We made from water
Every living thing

Prophets {30}
"I have little need to remind you that water has become one of our major national concerns."

Ezra Taft Benson, U.S. Secretary of Agriculture

"Anyone who can solve the problems of water will be worthy of two Nobel prizes - one for peace and one for science."

John F. Kennedy

"Water is a very good servant, but it is a cruel master."

Roberts, Sir Charles George Douglas, "Adrift in America", 1891
Water and Health - two precious re-sources linked to one another",

Basic Facts

- The human body contains about **70%** water.
- Water is critical in regulating all body organs and temperature as well as dissolving solids and moving nutrients throughout the body.
- Just a **5%** drop in body water will cause up to a **30%** loss of energy in the average person.
• 1 billion people do not have access to safe drinking water.

• 2.9 billion people do not have adequate sanitation facilities.

• 11,000 children die each day of water-related diseases.
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
Classification of Water-Related Diseases

1. Physical Health Hazards

• Spinal Injury
• Drowning
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
2. Chemical Health Hazards

- Fluorosis
- Arsenicosis
- Lead Poisoning
- Methaemoglobinemia
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
Classification of Water-related Diseases

3. Biological Health Hazards

- Water-Born Diseases
- Water-Washed Diseases
- Water-Based Diseases
- Water-Related Insect-Vector Diseases
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
Classification of Water-Related Diseases

1. Physical Health Hazards
2. Chemical Health Hazards
3. Biological Health Hazards
4. Nutritional Health Hazards
Classification of Water-Related Diseases

4. Nutritional Health Hazards

- Anaemia
- Malnutrition
Description of Selected Water Born Diseases
1. Physical Health Hazards

**Drowning**

Defined as death by suffocation due to being immersed in water

- **Causes:**
  - In children, a lapse in adult supervision is the single most important contributory cause for drowning.
  - Lack of swimming skills in adults
  - Accidents related to yacht, boat... etc.
1. Physical health Hazards

Drowning

• **Scope of the Problem:**

  - **Overall death rate**: 8.4/100,000 population
  
  - Children aged 5 to 14 years, drowning is the fourth leading cause of death.
  
  - Adults aged 15-44 years, drowning is the 10th leading cause of death.
1. Physical health Hazards

Drowning

- **Prevention:**
  - Education about *Swimming skills* & Hazards.
  - Swimming in will *supervised* places.
  - Inflatable *life jackets* for children and adults with low swimming skills.
  - Adequate *rescue aids* on boats and ships, training of crew in rescue procedures.
  - Learning *First Aid measures* for drowning.
1. Physical Health Hazards

Drowning
1. Physical Health Hazards

- The most common cause of spinal injuries in pools is from diving into the upslope of the pool bottom or into shallow water.
- Injuries range from damage to the vertebrae, ligaments and discs, to damage to the spinal cord itself.
1. Physical health Hazards

Spinal Injury

- **Scope of the Problem:**
  - 4-14% of spinal cord injuries
  - Typically occur high in the spine. Those affected are commonly young adult males.
  - Cause Quadriplegia if occurs in cervical spine or paraplegia if occur in lumber spines.
1. Physical Health Hazards

### Spinal Injury

- **Prevention:**
  - Education about diving hazards and safe behaviour
  - Supervision by life guards
  - Diving instruction
  - Access to emergency services for rapid first aid and treatment
2. Chemical health Hazards

**Causes:**

- **Waters with high levels of fluoride** (above 1.5 mg/litre of water - the WHO guideline value for fluoride in water)

- **Areas where the sea has made geological deposits**: Known fluoride belts on land include: one that stretches from Syria through Jordan, **Egypt**, Libya, Algeria, Sudan and Kenya, and another that stretches from Turkey through Iraq, Iran, Afghanistan, India, northern Thailand and China. There are similar belts in the Americas and Japan. In these areas fluorosis has been reported.
2. Chemical health Hazards

Fluorosis

- **Scope of the Problem:**
  - Affects millions of people all over the world. It is endemic in at least 25 countries across the globe.
  - An estimated 30 million people suffer from chronic fluorosis in China alone.
  - Increase in areas depending on groundwater.

