Foodborne Illnesses

National Digestive Diseases Information Clearinghouse

U.S. Department of Health and Human Services

NATIONAL INSTITUTES OF HEALTH

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NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

What are foodborne illnesses?

Foodborne illnesses are infections or irritations of the gastrointestinal (GI) tract caused by food or beverages that contain harmful bacteria, parasites, viruses, or chemicals. The GI tract is a series of hollow organs joined in a long, twisting tube from the mouth to the anus. Common symptoms of foodborne illnesses include vomiting, diarrhea, abdominal pain, fever, and chills.

Most foodborne illnesses are acute, meaning they happen suddenly and last a short time, and most people recover on their own without treatment. Rarely, foodborne illnesses may lead to more serious complications. Each year, an estimated 48 million people in the United States experience a foodborne illness. Foodborne illnesses cause about 3,000 deaths in the United States annually.[1]

What causes foodborne illnesses?

The majority of foodborne illnesses are caused by harmful bacteria and viruses.[2] Some parasites and chemicals also cause foodborne illnesses.

Bacteria

Bacteria are tiny organisms that can cause infections of the GI tract. Not all bacteria are harmful to humans.

Some harmful bacteria may already be present in foods when they are purchased. Raw foods including meat, poultry, fish and shellfish, eggs, unpasteurized milk and dairy products, and fresh produce often contain bacteria that cause foodborne illnesses. Bacteria can contaminate food—making it harmful to eat—at any time during growth, harvesting or slaughter, processing, storage, and shipping.

Foods may also be contaminated with bacteria during food preparation in a restaurant or home kitchen. If food preparers do not thoroughly wash their hands, kitchen utensils, cutting boards, and other kitchen surfaces that come into contact with raw foods, cross-contamination—the spread of bacteria from contaminated food to uncontaminated food—may occur.

If hot food is not kept hot enough or cold food is not kept cold enough, bacteria may multiply. Bacteria multiply quickly when the temperature of food is between 40 and 140 degrees. Cold food should be kept below 40 degrees and hot food should be kept above 140 degrees. Bacteria multiply more slowly when food is refrigerated, and freezing food can further slow or even stop

[1]Scallan E, Griffin PM, Angulo FJ, Tauxe RV, Hoekstra RM. Foodborne illness acquired in the United States—unspecified agents. *Emerging Infectious Diseases.* 2011;17(1):16–22.

[2]Centers for Disease Control and Prevention. Surveillance for foodborne disease outbreaks—United States, 2007. *Morbidity and Mortality Weekly Report.* 2010;59(31):973–979.

the spread of bacteria. However, bacteria in refrigerated or frozen foods become active again when food is brought to room temperature. Thoroughly cooking food kills bacteria.

Many types of bacteria cause foodborne illnesses. Examples include

- *Salmonella,* a bacterium found in many foods, including raw and undercooked meat, poultry, dairy products, and seafood. *Salmonella* may also be present on egg shells and inside eggs.
- *Campylobacter jejuni (C. jejuni),* found in raw or undercooked chicken and unpasteurized milk.
- *Shigella,* a bacterium spread from person to person. These bacteria are present in the stools of people who are infected. If people who are infected do not wash their hands thoroughly after using the bathroom, they can contaminate food that they handle or prepare. Water contaminated with infected stools can also contaminate produce in the field.
- *Escherichia coli (E. coli),* which includes several different strains, only a few of which cause illness in humans. *E. coli O157:H7* is the strain that causes the most severe illness. Common sources of *E. coli* include raw or undercooked hamburger, unpasteurized fruit juices and milk, and fresh produce.
- *Listeria monocytogenes (L. monocytogenes),* which has been found in raw and undercooked meats, unpasteurized milk, soft cheeses, and ready-to-eat deli meats and hot dogs.
- *Vibrio,* a bacterium that may contaminate fish or shellfish.
- *Clostridium botulinum (C. botulinum),* a bacterium that may contaminate improperly canned foods and smoked and salted fish.

