Understanding Foodborne Illness

What is foodborne illness?

Foodborne illness, also called food poisoning, is an illness acquired from eating or drinking contaminated food or water.

- When food is contaminated by bacteria, viruses, parasites, or chemicals it can make you sick
- For each reported case of foodborne illness, it's estimated that hundreds of additional cases go unreported in the community each year
- Public Health Agency of Canada estimates that each year roughly one in eight Canadians (four million people) get sick with a domestically acquired foodborne illness.

Symptoms of foodborne illness

- Nausea
- Fever/chills
- Diarrhea
- Bloody diarrhea
- Vomiting
- Muscle soreness
- Cramps
- Headaches

The symptoms may occur anywhere from 30 minutes to 70 days after consuming the contaminated food or drink. This depends on:

- The type of microorganism
- The immune system of the person
- The amount of contaminated food or drink consumed

Some populations that are at greater risk for foodborne illness include:

- Young children
- People with chronic illness and weakened immune systems
- Elderly
- Pregnant women

Costs of foodborne illness

- Personal suffering (illness and/or death)
- Law suits from customers/clients who are ill
- Fines and/or court appearances
- Bad publicity, resulting in loss of business
- Employees being absent from work, resulting in lost wages and staff shortages
- Time consuming and expensive foodborne illness investigations

Types of foodborne illness

- **Microorganisms**
  - Bacteria
  - Viruses
  - Parasites
  - Mould
- **Chemical**
  - Accidental addition of poisons to food
  - Poisonous plants and animals
- **Food allergies**

Microorganisms

- **Microorganisms** are living single cells that are invisible to the naked eye
  - Examples of microorganisms include bacteria, parasites, viruses, moulds, and yeasts
- **Pathogens** are harmful microorganisms that can cause disease in humans
  - Pathogens are usually odourless and tasteless
  - Spoilage organisms cause odours and odd tastes
- Some microorganisms are beneficial to humans, such as the ones that are used to make sauerkraut, yogurt and cheese

Potential sources of microorganisms include:

- Environment (i.e. soil)
- Humans (i.e. sick food handlers)
- Insects and rodents
- Raw foods (i.e. raw chicken)

Cross-contamination is the transfer of pathogens, chemicals or unwanted items onto food that may make it unsafe to eat.

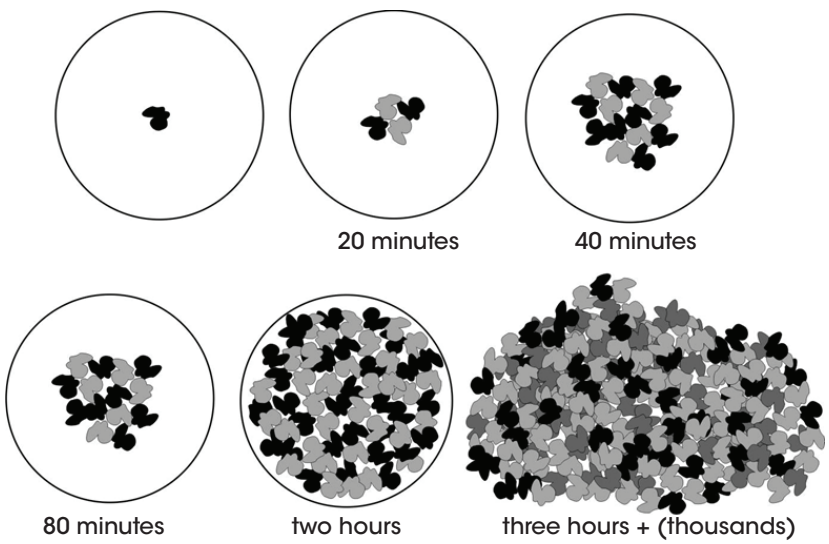
Bacteria

- Cause of most cases of food poisoning
- Are invisible and found everywhere
- Can double in number every 20 minutes
- Only pathogenic bacteria can cause food poisoning

How pathogenic bacteria grow

- Bacteria reproduce by dividing themselves in two (one cell becomes two, two become four)
- They will divide when the conditions of their surroundings are ideal
- The number of bacteria can reach dangerous levels in a short period of time
- When exposed to unfavourable conditions, such as very hot or cold temperatures, some bacteria can protect themselves by changing into a spore state
- The spore protects the bacteria from unfavourable conditions and, when ideal conditions present themselves, shed the protective coating and begin reproducing again