- Cause staining and pitting of the teeth, and skeletal deformities in severe cases.
2. Chemical health Hazards

Fluorosis

• **Prevention:**

- De-fluoridation may be the only solution. Methods e.g.
  
  * use of bone charcoal
  * contact precipitation
  * use of Nalgonda or activated alumina
2. Chemical health Hazards

**Causes:**

- **chronic intake of Water with high levels of Arsenic** (WHO's Guideline Value for arsenic in drinking water is 0.01 mg/liter.)
- Natural arsenic contamination may occur in many countries.
- Chemical arsenic contamination may also be due to industrial processes such as those involved in mining, metal refining.
2. Chemical health Hazards

**Arsenicosis**

- Scope of the Problem:
  - Approximately **1 in 100** people who drink water containing 0.05 mg arsenic per litre or more for a long period may eventually die from arsenic related cancers.

Leads to

- skin problems
- skin cancer,
- cancers of the bladder, kidney and lung,
2. Chemical health Hazards

Arsenicosis

- **Prevention:**
  
  - Provision of safe drinking (arsenic-free) water:
    
    @ Deeper wells are often less likely to be contaminated
    
    @ Use of arsenic removal systems in households
    
    @ Testing of water for levels of arsenic and informing users.

- **Health Promotion:**
  
  @ Monitoring for early signs of arsenicosis.
  
  @ Health education regarding harmful effects of arsenicosis and how to avoid them.
2. Chemical health Hazards

• Causes:

• The main source of lead in drinking water is (old) lead piping. (The WHO guideline for lead in drinking water is 0.1 mg/l).
2. Chemical health Hazards

- The amount of lead that may dissolve in water depends on acidity (pH), temperature, water hardness and standing time of the water.

Leads to

>> Neurological Insult,
>> blue line in gum,
>> Reproductive system & Kidney
>> Anaemia.
2. Chemical health Hazards

- Lead poisoning

Later Symptoms of Lead Poisoning

- Memory Problems
- Nausea
- Kidney Problems
- Weight Loss
- Constipation
- Weak Wrists or Ankles
2. Chemical health Hazards

Lead poisoning

- **Prevention:**
  - Provision of safe drinking (lead-free) water:
    - Water treatment.
    - Use of lead-free pipes
  - **Health Promotion:**
    - Screening of children for blood levels over acceptable limit and referral for medical care as necessary.
2. Chemical health Hazards

Methaemoglobinemia

- Decreased ability of blood to carry vital oxygen around the body.

- High nitrate levels may be present in drinking-water due to the use of manure and fertilizers on agricultural land, but rare now in industrial countries.

- Levels greater than 50mg/litre are known to have been associated with methaemoglobinemia in bottle fed infants.

- Controlling nitrate levels in drinking water sources to below around 50mg/litre is an effective preventive measure.
3. Biological Health Hazards

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
3. Biological Health Hazards

Water-Borne Diseases

- cholera, typhoid,
- amoebic and bacillary dysentery
- diarrheal diseases
3. Biological Health Hazards

Diarrheal Diseases

- Caused by viruses, bacteria and protozoan.
- Loss of both water and electrolytes, >> dehydration.
- In developing countries, diarrhea is a major killer.
- In 1998, diarrhea killed 2.2 million people, mostly were under 5 years of age (WHO, 2000).
- Each year approximately 1-4 billion cases of diarrhea worldwide.
Cholera

- Cholera is an acute bacterial infection, causes severe diarrhea, that can quickly lead to acute dehydration and death.
- A world-wide problem that could be prevented by providing access to safe drinking water, sanitation and good hygiene behavior (including food hygiene).
- **Year 2000**, 140,000 cases resulting in approximately 5000 deaths were officially notified to WHO.
- **In 2002**, over 120,000 cholera cases were reported worldwide.
- **Africa** accounted for 87% of these cases.
3. Biological health Hazards

cholera
3. Biological health Hazards

Typhoid

• Typhoid fever is a bacterial infection (Salmonella typhi) (contaminated food or water).

• Infection occurs by drinking water contaminated by sewage containing the bacteria.