Viruses

Viruses are tiny capsules, much smaller than bacteria, that contain genetic material. Viruses cause infections that can lead to sickness. People can pass viruses to each other. Viruses are present in the stool or vomit of people who are infected. People who are infected with a virus may contaminate food and drinks, especially if they do not wash their hands thoroughly after using the bathroom.

Common sources of foodborne viruses include

- food prepared by a person infected with a virus
- shellfish from contaminated water
- produce irrigated with contaminated water

Common foodborne viruses include

- norovirus, which causes inflammation of the stomach and intestines
- hepatitis A, which causes inflammation of the liver

Parasites

Parasites are tiny organisms that live inside another organism. In developed countries such as the United States, parasitic infections are relatively rare.

Cryptosporidium parvum and *Giardia intestinalis* are parasites that are spread through water contaminated with the stools of people or animals who are infected. Foods that come into contact with contaminated water during growth or preparation can become contaminated with these parasites. Food preparers who are infected with these parasites can also contaminate foods if they do not thoroughly wash their hands after using the bathroom and before handling food.

Trichinella spiralis is a type of roundworm parasite. People may be infected with this parasite by consuming raw or undercooked pork or wild game.

Chemicals

Harmful chemicals that cause illness may contaminate foods such as

- fish or shellfish, which may feed on algae that produce toxins, leading to high concentrations of toxins in their bodies. Some types of fish, including tuna and mahi mahi, may be contaminated with bacteria that produce toxins if the fish are not properly refrigerated before they are cooked or served.
- certain types of wild mushrooms.
- unwashed fruits and vegetables that contain high concentrations of pesticides.

Who gets foodborne illnesses?

Anyone can get a foodborne illness. However, some people are more likely to develop foodborne illnesses than others, including

- infants and children
- pregnant women and their fetuses
- older adults
- people with weak immune systems

These groups also have a greater risk of developing severe symptoms or complications of foodborne illnesses.

What are the symptoms of foodborne illnesses?

Symptoms of foodborne illnesses depend on the cause. Common symptoms of many foodborne illnesses include

- vomiting
- diarrhea or bloody diarrhea
- abdominal pain
- fever
- chills

Symptoms can range from mild to serious and can last from a few hours to several days.

C. botulinum and some chemicals affect the nervous system, causing symptoms such as

- headache
- tingling or numbness of the skin
- blurred vision
- weakness
- dizziness
- paralysis

What are the complications of foodborne illnesses?

Foodborne illnesses may lead to dehydration, hemolytic uremic syndrome (HUS), and other complications. Acute foodborne illnesses may also lead to chronic—or long lasting—health problems.

Dehydration

When someone does not drink enough fluids to replace those that are lost through vomiting and diarrhea, dehydration can result. When dehydrated, the body lacks enough fluid and electrolytes—minerals in salts, including sodium, potassium, and chloride—to function properly. Infants, children, older adults, and people with weak immune systems have the greatest risk of becoming dehydrated.

Signs of dehydration are

- excessive thirst
- infrequent urination
- dark-colored urine
- lethargy, dizziness, or faintness

Signs of dehydration in infants and young children are

- dry mouth and tongue
- lack of tears when crying
- no wet diapers for 3 hours or more
- high fever
- unusually cranky or drowsy behavior
- sunken eyes, cheeks, or soft spot in the skull

Also, when people are dehydrated, their skin does not flatten back to normal right away after being gently pinched and released.

Severe dehydration may require intravenous fluids and hospitalization. Untreated severe dehydration can cause serious health problems such as organ damage, shock, or coma—a sleeplike state in which a person is not conscious.

HUS

Hemolytic uremic syndrome is a rare disease that mostly affects children younger than 10 years of age. HUS develops when *E. coli* bacteria lodged in the digestive tract make toxins that enter the bloodstream. The toxins start to destroy red blood cells, which help the blood to clot, and the lining of the blood vessels.

In the United States, *E. coli O157:H7* infection is the most common cause of HUS, but infection with other strains of *E. coli,* other bacteria, and viruses may also cause HUS. A recent study found that about 6 percent of people with *E. coli O157:H7* infections developed HUS. Children younger than age 5 have the highest risk, but females and people age 60 and older also have increased risk.[3]

Symptoms of *E. coli O157:H7* infection include diarrhea, which may be bloody, and abdominal pain, often accompanied by nausea, vomiting, and fever. Up to a week after *E. coli* symptoms appear, symptoms of HUS may develop, including irritability, paleness, and decreased urination. HUS may lead to acute renal failure, which is a sudden

[3]Gould HL, Demma L, Jones TF, et. al. Hemolytic uremic syndrome and death in persons with *Escherichia coli O157:H7* infection, Foodborne Diseases Active Surveillance Network sites, 2000–2006. *Clinical Infectious Diseases.* 2009:49(10):1480–1485.

and temporary loss of kidney function. HUS may also affect other organs and the central nervous system. Most people who develop HUS recover with treatment. Research shows that in the United States between 2000 and 2006, fewer than 5 percent of people who developed HUS died of the disorder. Older adults had the highest mortality rate—about one-third of people age 60 and older who developed HUS died.[3]

Studies have shown that some children who recover from HUS develop chronic complications, including kidney problems, high blood pressure, and diabetes.

Other Complications

Some foodborne illnesses lead to other serious complications. For example, *C. botulinum* and certain chemicals in fish and seafood can paralyze the muscles that control breathing. *L. monocytogenes* can cause spontaneous abortion or stillbirth in pregnant women.

Research suggests that acute foodborne illnesses may lead to chronic disorders, including

- **reactive arthritis,** a type of joint inflammation that usually affects the knees, ankles, or feet. Some people develop this disorder following foodborne illnesses caused by certain bacteria, including *C. jejuni* and *Salmonella.* Reactive arthritis usually lasts fewer than 6 months, but this condition may recur or become chronic arthritis.[4]
- **irritable bowel syndrome (IBS),** a disorder of unknown cause that is associated with abdominal pain, bloating, and diarrhea or constipation or both. Foodborne illnesses caused by bacteria increase the risk of developing IBS.[5]
- **Guillain-Barré syndrome,** a disorder characterized by muscle weakness or paralysis that begins in the lower body and progresses to the upper body. This syndrome may occur after foodborne illnesses caused by bacteria, most commonly *C. jejuni.* Most people recover in 6 to 12 months.[6]

A recent study found that adults who had recovered from *E. coli O157:H7* infections had increased risks of high blood pressure, kidney problems, and cardiovascular disease.[7]

[4]Burns B. Reactive arthritis in emergency medicine. Emedicine. http://emedicine.medscape.com/article/808833-overview. Updated February 1, 2010. Accessed May 16, 2012.

[5]Spiller R, Aziz Q, Creed F. Guidelines on the irritable bowel syndrome: mechanisms and practical management. *Gut.* 2007;56(12):1770–1798.

[6]Andary MT. Guillain-Barré syndrome. Emedicine. http://emedicine.medscape.com/article/315632-overview. Updated August 26, 2011. Accessed May 16, 2012.

[7]Clark WF, Sontrop JM, Macnab JJ, et al. Long term risk for hypertension, renal impairment, and cardiovascular disease after gastroenteritis from drinking water contaminated with *Escherichia coli O157:H7:* a prospective cohort study. *British Medical Journal.* 2010;341:c6020.

When should people with foodborne illnesses see a health care provider?

People with any of the following symptoms should see a health care provider immediately:

- signs of dehydration
- prolonged vomiting that prevents keeping liquids down
- diarrhea for more than 2 days in adults or for more than 24 hours in children
- severe pain in the abdomen or rectum
- a fever higher than 101 degrees
- stools containing blood or pus
- stools that are black and tarry
- nervous system symptoms
- signs of HUS

If a child has a foodborne illness, parents or guardians should not hesitate to call a health care provider for advice.

How are foodborne illnesses diagnosed?

To diagnose foodborne illnesses, health care providers ask about symptoms, foods and beverages recently consumed, and medical history. Health care providers will also perform a physical examination to look for signs of illness.

Diagnostic tests for foodborne illnesses may include a stool culture, in which a sample of stool is analyzed in a laboratory to check for signs of infections or diseases. A sample of vomit or a sample of the suspected food, if available, may also be tested. A health care provider may perform additional medical tests to rule out diseases and disorders that cause symptoms similar to the symptoms of foodborne illnesses.

If symptoms of foodborne illnesses are mild and last only a short time, diagnostic tests are usually not necessary.

How are foodborne illnesses treated?

The only treatment needed for most foodborne illnesses is replacing lost fluids and electrolytes to prevent dehydration.

Over-the-counter medications such as loperamide (Imodium) and bismuth subsalicylate (Pepto-Bismol and Kaopectate) may help stop diarrhea in adults. However, people with bloody diarrhea—a sign of bacterial or parasitic infection—should not use these medications. If diarrhea is caused by bacteria or parasites, over-the-counter medications may prolong the problem. Medications to treat diarrhea in adults can be dangerous for infants and children and should only be given with a health care provider's guidance.

If the specific cause of the foodborne illness is diagnosed, a health care provider may prescribe medications, such as antibiotics, to treat the illness.

Hospitalization may be required to treat life-threatening symptoms and complications, such as paralysis, severe dehydration, and HUS.

Eating, Diet, and Nutrition

The following steps may help relieve the symptoms of foodborne illnesses and prevent dehydration in adults:

- drinking plenty of liquids such as fruit juices, sports drinks, caffeine-free soft drinks, and broths to replace fluids and electrolytes
- sipping small amounts of clear liquids or sucking on ice chips if vomiting is still a problem
- gradually reintroducing food, starting with bland, easy-to-digest foods such as rice, potatoes, toast or bread, cereal, lean meat, applesauce, and bananas
- avoiding fatty foods, sugary foods, dairy products, caffeine, and alcohol until recovery is complete

Infants and children present special concerns. Infants and children are likely to become dehydrated more quickly from diarrhea and vomiting because of their smaller body size. The following steps may help relieve symptoms and prevent dehydration in infants and children:

- giving oral rehydration solutions such as Pedialyte, Naturalyte, Infalyte, and CeraLyte to prevent dehydration
- giving food as soon as the child is hungry
- giving infants breast milk or full-strength formula, as usual, along with oral rehydration solutions

Older adults and adults with weak immune systems should also drink oral rehydration solutions to prevent dehydration.

How are foodborne illnesses prevented?

Foodborne illnesses can be prevented by properly storing, cooking, cleaning, and handling foods.

- Raw and cooked perishable foods—foods that can spoil—should be refrigerated or frozen promptly. If perishable foods stand at room temperature for more than 2 hours, they may not be safe to eat. Refrigerators should be set at 40 degrees or lower and freezers should be set at 0 degrees.
- Foods should be cooked long enough and at a high enough temperature to kill the harmful bacteria that cause illnesses. A meat thermometer should be used to ensure foods are cooked to the appropriate internal temperature:
  - 145 degrees for roasts, steaks, and chops of beef, veal, pork, and lamb, followed by 3 minutes of rest time after the meat is removed from the heat source
  - 160 degrees for ground beef, veal, pork, and lamb
  - 165 degrees for poultry
- Cold foods should be kept cold and hot foods should be kept hot.
- Fruits and vegetables should be washed under running water just before eating, cutting, or cooking. A produce brush can be used under running water to clean fruits and vegetables with firm skin.
- Raw meat, poultry, seafood, and their juices should be kept away from other foods.
- People should wash their hands for at least 20 seconds with warm, soapy water before and after handling raw meat, poultry, fish, shellfish, produce, or eggs. People should also wash their hands after using the bathroom, changing diapers, or touching animals.
- Utensils and surfaces should be washed with hot, soapy water before and after they are used to prepare food. Diluted bleach—1 teaspoon of bleach to 1 quart of hot water—can also be used to sanitize utensils and surfaces.

More information about preventing foodborne illnesses is available at *www.foodsafety.gov.*

Traveler's Diarrhea

People who visit certain foreign countries are at risk for traveler's diarrhea, which is caused by eating food or drinking water contaminated with bacteria, viruses, or parasites. Traveler's diarrhea can be a problem for people traveling to developing countries in Africa, Asia, Latin America, and the Caribbean. Visitors to Canada, most European countries, Japan, Australia, and New Zealand do not face much risk for traveler's diarrhea.

To prevent traveler's diarrhea, people traveling from the United States to developing countries should avoid

- drinking tap water, using tap water to brush their teeth, or using ice made from tap water
- drinking unpasteurized milk or milk products
- eating raw fruits and vegetables, including lettuce and fruit salads, unless they peel the fruits or vegetables themselves
- eating raw or rare meat and fish
- eating meat or shellfish that is not hot when served
- eating food from street vendors

Travelers can drink bottled water, bottled soft drinks, and hot drinks such as coffee or tea.

People concerned about traveler's diarrhea should talk with a health care provider before traveling. The health care provider may recommend that travelers bring medication with them in case they develop diarrhea during their trip. Health care providers may advise some people—especially people with weakened immune systems—to take antibiotics before and during a trip to help prevent traveler's diarrhea. Early treatment with antibiotics can shorten a bout of traveler's diarrhea.

Points to Remember

- Foodborne illnesses are infections or irritations of the gastrointestinal (GI) tract caused by food or beverages that contain harmful bacteria, parasites, viruses, or chemicals.
- Anyone can get a foodborne illness. However, some people are more likely to develop foodborne illnesses than others, including infants and children, pregnant women and their fetuses, older adults, and people with weakened immune systems.
- Symptoms of foodborne illnesses depend on the cause. Common symptoms of many foodborne illnesses include vomiting, diarrhea or bloody diarrhea, abdominal pain, fever, and chills.
- Foodborne illnesses may lead to dehydration, hemolytic uremic syndrome (HUS), and other complications. Acute foodborne illnesses may also lead to chronic—or long lasting—health problems.
- The only treatment needed for most foodborne illnesses is replacing lost fluids and electrolytes to prevent dehydration.
- Foodborne illnesses can be prevented by properly storing, cooking, cleaning, and handling foods.

Hope through Research

The Division of Digestive Diseases and Nutrition at the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) supports basic and clinical research into GI diseases, including foodborne illnesses. Researchers are investigating the relationship between foodborne illnesses and digestive disorders such as IBS. Researchers are also studying ways to prevent foodborne illnesses. Clinical trials include

- The Role of Intestinal Inflammation in Irritable Bowel Syndrome, funded by the NIDDK under National Institutes of Health (NIH) clinical trial number NCT01072903
- Shigella Sonnel O-SPC/rBRU Conjugate Vaccine, funded under NIH clinical trial number NCT01369927
- Phase I Safety and Efficacy Study of CVD 1902, a Live, Attenuated Oral Vaccine to Prevent Salmonella Enterica Serovar Paratyphi A Infection, funded under NIH clinical trial number NCT01129453

Participants in clinical trials can play a more active role in their own health care, gain access to new research treatments before they are widely available, and help others by contributing to medical research. For information about current studies, visit *www.ClinicalTrials.gov.*

For More Information

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You may also find additional information about this topic by visiting MedlinePlus at *www.medlineplus.gov*.

This publication may contain information about medications. When prepared, this publication included the most current information available. For updates or for questions about any medications, contact the U.S. Food and Drug Administration toll-free at 1–888–INFO–FDA (1–888–463–6332) or visit *www.fda.gov*. Consult your health care provider for more information.

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This publication is available at *www.digestive.niddk.nih.gov.*

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