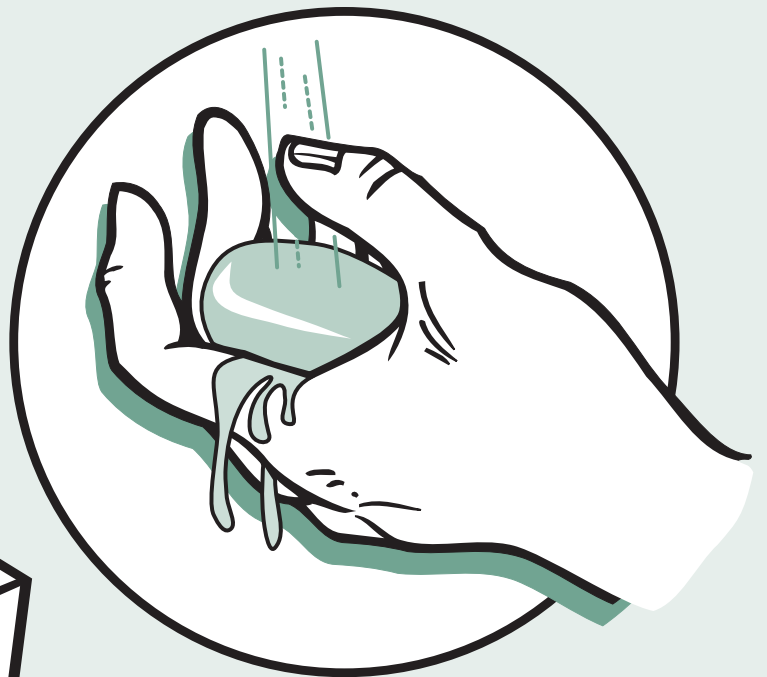
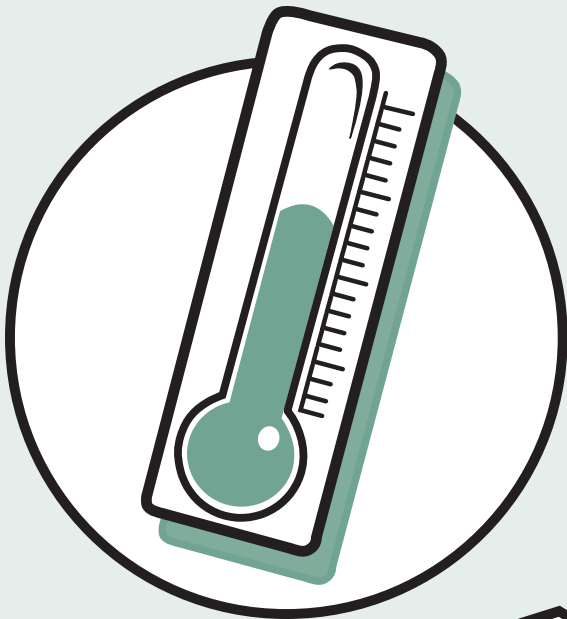


You Can Prevent Foodborne Illness

PACIFIC NORTHWEST PUBLICATIONS

PNW0250



Washington State University
Oregon State University
University of Idaho

Key Food Safety Guidelines

See pages 6–12 for additional details on these food safety basics.

Practice Good Personal Hygiene

- Wash hands with soap and warm running water before handling food, especially after using the toilet, changing a baby's soiled diaper, or touching animals.
- If you are ill with diarrhea, prepare food only for yourself.
- Properly bandage and glove cuts and burns on hands before handling food.

Cook Foods Adequately

- Use a thermometer to make sure meat and poultry (including ground) are cooked to safe temperatures.
- Cook shellfish until the shell opens and the flesh is fully cooked.
- Cook fish until flesh is opaque and flakes easily with a fork.
- Heat hot dogs and lunch meats to steaming hot or 165°F before serving to those who are pregnant, immunocompromised, very young, or elderly.
- Use a thermometer to make sure leftovers are reheated to 165°F.
- Cook eggs until both the yolk and white are firm
- Use a thermometer to make sure foods containing eggs are cooked to 160°F.

Avoid Cross-contamination

- Wash knives, cutting boards, and food preparation surfaces with hot water and soap after contact with raw poultry, meat, and seafood.
- Wash hands with soap and warm running water after handling raw and potentially hazardous foods.
- Keep cooked and ready-to-eat foods separate from raw meat, poultry, seafood, and their juices.
- Clean food preparation surfaces with hot soapy water before and after food preparation.
- Use paper towels or clean cloths to wash food preparation surfaces.

Keep Foods at Safe Temperatures

- Keep cold food at or below 40°F.
- Do not prepare food too far in advance of serving without plans for proper cooling and reheating.
- Keep hot food at or above 140°F.
- Refrigerate food in shallow containers within 2 hours of preparation.
- Store all perishable foods at or below 40°F.
- Take only foods that can be kept at a safe temperature on picnics.
- Use a thermometer to make sure the refrigerator temperature is between 35 and 40°F.
- Thaw perishable foods in the refrigerator, microwave oven, or under cold running water.

Avoid Foods & Water from Unsafe Sources

- When drinking milk and fruit juices, make sure they are pasteurized.
- Use water from a safe water supply for drinking and rinsing fresh produce.
- Thoroughly rinse fresh fruits and vegetables under running water before eating.
- Avoid eating alfalfa and other raw sprouts.
- Avoid serving soft unpasteurized cheeses, smoked seafood, or cold deli salads to those who are pregnant, immunocompromised, very young, or elderly.
- Avoid serving hot dogs and lunch meats that have not been reheated to steaming hot or 165°F to those who are pregnant, immunocompromised, very young, or elderly.
- Avoid eating raw or undercooked seafood.
- Avoid eating foods containing raw eggs; substitute pasteurized eggs or egg products in uncooked foods containing eggs.
- Use cheese and yogurt made from pasteurized milk.
- Obtain shellfish from approved sources.

Developed by a national panel of experts, Spring 2000.

Project leaders: L. Medeiros, Ohio State University; V. Hillers, Washington State University; P. Kendall, Colorado State University.

Foodborne illnesses can fool you. When you're sick and up half the night with a headache, nausea, vomiting, and/or diarrhea, you probably blame it on what you ate last. You may be blaming the wrong food, however, for it can take several days to get sick from some of the pathogens (disease-causing microorganisms) that cause foodborne illness. You also might be surprised to know that you could just as easily have gotten sick from food prepared at home as from eating in a restaurant.

Foodborne illnesses affect millions of Americans each year. The Centers for Disease Control and Prevention (CDC) estimate that in the United States alone there are 76 million cases of foodborne illnesses each year, and these result in 325,000 hospitalizations and 5,000 deaths.

