead-containing vessels; storing pesticides in same area as food</td>
</tr>
<tr>
<td>Tin poisoning</td>
<td>Tin in tinned cans or containers</td>
<td>30 min to 2 h</td>
<td>Bloating, nausea, vomiting, abdominal cramps, diarrhea, headache</td>
<td>High-acid foods and beverages</td>
<td>Vomitus, gastric washing, urine, blood, stools</td>
<td>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</td>
</tr>
<tr>
<td>Zinc poisoning</td>
<td>Zinc in galvanized containers</td>
<td>Few min to few h</td>
<td>Pain in mouth and abdomen, nausea, vomiting, dizziness</td>
<td>High-acid foods and beverages</td>
<td>Vomitus, gastric washing, urine, blood, stools</td>
<td>Storing high-acid foods in galvanized cans</td>
</tr>
<tr>
<td>Illness</td>
<td>Etiologic agent and source</td>
<td>Incubation or latency period</td>
<td>Signs and symptoms</td>
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<tr>
<td><strong>Bacillus cereus</strong> gastroenteritis</td>
<td>Exotoxin of <em>B. cereus</em>; organism in soil (strains differ from those cited on page 7)</td>
<td>½ to 5 h</td>
<td>Nausea, vomiting, occasionally diarrhea</td>
<td>Boiled or fried rice, cooked cornmeal dishes, porridge, pasta</td>
<td>Vomitus, stool</td>
<td>Storing cooked foods at room temperature; storing cooked foods in large containers in refrigerator; preparing foods several hours before serving</td>
</tr>
<tr>
<td><strong>Staphylococcal intoxication</strong></td>
<td>Exoenterotoxins A, B, C, D, E, F, or H of <em>Staphylococcus aureus</em>. Staphylococci from nose, skin and lesions of human beings and other animals and from udders of cows</td>
<td>1 to 8 h, typically 2 to 4 h</td>
<td>Nausea, vomiting, retching, abdominal pain, diarrhea, prostration</td>
<td>Ham, meat and poultry products; cream-filled pastries; whipped butter, cheese; dry milk; food mixtures; high protein leftover foods</td>
<td>Ill: vomitus stools, rectal swabs. Food handlers: nasal swabs, swabs of lesions</td>
<td>Storing cooked foods at room temperature; storing cooked foods in large containers in refrigerator; 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</td>
</tr>
</tbody>
</table>

**Incubation (latency) period usually between 1 and 6 h**

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

**Chemicals**

**Incubation (latency) period usually between 7 and 12 h**

**Fungi**
### Incubation (latency) period between 13 and 72 h

#### Viruses

<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
<th>Incubation or latency period</th>
<th>Signs and symptoms</th>
<th>Foods usually involved</th>
<th>Specimen to collect</th>
<th>Factors contributing to food-borne outbreaks</th>
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</thead>
<tbody>
<tr>
<td>Small round structured virus gastroenteritis</td>
<td>Norwalk, Hawaii, Snow Mountain, Taunton Viruses: Caliciviruses</td>
<td>½ to 3 days, typically 36 hours</td>
<td>Nausea, vomiting, diarrhea, abdominal pain, myalgia, headache, malaise, low-grade fever; duration 36 hours</td>
<td>Human feces</td>
<td>Stools, acute and convalescent blood</td>
<td>Infected persons touching ready-to-eat foods; harvesting shellfish from sewage polluted waters; inadequate sewage disposal; using contaminated water</td>
</tr>
</tbody>
</table>