• Often occurs in epidemics

• Symptoms:
  * Headaches, delirium.
  * Nausea, vomiting, loss of appetite.
  * Diarrhea or constipation.
  * Rose-coloured spots on the chest.
  * Enlarged spleen and liver.
3. Biological health Hazards

**Typhoid**

- **Carriers**: continue to carry the bacteria. These people can be a source of infection for others.

- The annual incidence of typhoid is estimated to be about **12 - 17 million** cases worldwide.
3. Biological health Hazards

Typhoid
3. Biological health Hazards

Typhoid

Typhoid Fever: Clinical Course

- Temperature
- Pulse

Abdominal pain, headache, constipation
Abnormal mental status
Rose spots, splenomegaly
Diarrhea, hemorrhage, perforation
Cough, epistaxis
Improvement

Cultures

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</table>
3. Biological health Hazards

Typhoid

Control measures:

- **Antibiotic** treatment
- **Health education** * personal hygiene, (hand-washing after toilet use and before food preparation;)
  * safe water supply.
- **Proper sanitation** systems.
- **Excluding disease carriers** from food handling
- A **vaccine** is available, although it is not routinely recommended except for those who will have prolonged exposure to potentially contaminated food and water in high-risk areas.
3. Biological Health Hazards

**Water-Born Diseases**
- cholera, typhoid,
- amoebic and bacillary dysentery
- diarrheal diseases

**Water-Washed Diseases**
- scabies,
- trachoma
- flea, lice and tick-born diseases.

**Water-Based Diseases**
- Schistosomiasis
- Dracunculiasis

**Water-Related Insect-Vector Diseases**
- filariasis, malaria,
- onchocerciasis,
- trypanosomiasis
- yellow fever
3. Biological Health Hazards

Water-Washed Diseases

- scabies,
- trachoma
- flea, lice and tick-born diseases.
Trachoma

- Trachoma is an eye infection caused by *(Chlamydia trachomatis)* spread mainly through poor hygiene caused by lack of adequate water supplies and unsafe environmental sanitation conditions.

- It is the world's leading cause of *preventable blindness*.

- Cause scarring on the inside of the eyelid & may result in blindness after repeated re-infections.

- The World Health Organization (WHO) estimates that 6 million worldwide are blind due to trachoma.
Scabies

• Scabies is a contagious skin infection that spreads rapidly in conditions associated with bad personal hygiene, poor water-supply, sanitation.

• The principal sign is a pimple-like rash, itching, scratching, sores that may become infected by bacteria.

• There are about 300 million cases of scabies in the world each year.
3. Biological health Hazards

scabies

- Itching
- Scratching
- Sores, Infection
3. Biological Health Hazards

scabies
3. Biological health Hazards

- **Controlled by:**
  - Improved personal hygiene,
  - Treatment of patients with acaricide,
  - Sterilization of Bedding, mattresses, sheets and clothes.
3. Biological Health Hazards

Water-Born Diseases
- cholera, typhoid,
- amoebic and bacillary dysentery
- diarrheal diseases

Water-Washed Diseases
- scabies,
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- yellow fever
3. Biological Health Hazards

Water-Based Diseases

- Schistosomiasis
- Dracunculiasis
3. Biological health Hazards

Schistosomiasis

- Schistosomiasis is the second most important parasitic infection after malaria (public health and economic impact).
- Caused by: Schistosoma haematobium, S. japonicum, and S. mansoni.
- Free-swimming larvae penetrate human skin.
- The larvae develop in fresh-water snails.
3. Biological health Hazards

Schistosomiasis

- In Egypt, it is a major cause for chronic liver disease, esophageal varices, ascitis, splenomegaly, and bladder cancer.
3. Biological health Hazards

Schistosomiasis

At least 600 million people are at risk of infection and 200 million are infected with schistosomiasis. Of these 20 million have severe disease and 120 million have symptoms.
3. Biological Health Hazards

**Schistosomiasis**

![Figure 3. Priorities for schistosomiasis research](image)

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Legend:
- Red: Epidemiology
- Orange: Intervention tools
- Green: Operational research
- Purple: Basic research
Schistosomiasis