You can reduce your risk of getting foodborne illnesses by following the guidelines in this publication for food that you buy, store, prepare, cook, and serve.

Take special precautions if you are preparing food for people who are:

- Very young
- Elderly
- Pregnant (because of risk to the fetus)
- Already seriously ill with diseases such as AIDS, cancer, diabetes, or other medical condition that causes a weakened immune system

Foodborne illness may be life-threatening to the above-listed people. To protect such individuals, reheat the following precooked foods:

- Hot dogs
- Luncheon meats or cold cuts
- Fermented and dry sausage
- Other deli style meat and poultry products

These pre-cooked foods can become contaminated with the pathogen *Listeria monocytogenes* after they have been processed and packaged. *Listeria* infections are rare, but can cause ex-

tremely serious illness in some people. If you are in one of the high-risk groups, it is best to avoid long-term refrigerator storage of meats; instead, freeze them.

If you are particularly vulnerable to infection, you are especially advised not to eat:

- Raw or unpasteurized milk or cheese
- Raw or undercooked meat or poultry
- Soft cheeses such as feta, Brie, Camembert, blue-veined, and Mexican-style, unless made from pasteurized milk
- Raw fish or shellfish, including oysters, clams, mussels, and scallops
- Raw or undercooked eggs and foods containing raw or lightly cooked eggs, including some salad dressings, cookie and cake batters, homemade ice cream, sauces, and beverages such as unpasteurized eggnog (foods made with commercially pasteurized eggs are safe to eat)
- Raw sprouts such as alfalfa, clover, and radish (cooked sprouts are okay to eat)
- Unpasteurized fruit or vegetable juices

SOME KNOWN CAUSES OF FOODBORNE ILLNESSES

Most foodborne illnesses are caused by eating food that contains harmful bacteria, viruses, or parasites. After the food is eaten, these microorganisms or germs continue to grow and reproduce in your body, causing an infection. Foods also can cause illness if they contain a toxin or poison that is produced by bacteria growing in the food.

Bacteria

Bacteria are a very large group of tiny organisms that reproduce by cell division. They can be found in virtually any environment, including food, and plants and animals produced for food. Bacteria thrive in warm, moist foods that are low in acid. Most disease-causing bacteria

grow very slowly at low temperatures, multiply rapidly in mid-range temperatures, and are killed at high temperatures. Antibiotics are effective for controlling most kinds of bacteria infection. However, some bacteria types are developing the ability to resist antibiotics, which means that illnesses caused by these bacteria are not easily treated. It appears that antibiotic-resistant bacteria are increasing in the food supply, making prevention of foodborne illnesses very important.

Hand washing, heating to appropriate temperatures, kitchen cleanliness, and refrigeration are essential to control bacterial pathogens.

Some of the many different species of bacteria that cause foodborne illnesses are discussed below.

- Two similar groups of bacteria, *Salmonella* and *Campylobacter*, are normally found in warm-blooded animals such as cattle, poultry, and pigs. *Salmonella* and *Campylobacter* may be present in food products that come from these animals—such as raw meat, poultry, eggs, or unpasteurized dairy products. *Salmonella* also may be present on fresh fruits and vegetables.
- Several types of the common bacteria *Escherichia coli* have the potential to cause severe illness. *E. coli* O157:H7 bacteria can cause severe bloody diarrhea. The symptoms begin to occur within 1–8 days, and the illness generally lasts 5–10 days. About 5% of persons who are infected with *E. coli* O157:H7 develop serious complications such as kidney failure and blood clots in the brain. Children and the elderly are much more likely to have serious complications from *E. coli* O157:H7 than adults. In young children, *E. coli* O157:H7 is the leading cause of acute kidney failure.

E. coli O157:H7 can be transmitted through both food and water. A wide variety of foods, including undercooked ground beef, raw (unpasteurized) milk, uncooked sprouts, unpasteurized juices, and contaminated water have been associated with *E. coli*

O157:H7 outbreaks. *E. coli* O157:H7 also can be transmitted from person to person. This is particularly a problem in day care centers where young children are in close contact. If *E. coli* bacteria are on the hands, they can be spread by touching another person or food that won't be cooked before eating.

- Unlike most foodborne pathogens, *Listeria* can grow at refrigerator temperatures. Even a few of these bacteria on food can reproduce and become a large population if food is stored in your refrigerator for a long period of time. *Listeria* bacteria rarely cause illness, but if a pregnant woman gets listeriosis, the infection can be passed to the unborn child and cause death of the fetus. *Listeria* bacteria are found in many types of foods, but illness is most often associated with raw meats, unpasteurized milk, and cheese made from unpasteurized milk. Processed food such as hot dogs, luncheon meats, cold-smoked fish, and deli salads have caused *Listeria* outbreaks, which is why pregnant women and others who are at high risk of listeriosis are advised to heat these foods before eating them.
- Botulism is a rare but deadly food poisoning. The bacteria that cause botulism, *Clostridium botulinum*, are found in many places, including soil, water, and air. They become dangerous when environmental conditions of low oxygen and low acidity allow them to multiply and produce a toxin. Low-acid foods such as meat, fish, poultry, or vegetables that are improperly canned can be breeding grounds for these bacteria. The toxin also may be produced in low-acid cooked foods left too long at room temperature, such as baked potatoes or potpies. Homemade mixtures of raw garlic stored in oil at room temperature have also caused outbreaks.
- *Staphylococcus aureus* or *Staph* bacteria occur normally on human skin and in the nose and throat. These bacteria can be transmitted to food during handling or preparation. When moist, low-acid foods such as egg custards or salads containing meat, poultry,

eggs, or vegetables are left at room temperature, any *Staph* present may grow and multiply to unsafe numbers within a few hours. *Staph* bacteria produce a toxin that causes food poisoning. The toxin produced by *Staph* is not destroyed by cooking.

- Meat, poultry, vegetables, beans, rice, and herbs may be the source of the bacteria *Clostridium perfringens*. Growth of this microorganism can occur when big pots of food such as stews, soups, or gravies are cooled improperly or left at room temperature for longer than 3 hours.

Viruses

Viruses are extremely small pathogens that reproduce only within a living host cell. Some viruses (such as noroviruses and Hepatitis A) can be transmitted by food and water. Other viruses (such as Human Immunodeficiency Virus, the cause of AIDS) are transmitted from person to person, but not through food or water. Washing hands thoroughly after using the toilet and avoiding shellfish and other foods that may have been exposed to sewage-contaminated water are essential to avoiding the transmission of viral diseases through food. Viruses are killed when foods are adequately cooked.