#### BURNING MOUTH, SORE THROAT AND/OR RESPIRATORY SYMPTOMS AND SIGNS OCCUR

Incubation period less than 1 h

#### Chemicals

<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
<th>Incubation or latency period</th>
<th>Signs and symptoms</th>
<th>Foods usually involved</th>
<th>Specimen to collect</th>
<th>Factors contributing to food-borne outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride poisoning</td>
<td>Calcium chloride freezing mixture for frozen dessert bars</td>
<td>Few min</td>
<td>Burning lips, mouth, throat; vomiting</td>
<td>Frozen dessert bars</td>
<td>Vomitus</td>
<td>Splashing of freezing mixture onto popsicles while freezing; cracks in molds allowing CaCl₂ to penetrate popsicle syrup</td>
</tr>
<tr>
<td>Sodium hydroxide poisoning</td>
<td>Sodium hydroxide in bottle-washing compounds, detergents, drain cleaners, or hair straighteners</td>
<td>Few min</td>
<td>Burning of lips, mouth and throat; vomiting, abdominal pain, diarrhea</td>
<td>Bottled beverages, pretzels</td>
<td>Vomitus</td>
<td>Inadequate rinsing of bottles cleaned with caustic soda; inadequate baking of pretzels</td>
</tr>
</tbody>
</table>

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Missouri Department of Health and Senior Services
Communicable Disease Investigation Reference Manual
<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
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</tr>
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<tbody>
<tr>
<td>Beta-hemolytic streptococcal infections</td>
<td><em>Streptococcus pyogenes</em> from throat and lesions of infected humans</td>
<td>1 to 3 days</td>
<td>Sore throat, fever, nausea, vomiting, rhinorrhea; sometimes a rash. Sequela: rheumatic fever</td>
<td>Raw milk, egg-containing salads</td>
<td>Throat swabs, vomitus</td>
<td>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</td>
</tr>
<tr>
<td>Bacillus cereus enteritis</td>
<td>Enterotoxins of <em>B. cereus</em>. Organisms in soil (strains differ from those cited in page 4)</td>
<td>8 to 16 h, mean 12 h</td>
<td>Nausea, abdominal pain, watery diarrhea</td>
<td>Cereal products, soups, custards and sauces, meatloaf, sausage, cooked vegetables, reconstituted dried potatoes, refried beans</td>
<td>Stools</td>
<td>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</td>
</tr>
</tbody>
</table>

**LOWER GASTROINTESTINAL TRACT SIGNS AND SYMPTOMS [ABDOMINAL CRAMPS, DIARRHEA] PREDOMINATE**

**Incubation (latency) period usually between 7 and 17 h**

**Bacteria**

<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
<th>Incubation or latency period&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Signs and symptoms&lt;sup&gt;a&lt;/sup&gt;</th>
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<td>Enterotoxins of <em>B. cereus</em>. Organisms in soil (strains differ from those cited in page 4)</td>
<td>8 to 16 h, mean 12 h</td>
<td>Nausea, abdominal pain, watery diarrhea</td>
<td>Cereal products, soups, custards and sauces, meatloaf, sausage, cooked vegetables, reconstituted dried potatoes, refried beans</td>
<td>Stools</td>
<td>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</td>
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<td>Specimen to collect</td>
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<tr>
<td>Clostridium perfringens enteritis</td>
<td>Endoenterotoxin formed during sporulation of C. perfringens in intestines; organism in feces of humans, other animals, and in soil</td>
<td>8 to 22 h, typically 10 h</td>
<td>Abdominal pain, diarrhea</td>
<td>Cooked meat, poultry, gravy, sauces, meat-containing soups, refried beans</td>
<td>Stools</td>
<td>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</td>
</tr>
<tr>
<td>Aeromonas diarrhea</td>
<td>Aeromonas hydrophila</td>
<td>1 to 2 days</td>
<td>Water diarrhea, abdominal pain, nausea, chills, headache</td>
<td>Fish, shellfish, snails, water</td>
<td>Stools</td>
<td>Contamination of foods by sea or surface water</td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>Campylobacter jejuni</td>
<td>2 to 7 days, usually 3 to 5 days</td>
<td>Abdominal cramps, diarrhea (blood and mucus frequently in stools), malaise, headache, myalgia, fever, anorexia, nausea, vomiting. Sequela: Guillain-Barre syndrome</td>
<td>Raw milk, poultry, beef liver, raw clams, water</td>
<td>Stools, rectal swabs, blood</td>
<td>Drinking raw milk; handling raw poultry; eating raw or rare meat or poultry; inadequate cooking or pasteurization; cross contamination from raw meat</td>
</tr>
</tbody>
</table>

