Water- Related Diseases
Water Related Diseases

• WHO recognizes that access to adequate water supplies is a fundamental human right.
• Water-related diseases are a human tragedy, killing millions of people each year (account for 80% of all deaths in developing countries).
## Global Morbidity and Mortality Rates

<table>
<thead>
<tr>
<th>Disease</th>
<th>Number/Year or Total Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases of disease</td>
</tr>
<tr>
<td>Cholera</td>
<td>384,000</td>
</tr>
<tr>
<td>Typhoid</td>
<td>500,000</td>
</tr>
<tr>
<td>Giardiasis</td>
<td>500,000</td>
</tr>
<tr>
<td>Amoebiasis</td>
<td>48,000,000</td>
</tr>
<tr>
<td>Diarrhoeal disease</td>
<td>1,500,000,000</td>
</tr>
<tr>
<td>Dracunuliasis (guinea-worm)</td>
<td>&gt; 5,000</td>
</tr>
<tr>
<td>Schistosomiasis</td>
<td>200,000,000</td>
</tr>
</tbody>
</table>
Improved water supply and sanitation will lead to reduced incidence of morbidity and mortality (this may be up to 100% for some diseases such as typhoid or dracunculiasis).
Potential Reductions in Morbidity for different Diseases as a Result of improvements in Water Supply and Sanitation

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Projected reduction in morbidity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholera, typhoid</td>
<td>80 – 100</td>
</tr>
<tr>
<td>Diarrheal diseases, dysentery, gastroenteritis</td>
<td>40 – 50</td>
</tr>
<tr>
<td>Dracunuliasis</td>
<td>100</td>
</tr>
<tr>
<td>Schistosomiasis</td>
<td>60 - 70</td>
</tr>
</tbody>
</table>
Infant Mortality
versus Access to Safe Water

% deaths in infants of less than 1 year of age

% population with access to safe water
Disease Transmission

• Many diseases may be transmitted via the fecal-oral route, and that occurs when human faecal is ingested through drinking contaminated water or eating contaminated food.
The Classical Waterborne Infection Cycle

- Infected person
- Pathogens in excreta
- Consumption of untreated water
- Contaminated water source
- Susceptible person
The Faecal-Oral Route of Diseases Transmission

Excreta

Water

Flies

Hands

Food

Mouth
### Pathogens in Water-related Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typhoid, cholera, Bacillary dysentery</td>
<td>Bacterial infections</td>
</tr>
<tr>
<td>Hepatitis, poliomyelitis</td>
<td>Viral infections</td>
</tr>
<tr>
<td>Amoebic dysentery</td>
<td>Protozoal infections</td>
</tr>
</tbody>
</table>
Water-related Diseases Can be Classified into:

- Water-borne diseases.
- Water-based diseases.
- Water-related vector diseases.
- Water-scarce (also called water-washed) diseases.
Waterborne Diseases

- Waterborne diseases are "dirty-water" diseases – those caused by water that has been contaminated by human, animal, or chemical wastes.
Water-based Diseases

- Water-based diseases are caused by aquatic organisms that spend part of their life cycle in the water and another part as parasite of animals.
Water-related Vector Diseases

- Water-related vector diseases: that are transmitted by vectors-insects or other animals.
Water-scarce Diseases (Water-washed Diseases).

- Water-scarce diseases: thrive in conditions where freshwater is scarce and sanitation poor
## Classification of Water-related Diseases

<table>
<thead>
<tr>
<th>Group</th>
<th>Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Water-borne diseases</em> (diseases transmitted by water)</td>
<td>Cholera; Typhoid; Bacillary dysentery; Infectious hepatitis; Giardiasis</td>
</tr>
<tr>
<td><em>Water-washed diseases</em> (caused by lack of water)</td>
<td>Scabies; Skin sepsis and ulcers; Yaws; Leprosy; Lice and thypus; Trachoma; Dysenteries; Ascariasis; Parathphoid</td>
</tr>
<tr>
<td><em>Water based diseases</em></td>
<td>Schistomiasis; Dracunuliasis; Bilharziosis; Filariasis; Threadworm</td>
</tr>
<tr>
<td><em>Water-related insect vector diseases</em></td>
<td>Yellow fever; Dengue fever; Bancroftian filariasis; Malaria; Onchocerciasis</td>
</tr>
</tbody>
</table>
Major Waterborne Diseases

- **Cholera:**
  - **Cause:** Bacteria
  - **Symptoms:** diarrhoea, vomiting, dehydration lead to death.
Major Waterborne Diseases

- Amoebic dysentry:
  - **Cause**: Protozoa
  - **Symptoms**: diarrhoea, dehydration.
Major Waterborne Diseases

- Diarrheal disease (including amoebic and bacillary dysentery)
  - **Cause**: Bacteria, Viruses, and Protozoa
  - **Symptoms**: diarrhoea, dehydration.
Major Waterborne Diseases

- **Hepatitis**
  
  **Cause**: Viruses  
  HAV, HEV
  
  **Symptoms**: Body weakness, loss of appetite, abdominal discomfort.
Major Waterborne Diseases

- Typhoid

**Cause**: Bacteria

**Symptoms**: diarrhoea, dehydration.
Major Water-Based Diseases

- **Ascariasis**
  - **Cause:** parasitic roundworms
  - **Symptoms:** enlargement of liver, toxicity, pneumonia, nutritional deficiency.
  - **Transmission:** Faecal – soil – oral
Major Water-Based Diseases

- Dracunculiasis (guinea worm)
  