- Noroviruses are believed to be responsible for 9 million cases of foodborne illness each year in the United States, which makes them the most common cause of foodborne illness. Fortunately, the illness usually is mild. Noroviruses are passed from the feces of infected persons onto the hands of food handlers or into sewage. Any food subject to human fecal contamination may cause a noroviral infection. Outbreaks are usually associated with food or contaminated water in swimming pools, lakes, or municipal supplies. People also get sick by eating inadequately cooked shellfish or salad ingredients contaminated by food handlers. Noroviruses have a low infective dose, which means that it is relatively easy for a person with this infection to spread the disease to other people.

Parasites

Parasites are small, primitive animals that live within the bodies of other animals. Several types of parasites can be found in food and water, including *Toxoplasma gondii* (the cause of toxoplasmosis), *Trichinella spiralis* (the cause of trichinosis), *Giardia lamblia*, *Cryptosporidium parvum*, and *Cyclospora cayetanensis*. Parasites are larger in size than bacteria, do not reproduce in food, and usually require more than one animal species to carry out their life cycle. Cooking food and heating or filtering water are the ways to avoid infection by parasites.

- *Toxoplasma gondii* usually causes a mild infection. About 30% of Americans have likely been infected with *Toxoplasma*. House cats and many other animal species may carry *Toxoplasma*, including animals raised for meat, and humans. Women who become infected with *Toxoplasma gondii* during pregnancy may transmit the disease to their unborn child, resulting in severe illness in the child.

Although causes of foodborne illness like those described above have been recognized for decades, new foodborne diseases continue to be identified, and that trend is likely to continue. The CDC estimates that 81% of the total or 62 million cases per year of foodborne illness are caused by as-yet-unknown pathogens.

For additional details about the most common foodborne illnesses, see pages 16–18.

FOOD SAFETY BASICS

It's easiest to prevent foodborne illness if you remember 5 basic rules:

1. Practice good personal hygiene.
2. Cook foods adequately.
3. Avoid cross-contamination.
4. Keep foods at safe temperatures.
5. Avoid foods and water from unsafe sources.

Practice Good Personal Hygiene

The single most important thing you can do to prevent foodborne illness is to wash your hands—frequently, and especially after using the toilet, changing a diaper, petting an animal, and before preparing or eating food.

Most of the foodborne illnesses that can be prevented by good personal hygiene are transmitted from an infected person's intestines to another person. Many—but not all—of these are viruses.

Several foodborne pathogens, including noroviruses, Hepatitis A, *E. coli*, and some other types of bacteria, plus some parasites such as *Giardia*, also can be transmitted directly from person to person. Sometimes it's from the hands of a person who is infected with it. Sometimes it's from an animal such as those at home or in a petting zoo. Sometimes it's from dirt or manure or a sandbox. *Toxoplasma gondii*, for example, is commonly found in dirt or sand in areas with outdoor cats. That's why it's so important to wash your hands before eating and to teach your children to do the same.

The most important part of hand washing is that you use enough water to wash pathogens from your hands. Use warm water and soap (antibacterial soap is not necessary). Soap is important to loosen dirt and pathogens so they can be washed off your hands. Lather your hands with soap, rub thoroughly so that the soap is all over your fingers and hands, then rinse them thoroughly, using enough water to remove all of the soap. A fingernail brush helps remove dirt and feces. It takes at least 20 seconds to wash your hands thoroughly. Dry them on a paper towel or a cloth hand towel changed at least daily.



Even if you're not preparing foods, you should always wash your hands after using the toilet, changing a baby's diaper, or touching animals. Teach your children to do the same.

If you are sick with diarrhea, do not prepare food for others. An amazingly high number of infectious viruses or bacteria can be in fecal matter, and the infectious dose is low for many of these pathogens. It's easy to miss a few pathogens when you wash your hands and pass them along to someone else.

Be sure to cover cuts and burns on your hands while you prepare food. Infected cuts can be a source of *Staph* and other germs. Keep disposable plastic gloves in the kitchen for this purpose.

Other things to remember when handling food:

- Wash your hands after any contact with raw poultry, meat, or seafood.
- Work with clean hands, clean hair, clean fingernails, and clean clothing.
- Avoid using your hands to mix foods when clean utensils can be used.
- Keep your hands away from your mouth, nose, and hair.
- Cover your nose and mouth with disposable tissues when coughing or sneezing and wash your hands thoroughly afterward.
- Use a clean spoon each time you taste food while preparing, cooking, or serving.
- Wash your hands after smoking.

If you follow these guidelines, you will avoid transferring pathogens from raw food, the environment, or your body onto ready-to-eat foods.

Cook Foods Adequately

Cooking is an essential part of making foods safe to eat because almost all pathogens are killed when food is heated to 160°F for a few

seconds (lower temperatures for longer periods of time also kill pathogens). The best way to be certain food has been cooked to the proper temperature is to check it with a thermometer, preferably a digital thermometer.

It is risky to eat rare meats or poultry, raw or lightly cooked fish and shellfish, raw milk, and foods made with raw or lightly cooked eggs. Many pathogens live naturally in the intestinal tracts of food animals—*Salmonella* and *Campylobacter*, for example. Surveys about meat sold in retail food stores indicate that between ¼ and ¾ of all meat and poultry cuts may be contaminated with one or more of these pathogens. Ground meats are contaminated with pathogens throughout the meat. That's why it is important to cook ground meat until the temperature is 160°F on the inside, not just the outside.

Parasites such as *Toxoplasma* or *Trichinella* may be in the muscles of some animals, particularly pigs. Thus, you should eat pork only when it is thoroughly cooked. Roasts and steaks from other animals usually only have pathogens on the surface unless the meat is pierced for tenderizing. Rare beef steaks and roasts are much less risky than rare pork or undercooked ground meat.

Wild game may have a high level of bacteria because of the difficulty of handling game in the field. Thorough cooking of all cuts is recommended. (*Big Game from Hunt to Home*, PNW 517, has information about field-dressing and preparing game meats.)

Salmonella sometimes contaminate the inside of eggs as well as the eggshell itself (about 1 egg out of every 20,000 contains *Salmonella* inside the shell).

Shellfish may pick up bacteria and viruses from contaminated waters. Fish may contain parasitic worms and *Listeria* bacteria. These microorganisms then can infect anyone who eats the shellfish or fish if the food is not cooked properly.

Any foods likely to be contaminated with pathogens should be heated to 160°F; at this

temperature, most pathogens are killed very quickly. Check the temperature with a thermometer to be certain the food is fully cooked.

