Bacteria and Foodborne Illness

National Digestive Diseases Information Clearinghouse

National Institute of Diabetes and Digestive and Kidney Diseases

NATIONAL INSTITUTES OF HEALTH

What are foodborne illnesses?

Foodborne illnesses are caused by eating food or drinking beverages contaminated with bacteria, parasites, or viruses. Harmful chemicals can also cause foodborne illnesses if they have contaminated food during harvesting or processing. Foodborne illnesses can cause symptoms that range from an upset stomach to more serious symptoms, including diarrhea, fever, vomiting, abdominal cramps, and dehydration. Most foodborne infections are undiagnosed and unreported, though the Centers for Disease Control and Prevention estimates that every year about 76 million people in the United States become ill from pathogens, or disease-causing substances, in food. Of these people, about 5,000 die.

What are the causes of foodborne illnesses?

Harmful bacteria are the most common cause of foodborne illnesses. Some bacteria may be present on foods when you purchase them. Raw foods are the most common source of foodborne illnesses because they are not sterile; examples include raw meat and poultry that may have become contaminated during slaughter. Seafood may become contaminated during harvest or through processing. One in 10,000 eggs may be contaminated with *Salmonella* inside the egg shell. Produce such as spinach, lettuce, tomatoes, sprouts, and melons can become contaminated with *Salmonella, Shigella,* or *Escherichia coli (E. coli)* O157:H7. Contamination can occur during growing, harvesting, processing, storing, shipping, or final preparation. Sources of produce contamination are varied as these foods are grown in soil and can become contaminated during growth or through processing and distribution. Contamination may also occur during food preparation in a restaurant or a home kitchen. The most common form of contamination from handled foods is the calcivirus, also called the Norwalk-like virus.

When food is cooked and left out for more than 2 hours at room temperature, bacteria can multiply quickly. Most bacteria grow undetected because they don't produce a bad odor or change the color or texture of the food. Freezing food slows or stops bacteria's growth but does not destroy the bacteria. The microbes can become reactivated when the food is thawed. Refrigeration also can slow the growth of some bacteria. Thorough cooking is needed to destroy the bacteria.

U.S. Department of Health and Human Services

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What are the symptoms of foodborne illnesses?

In most cases of foodborne illnesses, symptoms resemble intestinal flu and may last a few hours or even several days. Symptoms can range from mild to serious and include

- abdominal cramps
- nausea
- vomiting
- diarrhea, which is sometimes bloody
- fever
- dehydration

What are the risk factors of foodborne illnesses?

Some people are at greater risk for bacterial infections because of their age or an unhealthy immune system. Young children, pregnant women and their fetuses, and older adults are at greatest risk.

What are the complications of foodborne illnesses?

Some micro-organisms, such as *Listeria monocytogenes* and *Clostridium botulinum,* cause far more serious symptoms than vomiting and diarrhea. They can cause spontaneous abortion or death.

In some people, especially children, hemolytic uremic syndrome (HUS) can result from infection by a particular strain of bacteria, *E. coli* O157:H7, and can lead to kidney failure and death. HUS is a rare disorder that affects primarily children between the ages of 1 and 10 years and is the leading cause of acute renal failure in previously healthy children. A child may become infected after consuming contaminated food or beverages, such as meat, especially undercooked ground beef; unpasteurized juices; contaminated water; or through contact with an infected person.

The most common symptoms of HUS infection are vomiting, abdominal pain, and diarrhea, which may be bloody. In 5 to 10 percent of cases, HUS develops about 5 to 10 days after the onset of illness. This disease may last from 1 to 15 days and is fatal in 3 to 5 percent of cases. Other symptoms of HUS include fever, lethargy or sluggishness, irritability, and paleness or pallor. In about half the cases, the disease progresses until it causes acute renal failure, which means the kidneys are unable to remove waste products from the blood and excrete them into the urine. A decrease in circulating red blood cells and blood platelets and reduced blood flow to organs may lead to multiple organ failure. Seizures, heart failure, inflammation of the pancreas, and diabetes can also result. However, most children recover completely.

See a doctor right away if you or your child has any of the following symptoms with diarrhea:

- High fever—temperature over 101.5°, measured orally
- Blood in the stools
- Diarrhea that lasts more than 3 days
- Prolonged vomiting that prevents keeping liquid down and can lead to dehydration
- Signs of severe dehydration, such as dry mouth, sticky saliva, decreased urination, dizziness, fatigue, sunken eyes, low blood pressure, or increased heart rate and breathing rate
- Signs of shock, such as weak or rapid pulse or shallow breathing
- Confusion or difficulty reasoning

How are foodborne illnesses diagnosed?

Your doctor may be able to diagnose foodborne illnesses from a list of what you've eaten recently and from results of appropriate laboratory tests. Diagnostic tests for foodborne illnesses should include examination of the feces. A sample of the suspected food, if available, can also be tested for bacterial toxins, viruses, and parasites.