Bacteria multiply by dividing



Factors affecting bacteria growth

Bacteria need a combination of factors to grow:

1. Food source high in protein
2. Acidity (pH)
3. Time
4. Temperature
5. Oxygen
6. Moisture (available water)

1. Food source high in protein

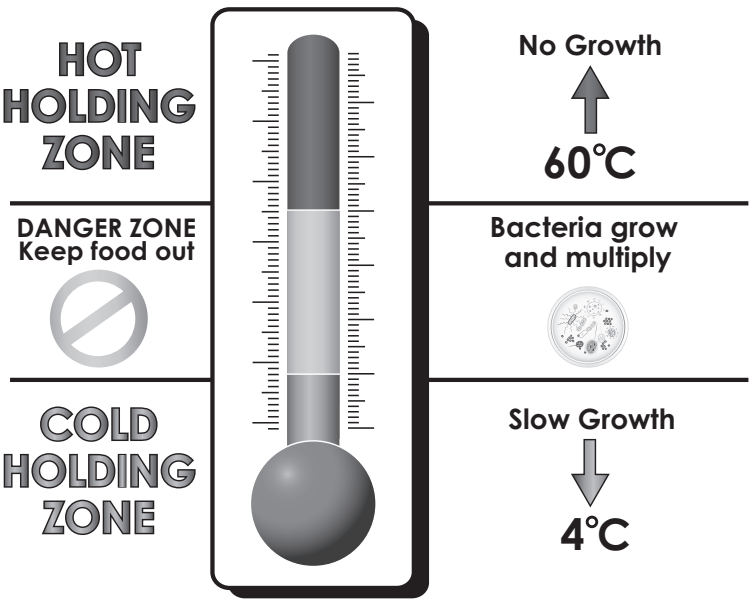
- Pathogenic bacteria and spoilage bacteria grow best in high protein foods such as meat, seafood and dairy

2. Acidity (pH)

- Acid and base concentrations are measured on a pH scale that ranges from 0 (most acidic) to 14 (most basic)
- Pathogenic bacteria survive best in a neutral environment.
- Tap water has a pH of 7 (neutral), bleach has a pH of 13 (alkaline) and lemon has a pH of 3 (acidic)

3. Time

- Leaving food in the "danger zone" (4°C to 60°C) for more than two hours may be long enough for pathogenic bacteria to multiply and cause food poisoning
- By reducing the time food is kept in the danger zone, the amount of bacterial growth is limited



4. Temperature

- Most bacteria grow best in the temperature danger zone
- Temperatures below 4°C will not kill pathogenic bacteria but will slow down their growth
- At temperatures above 60°C, pathogenic bacteria will not grow.
- Cooking food to appropriate final internal cooking temperatures is the only way to ensure pathogenic bacteria are destroyed (refer to page 46 for cooking temperatures)

5. Oxygen

- Most pathogenic bacteria can only grow where there is oxygen present while some can only grow where there is no oxygen
- For example, the pathogenic bacteria, Clostridium botulinum can grow in canned foods and in flavoured oils where there is no oxygen

For additional information see:
http://healthycanadians.gc.ca/eating-nutrition/safety-salubrite/fruits-vegetables-legumes-fruits/oil-huile-eng.php

6. Moisture (available water)

- Pathogenic bacteria need a water supply to survive
- The amount of water in food can be reduced by processes such as smoking, drying or adding salt or sugar

These six factors influence the growth of pathogenic bacteria. By sufficiently changing or eliminating one of the factors, bacterial growth and the risk of foodborne illness can be prevented. Time and temperature are the easiest factors for food handlers to control.

Potentially hazardous foods

- Foods that are able to support the growth of pathogenic bacteria and the production of toxins are considered hazardous
- However, any food can be the cause of food poisoning if it is not handled safely and becomes contaminated
- Foods that are considered most hazardous are those with a high protein and available water (moisture) content. Examples of these foods are:
  - Poultry
  - Beef/veal
  - Pork/ham
  - Fish/seafood
  - Egg dishes
  - Cooked rice
  - Milk and milk products

Types of bacterial foodborne illness

The most common microorganisms that cause food poisoning are bacteria. There are two types of bacterial food poisoning:

1. **Bacterial infection**
2. **Bacterial intoxication**

Bacterial Infection

- A bacterial infection occurs when the food eaten is contaminated with living pathogenic bacteria
- Bacteria will multiply in the digestive tract and most often cause diarrhea, stomach cramps and fever. The bacteria will pass through your stomach and down into your lower intestine. The bacteria will imbed themselves in the wall of the intestine and begin to multiply. When there are enough bacteria, diarrhea will result and may be bloody.
- Symptoms may occur 12 hours to 10 days (longer in some cases) after eating the contaminated food depending on:
  - Type of bacteria consumed
  - The amount of food eaten
  - The susceptibility of the person
- Examples of infectious bacteria are S*almonella, Campylobacter, E. coli* and *Shigella*.
- Pathogenic bacteria can be destroyed by cooking foods to the appropriate cooking temperature

Bacterial infections

Illness	Source	Onset time	Symptoms	Associated foods	Prevention
Salmonella	Intestinal tract and feces of humans and animals; in particular poultry and beef	12 –72 hrs	Abdominal pain, diarrhea, nausea, headache, and occasional vomiting	Poultry, meat and meat products, eggs, unpasteurized milk, roast beef	Keep foods out of Danger Zone, proper cold-holding/ hot-holding of foods
E. coli 0157:H7	Intestinal tract and feces of animals in particular beef	3–10 days; usually 3-4 days	Bloody or watery diarrhea, abdominal cramps; may lead to Hemolytic Uremic Syndrome or other serious kidney complications	Raw meats in particular ground beef, poultry, pork, contaminated water, unpasteurized milk/ juices	Keep foods out of Danger Zone, proper cold-holding/ hot-holding of foods
Campylobacter	Intestinal tract of poultry, cattle, swine, rodents, wild birds, and household pets (cats/dogs)	2- 5 days	Diarrhea (may be bloody), abdominal cramps, fever, vomiting	Raw/undercooked poultry, unpasteurized milk, contaminated water	Keep foods out of Danger Zone, proper cold-holding/ hot-holding of foods

Public Health Agency of Canada (PHAC) - Fact Sheets

http://www.phac-aspc.gc.ca/fs-sa/fs-fi

2. Bacterial Intoxication

- Food poisoning intoxication can happen when the food eaten is contaminated with toxins (poison) or toxin producing bacteria
- When these bacteria multiply in the food or in the body, a toxin is produced. Not all toxins are destroyed by cooking, therefore it is important to keep foods out of the temperature danger zone.
- Vomiting is the most common and first symptom of bacterial intoxication
- Examples of bacteria that produce toxins are *Staphylococcus aureus, Bacillus cereus* and *Clostridium botulinum*

Bacterial intoxications

Illness	Source	Onset	Symptoms	Associated foods	Prevention
Staphylococcus aureus	Nose, throat, hair, skin, hands, feces of humans	30 min-8 hrs, usually 2-4 hrs	Vomiting, stomach cramps, diarrhea	Ham, beef, pork, potato salad, cream sauces, custard, ready-to-eat foods	Proper handwashing, proper glove use, keep foods out of danger zone
Bacillus cereus	Ubiquitous in the environment, commonly found in raw, dried and processed foods	30 min-6 hrs (heat-stable toxin); 6-24 hrs (heat-labile toxin)	Nausea, vomiting (heat-stable toxin) Diarrhea (heat-labile toxin)	Cooked rice (heat-stable toxin) Various mishandled foods (heat-labile toxin)	Keep foods out of Danger Zone, proper cold-holding/ hot-holding of foods
Clostridium botulinum (foodborne toxin)	Pre-formed toxin present in contaminated foods	12-36 hrs	Nausea, vomiting, diarrhea, constipation, fatigue, blurred vision, dry mouth, difficulty speaking/ swallowing, descending paralysis	Improperly prepared low-acid canned foods, improperly smoked fish, improperly handled raw marine mammal meat, non-refrigerated low-acid juices, baked potato stored in aluminum foil	Use proper home canning methods, never eat foods from dented/ bulging/ leaking cans