<sup>a</sup> Incubation (latency) period usually between 18 and 72 h

**Bacteria**
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<tbody>
<tr>
<td>Cholera</td>
<td>Vibrio cholerae serogroup O1 classical and El Tor biotypes; serogroup O139</td>
<td>1 to 5 days, usually 2 to 3 days</td>
<td>Profuse watery diarrhea (rice-water stools), vomiting, abdominal pain, rapid dehydration, thirst, collapse, reduced skin turgor, wrinkled fingers, sunken eyes, acidosis</td>
<td>Raw fish, raw shellfish, crustacea; foods washed or prepared with contaminated water; water</td>
<td>Stools, rectal swabs</td>
<td>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</td>
</tr>
<tr>
<td>Cholera-like vibrio gastroenteritis</td>
<td>Non O-1/O139 V. cholerae and related spp. (e.g., V. mimicus, V. fluviatilis, V. hollisae)</td>
<td>1 to 5 days</td>
<td>Watery diarrhea (varies from loose stools to cholera-like diarrhea)</td>
<td>Shellfish, fish</td>
<td>Stools, rectal swabs</td>
<td>Obtaining fish and shellfish from sewage-contaminated waters; inadequate cooking; cross contamination</td>
</tr>
<tr>
<td>Enterohemorrhagic or verotoxigenic Escherichia coli diarrhea</td>
<td>E. coli O157:H7, O26, O111, O115, O113</td>
<td>1 to 10 days, typically 2 to 5 days</td>
<td>Watery diarrhea, followed by bloody diarrhea; severe abdominal pain; blood in urine. Sequela: hemolytic uremic syndrome</td>
<td>Hamburgers, raw milk, roast beef, sausages, apple cider, yogurt, sprouts, lettuce, water</td>
<td>Stools, rectal swabs</td>
<td>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</td>
</tr>
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<td>Illness</td>
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<tr>
<td>Enteroinvasive <em>Escherichia coli</em> diarrhea</td>
<td>Enteroinvasive-<em>E. coli</em> strains</td>
<td>½ to 3 days</td>
<td>Severe abdominal cramps, fever, watery diarrhea (blood and mucus usually present), tenesmus, malaise</td>
<td>Salads and other foods that are not subsequently heated; soft cheeses, water</td>
<td>Stools, rectal swabs</td>
<td>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</td>
</tr>
<tr>
<td>Enterotoxigenic <em>Escherichia coli</em> diarrhea</td>
<td>Enterotoxigenic-<em>E. coli</em> strains</td>
<td>½ to 3 days</td>
<td>Profuse watery diarrhea (blood and mucus absent), abdominal pain, vomiting, prostration, dehydration, low-grade fever</td>
<td>Salads and other foods that are not subsequently heated; soft cheeses, water</td>
<td>Stools, rectal swabs</td>
<td>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</td>
</tr>
<tr>
<td>Illness</td>
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<tr>
<td>Plesiomonas enteritis</td>
<td><em>Plesiomonas shigelloides</em></td>
<td>1 to 2 days</td>
<td>Diarrhea (blood and mucus in stools), abdominal pain, nausea, chills, fever, headache, vomiting</td>
<td>Water</td>
<td>Stools, rectal swabs</td>
<td>Inadequate cooking</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td><em>Salmonella</em> (&gt;2,000 serovars) from feces of infected animals</td>
<td>6-72 hours, typically 18-36 h</td>
<td>Abdominal pain, diarrhea, chills, fever, nausea, vomiting, malaise</td>
<td>Poultry, eggs and meat and their products, raw milk and dairy products, other foods contaminated by salmonellae (e.g., sprouts, melons, chocolate, cereal)</td>
<td>Stools, rectal swabs</td>
<td>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</td>
</tr>
<tr>
<td>Shigellosis</td>
<td><em>Shigella dysenteriae</em>, ½ to 7</td>
<td>Abdominal pain, Any ready-to-</td>
<td>Stools,</td>
<td>Infected person touching ready-to-eat foods</td>
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</tr>
</tbody>
</table>
### Illnesses Acquired by Ingestion of Contaminated Foods

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<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
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<th>Specimen to collect</th>
<th>Factors contributing to foodborne outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Vibrio parahaemolyticus</em> gastroenteritis</td>
<td><em>Vibrio parahaemolyticus</em></td>
<td>4 to 96 h, typically 12 h</td>
<td>Abdominal pain, diarrhea, nausea, vomiting, fever, chills, headache</td>
<td>Marine fish, molluscan shellfish, crustacea (raw or recontaminated)</td>
<td>Stool, rectal swabs</td>
<td>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</td>
</tr>
<tr>
<td>Yersiniosis</td>
<td><em>Yersinia enterocolitica, Y. pseudotuberculosis</em></td>
<td>1 to 7 days</td>
<td>Abdominal pain (may simulate acute appendicitis); low-grade fever, headache, malaise, anorexia, chills, diarrhea, nausea, vomiting</td>
<td>Raw milk, tofu, water</td>
<td>Stools, rectal swabs</td>
<td>Inadequate cooking or pasteurization; contamination after cooking; surface or spring water as ingredients or for packing foods; cross contamination</td>
</tr>
</tbody>
</table>
### Viruses

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

### Incubation Periods from a Few Days to a Few Weeks

**Parasites**

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<tr>
<td>Amebiasis</td>
<td><em>Entamoeba histolytica</em></td>
<td>Few days to several months, typically 2 to 4 wk</td>
<td>Mild to severe gastroenteritis; abdominal pain, constipation or diarrhea (stools contain blood and mucus), fever, chills, skin ulcers</td>
<td>Raw fruit, vegetable or seafood salads</td>
<td>Stools, blood</td>
<td>Poor personal hygiene, infected persons touching ready-to-eat foods; inadequate cooking and reheating</td>
</tr>
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</tr>
<tr>
<td>Anisakiasis</td>
<td><em>Anisakis, pseudoterranova</em></td>
<td>4 to 6 wk</td>
<td>Stomach pain, nausea, vomiting abdominal pain, diarrhea, fever</td>
<td>Rock fish, herring, cod, salmon, squid, sushi</td>
<td>Stools</td>
<td>Ingestion of raw fish, inadequate cooking</td>
</tr>
<tr>
<td>Beef tapeworm infection (Taeniasis)</td>
<td><em>Taenia saginata</em> from flesh of infected cattle</td>
<td>8 to 14 wk</td>
<td>Vague discomfort, hunger pains, loss of weight, abdominal pain</td>
<td>Raw or insufficiently cooked beef</td>
<td>Stools</td>
<td>Lack of or proper meat inspection; inadequate cooking; inadequate sewage disposal, contaminated pastures</td>
</tr>
<tr>
<td>Cyclosporosis</td>
<td><em>Cyclospora cayetanensis</em></td>
<td>1-11 days, typically 7 days</td>
<td>Prolonged watery diarrhea, weight loss, fatigue, nausea, anorexia, abdominal cramps</td>
<td>Raspberries, lettuce, basil, water</td>
<td>Stools</td>
<td>Sewage contaminated irrigation or spraying water suspected; washing fruits with contaminated water; possibly, handling foods that are not subsequently heated</td>
</tr>
<tr>
<td>Cryptosporidium</td>
<td><em>Cryptosporidium parvum</em></td>
<td>1-12 days, usually 7 days</td>
<td>Profuse watery diarrhea, abdominal pain, anorexia, vomiting, low-grade fever</td>
<td>Apple cider, water</td>
<td>Stools, intestinal biopsy</td>
<td>Inadequate sewage or animal waste disposal; contamination by animal manure; contaminated water; inadequate filtration of water</td>
</tr>
<tr>
<td>Illness</td>
<td>Pathogen</td>
<td>Incubation Period</td>
<td>Symptoms</td>
<td>Source of Infection</td>
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<tr>
<td>Fish tapeworm infection (Diphyllobothriasis)</td>
<td><em>Diphyllobothrium latum</em> from fresh of infested fish</td>
<td>5 to 6 wk</td>
<td>Vague gastrointestinal discomfort, anemia may occur</td>
<td>Raw or insufficiently cooked fresh-water fish (perch, pike, turbot, trout, salmon)</td>
<td>Inadequate cooking; improper sewage disposal; sewage-contaminated lakes</td>
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</tr>
<tr>
<td>Giardiasis</td>
<td><em>Giardia lamblia</em></td>
<td>5 to 25 days, typically 7 to 10 days</td>
<td>Diarrhea (pale, greasy, malodorous stools), abdominal pain, bloating, nausea, weakness, vomiting, dehydration, fatigue, weight loss, fever</td>
<td>Salmon, salads, water</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td>Pork tapeworm infection (Taeniasis)</td>
<td><em>Taenia solium</em> from flesh of infected swine</td>
<td>8 to 14 wk</td>
<td>Vague discomfort, hunger pains, weight loss</td>
<td>Raw or insufficiently cooked pork</td>
<td>Lack of improper meat inspection; inadequate cooking; improper sewage disposal; contaminated pastures</td>
<td></td>
</tr>
</tbody>
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### NEUROLOGICAL SYMPTOMS AND SIGNS (VISUAL DISTURBANCES, TINGLING, AND/OR PARALYSIS) OCCUR

