

Food-borne Disease Outbreaks

1. DISEASE REPORTING

A. Purpose of Reporting, Surveillance and Investigation

1. To identify high-risk foods.
2. To expeditiously remove from the commercial market a food product contaminated with a food-borne disease (FBD) agent.
3. To correct food-preparation practices that permit contamination with FBD agents.
4. To identify, treat and exclude from work humans at risk of contaminating foods with FBD agents.
5. To identify additional cases and prevent secondary transmission.
6. To identify new food-borne pathogens and toxins.
7. To expand current understanding of the transmission, pathogenesis and community impact of illness caused by known food-borne pathogens.

B. Laboratory and Physician Reporting Requirements

An outbreak is broadly defined as two or more non-householders who develop with the same clinical illness after eating at the same place. Physicians are required by law to report suspected FBD outbreaks due to a common source of exposure by telephone, any time day or night, to their local health department (LHD) during business hours, or, after-hours, to the on-call DHS Oregon Health Services (OHS) epidemiologist (503/731-4030) immediately upon identification.

C. Local Health Department Reporting and Follow-up Responsibilities

1. LHD investigators must notify the OHS epidemiologist on-call on work days (503/731-4024) or after-hours (503/731-4030) within 24 hours of receiving a report of a possible FBD outbreak. Likewise, if the report is first made to the Health Division, the OHS epidemiologist must notify the LHD. An OHS epidemiologist from Acute and Communicable Disease Prevention (ACDP) will be assigned to assist with the investigation.
2. OHS epidemiologists are eager to assist by telephone with planning and executing FBD outbreak investigations and can be in-county within 24 hours of notification to assist with the investigation.
3. The Food-borne Outbreak Investigation Report is usually completed by the OHS epidemiologist assigned to work with LHD staff on the investigation. The form is available at <http://www.healthoregon.org/odpe/guideln/forms/foodform.pdf>.
4. OHS epidemiologists are responsible for coordinating the investigation of multi-county and any Oregon extension of multi-state FBD outbreaks.

D. Confidentiality

1. Data about individuals collected for outbreak investigations are strictly confidential under Oregon law¹ and official DHS policy. For this reason, data collection is the sole responsibility of either state or local public health officials and *must never be delegated*. When data collection instruments (questionnaires) are delivered via a third-party to people in the investigation, they must be returned by mail or fax to the state or local public health officials without passing through the third party, except when the third party is obligated to maintain patient confidentiality (as in an outbreak in a nursing home).
2. If it is necessary to provide patient-specific information in a written report (other than the case interview forms and disease investigation forms) you should refer to the patient by a pseudonym, such as: the index case, patient A, patient 2, etc.

¹ Oregon Administrative Rule 333-019-0005

2. EPIDEMIOLOGY OF FOOD-BORNE DISEASE

A. Etiologic Agents, Descriptions of Their Illnesses, Usual Foods, Incubation Periods

The OHS *Compendium of Acute Food-borne Diseases*, appended to these guidelines, provides information about FBD agents organized by incubation periods, hallmark symptoms and the presence of fever.

B. Reservoirs

Humans are the reservoirs of astroviruses, *Entamoeba histolytica*, hepatitis A virus, Norwalk-like viruses, rotaviruses, *Shigella* species, *Salmonella* Typhi, *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Vibrio cholerae*. Animals carry and transmit *Brucella* species, *Campylobacter jejuni*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*, *Escherichia coli* O157, *Francisella tularensis*, *Giardia lamblia*, *Listeria monocytogenes*, *Salmonella* species, *Trichinella spiralis*, *Yersinia enterocolitica*, *Vibrio parahaemolyticus*, and *Vibrio vulnificus*. *Bacillus cereus*, *Clostridium* species, heavy metals, marine toxins, and mushroom toxins are found in the environment.