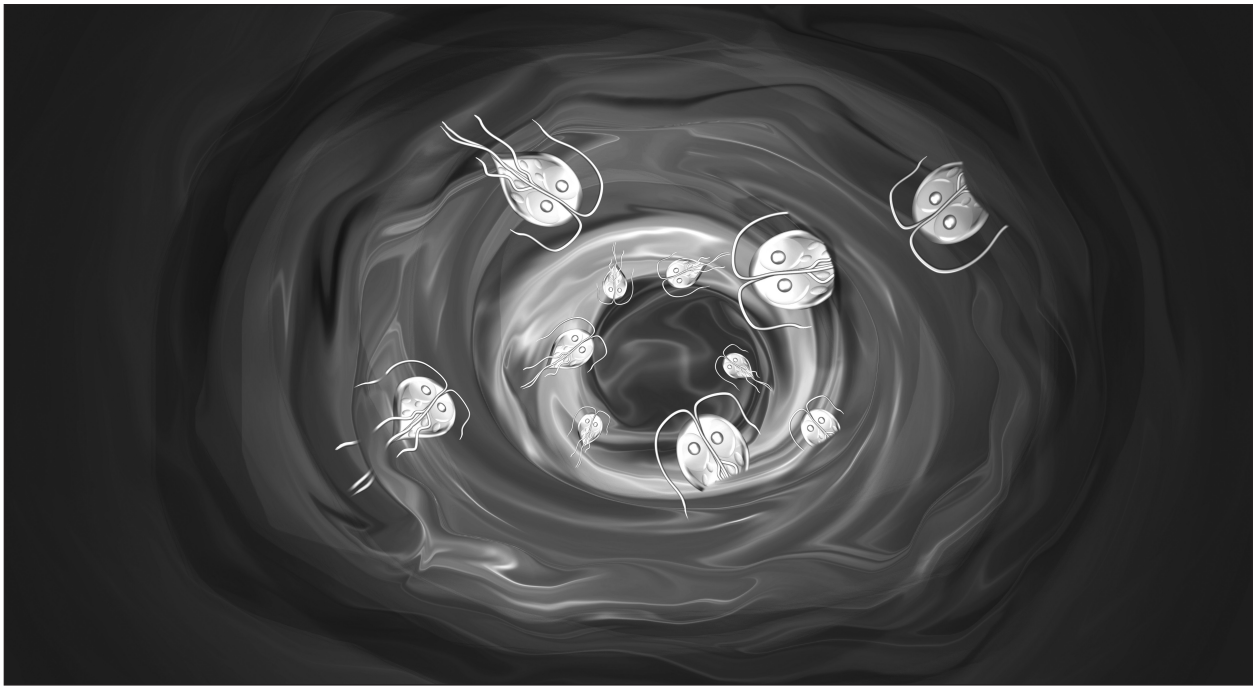
Notes:

Viruses

- Viruses are microorganisms that multiply inside living cells and cause illness
- Viruses do not multiply in food; they are simply passed to humans through food
- Antibiotics do not work against viruses but some vaccines will help people build immunity against certain viruses
- Examples of viruses that can be passed through food are Hepatitis A, Norovirus, and Rotavirus
- Foods can be contaminated by viruses through unwashed hands, unclean preparation areas, and unsafe water
- Some viruses can survive on counter tops and food contact surfaces for a long period of time

Viruses

Illness	Source	Onset time	Symptoms	Associated foods	Prevention
Hepatitis A	Feces of humans, contaminated water	15-50 days; average 28-30 days	Loss of appetite, fever, fatigue, nausea, jaundice, dark urine, may be asymptomatic	Shellfish, water, any ready-to-eat foods contaminated by food-handler	Prevent infected food handler from handing foods, good hand and personal hygiene
Norovirus	Feces of humans, contaminated water, contaminated work surfaces	12-48 hrs	Vomiting, diarrhea, abdominal cramps, nausea, fever	Shellfish, fecally contaminated foods, ready-to-eat foods touched by infected food handler	Good hand and personal hygiene, proper sanitation of work surfaces



Parasites

- Parasites are organisms that cause illness by living and feeding off a host organism
- Various symptoms are associated with parasitic diseases. Some of these symptoms include nausea and diarrhea, and other symptoms are more disease-specific such as ulcers, anemia, muscle pain and, in some cases, muscle damage
- Parasites are killed and inactivated by cooking the food product to the proper internal temperature (See final cooking temperature chart on page 46)

Transmission of parasites to humans can occur in three ways:

1) Consumption of contaminated water

- Consuming untreated or unprotected water which may be contaminated with parasites.
- Exposure to fecally contaminated recreational water.
- Use of contaminated water to wash or rinse food.

2) Consumption of undercooked or raw contaminated meat products

- Consumption of wild game meats such as bear or boar which are raw or undercooked.

3) Consumption of food contaminated by infected food handlers

- An infected food handler can transmit a parasite to food they are working with.

