

## FOODBORNE DISEASES

### Facts

- Enteric infections are the second most common cause of mortality among children less than five in developing countries.

Foodborne illnesses are estimated to cause in the U.S. each year:

- 76 million illnesses
- 325,000 hospitalizations
- 5,000 deaths

Survival of pathogens depends on:

- The type of organism
- Temperature (low temperatures favor survival)
- Moisture (soil moisture of 10–20% saturation is best for survival of pathogens)
- Nutrients (increase survival)
- pH
- Sunlight

Development of illness depends on:

- The toxicity or virulence of a substance
  - The amount of the substance or microorganisms ingested
  - The susceptibility of the individual
- **Ingestion of as few as one viral particle can infect a susceptible host.**
  - Urine is usually sterile except for schistosomiasis, typhoid, and leptospirosis carriers.
  - ***Staphylococcus* food poisoning is one of the most common foodborne diseases.**
  - Foods with pH value <4.5 are usually not easily spoiled by bacteria, but are more susceptible to spoilage by yeasts and molds.

Mycotoxins:

- Secondary metabolites produced by several groups of fungi
- Some may be teratogenic and carcinogenic
- May be resistant to heat and dessication
- Can survive a range of temperatures from 14–131°F
- **Aflatoxin**, a potential carcinogen, is produced by *Aspergillus* spp.
- Compost piles are common reservoirs and sources of infection
- Most are not destroyed by boiling, autoclaving, or cooking

- ***Salmonella*, *Listeria*, and *Toxoplasma* cause more than 75% of deaths by known pathogens.**
- The total number of foodborne illnesses in the U.S. has been estimated at 5 million, with a total cost of \$1 billion to \$10 billion per year.
- It is estimated that only **10–20% of the actual number of cases of foodborne illness are reported** due to underreporting, many can be caused by means other than food (thus uncertainty), some are caused by unknown pathogens and cannot be diagnosed.

The most common contributing factors:

- Improper holding temperatures
- Food from an unsafe source
- Inadequate cooking
- Poor personal hygiene on the part of food handlers
- Contaminated equipment
- *Campylobacter jejuni* is a common contaminant in poultry processing plants and is frequently found in conjunction with salmonella. It may also be found in raw milk and contaminated water. Poor food handling, storage, and sanitation facilitate transmission.
- Shell eggs are the major vehicle for *Salmonella enterica* infection in humans. They are contaminated internally via transovarial transmission from the laying hen.
- *Listeria* grows at below refrigeration temperatures.

Seafood:

- Implicated as the vehicle in 10–19% of foodborne illnesses in the U.S.
- Implicated as the vehicle in more than 70% of foodborne illness in Japan
- Consumption of raw or undercooked is most common factor in illness
- Norovirus outbreaks have been associated with consumption of raw oysters
- Often contaminated by the discharge of human waste into harvest areas
- Oyster consumption accounts for nearly 50% of *Vibrio* infections

Pasteurization:

- Batch pasteurization at 145°F for 30 minutes
- High temperature, short time pasteurization at 160°F for 15 seconds
- Ultra-high temperature pasteurization at 191°F for 1 second

*Clostridium perfringens*

- Incomplete cooking of stews, meats, gravies, and large cuts of meat that have been rolled or penetrated with skewers and failure to provide prompt and thorough refrigeration can lead to contamination

- Destroyed by heat and thorough cooking, but spores are not completely destroyed by thorough cooking
- Toxin forms in the intestinal tract, not in the food like it does in *Staphylococcus* food poisoning and botulism
- Spores can survive 212°F for 1 hour or more

Essential elements in food establishments are:

- Cook to proper internal temperature
- Serve prepared foods promptly
- Ensure adequate refrigeration
  - Store in shallow pans, with food thickness or depth not greater than 4 inches
  - Cool to 45°F or less within 4 hours
  - Do not allow foods to remain at room temperature longer than 2 hours
  - Refrigeration temperature of 38–40°F is recommended
- Plan food preparation to coincide as closely as possible with serving time
- Stress cleanliness and good personal hygiene
  - Wash hands
  - Use utensils or plastic gloves to mix or serve food
  - Thoroughly clean and sanitize
- Use wholesome food and food ingredients
- Have adequate supply of potable water
- Control rodents, vermin, insects, flies, etc...
- Protect dry food stores
  - Store all foods at least 6 inches above the floor
  - Rotate stock—first in, first out

Mercury:

- A whole-blood level above 20 ppb may pose a mercury poisoning hazard
- Methylmercury has an estimated biological ½-life of 70–74 days in humans
- It is ubiquitous in the environment from both natural and manmade sources
- In fish, eggs, and meat the mercury is usually in methylmercury form.
- Maximum allowable concentration in food is 0.05 ppm
- Maximum allowable concentration in drinking water is 0.002 mg/l

Fluoride:

- Fluoride deficiency is associated with dental carries and osteoporosis
- Water with 0.8–1.7 mg/l is beneficial to children during permanent tooth development
- MCL in water is 4.0 mg/l
- Alternate to water fluoridation is a 1-minute mouth rinse by children once a week

- Most malnutrition comes in the form of protein deficiency.

Essential elements to human life are:

- Iron

- Iodine
  - Fluoride
  - Copper
  - Manganese
  - Zinc
  - Selenium
  - Chromium
  - Cobalt
- 
- **Dehydration is the leading cause of diarrheal illness-associated morbidity and mortality.**