C. Sources and Routes of Transmission

Most FBD agent transmission is person-to-person via the fecal-oral or vomitus-oral route. Outbreaks due to *Shigella*, *Staphylococcus aureus*, Group A streptococci, hepatitis A, and Norwalk-like viruses are generally caused by contamination of uncooked or cooled food by an infected food handler. FBD agents from animal-derived foods (beef and eggs, for example) can cross-contaminate raw foods through cooking utensils, the hands of food workers, unclean food preparation surfaces, or improper storage.

Some agents are transmitted animal-to-person without the assistance of unhygienic humans. These include raw milk or milk products contaminated with *Brucella*, *Campylobacter*, *Listeria monocytogenes*, *Salmonella* species, or *Cryptosporidium parvum*; ground beef contaminated with *E. coli* O157; and pork contaminated with *Trichinella spiralis*.

Ciguatera, scombroid, and paralytic shellfish poisoning are caused by heat-stable toxins within fish or shellfish. *Clostridium perfringens* and *Bacillus cereus* are ubiquitous in the environment, and outbreaks caused by these bacteria generally result from holding food at temperatures that allow them to proliferate (between 45°–140°F, usually).

Vibrio parahaemolyticus is a bacterium commonly found in coastal marine waters and seafood throughout the world. FBD outbreaks of hepatitis A and Norwalk-like virus infection have been associated with consumption of raw oysters.

D. Periods of Communicability

The OHS *Compendium of Acute Food-borne Diseases*, appended to these guidelines, provides periods of communicability, which vary among etiologic agents.

E. Treatment

Though treatment varies with the etiologic agent, most FBD requires only adequate hydration. At the other extreme, botulism calls for urgent administration of antitoxin and close observation, generally in an intensive care unit.

Antibiotics are useful in treating *Shigella*, *Yersinia*, *Brucella*, Group A *Streptococcus*, and some *Vibrio* infections. Antibiotics should not be prescribed for FBD caused by *Salmonella* (excluding typhoid fever), *Campylobacter*, *Staphylococcus aureus*, *Escherichia coli* O157, *Clostridium perfringens*, or *Bacillus cereus*. However, some *Salmonella* and *Campylobacter* infections will be complicated by bacteremia, and antibiotics are then indicated. Severe cases of scombroid can be treated with antihistamines.

F. Susceptibility/Immunity

Essentially everyone is susceptible to these agents. Infants and persons with inadequate gastric acid may be stricken by lower inocula, as are taking antacids. Infants, the elderly, and immunosuppressed persons are more likely to suffer serious illness from selected agents.

3. DEFINITIONS, DIAGNOSIS AND LABORATORY SERVICE

A. Confirmed FBD outbreak

Two or more people with the same laboratory confirmed FBD agent epidemiologically associated with consumption of the same food or meal.

B. Presumptive FBD outbreak

Two or more people from different households with the same clinical illness epidemiologically associated with consumption of a particular food or meal, but without laboratory confirmation due to inconclusive results, inadequate specimen collection or no specimen collection.

C. Suspect FBD outbreak

Two or more people from different households who develop similar illness about the same time after sharing a common food or meal; *ALL SUSPECT FBD OUTBREAKS MUST BE INVESTIGATED.*

D. Public Health Laboratory Services

Laboratory testing for multiple agents is prohibitively expensive. While clinical specimens collected during most investigations will be analyzed at the Oregon State Public Health Laboratory (OSPHL), some will not be if the epidemiologic evidence clearly points to an etiologic agent and control measures can be implemented in the absence of laboratory confirmation (FBD caused by *Bacillus cereus*, for example). Consultation with OHS epidemiologists and making a "best guess" about the etiologic agent based on case histories is, therefore, required prior to submitting clinical specimens for analysis.