**Incubation (latency) period usually less than 1 h**

#### Fungi

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<tr>
<th>Illness</th>
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<tr>
<td>Ibotenic acid group of</td>
<td>Ibotenic acid and muscinol in some mushrooms (mushroom strains are different from those cited on pages 1 and 5)</td>
<td>30 to 60 min</td>
<td>Drowsiness and state of intoxication, confusion, muscular spasms, delirium, visual disturbances</td>
<td><em>Amanita muscaria, A. pantherina</em> and related species of mushrooms</td>
<td>Blood, urine, fat biopsy</td>
<td>Eating <em>A. muscaria</em> and related species of mushrooms; eating unknown varieties of mushrooms; mistaking toxic mushrooms for edible varieties; seeking hallucinogenic effects</td>
</tr>
<tr>
<td>mushroom poisoning</td>
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<tr>
<td>Muscarine group of</td>
<td>Muscarine in some mushrooms (mushroom strains are different from those cited on pages 1 and 5)</td>
<td>15 min to few h</td>
<td>Excessive salivation, perspiration, tearing, reduced pressure, irregular pulse, constricted pupils, blurred vision, asthmatic breathing</td>
<td><em>Clitocybe dealbata, C. rivulosa</em> and many species of <em>Inocybe</em> and <em>Boletus</em> mushrooms</td>
<td></td>
<td>Eating muscarine group of mushrooms; eating unknown varieties of mushrooms; mistaking toxic mushrooms for edible mushrooms</td>
</tr>
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<tr>
<td>Organophosphorous poisoning</td>
<td>Organic phosphorous insecticides (such as parathion, TEPP, diazinon, malathion)</td>
<td>Few min to few h</td>
<td>Nausea, vomiting, abdominal cramps, diarrhea, headache, nervousness, blurred vision, chest pain, cyanosis, confusion,</td>
<td>Any accidentally-contaminated food</td>
<td></td>
<td>Spraying foods just before harvesting, storing insecticides in same area as foods; mistaking pesticides for dried foods</td>
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<tr>
<td>Carbamate poisoning</td>
<td>Carbamyl (sevin), Temik (aldicarb)</td>
<td>½ h</td>
<td>Epigastric pain, vomiting, abnormal salivation, sweating, twitching, fasciculations, contractions of pupils, muscular incoordination</td>
<td>Watermelons, cucumbers, any accidentally-contaminated food</td>
<td>Blood, urine</td>
<td>Inappropriate application for vine foods; storing insecticides in same area as foods; mistaking pesticides for powdered foods</td>
</tr>
<tr>
<td>Paralytic/neurologic shellfish poisoning</td>
<td>Saxitoxin and similar toxins from dinoflagellates <em>Alexandrium</em> and <em>Gymnodinium</em> species</td>
<td>Few min to 30 min</td>
<td>Tingling, burning, numbness around lips and finger tips, giddiness, incoherent speech, difficulty standing, respiratory paralysis</td>
<td>Mussels, clams, scallops</td>
<td>Gastric washing</td>
<td>Harvesting shellfish from waters with high concentration of <em>Alexandrium</em> or <em>Gymnodinium</em> species (Red tides)</td>
</tr>
<tr>
<td>Tetrodotoxin (Fugu/Puffer) poisoning</td>
<td>Tetrodotoxin from intestines and gonads of puffer-type fish</td>
<td>10 min to 3 h</td>
<td>Tingling sensation of fingers and toes; dizziness, pallor, numbness of mouth and extremities, gastrointestinal symptoms,</td>
<td>Puffer-type fish</td>
<td></td>
<td>Eating puffer-type fish; failure to effectively remove intestines and gonads from puffer-type fish if they are to be eaten</td>
</tr>
<tr>
<td>Illness</td>
<td>Etiologic agent and source</td>
<td>Incubation or latency period</td>
<td>Signs and symptoms</td>
<td>Foods usually involved</td>
<td>Specimen to collect</td>
<td>Factors contributing to food-borne outbreaks</td>
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</tr>
<tr>
<td>Jimson weed</td>
<td>Tropane alkaloids</td>
<td>Less than 1 h</td>
<td>Abnormal thirst, photophobia, distorted sight, difficulty speaking, flushing, delirium, coma, rapid heart beat</td>
<td>Any part of jimson weed; tomatoes grafted to jimson weed stock</td>
<td>Urine</td>
<td>Eating any part of jimson weed or eating tomatoes from tomato plant grafted to jimson weed stock</td>
</tr>
<tr>
<td>Water hemlock poisoning</td>
<td>Resin and cicutoxin in hemlock root</td>
<td>15 to 60 min</td>
<td>Excessive salivation, nausea, vomiting, stomach pain, frothing at mouth, irregular breathing, convulsions, respiratory paralysis</td>
<td>Root of water hemlock</td>
<td>Urine</td>
<td>Eating water hemlock; mistaking water hemlock root for wild parsnip, sweet potato, or carrot</td>
</tr>
</tbody>
</table>