  **Cause**: worm
  
  **Symptoms**: fever, burning sensation
  
  **Transmission**: cutaneous – cyclops - cutaneous
How is Guinea worm disease contracted?
Major Water-Based Diseases

• Paragoniamiasis
  
  **Cause**: worm
  
  **Symptoms**: cough, nutritional deficiency.
  
  **Transmission**: faecal – snail – fish- oral
Major Water-Based Diseases

- **Schistosomiasis (bilharzia)**

  **Cause**: worm
  
  **Transmission**: Urine/faeces – snail – cutaneous
Major Water-Related Vector Diseases

- Denque fever (bone crusher disease)

**Cause**: virus

**Symptoms**: fever, chills, headache, pain in joints

**Transmission**: mosquito bite
Major Water-Related Vector Diseases

- **Filariasis** (includes elephantiasis)

  **Cause**: worm

  **Symptoms**: damage and swelling in lymphatic vessels

  **Transmission**: mosquito bite
Major Water-Related Vector Diseases

- **Malaria**
  - **Cause**: Protozoa
  - **Symptoms**: Fever, headache, destroy liver and nerves
  - **Transmission**: mosquito bite
Table 1: Diseases related to water and sanitation

<table>
<thead>
<tr>
<th>Group</th>
<th>Disease</th>
<th>Route leaving host</th>
<th>Route of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases which are often water-borne</td>
<td>Cholera</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Typhoid</td>
<td>faeces/urine</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Infectious hepatitis</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Giardiasis</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Amoebiasis</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Dracunculiasis</td>
<td>cutaneous</td>
<td>percutaneous</td>
</tr>
<tr>
<td>Diseases which are often associated with poor hygiene</td>
<td>Bacillary dysentery</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Entero viral diarrhoea</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Paratyphoid fever</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Pinworm (Enterobius)</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Amoebiasis</td>
<td>faeces</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Scabies</td>
<td>cutaneous</td>
<td>cutaneous</td>
</tr>
<tr>
<td></td>
<td>Skin sepsis</td>
<td>cutaneous</td>
<td>cutaneous</td>
</tr>
<tr>
<td></td>
<td>Lice and typhus</td>
<td>bite</td>
<td>bite</td>
</tr>
<tr>
<td></td>
<td>Trachoma</td>
<td>cutaneous</td>
<td>cutaneous</td>
</tr>
<tr>
<td></td>
<td>Conjunctivitis</td>
<td>cutaneous</td>
<td>cutaneous</td>
</tr>
<tr>
<td>Diseases which are often related to inadequate sanitation</td>
<td>Ascariasis</td>
<td>faecal</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Trichuriasis</td>
<td>faecal</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>Hookworm</td>
<td>faecal</td>
<td>oral</td>
</tr>
<tr>
<td></td>
<td>(Ancylostoma/Necator)</td>
<td>faecal</td>
<td>oral/ percutaneous</td>
</tr>
<tr>
<td>Diseases with part of life cycle of parasite in water</td>
<td>Schistosomiasis</td>
<td>urine/faeces</td>
<td>percutaneous</td>
</tr>
<tr>
<td>Diseases with vectors passing part of their life cycle in water</td>
<td>Dracunculiasis</td>
<td>cutaneous</td>
<td>percutaneous</td>
</tr>
</tbody>
</table>

adapted from Bradley, D J, London School of Hygiene and Tropical Medicine, various
Causes of waterborne diseases

- Lack of proper sanitation (sewage treatment is inadequate. Instead, human wastes disposed in open canals).
- Using contaminated sewage for fertilizers.
- Agricultural chemicals, pesticides, and industrial wastes.
Prevention of waterborne diseases

- Improving public sanitation.
- Providing a clean water supply
Causes of water-based diseases

• Stagnant water behind dams and water channels is ideal for snails.
• Lack of proper sanitation and clean water supply.
Prevention of water-based diseases

- Washing vegetables in clean water.
- Not entering infected rivers.
- Eating well-cooked meat.
- In areas where guinea worm is endemic, people can use a piece of cloth to filter water.
- Hygienic disposal of human wastes.
- Building the water channels in fast-flowing streams to make it difficult for snails to survive.
Causes of water-related vector diseases

• Lack of appropriate water management.
• Construction projects often increase the mosquito population. Pools of stagnant water.
• Mosquitoes are developing resistance to DDT.
Prevention of water-related vector diseases

• Eliminate the insects that transmit the diseases (be careful when using pesticides).
• Use bednets.
• Introduce natural predators.
• Use of polystyrene spheres floating static water, the mosquito larvae die from lack of air.
Prevention of water-related vector diseases

- Covering water storage containers.
- installing sprinkler instead of canals.
- Integration education about disease prevention into health services.
Waterborne diseases caused by chemical substances

- **Arsenicosis**
  - **Cause**: high levels of arsenic (GV = 0.01 mg/l)
  - **Symptoms**: Skin cancer, diabetes, bladder cancer, high blood pressure, ..
Waterborne diseases caused by chemical substances

- **Fluorosis**
  - **Cause**: high levels of fluorine
    (GV=1.5 mg/l)
  - **Symptoms**: Severe skeletal problems.
Waterborne diseases caused by chemical substances

- **Methaeglobinemia**
  - **Main Cause**: high levels of nitrates (GV=50mg/l)
  - **Symptoms**: blueness around the mouth, vomiting, diarrhoea.
Waterborne diseases caused by chemical substances

- DDT and heptachlor (pesticides)
  (heptachlor GV = 0.03 mg/l)

**Symptoms:**
Cause cancer, neurological disease
(In Dakka, heptachlor residues in water sources reached 0.789 mg/l).
Waterborne diseases caused by chemical substances

- **Lead**
  - Symptoms:
    - Affect the central nervous system.
    - Petrochemicals
  - Symptoms:
    - Cause cancer even at low exposure.