4. ROUTINE INVESTIGATION

A. Take the following steps to confirm the existence of an outbreak, verify the diagnosis and initiate data collection.

- 1. Collect systematically the following information from each person who contacts you, or who you contact, about a possible FBD outbreak. You will be asked for this information when you contact OHS.
 - Demographics, including name, address, telephone number, age, sex, and other relevant factors such as occupation, residence, classroom, unit/wing/ward, cell block, etc.;
 - Symptoms, including nausea, vomiting, diarrhea, fever, abdominal cramps, muscle aches, chills, unusual fatigue, headache, bloody diarrhea, and any others mentioned;
 - Date and time of symptom onset and how long symptoms lasted (duration);
 - Food and drink consumption history for a period of at least 72 hours before illness onset;
 - Names, addresses, phone numbers, and other locating information of anyone else who might be involved in the outbreak, both people who are sick and people who are not, and the name of the coordinator of a group activity, if applicable.
- 2. Make arrangements to **collect stool specimens** from each person who contacts you, or who you contact, about the possible outbreak.
 - Collect 15-20 grams of whole stool (about the size of a walnut), 10-15 ml. of diarrheal stool (about 3 tablespoons) or 3-4 rectal swabs with a visible amount of fecal material from each person. Collect 10-15 ml of vomitus too, if available.
 - Collect fresh stool specimens as soon as possible after onset of illness. The sicker people are when specimens are collected, the more likely it is that the etiologic agent will be recovered. The optimum time for collecting specimens is the first three to four days of illness (although stools for virus isolation can be collected up to four weeks after onset).
 - Collect fresh stool specimens from as many people as you can. The criteria for confirming that an outbreak was caused by a specific agent depends on isolating the agent from at least two people involved in the outbreak.
 - Keep fresh stool specimens cold from the time they are produced until the time they reach OSPHL. Refrigeration temperature (4°C [39° F]) prevents the proliferation of normal intestinal

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flora from obliterating the foodborne pathogen.

- Advise outbreak-involved persons to double-bag and refrigerate their stool specimens prior to delivering them to the health department (or before they are picked up by someone from the health department).
- Refrigerate fresh stool specimens at the health department, preferably in the laboratory, in the same containers in which they were received. Never, never freeze clinical specimens or everything will die.
- Send OSPHL fresh stool specimens in the same containers in which they were received plus 2-3 swabs of fecal material inserted into Cary-Blair transport media. Dip sterile swabs into fecal specimens, collecting at least enough material to thoroughly soil the entire swab tip. Push the swabs into the Cary-Blair medium, break off protruding sticks and cap the tube tightly.
- Ship fresh stool specimens and Cary-Blair tubes to OSPHL in a securely-packed styrofoam container with enough artificial ice to keep the specimens cold en route to OSPHL. Use the most expeditious means of transport available.
- Include OSPHL form 42, Virology/Immunology Request and/or OSPHL Form 75, Bacterial/Parasitology Request (links to download PDF files available at <http://www.healthoregon.org/phl/forms.cfm>). Clearly label each form with the outbreak number provided by the OHS epidemiologist assisting with the investigation.

In general, clinical specimens from food handlers should only be collected when they have had an illness compatible with that of cases involved in the outbreak (to ensure that they get appropriate treatment and their disease has resolved); or when humans are the only reservoir for the etiologic agent and it is necessary to identify the source of the infection (for example, *Salmonella* Typhi).