**Incubation (latency) period usually between 1-6 h**

| Chemicals                       |                              | 30 min to 6 h               | Nausea, vomiting, parasthesia, dizziness, muscular | Any accidentally-contaminated | Blood, urine, stools, gastric | Storing insecticides in same area as food; mistaking pesticides for dried foods |

**Plant toxicants**

**Chemicals**

**Division of Community and Public Health**

**Section: 4.0 Diseases and Conditions**

**Updated 12/12**

**Subsection: Illnesses Acquired by Ingestion of Contaminated Foods**

**Missouri Department of Health and Senior Services**

**Communicable Disease Investigation Reference Manual**
<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
<th>Incubation or latency period(^a)</th>
<th>Signs and symptoms(^a)</th>
<th>Foods usually involved(^b)</th>
<th>Specimen to collect</th>
<th>Factors contributing to foodborne outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciguatera poisoning</td>
<td>Ciguatoxin in fatty tissues in head and flesh of tropical marine fish. From marine plankton</td>
<td>3 to 5 h, sometimes longer</td>
<td>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</td>
<td>Numerous varieties of tropical fish, e.g., barracuda, grouper, red snapper, amber jack, goat-fish, skipjack, parrotfish</td>
<td>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.)</td>
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</tr>
</tbody>
</table>
**Illness** | Etiologic agent and source | Incubation or latency period | Signs and symptoms | Foods usually involved | Specimen to collect | Factors contributing to food-borne outbreaks
--- | --- | --- | --- | --- | --- | ---
Botulism | Neurotoxins A, B, E, and F of *Clostridium botulinum*; spores found in soil, freshwater 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

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*Incubation (latency) period usually between 12 to 72 h*

**Bacteria**
<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
<th>Incubation or latency period(^a)</th>
<th>Signs and symptoms(^a)</th>
<th>Foods usually involved(^b)</th>
<th>Specimen to collect</th>
<th>Factors contributing to food-borne outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury poisoning</td>
<td>Methyl and ethyl mercury compounds from industrial waste and organic mercury in fungicides</td>
<td>1 wk or longer</td>
<td>Numbness, weakness of legs, spastic paralysis, impaired vision, blindness, coma</td>
<td>Grains treated with mercury-containing fungicide; pork, fish and shellfish exposed to mercury compounds</td>
<td>Urine, blood, hair</td>
<td>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</td>
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<tr>
<td>Triorthocresyl phosphate poisoning</td>
<td>Triorthocresyl phosphate used as extracts or as oil substitute</td>
<td>5 to 21 days, mean 10 days</td>
<td>Gastrointestinal symptoms, leg pain, ungainly high-stepping gait, foot and wrist drop</td>
<td>Cooking oils, extracts and other foods contaminated with triorthocresyl phosphate</td>
<td>Biopsy of gastrocnemius muscle</td>
<td>Using compounds as food extractant or as cooking or salad oil</td>
</tr>
</tbody>
</table>

**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 |
### Illnesses Acquired by Ingestion of Contaminated Foods

<table>
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<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
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<th>Factors contributing to food-borne outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucellosis</td>
<td><em>Brucella abortus, B. melitensis</em> and <em>B. suis</em> from tissues and milk of infected animals</td>
<td>7 to 21 days</td>
<td>Fever, chills, sweating, weakness, malaise, headache, muscle and joint pain, loss of weight</td>
<td>Raw milk, goat cheese made from unpasteurized milk</td>
<td>Blood</td>
<td>Failure to pasteurize milk, livestock infected with brucellae</td>
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<tr>
<td>Listeriosis</td>
<td><em>Listeria monocytogenes</em></td>
<td>3 to 70 days, usually 4 to 21 days</td>
<td>Fever, headache, nausea, vomiting, stillbirths, meningitis, encephalitis, sepsis</td>
<td>Coleslaw, milk, soft cheese, pate, turkey franks, processed meats</td>
<td>Blood, urine</td>
<td>Inadequate cooking; failure to properly pasteurize milk; prolonged refrigeration</td>
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<tr>
<td>Typhoid or paratyphoid fevers</td>
<td><em>Salmonella typhi</em> for typhoid from feces of infected humans; other serovars. (e.g., <em>paratyphi A, choleraesuis, enteritidis</em>) for paratyphoid from infected</td>
<td>7 to 28 days, usually 14 days</td>
<td>Continued fever, malaise, headache, cough, nausea, vomiting, anorexia, abdominal pain, chills, rose spots, constipation or bloody diarrhea</td>
<td>Shellfish; any food contaminated by infected person, raw milk, post-process-con-</td>
<td>Stools, rectal swabs, blood in incubatory and early acute phase, urine in acute phase</td>
<td>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</td>
</tr>
<tr>
<td>Illness</td>
<td>Etiologic agent and source</td>
<td>Incubation or latency period</td>
<td>Signs and symptoms</td>
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<tr>
<td>Hepatitis A</td>
<td>Hepatitis A virus</td>
<td>15 to 50 days, usually 25-30</td>
<td>Fever, malaise, lassitude, anorexia, nausea, abdominal pain, jaundice, dark urine, light-colored stools</td>
<td>Raw shellfish, any food contaminated by infected person</td>
<td>Stools, urine, blood</td>
<td>Infected persons touching foods; failure to wash hands after defe- cation; inadequate cooking; harvesting shellfish from sewage-contaminated waters; improper sewage disposal</td>
</tr>
<tr>
<td>Hepatitis E</td>
<td>Hepatitis E virus</td>
<td>15 to 65 days, usually 35-40</td>
<td>Similar to above (high mortality for pregnant women)</td>
<td>Raw shellfish, any food contaminated by infected person</td>
<td>Stools, urine, blood</td>
<td>Infected persons touching foods; failure to wash hands after defe- cation; inadequate cooking; harvesting shellfish from sewage-contaminated waters; improper sewage disposal</td>
</tr>
</tbody>
</table>
### Parasites