Mould

- Moulds are fungi that grow on a variety of vegetable and animal matter, especially under warm, moist conditions
- Moulds produce elaborate root networks
- Although most mould found on food products is more of a spoilage and quality issue, some moulds can produce toxins which can be harmful and cause illness
- Examples of toxins produced by certain mould species include:
  - Aflatoxin- occasionally found in nuts or peanut
  - Orchratoxin- occasionally found in grain or coffee
- Unless mold is a characteristic of the food, when food goes mouldy throw it out

Chemical poisoning

- Chemical food poisoning can occur when chemicals are intentionally or unintentionally added to food
- Vomiting is a common symptom of chemical contamination and usually occurs within one hour of ingestion
- Ensure chemicals are properly stored below or away from any food products or food preparation areas
- Examples of chemicals that can cause chemical food poisoning:
  - Pest control poisons
  - Additives
  - Cleaners
  - Degreasers

Avoiding accidental contamination

- Pesticides or pest poisons should be used appropriately and away from any food preparation areas
- Mislabelled chemical containers such as spray bottles or buckets have the potential to contaminate food if mishandled
- Cleaners and degreasers should be stored and handled away from any food items or food preparation areas

Dickey's Barbecue, a restaurant in Salt Lake City, was involved in a case where their iced tea was accidentally poisoned.

http://pennstatefoodsafety.blogspot.ca/2014/08/tea-sweetened-with-industrial-cleaner.html

Poisonous plants and animals

- Some plants and animals are naturally poisonous when consumed. This is why it's important to purchase foods from approved sources.
- Some examples of poisonous plants and animals are:
  a) Solanine in green potatoes
  b) Poisonous mushrooms
  c) Fish and shellfish toxins

For additional information see:

http://www.inspection.gc.ca/food/information-for-consumers/fact-sheets/specific-products-and-risks/fruits-and-vegetables/natural-toxins/eng/1332276569292/1332276685336

Notes:

Food allergies

- An allergy is an overreaction of the immune system to unwanted substances
- Allergies can result in a wide range of symptoms. The most common are vomiting, diarrhea, nausea, throat itchiness, and swelling. Symptoms may also include tingling in the mouth, hives, tightness in the throat and chest, wheezing, shallow breathing, coughing/choking, dizziness and abdominal pain.
- Common food allergens:
  - Peanuts/tree nuts
  - Eggs
  - Seafood
  - Dairy products
  - Soy
  - Wheat gluten
  - Seeds
  - Sulphites
- Anaphylactic shock or anaphylaxis is the severe form of an allergic reaction. It is a dramatic loss in blood pressure which leads to unconsciousness and can result in death within three to 15 minutes.

Allergies and the role of the food service industry

- Keep an accurate list of all ingredients that are put into foods.
- Keep ingredient lists from the packages of all pre-packaged food
- If you are not sure of the food's ingredients, tell the customer that you are not sure
- Be aware of potential cross-contamination of food when using utensils and equipment like cooking utensils, cutting utensils and baking pans
- Where possible on the menu, substitute with food that will be less likely to cause an allergic reaction. For example, substitute vegetable oil for peanut oil
- Call 911 if a customer is having a severe allergic reaction

For additional information see:

http://www.inspection.gc.ca/food/information-for-consumers/fact-sheets/food-allergies/eng/1332442914456/1332442980290

Food intolerance

- Some foods (lactose) and food additives (MSG, sulphites) can cause a food intolerance with similar symptoms as food allergies.
- The difference is food intolerances do not affect the immune system

What to do if someone reports possible food poisoning

- Ask the customer what date and time he or she visited the restaurant and what foods were consumed
- Call the local public health unit and advise the customer to call the health unit
- Refrigerate, label and keep any leftover food portions from menu item. Inform staff not to use samples.
- Review with the staff how the meal was prepared (using the HACCP system).
- Ask staff if they were ill with similar symptoms
- Document all information

Physical hazards

Protect food from being contaminated with anything that may cause illness, a choking hazard or other injury. This includes items like:

- Bandages
- Gum
- Hair
- False finger nails
- Jewelry
- Glass
- Metal staples
- Broken equipment or containers

Review questions

1. Pathogenic microorganisms can cause illness
   (a) True
   (b) False

2. Food poisoning:
   (a) Is caused by the last meal you ate
   (b) Can have numerous symptoms such as diarrhea and vomiting
   (c) Is only caused by one type of microorganism
   (d) Can be stopped by not eating in restaurants

3. The following are types of micro-biological food poisonings
   (a) Infections
   (b) Intoxications
   (c) Parasitic
   (d) All of the above

Notes: