Lecture 7: Diseases caused by Pollution

By

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Types of Pollution

- Noise
- Land
- Radioactive
- Air
- Water

Health effects of pollution

Air pollution:
- Headache
- Fatigue
- Respiratory illness
- Cardiovascular illness
- Gastroenteritis
- Cancer risk
- Nausea
- Skin irritation

Air pollutants:
- CO
- Particulate matter
- Ozone
- Volatile organic compounds
- Lead

Water pollution:
- Bacteria
- Parasites
- Chemicals
- Pesticides

Soil contamination:
- Volatile organic compounds
Air Pollution

Main Pollutants

**Ozone:** (Caustic gas--clear, colorless, odorless)

Oxidizes proteins and lipids in the mucosal fluid layer

Highly irritating to lung linings

Increases lung secretions, decreases oxygenation

Sets off airway bronchospasm

Recruits inflammatory cells

Increases responses to allergens

 DAMAGES infection fighting responses

Chronic lung damage/remodeling

**Particulates, especially PM 2.5:** (Sulfates, nitrates, Polycyclic Aromatic Hydrocarbons (PAH), Soot/Carbon)

Penetrate deeply into lungs to alveoli

Irritate lung linings-more asthma

Stimulate immune system inflammatory proteins
Air Pollution and Medical Care Costs (Examples from USA)

Every 10 ppb particulates = $177 extra cost to Medicare per patient per year

Charlotte = $94 Million extra Medicare costs per year

Rowan County = $5.7 Million extra Medicare costs per year

Source: Health Affairs, vol. 21, no. 26 pp207-214
Effects and Diseases

- Reduced energy level
- Irritation of eyes, nose, mouth and throat
- Headaches and dizziness
- Respiratory symptoms such as coughing and wheezing
- Disruption of endocrine, reproductive and immune systems
- Neurobehavioral disorders
- Cardiovascular problems
- Cancer
- Premature death
Respiratory and lung diseases including:

Asthma attacks

Chronic Obstructive Pulmonary Disease – COPD diseases of the lungs in which the airways become narrowed

Reduced lung function

Pulmonary cancer - caused by a series of carcinogen chemicals that through inhalation

Mesothelioma – a particular type of lung cancer, usually associated with exposure to asbestos (it usually occurs 20-30 years after the initial exposure)

Pneumonia

Bronchitis

Emphysema
**Water Pollution**

**Waterborne Diseases**

Water – and sanitation-related diseases are major causes of illness and death among people in both rural and urban areas in many developing countries.

The health and well being of people cannot be improved without understanding these diseases and knowing how they are transmitted from one person to another.

Such diseases are caused by living organisms that must spend much of their life in or on a human body.

They include viruses so tiny that they can pass through the finest filter, bacteria and protozoa that can be seen only with the aid of a microscope, tiny mites that are barely visible to the eye and worms that may be a meter long.

The transmission of all of these diseases is related in some way to water supply and sanitation, usually to inadequate disposal of human wastes and to contaminated water supplies.

The disease are transmitted through contact with or consumption of water, contact with infected soil, the bites of insects that breed in or near water and poor personal and family hygiene.

Man is usually the source of the organisms that cause the diseases and human activity is an important factor in the diseases and human activity is an important factor in the transmission of them.
One of the WHO surveys in the field of water quality and health has reached the following facts:

Each day some 30000 people die from water–related diseases. In developing countries 80 percent of all illness water–related.

A quarter of children born in developing countries will have died before the age of 5, the great majority from water-related disease.

At any one time there are likely to be 400 million people suffering from gastroenteritis, 160 million with malaria. All environmental factors may also be important.

Because of this and due to the possibility that other contaminants may have a negative impact on human health, it is important that the relationship between water quality and health be fully appreciated by the engineers and scientist concerned with water quality the engineers and scientists concerned with water quality control.

Person to another or, sometimes, to or from an animal.

During the transmission process, the organisms may be exposed to the environment, and their safe passage to the body of a new victim is the vulnerable to changes in the environment.

The role of environment engineer is therefore, to modify the human environment in such a way as to prevent or reduce the transmission of infectious diseases.

It is important to distinguish between being infected and the state of being ill.
Classification of transmission mechanism

It is known today that water-related diseases are transmitted in four distinct mechanisms.

These include water-born, water-washed, water-based and water-related insect vector.

1. Water-born mechanism: this refers to the situation when the pathogen is in water which is drunk by a person or an animal which may then become infected. Infections in this group include cholera, typhoid, infectious hepatitis, diarrheas and dysenteries.