<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic agent and source</th>
<th>Incubation or latency period</th>
<th>Signs and symptoms</th>
<th>Foods usually involved</th>
<th>Specimen to collect</th>
<th>Factors contributing to foodborne outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiostrongyliasis</td>
<td>Angiostrongylus cantonensis (rat lung worm) from rodent feces and soil</td>
<td>14 to 16 days</td>
<td>Gastroenteritis, headache, stiff neck and back, low-grade fever</td>
<td>Raw crabs, slugs, prawns, shrimp, snails</td>
<td>Blood</td>
<td>Ingesting raw foods, inadequate cooking</td>
</tr>
<tr>
<td>Toxoplasmosis</td>
<td>Toxoplasma gondii from tissue and animal</td>
<td>10 to 13 days</td>
<td>Fever, headache, myalgia, rash</td>
<td>Raw or insufficiently-cooked beef, lamb, wild pig, venison</td>
<td>Biopsy of lymph nodes, blood</td>
<td>Ingesting raw meat, inadequate cooking</td>
</tr>
<tr>
<td>Trichinosis</td>
<td>Trichinella spiralis (roundworm) from flesh of infected swine, bear, walrus</td>
<td>4 to 28 days, mean 9 days</td>
<td>Gastroenteritis, fever, edema about eyes, muscular pain, chills, prostration, labored breathing</td>
<td>Pork, bear meat, walrus flesh; cross contaminated ground beef and lamb, often in grinders</td>
<td>Blood, muscle biopsy, skin test</td>
<td>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</td>
</tr>
</tbody>
</table>
### Allergic-Type Symptoms and Signs (Facial Flushing and/or Itching) Occur

**Incubation (Latency) Period Usually Less Than 1 h**

<table>
<thead>
<tr>
<th>Illness</th>
<th>Etiologic Agent and Source</th>
<th>Incubation or Latency Period</th>
<th>Signs and Symptoms</th>
<th>Foods Usually Involved</th>
<th>Specimen to Collect</th>
<th>Factors Contributing to Food-Borne Outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histamine poisoning (scombroid poisoning)</td>
<td>Histamine-like substance produced by <em>Proteus</em> spp. and other bacteria</td>
<td>Few min to 1 h</td>
<td>Headache, dizziness, nausea, vomiting, peppery taste, burning throat, facial swelling and flushing, stomach pain, diarrhea, itching skin</td>
<td>Tuna, mackerel, Pacific dolphin (mahi mahi), blue-fish, cheese</td>
<td>Inadequate cooling; improper refrigeration of fish; improper curing of cheese</td>
<td></td>
</tr>
<tr>
<td>Monosodium glutamate poisoning</td>
<td>Excessive amounts of monosodium glutamate (MSG)</td>
<td>Few min to 1 h</td>
<td>Burning sensation in back of neck, forearms, chest; feeling of tightness in chest, tingling, flushing, dizziness, headache, nausea</td>
<td>Foods seasoned with MSG</td>
<td>Using excessive amounts of MSG as flavor intensifier. ONLY certain individuals are sensitive to MSG</td>
<td></td>
</tr>
</tbody>
</table>

**Bacterial (and Animal) Agents**

- Histamine 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
<table>
<thead>
<tr>
<th>Disease</th>
<th>Symptoms</th>
<th>Incubation Period</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicotinic acid (niacin) poisoning</td>
<td>Flushing, sensation of warmth, itching, abdominal pain, puffing of face and knees</td>
<td>Few min to 1 h</td>
<td>Meat or other food in which sodium nicotinate has been added, including baby food and baked goods</td>
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<td></td>
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<td></td>
<td>Using sodium nicotinate as color preservative, improper mixing</td>
</tr>
</tbody>
</table>
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.
Division of Community and Public Health

Section: 4.0 Diseases and Conditions  Updated 12/12

Subsection: Guidelines for Release of Information About an Outbreak  Page 60 of 67

Does the Possibility Exist for 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.
# Sample Line List

<table>
<thead>
<tr>
<th>Resident Name</th>
<th>Age</th>
<th>Sex</th>
<th>Room #</th>
<th>Infection Site</th>
<th>Date*/Lab Pathogen</th>
<th>Date/ Symptoms</th>
<th>Predisposing Factors</th>
<th>Date/ Treatment</th>
<th>Approp**</th>
<th>Resolved</th>
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**Resident Days for Month

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* Date of Specimen Collection

** Appropriate = Yes, Organism Sensitive to Antibiotic

Reviewed: 4/21/03
NOTE: This form is no longer being used by the SPHL - 11/29/2012.