Foods that should be cooked until they reach 160°F include:

- **Ground meats.** People usually judge whether ground meats are cooked by checking to see if the meat is brown. Using visual signs to determine that meat is done is risky because it has been shown that hamburgers may appear brown before they reach 160°F or remain pink after reaching 160°F.
- **Pork and game meats.**
- **Eggs.** Either check the temperature with a thermometer or else cook eggs until both the yolk and white are firm. (In this case, visual cues DO work.) If you use recipes in which eggs are only partially cooked or remain raw, use pasteurized eggs or modified recipes. The latter are available from the American Egg Board at www.aeb.org.
- **Casseroles and other dishes containing eggs or raw meat.**

Other temperatures to remember:

- **Cook steaks and roasts to at least 145°F** and until all the exterior surface appears to be cooked.
- **Cook fish and shellfish to 145°F.** Visual cues are commonly used to determine if fish and shellfish are thoroughly cooked. Cook fish until it flakes and loses its translucent or raw appearance and cook shellfish until the shell opens and the flesh is fully cooked. You should be aware, however, that little research has been done to identify the cooking temperatures required to kill pathogens on fish and shellfish, and that cooking recommendations are based more on the quality of the cooked product than scientific data.
- **Cook poultry to 165°F.**
- **Reheat leftovers to 165°F** to kill pathogens that may have survived the first cooking or

USING THERMOMETERS

The only way to be sure your food has cooked to a safe temperature inside and out is to measure the temperature with a clean thermometer. The best kind of thermometer to use is a digital thermometer. It's quick and can be used in both thick and thin foods. The tip of a digital thermometer must be inserted at least ½ inch deep into food for about 10 seconds for it to register the correct temperature.



You should test the middle of the thickest part of what you're cooking because the center of the food is usually cooler than the surface. When you're testing a hamburger for temperature, lift it out of the pan on a spatula and insert the thermometer in from the side. That's because even if the patty is thick, it's easy to push the thermometer too far down and be beyond the center.

If you can't find a digital thermometer, you can still use one of the readily available bimetallic coil thermometers, which you can recognize because of the dial gauge. These thermometers read food temperature along a full 2–3 inches of the stem (up to the dimple). That means that the entire part of the stem from the dimple to the tip must be inside the food. For thin foods, a coil thermometer must be inserted sideways, as for hamburger.



Use your thermometer to test for doneness near the end of the cooking time. Most thermometers are not designed to be left in food during cooking.

Make sure your thermometer is accurate. Some thermometers can be calibrated for accuracy. If yours can, follow the directions that come with it. If it cannot, test it in boiling water. It should read 212°F if you live at sea level. If you live at elevations higher than sea level, determine your elevation and check a reference book to determine the temperature of boiling water at that elevation. For information on thermometers and their use, check out www.fsis.usda.gov/thermy.

that were introduced after cooking. However, *Staph* toxin won't be destroyed by heating leftovers.

- **Reheat hot dogs and deli meats to 165°F** before serving to pregnant women, the elderly, and those with compromised immune systems.

Avoid Cross-contamination

Avoid cross-contamination or the moving of pathogens from one food to another food. This is an especially critical consideration when you're dealing with food that is ready-to-eat.

It appears that cross-contamination is a relatively common mistake made by home food preparers. A case in point is *Campylobacter*

jejuni, a widespread contaminant of poultry from the grocery store. *Campylobacter* is easy to kill by cooking, and few people eat undercooked poultry—yet there are more than 2 million cases of human campylobacteriosis each year.

An excellent general rule to avoid cross-contamination is to always keep cooked and ready-to-eat foods separate from raw foods.

- Clean food preparation surfaces before and after preparing food. Thoroughly wash your hands, knives, cutting boards, food preparation surfaces, and sink after any contact with raw poultry, meat, seafood, or any other potentially hazardous foods. Finish by rinsing with a dilute bleach solution (see the sanitizing information on page 9).

- Wash your countertops with soap and water before and after food preparation. It is especially important to wash your countertops before food preparation if there is a cat in the house that gets on the counters. Sanitizing sprays and wipes are useful as an additional safety measure to assist in kitchen cleaning.
- Rinse all fresh fruits, including melons and vegetables, thoroughly under running water before preparing or eating them. It is true this will not remove all microorganisms, but it will reduce the number present. Pathogens have been isolated from a wide variety of fresh produce, and outbreaks of foodborne illness have been associated with many types of produce—cantaloupes and tomatoes, for example. If the skin of the fruit or vegetable is contaminated, the pathogens move into the fruit when it is sliced. Removing the skin or rind reduces the risk.
- When grilling outdoors, always use a clean plate for the cooked meat.
- Store raw meat and poultry items in the refrigerator on a tray or plate to prevent juices from dripping onto other food.
- Don't store both raw and ready-to-eat meats together in the refrigerator meat drawer; reserve this space for one or the other and let everyone in the family know which type of meat should be stored in the drawer.
- Keep kitchen cloths and sponges clean. Launder dishcloths frequently and dry in the dryer to aid in killing pathogens. Sponges can be washed in the dishwasher on a regular basis. Wet dishcloths and sponges can be sanitized by heating them in a microwave oven until steaming or soaking in the sink with a gallon of water and $\frac{3}{4}$ cup bleach for 5 minutes, followed by rinsing and drying.
- Use paper towels to clean up spilled juices from meat or poultry.
- It is best to have 2 cutting boards—one for raw meat, fish, and poultry and another for

cooked food, salads, and ready-to-eat food. A hard, non-porous cutting board such as one made of acrylic is easier to clean than a wooden board because you can put the acrylic board in the dishwasher. If you wash your cutting board by hand, sanitize it frequently.

Sanitizing is the process of killing most pathogens.

• ***To sanitize cutting boards:***

Wash the cutting board with hot sudsy water. Rinse, then drain and sanitize with either a kitchen sanitizer (follow directions on the bottle) or a dilute chlorine bleach solution. To make the bleach solution, mix 1 teaspoon of bleach with a quart of water. Spray or wipe the mixture onto the cutting board and let it sit for at least 2 minutes. Then rinse and air dry.



• ***To sanitize dishes and utensils:*** Wash dishes, then soak for 10–15 seconds in a solution of 1 tablespoon chlorine bleach per gallon of water. Drain and air dry.

• Dishes washed in a dishwasher will have most pathogens removed by the hot water and detergent. Using the heated drying cycle of the dishwasher increases the destruction of pathogens.

Note: *Sanitizing dishes is most important if there is illness in the family or the dishes and utensils are used by a person who is at high risk for foodborne illness due to a weakened immune system.*

Keep Foods at Safe Temperatures

Like most other living things, bacteria need food, warmth, moisture, and time to grow

and multiply. In order to prevent bacteria from growing in your food, keep hot foods hot (above 140°F) and cold foods cold (below 40°F).