2. Water-washed mechanism: this includes diseases that can be significantly reduced if the water volume used is increased. Thus quantity rather than quality is important in this category. The relevance of water to these diseases is that it is an aid to hygiene and cleanliness. This category includes types: Intestinal tract infection, such as diarrhea diseases like cholera, bacillary dysentery. Thus are all faecal-oral in their transmission route and therefore can be water-washed or water born.

Skin or eyes infections: bacterial skin sepsis, scabies, fungal infections, trachoma are examples.

3. Water-based mechanism: a water-based disease it one in which the pathogen spends a part of its life cycle in a water snail or other aquatic animal.

All these diseases are due to infection by parasitic worms which depends on aquatic intermediate host to complete their life cycle. Important examples are schistosomiasis, and Guinea worm (Dranculus medinensis).
4. **Insect vector mechanism.** In this case, insects breed in water or bite near water. Examples include Malaria, Yellow fever, and onchocerciasis.

5. **Chemical – related diseases**
   Due to the presence of harmful or fatal chemicals in water. This can be due to accidental discharge of sufficient toxic matter into a water source.

   Or due to long –term hazard due to exposure to minute concert concentrations, perhaps over many years, example, lead piping and tanks in domestic plumbing.
## Water Pollution

### Effects and Diseases

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<th>Caused by polluted beach water</th>
<th>Infectious diseases caused by pathogens</th>
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<td>التهاب المعدة والأمعاء</td>
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Liver damage and even cancer

Kidney damage

Neurological problems

Reproductive and endocrine damage

Thyroid system disorders

**Minamata Disease:** chronic poisoning by alkyl mercury compounds from industrial waste, characterized by (usually permanent) impairment of brain functions such as speech, sight, and muscular coordination.
Foodborne Disease

- Illness caused by ingestion of contaminated food
- Symptoms often affecting stomach or intestinal tract including
  - Nausea and vomiting
  - Diarrhea
  - Abdominal pain
- Sometimes nonspecific symptoms and symptoms outside GI tract, depending on agent
- Young children, pregnant women, elderly, and immunocompromised persons at greatest risk for severe illness
- An estimated 1 in 6 people suffers from foodborne illness each year in the United States leading to an estimated
  - 48 million illnesses
  - 128,000 hospitalizations
  - 3,000 deaths
- More than 1,000 outbreaks detected annually
- $35 billion in medical costs, lost productivity, illness related mortality each year
Common Causative Agents

Bacteria
- *Bacillus cereus*
- *Campylobacter*
- *Clostridium botulinum*
- *Clostridium perfringens*
- *Escherichia coli*
  - Shiga toxin-producing *E. coli*
  - Enterotoxin producing *E. coli*
  - Enteroinvasive *E. coli*
  - Enteropathogenic *E. coli*
- *Listeria monocytogenes*
- *Salmonella*, non-typhoid
- *Salmonella Typhi*
- *Shigella*
- *Staphylococcus aureus*
- *Vibrio*
- *Yersinia enterocolitica*

Viruses
- Norovirus
- Astrovirus
- Hepatitis A virus

Parasites
- *Cryptosporidium*
- *Cyclospora cayetanensis*
- *Entamoeba histolytica*
- *Giardia intestinalis*
- *Trichinella*

Chemicals/other
- Heavy metals
- Pesticides
- Fungal toxins
- Fish toxins
Food Vehicles

- Variety of foods associated with foodborne illnesses
- Almost any food can be a vehicle for disease but food and production/processing must
  - Allow opportunity for contamination by causative agent
  - Allow agent (or toxin) to survive (not be inactivated) and
  - (For some agents) support proliferation of agent and/or elaboration of preformed toxins
- Common food-causative agent pairings
- Pathogens associated with food can also be spread through other modes
  - Waterborne
  - Person-to-person
  - Animal-to-person
- Multiple modes of transmission possible in a single outbreak
Soil Pollution

Diseases and Effects

Cancer- Brain and Nerve damage- Kidney and Liver Disease- Malaria

Viruses
  - Ebola virus in the Congo
  - Nipah virus in Malaysia
  - Hantavirus and West Nile virus in the United States

Radioactive Pollution

Diseases and Effects

- damage proteins, membranes, and nucleic acids
- Damage DNA
- Tumours
- Leakaemania
- blood in cough
- Ulcer

- Swelling of bone joints
- Cancer, Lung Cancer, Skin Cancer, Bone Cancer
- Eye Problems
Noise Pollution

Diseases and Effects

• Blood Pressure
• Temporary or permanent deafness
• Heart disease
• Disturbed sleep, tinnitus، and severe irritation
• Increase of the stress hormones like adrenaline, noradrenalin, and cortisol in the body