DISEASE TRANSMISSION BY CONTAMINATED WATER

Water & Disease Transmission Facts

- Water is traditionally viewed as the "universal solvent"

Surface waters:
- Streams, rivers, lakes, ponds, reservoirs

Groundwater:
- Most plentiful form of available freshwater

Fresh water:
- Only 2.6% of the global content of water constitutes fresh water (atmospheric & both surface and subsurface water bodies)

- WHO estimates that 80% of all diseases are attributable to inadequate water or sanitation and that 50% of hospital beds worldwide were occupied by people afflicted with a water-related disease.

- Water- and food-borne diseases are sometimes referred to as the "intestinal" or "filth" diseases.

- Soil moisture of 10-20% saturation appears to be best for pathogen survival.

- Water treatment plants that maintain a free residual chlorine in the distribution system of at least 0.5 mg/l for at least 30 min and low turbidity (<1 NTU) in the finished water can achieve satisfactory virus inactivation.

Development of illness depends on:
- Toxicity or virulence of a substance or pathogen
- The amount of the substance or pathogen ingested
- The resistance or susceptibility of the individual

Bacteria:
- Prokaryotic, microscopic organisms, typically unicellular w/morphologies described as coccoidal (ovoid), bacillary (rodlike), spiral (vibroid or helical), and filamentous.

Viruses:
- Submicroscopic, genetic parasitic elements consisting of a nucleic acid (DNA or RNA) core surrounded by a protein coat, fall in the size range of 10–100 nm, pass thru filters that retain bacteria, are visible only with the aid of an electron microscope, and can replicate only following invasion of living (host) cells.
- Viruses responsible for diseases transmitted via water are all RNA viruses.
- Viruses appear stable over the pH range of 3–9.

- Low temperatures favor survival.

Algae:
- Chlorophyllous microorganisms ranging from microscopic unicellular to "seaweed"-size multicellular forms.
- Their oxygenic capability in performing the light reaction in photosynthesis is the major source of atmospheric oxygen.
- Some marine dinoflagellates (e.g., Gonyaulax spp.) are producers of saxitoxin and gonyautotoxin, two of the most virulent non-protein neurotoxins of record.

Protozoa:
- Aerobic or anaerobic protists having a true nucleus (eukaryotic) and reproduce usually by fission.
- Motility may be by protoplasmic streaming (amoeba), flagellation, or the synchronized thrashing of cilia.

Fungi:
- Aerobic, achlorophyllous microorganisms represented by single and multicellular forms.

Helminths:
- Include intestinal worms and worm-like parasites
- Roundworms (nematodes)
- Tapeworms (cestodes)
- Flatworms or flukes (trematodes)

Modes of Transmission:
- Drinking
- Bathing in swimming pools & recreational waters
- Showering (mists)
- Natural aerosols
- Contaminated hand towels & wash cloths
- Contaminated water (fish & shellfish)
- Produce irrigated or washed with contaminated water
- Contact with water containing invasive parasites
- Bites of insects that spend at least a part of the life cycle in water

- John Snow, London, 1854, discovered the possible link between water and infectious disease (cholera). He is considered the epidemiological giant of his time.

- Koch proved the relationship proposed by Snow by isolating *Vibrio cholerae* from the Elbe River.

- Waterborne outbreaks occur more frequently in non-community systems than in community systems.

- Drinking water contaminated with sewage is the principal cause of waterborne diseases.

- Waterborne salmonellosis in the U.S. is usually confined to small water systems and private wells.

Core health issues of **developing** countries are:
- Communicable disease
- Malnutrition

Core health issues of developed countries are:
- Chronic diseases (heart, cerebrovascular disease, cancer, diabetes)
- Injuries

- The total environment is the most important determinant of health.

CDC classification of illness outbreaks of unknown etiology based on incubation period:
- <1 hour (probable chemical poisoning)
- 1–7 hours (probable *Staphylococcus* food poisoning)
- 8–14 hours (probable *Clostridium perfringens* food poisoning)
- >14 hours (other infectious or toxic agents)

Lab analyses for water samples should include:
- Standard plate count (because large bacterial populations can suppress growth of coliform organisms)
- Test for coliform bacteria

- Incidence measures reflect the level of infectivity of the causative agent of the disease. They do **not** establish the virulence of the causative agent because virulence relates to the damage produced as a result of the infection.