- Refrigerate all prepared and leftover foods within 2–3 hours. Food can become unsafe if held for too long in the 60–125°F range, the zone where bacteria grow most rapidly. Remember to include all the time involved during preparation, storage, and serving to determine how long a food has been in a particular temperature range. For example, holding foods for more than 3 hours in a 60–125°F oven with an automatic timer prior to cooking is not safe. (Figure 1 summarizes the temperatures needed to control the growth of bacteria in foods.)
- Take care with **perishable** foods before you get them home. When shopping, pick up the perishable foods as your last stop in the grocery store, and—especially in hot weather—get them home and into the refrigerator quickly. Do not leave perishable foods in your car while you run other errands. If you live more than 30 minutes from the store, consider using an ice chest or cooler when you shop.
- Store all perishable foods such as eggs, meat, and dairy at or below 40°F.
- In most cases, prompt cooling and proper refrigeration of foods can keep the number of bacteria at a safe level.
- Small amounts of warm foods may be put into the refrigerator. Speed the cooling of larger quantities of food by putting the food in shallow, uncovered containers. (Add the cover after the food has cooled to prevent drying and preserve quality.)
- If you have a large volume of hot food, cool in a container of ice water. Stir and replace the ice frequently until the food is about 100°F, then refrigerate in shallow containers. Set a timer for 30–45 minutes as a reminder to check the food temperature and refrigerate.
- Do not prepare perishable food more than 2 hours before serving unless you can properly cool and reheat it.
- Do not overpack the refrigerator; cool air must circulate to keep food safe.
- Keep foods at safe temperatures when they will be eaten away from home, such as at picnics, potluck dinners, camping trips, school, or work. If ice is not available, choose foods that will not support bacterial growth such as nuts, peanut butter, canned foods, crackers, whole raw fruits, or dried foods.
- Discard any perishable foods from picnics or potlucks that have not been kept adequately chilled or heated during serving. “If in doubt, throw it out.”
- The colder food is kept, the less chance bacteria have to grow. Check your refrigerator temperature. It should be between 35 and 40°F.
- Thaw perishable foods in the refrigerator or under cold running water. If you wish to thaw food more quickly in a microwave, cook immediately thereafter.

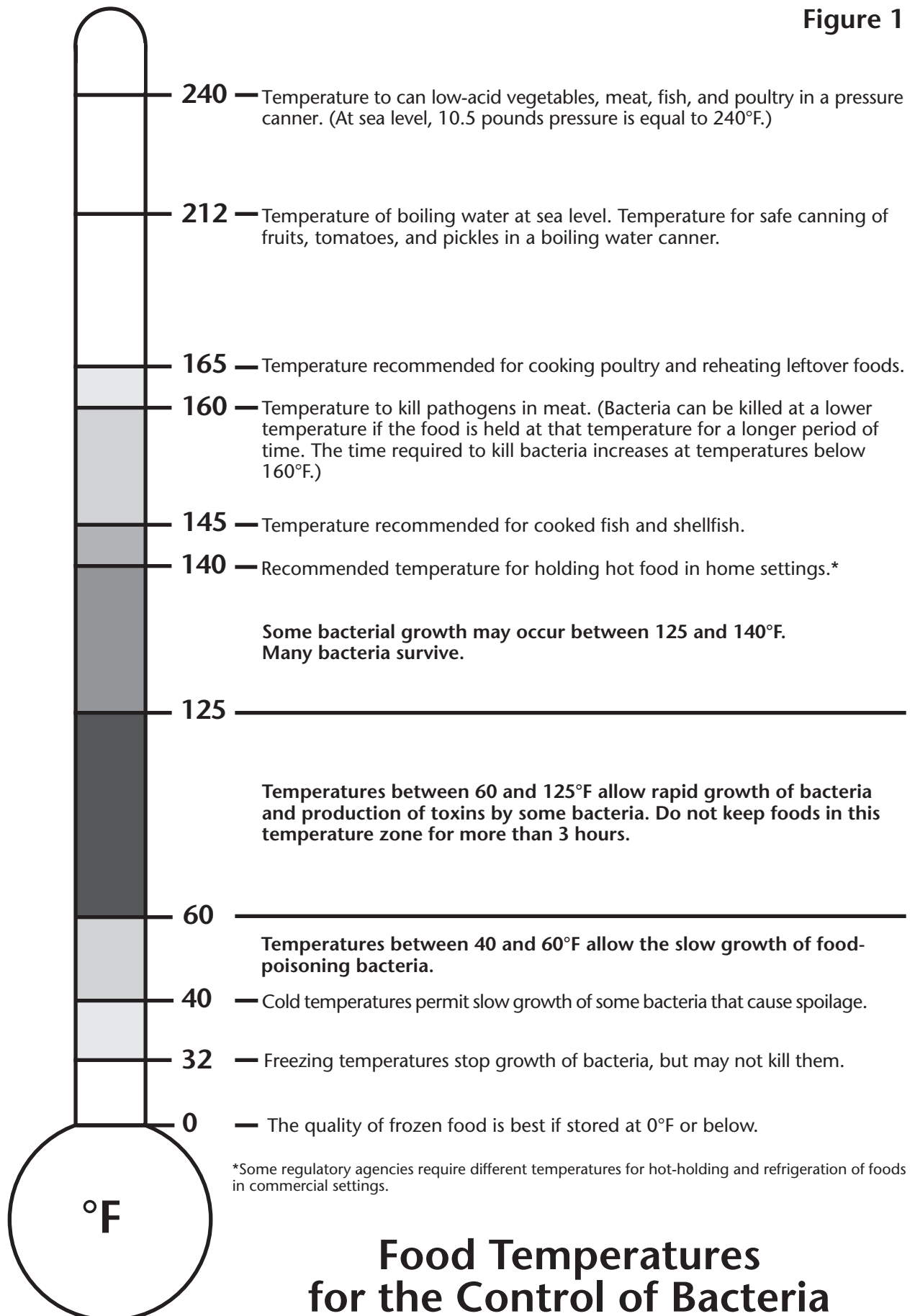
Avoid Foods and Water from Unsafe Sources

Some foods have such a high probability of being contaminated with pathogens or toxins that their consumption should be avoided altogether. The risk is highest for people susceptible to foodborne illness. Many of these foods are known as “ready-to-eat” but have been produced or processed in a way that does not kill pathogens.

Foods and beverages frequently linked to foodborne illness include:

- Unpasteurized milk and milk products
- Raw or undercooked meats and poultry
- Unpasteurized fruit juice
- Raw sprouts of all types
- Raw seafood and fish
- Raw or undercooked eggs
- Contaminated water

Figure 1



*Some regulatory agencies require different temperatures for hot-holding and refrigeration of foods in commercial settings.