- 3. If people have specimens of the food they think made them sick (in the form of left-overs or "doggie bags"), ask that they be stored cold (not frozen) at home in containers that will resist breakage and contain spillage (or offer to pick them up and store them cold at the LHD). Tell them that their food specimens may not be needed for microbiologic testing.
- 4. Contact the OHS epidemiologist on call for the day (503/731-4024) or after-hours (503-731-4030) to confirm the existence of an outbreak, considering the following questions:
 - Are there two or more people from different households with the same clinical illness resulting from the ingestion of the same food or meal?
 - Are the clinical signs and symptoms, along with the incubation period, consistent with a FBD agent?
 - Is the number of illnesses more than what would be expected in this group of people and in the population as a whole?
 - Are there any other reports of potentially associated cases?
- 5. With the help of the OSH epidemiologist assisting with the investigation, develop a preliminary case definition that includes time, place, and person, for example: diarrhea with abrupt onset between December 25 and December 26, 1994 (time) in any person at least 5 years of age (person) who ate supper at Church A on December 25, 1994 (place). [Case definition will be finalized before data analysis begins.]
- 6. With the help of the OHS epidemiologist assisting with the investigation, make a best guess about the FBD agent by referring to the OHS *Compendium of Acute Food-borne Diseases* and order the appropriate clinical laboratory tests (or not). Decide whether or not to collect food specimens for laboratory analysis.
- 7. Call the environmental health specialist who will assist with the investigation. Provide the above information, and, if the suspected source of FBD is a local restaurant or other commercial establishment, ask the sanitarian to get a menu, conduct a process-focused inspection using the form available at <http://www.healthoregon.org/odpe/guideln/forms/foodform.pdf>, and obtain the following additional information from both managers and staff:
 - What are the usual food-handling practices? How long is food prepared in advance? Is food allowed to sit unrefrigerated? For how long?
 - Were there any unusual circumstances or practices operative just before the outbreak began?

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Power outages? Water back-ups? Other equipment failures?

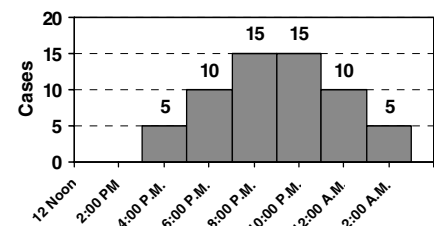
- Were food handlers ill during the incubation period of the suspect FBD agent? When did they become ill? With which foods do they work? Do any food workers have cuts on their hands?
- Do the food workers eat the foods they prepare? (Most ill food workers are victims rather than sources of FBD agents.)
- 8. Recommend control measures based on the hypothesized FBD agent, the usual vehicles for this agent and food-handling malpractice that permitted or facilitated transmission. Depending on circumstances, this may include making recommendations to restaurant workers, furloughing or re-assigning a particular worker, closing a restaurant, disposing of contaminated food (after specimens have been collected), or issuing a press release to advise citizens who may develop symptoms.
- 9. Get as complete a list as possible of all the people who attended the same function, ate at the same restaurant, etc.; lists can be obtained from the host/hostess or event organizer, from credit card receipts or from reservation lists. (This may also be done by interviewing relatives, friends, or meal companions of ill persons; or by issuing a press release.)
- 10. Send a menu from the restaurant or other list of foods served to the OHS epidemiologist assigned to the investigation to develop a questionnaire, or use the templates available at <http://www.healthoregon.org/acd/foodrpt.cfm> to develop your own.
- 11. Administer *FBD Outbreak Questionnaires* to as many people as possible, both sick and well, as soon as possible after the first case or cases are reported (the longer you wait, the less reliable the data are). Ask all the questions on the questionnaire (except those in the skip patterns, of course) of as many of the sick and well people as possible.
- 12. Please feel free to send the completed questionnaires to ACDP (fax 503/731-4798) so we can enter and help you analyze the data.

B. Data analysis

After finalizing a case definition (see 4.A.4), analyze the data to get the following results.

- 1. **Demographic profile:** the number of cases by age group and sex.
- 2. **Symptom profile:** the percentage of cases who have nausea, vomiting, diarrhea, stomach cramps, muscle aches, chills, unusual fatigue, fever, headache, bloody diarrhea and any other symptoms systematically collected.
- 3. **Epidemic curve:** the number of cases by time of onset of symptoms. Figure 1 provides an example of 60 cases of diarrhea with abrupt onset between December 25 and December 26, 1994 in any person at least 5 years old who ate supper at Church A on December 25, 1994.
- 4. **Total attack rate:** the number of cases divided by the total number of people exposed (or close to the total number). If 300 people at least 5 years old ate supper at Church A on December 25, 1994 (the "exposed group") and 60 had diarrhea with abrupt onset between December 25 and December 26, 1994, the attack rate would be 20% (60/300) if all the people who ate at the church supper were interviewed (which is almost never the case).
- 5. **Median incubation period:** the time it takes 50% of the cases to get sick after exposure to the FBD agent. If the cases who ate supper at Church A shared a common meal at noon, the median incubation period would be 9 hours, because 30/60 (50%) became ill by 9 p.m. (figure 1).
- 6. **Food-specific attack rate:** the percentage of people who became ill after eating a specific food (table 1, column 4).
- 7. **Relative risks:** the percentage of people who became ill after eating a certain food, divided by the percentage of people who became ill after not eating the same food (table 1, column 8).
- 8. **P value:** $P < .05$ means that a certain food or foods are implicated as the probable source of the food-borne illness. The jargon is that the food is "statistically significantly associated with illness" (table 1, column 9).

Fig. 1 Diarrhea, Church 'A' supper attendees at least 5 y.o. (N=60)



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Table 1. Food-specific attack rates, relative risks and P values, Church A supper attendees at least 5 years old, December 25, 1994								
Food Item	DID EAT the Specific Food			DID NOT EAT the Specific Food			Statistics	
	Number Sick	Number Well	Attack Rate	Number Sick	Number Well	Attack Rate	Relative Risk	P value
Turkey	55	45	55%	5	95	5%	11	<.001
Gravy	40	60	40%	20	80	20%	2	.004
Mashed potatoes	42	58	42%	18	82	18%	2.3	.005
Ham	35	65	35%	25	75	25%	1.4	0.1
Pears	30	70	3%	30	70	3%	1	1
Formulas	A	B	A÷(A+B) = X%	C	D	C÷(C+D) = Y%	X% ÷ Y%	Epi Info

To calculate P values, open Epi Info* and (in Version 6), click on "Programs," then on "STATCALC calculator," then on "Tables (2x2, 2xn)," and a blank 2x2 table will magically appear. For each food item in the above table, sequentially type in the numbers in the 2x2 table (see example below) and press enter for statistical results; use the "uncorrected" P value.

$$\begin{array}{r}
 \text{Exposures + Disease -} \\
 + \begin{array}{|c|c|} \hline A & B \\ \hline C & D \\ \hline \end{array} \begin{array}{l} A + B \\ C + D \end{array} \quad \text{OR} \quad \begin{array}{r}
 \text{Exposures + Disease -} \\
 + \begin{array}{|c|c|} \hline 55 & 45 \\ \hline 5 & 95 \\ \hline \end{array} \begin{array}{l} 100 \\ 100 \\ 60 \quad 140 \quad 200 \end{array}
 \end{array}$$

* Epi Info is a CDC-developed statistical software package that every local health department should have; it is available for free at <http://www.cdc.gov/epiinfo/index.htm>.

5. CONTROLLING FURTHER SPREAD

A. Education

Depending on circumstances, this may include educating food workers, managers, patients, or the public at large about adequate cooking, adequate holding temperatures, how to avoid cross-contamination, and the importance of good handwashing practices.

B. Isolation and Work or Day Care Restrictions

Persons with vomiting or diarrhea caused by non-reportable FBD agents should not handle food to be eaten by others.

Cases with the following FBDs are restricted from attending school, attending day care, providing direct patient care, or food handling while their diseases are in the communicable stage:

- Salmonella typhi*;
- shigellosis;
- shiga-toxigenic *Escherichia coli* (STEC);
- hepatitis A;
- group A *Streptococcus*;
- any illness accompanied by diarrhea or vomiting.

C. Follow-Up of Cases

Follow-up of cases varies with the etiologic agent. Please refer to the Oregon administrative rules at <http://www.healthoregon.org/acd/oars/rules.cfm>, and to *Investigative Guidelines* for individual reportable diseases at <http://healthoregon.org/odpe/guideln/index.cfm>.

D. Protection of Contacts

Patients and contacts should be instructed in good hand washing and food-handling practices. Close contacts of patients with hepatitis A infection should receive immunoglobulin and vaccine (see *Hepatitis A Investigative Guidelines*).