

# Water borne diseases



**By:**

**Dr. Bijendra Kumar**

**Assistant Professor**

**Bakhtiyarpur College of Engineering, Bakhtiyarpur**

# Introduction

- Drinking water is a major source of microbial pathogens in developing countries.
- Waterborne disease cause more than 2 million deaths and 4 billion cases of diarrhea annually.
- 9 out of 10 deaths are in children and virtually all of the deaths are in developing countries.



# The importance of water quality

- Safe water is a precondition for health and development and a basic human right.
- Water-related diseases caused by insufficient safe water supplies coupled with poor sanitation and hygiene.



# Terms to be known

- **Potable(clean) water:**

it is free of all objectional material, including pathogens, tastes, odors, colours, toxins, radioactive material, organisms, oils, gases, etc.

- **contaminated or polluted water**

Water contaminated with sewage, domestic or industrial waste with chemicals and pathogenic microorganisms .

# Diseases Related to Water

## Water-Born Diseases



- cholera, typhoid,
- amoebic and bacillary dysentery
- diarrheal diseases

## Water-Washed Diseases



- scabies,
- trachoma
- flea, lice and tick-borne diseases.

## Water-Based Diseases



- Schistosomiasis
- Dracunculiasis

## Water-Related Insect-Vector Diseases



- filariasis, malaria,
- onchocerciasis,
- trypanosomiasis
- yellow fever

# Water-borne Diseases

Diseases caused by ingestion of water contaminated by human or animal faeces or urine , which contain pathogenic microorganisms



- Many bacteria, viruses, protozoa and parasites can cause disease when ingested.
- The majority of these pathogens derive from human or animal faeces, and are transmitted through the faecal-oral route.
- Although both animal and human faeces are threats to human health, human faeces are generally the most dangerous.
- Faecal pathogens can be classified as causing both water-borne and water-washed diseases.

# Orally transmitted waterborne pathogens

## Bacteria

- *Campylobacter jejuni/coli*
- *E. coli* – enterohaemorrhagic
- *Legionella spp.*
- *Salmonella typhi*
- *Shigella spp.*
- *Vibrio cholerae*
- *Yersinia enterocolitica*
- *Pseudomonas aeruginosa*



# Viruses

- Adenoviruses
- Enteroviruses(polio)
- Hepatitis A
- Hepatitis E
- Noroviruses and Sapoviruses
- Rotavirus

- **Protozoa**
- *Cryptosporidium parvum*
- *Entamoeba histolytica*
- *Giardia lamblia/intestinalis*
- *Naegleria fowleri*
- *Toxoplasma gondii*

- **Helminths**
- *Dracunculus medinensis.*
- *Schistosoma spp.*

Diseases that transmitted by water can be divided in to:

- 1. Diarrhoeal water-borne diseases**
- 2. Non-diarrhoeal water-borne diseases**

# Diarrhoeal water-borne diseases

- Most water-borne pathogens infect the gastrointestinal tract and cause diarrhoeal disease.
- The most common causes of severe diarrhoeal disease are:
  - Rotaviruses.
  - Pathogenic *E. coli*
  - Campylobacter jejuni*.
  - Entamoeba histolytica*
  - Giardia intestinalis* (also known as *G. lamblia*)
  - Cryptosporidium parvum*
  - Norwalk-like viruses

- **Epidemic diarrhoeal disease**

Two diarrhoeal pathogens:

- *Shigella dysenteriae*
- *Vibrio cholera*

-are particularly infectious and can cause severe epidemics.

-Epidemic diarrhoea (both shigellosis and cholera) can be triggered by natural disasters or political upheavals that disrupt the normal water supply.

# Non-diarrhoeal water-borne diseases

- While most water-borne pathogens cause diarrhoeal disease, a few important water-borne diseases affect other parts of the body:
- **Typhoid fever**  
is caused by ingestion of *Salmonella typhi* bacteria in food or water and affects about 17 million people each year, causing some 600,000 deaths.
- **Hepatitis**(or liver inflammation)  
is caused by viral infection. A and E, are primarily caused by ingestion of faecally contaminated drinking water. Hepatitis A causes about 1.5 million infections each year (mostly in children)



- **Polio**

is a highly infectious viral disease that mainly affects children under 5. poliovirus is primarily transmitted through the faecal-oral route, safe water and sanitation interventions can help reduce risk.