How are foodborne illnesses treated?

Most cases of foodborne illnesses are mild and can be treated by increasing fluid intake, either orally or intravenously, to replace lost fluids and electrolytes. People who experience gastrointestinal or neurologic symptoms should seek medical attention.

In the most severe situations, such as HUS, hospitalization may be needed to receive supportive nutritional and medical therapy. Maintaining adequate fluid and electrolyte balance and controlling blood pressure are important. Doctors will try to minimize the impact of reduced kidney function. Dialysis may be needed until the kidneys can function normally. Blood transfusions also may be needed.

How are foodborne illnesses prevented?

Most cases of foodborne illnesses can be prevented through proper cooking or processing of food, which kills bacteria. In addition, because bacteria multiply rapidly between 40°F and 140°F, food must be kept out of this temperature range.

Follow these tips to prevent harmful bacteria from growing in food:

- Refrigerate foods promptly. If prepared food stands at room temperature for more than 2 hours, it may not be safe to eat. Set your refrigerator at 40°F or lower and your freezer at 0°F.
- Cook food to the appropriate internal temperature—145°F for roasts, steaks, and chops of beef, veal, and lamb; 160°F for pork, ground veal, and ground beef; 165°F for ground poultry; and 180°F for whole poultry. Use a meat thermometer to be sure. Foods are properly cooked only when they are heated long enough and at a high enough temperature to kill the harmful bacteria that cause illnesses.
- Prevent cross-contamination. Bacteria can spread from one food product to another throughout the kitchen and can get onto cutting boards, knives, sponges, and countertops. Keep raw meat, poultry, seafood, and their juices away from all ready-to-eat foods.
- Handle food properly. Always wash your hands for at least 20 seconds with warm, soapy water before and after handling raw meat, poultry, fish, shellfish, produce, or eggs. Wash your hands after using the bathroom, changing diapers, or touching animals.

- Wash utensils and surfaces before and after use with hot, soapy water. Better still, sanitize them with diluted bleach—1 teaspoon of bleach to 1 quart of hot water.
- Wash sponges and dish towels weekly in hot water in the washing machine.
- Keep cold food cold and hot food hot.
- Maintain hot cooked food at 140°F or higher.
- Reheat cooked food to at least 165°F.
- Refrigerate or freeze perishables, produce, prepared food, and leftovers within 2 hours.
- Never defrost food on the kitchen counter. Use the refrigerator, cold running water, or the microwave oven.
- Never let food marinate at room temperature—refrigerate it.
- Divide large amounts of leftovers into small, shallow containers for quick cooling in the refrigerator.
- Remove the stuffing from poultry and other meats immediately and refrigerate it in a separate container.
- Wash all unpackaged fruits and vegetables, and those packaged and not marked "pre-washed," under running water just before eating, cutting, or cooking. Scrub firm produce such as melons and cucumbers with a clean produce brush. Dry all produce with a paper towel to further reduce any possible bacteria.
- Do not pack the refrigerator. Cool air must circulate to keep food safe.

For more information about prevention of foodborne illnesses, the U.S. Department of Agriculture provides a fact sheet on safe food handling.

What is food irradiation?

Food irradiation is the treatment of food with high energy such as gamma rays, electron beams, or x rays as a means of cold pasteurization, which destroys living bacteria to control foodborne illnesses. The United States relies exclusively on the use of gamma rays, which are similar to ultraviolet light and microwaves and pass through food leaving no residue. Food irradiation is approved for wheat, potatoes, spices, seasonings, pork, poultry, red meats, whole fresh fruits, and dry or dehydrated products. Although irradiation destroys many bacteria, it does not sterilize food. Even if you're using food that has been irradiated by the manufacturer, you must continue to take precautions against foodborne illnesses—through proper refrigeration and handling—to safeguard against any surviving organisms. If you are traveling with food, make sure perishable items such as meats are wrapped to prevent leakage. Be sure to fill the cooler with plenty of ice and store it in the car, not the trunk. If any food seems warmer than 40°F, throw it out.

Links to Other Disorders Related to Foodborne Illnesses

Scientists suspect that foodborne pathogens are linked to chronic disorders and can even cause permanent tissue or organ destruction. Research suggests that when some people are infected by foodborne pathogens, the activation of their immune system can trigger an inappropriate autoimmune response, which means the immune system attacks the body's own cells. In some people, an autoimmune response leads to a chronic health condition.

Chronic disorders that may be triggered by foodborne pathogens are

- arthritis
- inflammatory bowel disease
- kidney failure
- Guillain-Barré syndrome
- autoimmune disorders

Further research is needed to explain the link between these disorders and foodborne illnesses.