1. Eggs hatch releasing miracidia
2. Miracidia penetrate snail tissue
3. Miracidia penetrate snail tissue (successive generations)
4. Sporocysts in snail
5. Cercariae released by snail into water and free-swimming
6. Penetrate skin
7. Cercariae lose tails during penetration and become schistosomulae
8. Circulation
9. Migrate to portal blood in liver and mature into adults
10. Paired adult worms migrate to: A. mesenteric venules of bowel/rectum (laying eggs that circulate to the liver and shed in stools)
    B. venous plexus of bladder

A. S. mansoni
B. S. japonicum
C. S. haematobium
3. Biological Health Hazards

- **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
3. Biological health Hazards

Water-Related Insect-Vector Diseases

- filariasis, malaria,
- onchocerciasis,
- trypanosomiasis
- yellow fever
3. Biological health Hazards

Malaria

• Malaria is the world's most important parasitic infectious disease.

• It is transmitted by mosquitoes which breed in fresh or occasionally brackish water.

• WHO estimates 300-500 million cases of malaria, with over one million deaths each year.
3. Biological health Hazards

Malaria

Burden of Disease Profile
African WHO Region

- HIV/AIDS: 21%
- Malaria: 10%
- Lower respiratory infections: 9%
- Perinatal conditions: 6%
- Diarrhoeal disease: 5%
- Measles: 5%
- Tuberculosis: 3%
- All other causes: 40%

3. Biological Health Hazards

Malaria

- **Cold stage** ≈ 1 hr
  - Headache/shiver/rapid weak pulse

- **Hot stage** 6hrs
  - Intense headache/nausea/thirst/distress

- **Sweating stage** 4hrs
  - Profuse sweating
  - Sleep!
3. Biological health Hazards

Malaria

While most of the clinical manifestations of malaria are caused by the malarial infection per se, **high grade fever** as well as the **side effects of anti malarial therapy** can also contribute to the clinical manifestations.

All these may act in unison, further confusing the picture.

In some cases, **secondary infections** like pneumonia or urinary tract infection can add to the woes.
4. Nutritional health Hazards

Anaemia

- The most important water-related causes of anaemia are:
  - Malnutrition
  - Water-born or water-related infections e.g.: malaria (haemolytic anemia), schistosomiasis (by chronic blood loss→ fe deficiency).

- Anaemia may contribute to up to 20% of maternal deaths.

- About 2 billion people suffer from anaemia.
4. Nutritional health Hazards

Anaemia

Image: Estimation of economic costs of anaemia (cognitive + productivity) as % of GDP, showing data for countries like Bangladesh, India, Pakistan, Mali, South Africa, Tanzania, Oman, Egypt, Bolivia, Honduras, and Nicaragua.
Malnutrition

• Due loss of food, water balance with the overall state of health leading to the inability to use nutrients properly to maintain health.
4. Nutritional Health Hazards

Malnutrition

Diarrhea

inadequate water supply and sanitation

Malnutrition
4. Nutritional Health Hazards

Malnutrition

- **The most important water-related causes of malnutrition are:**
  - diarrheal diseases.
  - water-borne infections.
  - lack of nutrients e.g inorganic chemicals (fluoride, copper, iodine..etc)
  - water-related habits.

- Malnutrition increases the risk of disease and early death.

- **Malnutrition affects one in three people** in the world.

- **Protein-energy malnutrition** plays a major role in half of all under-five deaths each year in developing countries.
Control of Water-Related Diseases

Safe Water

- For
- Drinking
- Washing
- recreational use e.g. swimming
- **Must Be safe:**

Chemically, physically, & biologically

Control of water-related Pathways

- e.g.

  - Snails in Schistosomiasis.
  - Mosquitos in Malaria
  - Safe water transmission e.g. safe pipes, safe containers

Control of Human-Related Cause

- e.g.

  - Health Education
  - Health promotion
  - Early detection & treatment
The WHO and UNICEF promote three key hygiene behaviors as having the greatest potential health impact -

• Hand washing
• Safe disposal of faeces.
• Safe water handling and storage.
The United Nations General Assembly, in December 2003, proclaimed the years 2005 to 2015 as the International Decade for Action 'Water for Life'.

'Water for Life'.

WATER FOR LIFE
2005–2015
World Water Day: 22nd March 2007
Coping With Water Scarcity

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Water website]