- **Legionellosis**

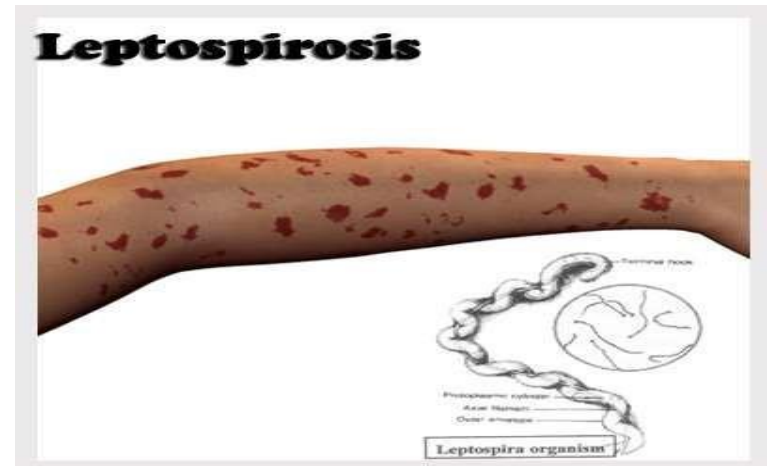
*Legionella* can grow in water storage tanks, boilers, or pipes in distribution systems. Outbreaks of Legionnaire's disease are fairly rare.





- **Leptospirosis**

is a bacterial disease caused by ingestion or bodily contact with water contaminated with the urine of infected animals, especially rats. The disease is difficult to diagnose and is often overlooked, but may be important, especially following flooding.



# Water-washed Diseases

Diseases caused by poor personal hygiene and skin and eye contact with contaminated water



- Four types of water-washed diseases are considered here:

## 1. Soil-transmitted *helminths*

transmitted primarily through contact with contaminated soil. The most prevalent helminths are:

- **Ascaris** (*Ascarislumbricoides*)
- **hookworm** (*Ancylostoma duodenale* and *Necator americanus*)
- **whipworm** (*Trichuris trichiura*).

-helminths cause about 12,000 deaths each year

-improved hygiene and sanitation can reduce disease incidence.



*Ascaris lumbricoides*

## 2. Acute Respiratory Infections

Acute respiratory infections (ARI) including pneumonia are responsible for approximately 19% of total child deaths every year.

There is an increasing body of evidence demonstrating that good hygiene practices, especially hand-washing with soap, can significantly reduce the transmission of ARI



### 3. Skin and eye diseases

- **Trachoma**

Trachoma is caused by the *Chlamydia trachomatis* bacteria, which inflame the eye.

The best control method for trachoma is improved access to water for face washing.



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- **Ringworm (tinea)**

is an infectious disease of the skin, scalp or nails. In spite of the name, the disease is caused by the fungus (tinea corporis).



# Water-based Diseases

Diseases caused by parasites found in intermediate organisms living in contaminated water



- **Schistosomiasis (bilharziasis)**

Infection is caused by flatworms called schistosomes, which spend part of their life cycle inside snail hosts. People become infected through skin contact with infected water, mainly during fishing and agricultural activities.





- **Dracunculiasis (guinea-worm disease)**

caused by the roundworm *Dracunculus medinensis*. Guinea-worm larvae in water bodies are ingested by the Cyclops water flea. People become infected by drinking water contaminated with Cyclops: the larvae are released in the stomach, migrate through the intestinal wall, and grow to adult worms.



# Water-related Diseases

Water-related diseases are caused by insect vectors, especially mosquitoes, that breed or feed near contaminated water.



- These diseases are not directly related to drinking-water quality. However, consideration of vector control can reduce the potential for water related disease transmission.
- The most common vector insects are **mosquitoes** and **flies**.
- **Mosquito-borne diseases:**
  - **malaria** (plasmodium-parasite)
  - **yellow fever** (virus)
  - **dengue fever** (virus)
  - **Filariasis** (worm)



filariasis

- **Fly-borne diseases**

- **onchocerciasis** (river-blindness)

caused by filarial worm ***Onchocerca volvulus***

- **trypanosomiasis** (West African sleeping sickness) caused by a parasite

- called ***Trypanosoma bruce***

- **leishmaniasis** (Kala-azar)

- **Loiasis** - caused by parasitic worm **Loa loa**



Kala-azar



Loiasis