Common Sources of Foodborne Illnesses

Sources of illness: Raw and undercooked meat and poultry
Symptoms: Abdominal pain, diarrhea, nausea, and vomiting
Bacteria: *Campylobacter jejuni, E. coli* O157:H7, *L. monocytogenes, Salmonella*

Sources of illness: Raw foods; unpasteurized milk and dairy products, such as soft cheeses
Symptoms: Nausea, vomiting, fever, abdominal cramps, and diarrhea
Bacteria: *L. monocytogenes, Salmonella, Shigella, Staphylococcus aureus, C. jejuni*

Sources of illness: Raw and undercooked eggs. Raw eggs are often used in foods such as homemade hollandaise sauce, caesar and other salad dressings, tiramisu, homemade ice cream, homemade mayonnaise, cookie dough, and frostings.
Symptoms: Nausea, vomiting, fever, abdominal cramps, and diarrhea
Bacterium: *Salmonella enteriditis*

Sources of illness: Raw and undercooked shellfish
Symptoms: Chills, fever, and collapse
Bacteria: *Vibrio vulnificus, Vibrio parahaemolyticus*

Sources of illness: Improperly canned goods; smoked or salted fish
Symptoms: Double vision, inability to swallow, difficulty speaking, and inability to breathe. Seek medical help right away if you experience any of these symptoms.
Bacterium: *C. botulinum*

Sources of illness: Fresh or minimally processed produce; contaminated water
Symptoms: Bloody diarrhea, nausea, and vomiting
Bacteria: *E. coli* O157:H7, *L. monocytogenes, Salmonella, Shigella, Yersinia enterocolitica,* viruses, and parasites

Points to Remember

Foodborne illnesses result from eating food or drinking beverages that are contaminated with bacteria, viruses, or parasites.

People at greater risk for foodborne illnesses include young children, pregnant women and their fetuses, older adults, and people with lowered immunity.

Symptoms usually resemble intestinal flu. See a doctor immediately if you have more serious problems or do not seem to be improving as expected.

Treatment may range from replacement of lost fluids and electrolytes for mild cases of foodborne illnesses to hospitalization for severe conditions such as HUS.

You can prevent foodborne illnesses by taking the following precautions:

- Wash your hands with warm, soapy water before and after preparing food and after using the bathroom or changing diapers.
- Keep raw meat, poultry, seafood, and their juices away from ready-to-eat foods.
- Cook foods properly and at a high enough temperature to kill harmful bacteria.
- Refrigerate foods within 2 hours or less after cooking because cold temperatures will help keep harmful bacteria from growing and multiplying.
- Clean surfaces well before and after using them to prepare food.

For More Information

American Dietetic Association
120 South Riverside Plaza, Suite 2000
Chicago, IL 60606–6995
Consumer Nutrition Hotline:
1–800–877–1600
Internet: www.eatright.org

Center for Food Safety and Applied Nutrition
5100 Paint Branch Parkway
College Park, MD 20740–3835
Food Information Line:
1–888–SAFEFOOD (723–3366)
Internet: www.cfsan.fda.gov

Centers for Disease Control and Prevention
1600 Clifton Road
Atlanta, GA 30333
Phone: 1–800–311–3435 or 404–639–3534
Internet: www.cdc.gov

Gateway to Government Food Safety Information
Internet: www.foodsafety.gov

Partnership for Food Safety Education
655 15th Street NW, 7th Floor
Washington, DC 20201
Phone: 202–220–0651
Internet: www.fightbac.org

U.S. Department of Agriculture
1400 Independence Avenue SW
Washington, DC 20250
Meat and Poultry Hotline:
1–888–674–6854
Internet: www.usda.gov

U.S. Department of Health and Human Services
200 Independence Avenue SW
Washington, DC 20201
Phone: 1–877–696–6775 or 202–619–0257
Internet: www.os.dhhs.gov

U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue NW
Washington, DC 20460
Phone: 202–272–0167
Internet: www.epa.gov

U.S. Food and Drug Administration
5600 Fishers Lane
Rockville, MD 20857–0001
Phone: 1–888–INFO–FDA (463–6332)
Internet: www.fda.gov

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The National Digestive Diseases Information Clearinghouse (NDDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health of the U.S. Department of Health and Human Services. Established in 1980, the Clearinghouse provides information about digestive diseases to people with digestive disorders and to their families, health care professionals, and the public. The NDDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about digestive diseases.

Publications produced by the Clearinghouse are carefully reviewed by both NIDDK scientists and outside experts. This publication was originally reviewed by Howard Trachtman, M.D., Long Island Jewish Medical Center; Peter McNally, M.D., American College of Gastroenterology; and Howard Sutter, U.S. Food and Drug Administration.

This fact sheet is also available at *www.digestive.niddk.nih.gov.*

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health

NIH Publication No. 07–4730
May 2007