To reduce your chance of having a foodborne illness, you should:

- ✓ Drink only pasteurized milk and fruit juices.
- ✓ Avoid eating undercooked or raw meat (such as steak tartare).
- ✓ Use cheese and yogurt made from pasteurized milk.
- ✓ Cook sprouts before eating.
- ✓ Cook fish and shellfish before eating.
- ✓ Avoid eating foods containing raw eggs. Use pasteurized eggs or egg products in food containing uncooked eggs.
- ✓ Use water from a safe water supply for drinking and food preparation.
- ✓ Obtain shellfish from approved sources such as grocery stores (rather than unlicensed roadside vendors). This will greatly reduce the chance that the shellfish were harvested from contaminated water.

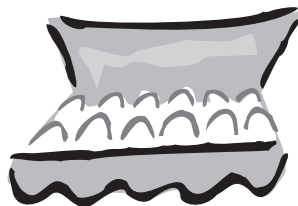
HANDLE THESE FOODS WITH EXTRA CARE

While all foods are subject to the 5 basic safety rules (practice good personal hygiene, cook foods adequately, avoid cross-contamination, keep foods at safe temperatures, and avoid food from unsafe sources), some foods require extra care or special handling.

Eggs and Foods Containing Eggs

Fresh eggs must be handled carefully, for even eggs with clean, uncracked shells may contain *Salmonella* bacteria.

Buy eggs only from a refrigerated case. Make sure they are clean and the shells are not cracked. Refrigerate them promptly at home in their original



carton. Avoid storing eggs in the rack on your refrigerator door, as the temperature here fluctuates widely.

Cook eggs and dishes containing eggs thoroughly. Both the yolk and white should be firm; scrambled eggs should not be runny. Dishes containing eggs should be cooked to 160°F as verified by a thermometer. Serve eggs and egg-containing foods immediately after cooking, or keep hot dishes hot (above 140°F) and cold dishes cold (below 40°F). If eggs and egg dishes are pre-cooked and refrigerated, they should be reheated as leftovers, to 165°F.

If you wish to prepare dishes with raw or lightly cooked eggs, use pasteurized eggs or a modified recipe. The latter are available from the American Egg Board at www.aeb.org. Dishes in which eggs are not thoroughly cooked include homemade salad dressings, eggnogs, ice creams, frostings, meringues, and puddings cooked on top of the stove.

Cooked eggs and egg dishes should be reheated or refrigerated within 3 hours of their preparation. If you use hard-cooked eggs for Easter egg hunts, be sure they are no more than 2 hours out of the refrigerator if you plan to eat them later. Discard those with cracked shells.

Meat/Fish/Poultry



Frozen meat, poultry, and fish may be thawed in a variety of ways:

1. Put the frozen item into the refrigerator overnight. Refrigerator thawing generally requires at least 24 hours for each 5 pounds of meat, poultry, or fish.
2. For faster thawing, put the frozen package in a watertight plastic bag under cold water. Change the water often.
3. When microwave-defrosting food, plan to cook it promptly after thawing because some areas of the food may become warm and begin to cook during microwaving.

4. If you thaw raw meat, poultry, or fish on the counter, refrigerate or cook the meat while it is still cold and contains ice crystals.

If you cook frozen meat, poultry, or fish without thawing, allow at least 1½ times as long for cooking as required for unfrozen or thawed products of the same size and shape.

A reminder: All meat, poultry, and fish should be cooked thoroughly.

Hamburger

Ground meat must be handled with special care because bacteria on the surface are spread throughout the meat during grinding. Always cook to 160°F, verified with a thermometer inserted sideways into meat that has been lifted out of the pan on a spatula.



Ham

Hams vary. Some types need to be cooked, while others are fully cooked and can be eaten as they come from the package or after heating just prior to serving. Read the label carefully and if you have any doubts, cook the ham. Remember that ham is perishable and should be kept cold or hot.

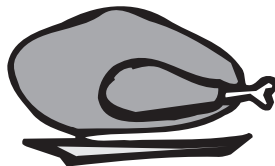
Hot dogs and lunch meats

These products are perishable and should be kept in the refrigerator. Cook hot dogs before eating, and cook lunch meats if they are to be eaten by a person at high risk for food-borne illness.



Stuffed meat or poultry

Stuff poultry, meat, or fish just before cooking. Put the stuffing in lightly, without packing, to allow heat to penetrate throughout quickly. Make sure the stuffing reaches a temperature of at least 165°F as verified with a thermometer. You may choose to bake stuffing separately. Do not cook whole, stuffed poultry in the microwave because the stuffing may not get hot enough to kill harmful bacteria.



Using the microwave to cook meat, poultry, or fish

- Take extra care when using a microwave oven to cook meat, poultry, or fish. Cooking in a microwave can leave areas that do not get as hot as the rest.
- Start with a piece of meat that is the same temperature throughout so that it will cook more evenly. If it has been defrosted in the microwave, allow a rest period of 20–30 minutes between defrosting and cooking to allow the temperature to equalize.
- Put the meat into a dish and cover with a lid, plastic wrap, or cooking bag. Loosen or vent the lid or wrap to let steam escape. (The moist heat that is created will help ensure even cooking.) *Note: Plastic wrap should not touch the food during cooking.*
- Cook large cuts of meat at medium power (50%) to allow heat to reach the center without overcooking outer areas.
- Stir or rotate food midway through the cooking time to eliminate cold spots.
- When partially cooking food in a microwave before cooking on a grill or in an oven, transfer the food immediately and continue the cooking process.
- Use a food thermometer to be sure the food is cooked to the proper temperature: 160°F for meat (including ground meats), 165°F for poultry, and 145°F for fish and shellfish. Let the food stand covered for 5–10 minutes after cooking to equalize internal temperatures and complete cooking.

Fresh Produce

Buy produce that is not bruised or damaged. If it is fresh-cut, it should be refrigerated or surrounded by ice at the store.

Promptly refrigerate perishable produce when you get it home.

Prewashed packaged vegetables that are labeled “ready to eat” do not need to be washed at home. For all other fresh produce, wash twice, using cool tap water and reasonable agitation, and remove bruised or damaged areas. Scrub firm produce such as melons and cucumbers with a clean produce brush. Washing should be done just before eating.

If you are making homemade apple cider, heat it to at least 160°F before drinking it.

Honey

Infants are susceptible to a rare form of botulism caused by ingesting *Clostridium botulinum* bacteria. An infection results when these bacteria grow in the infant’s intestinal tract. (In contrast, botulism in adults is caused by eating food contaminated with the toxin that the bacteria produce.) Babies with botulism are constipated and have difficulty holding up their heads and sucking. Because honey can contain *C. botulinum*, no form of raw or pasteurized honey should be fed to infants until they are 1 year old. (This includes baked foods made with honey such as honey graham crackers or muffins made with honey.)

Refrigerated Foods

Several pathogens, including *Listeria*, some types of *Clostridium botulinum*, and some types of *E. coli*, are able to grow and/or produce toxins at refrigerator temperatures. To reduce your risk of foodborne illness from any of these, use caution when storing foods in the refrigerator for extended periods of time. This is especially true for minimally processed or pre-cooked foods such as pre-made salads, fresh pasta, sauces, soups, entrees, uncured meat, and poultry.

Make sure your refrigerator temperature is less than 40°F, and observe the expiration or use-by dates on all foods.

Long-term refrigerated storage of smoked fish and garlic or herbs in oil is associated with a risk of botulism. Keep smoked fish and home-made garlic or herbs in oil refrigerated; use

within 3 weeks. (Commercial garlic in oil is acidified to prevent the growth of *C. botulinum*.)

A reminder on refrigerator safety:

- Make sure your refrigerator temperature is less than 40°F.
- Precool large pots of hot food in a container of cold water or ice water. Stir the food and replace the cold water frequently over a 30-minute period.
- Don’t overpack the refrigerator; cold air must circulate if food is to be kept cold and safe.
- Store meat, poultry, and fish on a dish or tray on the bottom shelf of your refrigerator to prevent cross-contamination.
- Wipe up spills promptly.
- Periodically clean your refrigerator thoroughly. Wash the surfaces with a solution of 1 gallon of water mixed with ½ cup of unscented ammonia. Rinse and dry the surfaces before replacing food.

Frozen Foods

When foods are frozen, only a small percentage of the bacteria on the food are killed. Most just stop growing while the food is in the freezer. But, once food is thawed, any bacteria that were on it will grow. Thus, it’s important to practice good sanitation when preparing food for the freezer. Freeze only high-quality foods and handle them as little as possible during processing.

Foods that have been frozen and thawed require the same care as fresh foods. Thawed ground meat, poultry, or fish that have an off-odor or off-color should not even be tasted. Long-term storage in the freezer will reduce the quality of foods, but food is not unsafe after long-term freezer storage if it has remained frozen.

If your freezer stops working, you need to decide which foods can be saved for later use. You can safely refreeze thawed foods if they still contain ice crystals or if they are still cold (about 40°F or less). Discard any foods that have developed an off-odor or about which you have any doubts.

Canned Foods

Commercially canned foods are processed under carefully controlled conditions and safety problems are rare. When commercially canned food shows any sign of spoilage—bulging can ends, leakage, spurting liquid, off-odor, or mold—do not use it. Do not even taste it.

Home-can low-acid foods (meat, fish, poultry, and vegetables) in a pressure canner. Boiling-water canners, ovens, steamers without pressure, and open kettles do not get the food hot enough to kill the spores of *Clostridium botulinum*, so it is not safe to can vegetables, fish, meat, or poultry—or mixtures containing these foods—by any method other than a pressure canner. Be sure the pressure canner is working properly and that each step of the canning process, including time and temperature directions, is followed exactly.

Tomatoes with added acid in the form of lemon juice or citric acid, pickled vegetables, and fruits can be canned safely in a boiling water canner because they are more acidic. However, over-ripe tomatoes or tomatoes from frost-killed vines should not be used for canning because they lose acidity as they mature or if they freeze on the vine.

For specific directions and scientific time and temperature recommendations for home canning and other food preservation methods, consult publications from your county Extension office such as:

- *Canning Vegetables*, PNW172
- *Canning Seafood*, PNW194
- *Canning Fruits*, PNW199
- *Canning Tomatoes and Tomato Products*, PNW300
- *Canning Meat, Poultry and Game*, PNW361
- *Salsa Recipes for Canning*, PNW395
- *Recetas Para el Envasado de Salsas*, PNW395S
- *Using and Caring for Your Pressure Canner*, PNW421
- *Fresh Cheese Made Safely*, PNW539
- *Queso Fresco Hecho Saludable*, PNW539S
- *Envasado de Tomates*, WREP0112

The following Web sites have additional information about food safety topics:

foodsafety.wsu.edu
extension.oregonstate.edu/fcd/foodsafety
pubs.wsu.edu
www.foodsafety.gov

FOODBORNE ILLNESSES

Botulism

Cause: *Clostridium botulinum*. Spore-forming bacteria that can grow and produce toxin in the absence of oxygen, such as in a sealed container or below the surface of food.

Examples of foods involved: Improperly canned low-acid food (vegetables, fish, meat, poultry), smoked fish, and improperly handled low-acid cooked foods.

Transmission: Eating food contaminated with the toxin.

Symptoms: Double vision, inability to swallow, speech difficulty, and progressive respiratory paralysis. The fatality rate is about 20%.

Onset: 12–72 hours.

Duration: Days to months.

Prevention: Follow reliable instructions for time and temperature for home canning low-acid vegetables, meat, fish, and poultry. Bacterial spores in these foods are destroyed only by high temperatures obtained in pressure canner.

Toxins are destroyed by boiling 10 minutes or heating in the oven until the temperature of the food reaches 185°F.

Refrigerate cooked, low-acid food promptly.

C. perfringens poisoning

Cause: *Clostridium perfringens*. Spore-forming bacteria that grow in the absence of oxygen. Temperatures reached in thorough cooking of most foods are not sufficient to destroy the heat-resistant spores that begin to grow if a large volume of food is cooled slowly.

Examples of foods involved: Cooked meat and poultry, stews, refried beans, soups, and gravies left at 60–125°F for many hours.

Transmission: Eating food contaminated with large numbers of the bacteria.

Symptoms: Diarrhea, abdominal cramps, and gas.

Onset: 8–16 hours.

Duration: 24–48 hours.

Prevention: Cool food rapidly and refrigerate promptly or hold above 140°F to prevent surviving bacteria from growing.

Reheat leftover foods to 165°F.

Escherichia coli O157:H7 infections

Cause: *Escherichia coli* O157:H7. Bacteria are found in the manure of cattle and other ruminant animals.

Examples of foods involved: Undercooked ground beef, unpasteurized (raw) milk, unpasteurized juices, and raw fruits and vegetables.

Transmission: Eating foods contaminated with the bacteria, from person-to-person contact with an infected person who has some on his or her hands, or by touching animals who carry the bacteria. *E. coli* O157:H7 has a low infective dose; possibly as few as 10 bacteria can make you sick.

Symptoms: Severe diarrhea that is often bloody, abdominal pain, and vomiting. Usually little or no fever.

Onset: 1–8 days.

Duration: 5–10 days.

Prevention: Adequate cooking and avoiding cross-contamination.

Listeriosis

Cause: *Listeria monocytogenes*. Bacteria widespread in nature can live in the soil as well as the intestinal tracts of humans and animals.

Examples of foods involved: Raw milk, soft cheese, and undercooked meat or poultry. Processed foods such as hot dogs, luncheon meats, and deli salads.

Symptoms: Headache, fever, and nausea. Can lead to meningitis, miscarriage, stillbirth, and death. Pregnant women, infants, and persons with low resistance to infections (such as cancer patients) are most susceptible.

Onset: 9–48 hours for intestinal symptoms; 2–6 weeks for meningitis and other serious complications.

Duration: Variable.

Prevention: Cook foods of animal origin thoroughly. Use pasteurized milk and dairy products. Prevent contamination of cooked foods by cleaning hands and surfaces after touching raw animal foods. Do not use animal manure in vegetable gardens unless composted. If in high-risk group, reheat processed food to 165°F and avoid eating deli salads.

Norovirus infection

Cause: A group of similar viruses called caliciviruses also known previously as “Norwalk-like viruses.”

Examples of foods involved: Contaminated shellfish, ready-to-eat foods touched by infected food handlers, contaminated water.

Transmission: Eating food or drinking water contaminated with relatively small numbers of viruses or directly person to person.

Symptoms: The illness is usually mild and characterized by nausea, vomiting, diarrhea, and abdominal pain. Fever is rare.

Onset: 24–48 hours.

Duration: 24–60 hours.

Prevention: Practice good personal hygiene and avoid raw or undercooked shellfish.

Salmonellosis and Campylobacteriosis

Cause: *Salmonella* species and *Campylobacter jejuni*. Bacteria widespread in nature; live and grow in the intestinal tracts of humans and animals.

Examples of foods involved: Raw or under-cooked poultry, meat, and eggs. Unpasteurized dairy products. Contaminated raw fruits and vegetables.

Transmission: Eating contaminated food or contact with infected persons or carriers of the infection. Also transmitted by insects, rodents, farm animals, and pets.

Symptoms: Diarrhea, fever, abdominal cramps, and vomiting. Infants, elderly people, and immunocompromised persons are most susceptible. Severe infections cause high fever and sometimes death. In a small number of cases, can lead to arthritis and Gullian-Barre syndrome (*Campylobacter*), an autoimmune disorder.

Onset: 1–5 days.

Duration: 2–7 days.

Prevention: Cook foods thoroughly. The bacteria are destroyed by heating food to 140°F for 10 minutes or to higher temperatures for less time—for instance, 160°F for a few seconds. Chill foods rapidly in small quantities. Refrigerate at 40°F. Wash hands, work surfaces, and equipment after touching raw meat and poultry.

Staphylococcal poisoning

Cause: *Staphylococcus aureus*. Bacteria growing in food produce a toxin that is extremely resistant to heat.

Examples of foods involved: Custards, egg salad, potato salad, chicken salad, macaroni salad, ham, salami, cheese, cooked poultry, and stuffing.

Transmission: Eating food containing the toxin. Food handlers can carry the bacteria in infected cuts and wounds and in the respiratory tract.

Symptoms: Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present.

Onset: 1–6 hours.

Duration: 24–48 hours.

Prevention: Growth of bacteria that produce toxin is stopped by keeping foods above 140°F or below 40°F. Chill food rapidly in small quantities. Once the toxin is formed, it is not easily destroyed by heat. Mishandled foods *cannot* be made safe by reheating.

Toxoplasmosis

Cause: *Toxoplasma gondii* is a parasite that infects essentially all cats that spend any time outdoors. The infective stage develops in the gut of the cat and the parasite is then shed in cat feces. Animals that have eaten food or water contaminated with cat feces may have the parasite in their meat. Soil contaminated with cat feces may also contain the parasite.

Examples of foods involved: Raw or partially cooked pork, lamb, or venison. Fruits and vegetables that have come into contact with soil.

Transmission: Eating food or drinking water that is contaminated with the parasite. Touching your hands to your mouth after gardening, handling cats, cleaning a cat's litter box, or anything that has come into contact with cat feces.

Symptoms: Adults generally have mild or no symptoms, but persons especially vulnerable to infection may develop severe toxoplasmosis

involving the heart, lungs, or nervous system. A pregnant woman infected for the first time can pass the infection to her fetus with possible serious consequences.

Onset: 6–10 days.

Duration: The duration of the illness depends on the health and immune status of the person.

Prevention: Avoid eating raw or undercooked meat, especially ground pork. Freeze ground pork products for several days before cooking (freezing kills the *Toxoplasma* cysts). Wash hands before eating or preparing food. Wash or peel fruits and vegetables thoroughly to remove all traces of soil. If you are pregnant or have a weakened immune system, you should discuss toxoplasmosis with your health care provider.

Vibriosis

Cause: *Vibrio parahaemolyticus*, *Vibrio vulnificus*. Bacteria are common in seawater. Other *Vibrio* species found in seawater (including *Vibrio cholera*) can cause foodborne disease.

Examples of foods involved: Raw or undercooked seafood such as oysters, shrimp, crabs, and clams.

Transmission: Eating seafood contaminated with large numbers of bacteria.

Symptoms: Vomiting, diarrhea, abdominal cramps, and nausea.

Onset: 1–7 days.

Duration: 2–8 days. *Vibrio vulnificus* infections can be fatal in persons with liver disease and the immunocompromised.

Prevention: Cook seafood thoroughly. Avoid cross-contamination between raw and cooked seafood. Refrigerate all seafood.

DEFINITIONS

Foodborne illness is any illness that results from eating contaminated food. **Foodborne infection** is an illness resulting from eating food contaminated by a pathogen that causes an infection in the person who ate the food.

All foodborne illnesses used to be called food poisoning. However, **food poisoning** occurs when a substance that is poisonous to humans is consumed, including toxins produced by some types of bacteria.

A **microorganism** or **microbe** is an organism so small that it cannot be seen without a microscope. Bacteria and viruses and some parasites are microorganisms. A **pathogen** is a microorganism that causes illness, and the word “germ” is generally used to mean the same thing. Pathogens vary in their **infective doses**—the number of microorganisms you need to swallow in order to become sick. It takes fewer microorganisms to make you sick when a pathogen has a **low infective dose**.

A **case** of foodborne illness is one individual who is sick. An **outbreak** is when 2 or more individuals from different households have a similar illness from consuming the same food.

Potentially hazardous foods are any (usually moist and low in acid) food that is capable of supporting the rapid growth of bacteria. Sometimes these foods are called perishable. Potentially hazardous foods must be kept out of the “danger zone” (40–140°F) to prevent foodborne illnesses.

Examples:

- ✓ Foods of animal origin such as meat, milk, cheese, poultry, eggs, fish, and other seafood
- ✓ Foods of plant origin that have been heat-treated, including cooked vegetables, beans, and rice
- ✓ Raw sprouts
- ✓ Cut melons, peeled carrots, and other peeled vegetables and fruits
- ✓ Cooked pasta
- ✓ Tofu and other moist soy protein products
- ✓ Low-acid sauces such as Hollandaise

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