Environmental Hazards and Human Health

Chapter 14
Three big ideas

• We face significant hazards from infectious diseases, and from exposure to chemicals.
  
  List examples of each (infectious and chemical)

• An ounce of (pollution) prevention is worth a pound of cure.
  
  Why?

• Becoming informed, thinking critically about risks, and making careful choices can reduce the major risks we face.
  
  Best approach?
WHAT MAJOR HEALTH HAZARDS DO WE FACE?
Risks are usually expressed as probabilities

- A risk is the probability of suffering harm from a hazard that can cause injury, disease, death, economic loss, or damage.
  - Probability—a mathematical statement about the likelihood that harm will be suffered from a hazard.
- “The lifetime probability of developing lung cancer from smoking one pack of cigarettes per day is 1 in 250.” This means that 1 of every 250 people who smoke a pack of cigarettes every day will likely develop lung cancer over a typical lifetime.
Risks are usually expressed as probabilities

- **Risk assessment** is the process of using statistical methods to estimate how much harm a particular hazard can cause. It helps us to establish priorities for avoiding or managing risks.

- **Risk management** involves deciding whether or how to reduce a particular risk to a certain degree.
Risk assessment and risk management

**Risk Assessment**
- Hazard identification: What is the hazard?
- Probability of risk: How likely is the event?
- Consequences of risk: What is the likely damage?

**Risk Management**
- Comparative risk analysis: How does it compare with other risks?
- Risk reduction: How much should it be reduced?
- Risk reduction strategy: How will the risk be reduced?
- Financial commitment: How much money should be spent?
WHAT TYPES OF BIOLOGICAL HAZARDS DO WE FACE?
Ways infectious disease organisms can enter the human body:

- Pets
- Livestock
- Wild animals
- Insects
- Food
- Water
- Air

Other humans, Humans, Fetus and babies
Deaths per year by the 7 deadliest infectious diseases

<table>
<thead>
<tr>
<th>Disease (type of agent)</th>
<th>Deaths per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia and flu (bacteria and viruses)</td>
<td>3.2 million</td>
</tr>
<tr>
<td>HIV/AIDS (virus)</td>
<td>1.8 million</td>
</tr>
<tr>
<td>Diarrheal diseases (bacteria and viruses)</td>
<td>1.6 million</td>
</tr>
<tr>
<td>Tuberculosis (bacteria)</td>
<td>1.3 million</td>
</tr>
<tr>
<td>Measles (virus)</td>
<td>800,000</td>
</tr>
<tr>
<td>Malaria (protozoa)</td>
<td>780,000</td>
</tr>
<tr>
<td>Hepatitis B (virus)</td>
<td>600,000</td>
</tr>
</tbody>
</table>
About 47% of the population live in areas where malaria is prevalent.
Ways to prevent or reduce the incidence of infectious diseases

### Solutions

**Infectious Diseases**

- Increase research on tropical diseases and vaccines
- Reduce poverty
- Decrease malnutrition
- Improve drinking water quality
- Reduce unnecessary use of antibiotics
- Educate people to take all of an antibiotic prescription
- Reduce antibiotic use to promote livestock growth
- Require careful hand washing by all medical personnel
- Immunize children against major viral diseases
- Provide oral rehydration for diarrhea victims
- Conduct global campaign to reduce HIV/AIDS
WHAT TYPES OF CHEMICAL HAZARDS DO WE FACE?
Some chemicals can cause cancers, mutations, and birth defects

- A toxic chemical is one that can cause temporary or permanent harm or death to humans and animals.
- In 2004, the EPA listed arsenic, lead, mercury, vinyl chloride (used to make PVC plastics), and polychlorinated biphenyls (PCBs) as the top five toxic substances in terms of human and environmental health.
- There are three major types of potentially toxic agents.
  - **Carcinogens** are chemicals, types of radiation, or certain viruses that can cause or promote cancer.
  - **Mutagens** are chemicals or forms of radiation that cause mutations, or changes, in the DNA molecules found in cells, or that increase the frequency of such changes.
  - **Teratogens** are chemicals that cause harm or birth defects to a fetus or embryo.
PCBs and other persistent toxic chemicals can move via many pathways.
Some chemicals may affect our immune and nervous systems

- Our body’s immune system protects us against disease and harmful substances by forming antibodies that render invading agents harmless, but some chemicals interfere with this process.
  - Arsenic.
  - Methylmercury.
  - Dioxins.
Some chemicals may affect our immune and nervous systems

- Some natural and synthetic chemicals in the environment, called neurotoxins, can harm the human nervous system, causing the following effects.
  - Behavioral changes.
  - Learning disabilities.
  - Retardation.
  - Attention deficit disorder.
  - Paralysis.
  - Death.
Some chemicals may affect our immune and nervous systems

- Examples of neurotoxins.
  - PCBs.
  - Methylmercury.
  - Arsenic.
  - Lead.
  - Certain pesticides.
Ways to prevent or control inputs of mercury pollution

**Solutions**

**Mercury Pollution**

**Prevention**
- Phase out waste incineration
- Remove mercury from coal before it is burned
- Switch from coal to natural gas and renewable energy resources

**Control**
- Sharply reduce mercury emissions from coal-burning plants and incinerators
- Label all products containing mercury
- Collect and recycle batteries and other products containing mercury
Some chemicals affect the human endocrine system

- The endocrine system is a complex network of glands that release tiny amounts of hormones that regulate human:
  - Reproduction.
  - Growth.
  - Development.
  - Learning ability.
  - Behavior.
Some chemicals affect the human endocrine system

- Hormonally active agents (HAA) are synthetic chemicals that disrupt the endocrine system in humans and some other animals.
  - Examples include aluminum, Atrazine™ and several other herbicides, DDT, PCBs, mercury, phthalates, and bisphenol A (BPA).
  - Some disrupt the endocrine system by attaching to estrogen receptor molecules.
  - Thyroid disrupters cause growth, weight, brain, and behavioral disorders.
Some chemicals affect the human endocrine system

- BPA is found in plastic water bottles, baby bottles and the plastic resins line food containers.
  - Studies found that low levels of BPA cause numerous problems such as brain damage, early puberty, prostate cancer, breast cancer, and heart disease.
  - Studies funded by the chemical industry found no evidence or only weak evidence, for adverse effects from low-level exposure to BPA in test animals.
  - In 2008, the FDA concluded that BPA in food and drink containers does not pose a health hazard.
  - In 2010, Canada classified BPA as a toxic chemical and banned its use in baby bottles, and the EU voted to ban the sale of plastic baby bottles that contain BPA.
Some chemicals affect the human endocrine system

- Phthalates are found in detergents, perfumes, cosmetics, deodorants, soaps, and shampoo, and in PVC products such as toys, teething rings, and medical tubing used in hospitals.
  - Phthalates cause cancer and other health problems in laboratory animals.
Section 14-4

HOW CAN WE EVALUATE CHEMICAL HAZARDS?
Many factors determine the harmful health effects of chemicals

- Toxicology is the study of the harmful effects of chemicals on humans and other organisms.
  - **Toxicity** is a measure of the harmfulness of a substance.
  - **Any** synthetic or natural chemical can be harmful if ingested in a large enough quantity.
  - The **dose** is the amount of a harmful chemical that a person has ingested, inhaled, or absorbed through the skin.
  - Many variables can affect the level of harm caused by a chemical.
    - Toxic chemicals usually have a greater effect on fetuses, infants, and children than on adults.
Many factors determine the harmful health effects of chemicals

- Toxicity also depends on genetic makeup, which determines an individual’s sensitivity to a particular toxin.
- Some individuals are sensitive to a number of toxins—a condition known as multiple chemical sensitivity (MCS).
- How well the body’s detoxification systems (such as the liver, lungs, and kidneys) work.
- Solubility: water-soluble toxins and oil- or fat-soluble toxins.
- Persistence, or resistance to breakdown such as DDT and PCBs.
- Biological magnification, in which the concentrations of some potential toxins in the environment increase as they pass through the successive trophic levels of food chains and webs.
Many factors determine the harmful health effects of chemicals

• The damage to health resulting from exposure to a chemical is called the response.
  – **Acute effect** is an immediate or rapid harmful reaction ranging from dizziness and nausea to death.
  – **Chronic effect** is a permanent or long-lasting consequence (kidney or liver damage, for example) of exposure to a single dose or to repeated lower doses of a harmful substance.
Scientists use live laboratory animals and non-animal tests to estimate toxicity

- The most widely used method for determining toxicity is to expose a population of live laboratory animals to measured doses of a specific substance under controlled conditions.
- Lab mice and rats are widely used because their systems function somewhat like human systems.
  - Results plotted in a dose-response curve.
  - Determine the lethal dose.
  - Median lethal dose (LD50) is the dose that can kill 50% of the animals (usually rats and mice) in a test population within an 18-day period.
Hypothetical dose-response curve for LD50
Toxicity ratings and average lethal doses for humans

<table>
<thead>
<tr>
<th>Toxicity Rating</th>
<th>LD50 (milligrams per kilogram of body weight)*</th>
<th>Average Lethal Dose**</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supertoxic</td>
<td>Less than 5</td>
<td>Less than 7 drops</td>
<td>Nerve gases, botulism toxin, mushroom toxin, dioxin (TCDD)</td>
</tr>
<tr>
<td>Extremely toxic</td>
<td>5–50</td>
<td>7 drops to 1 teaspoon</td>
<td>Potassium cyanide, heroin, atropine, parathion, nicotine</td>
</tr>
<tr>
<td>Very toxic</td>
<td>50–500</td>
<td>1 teaspoon to 1 ounce</td>
<td>Mercury salts, morphine, codeine</td>
</tr>
<tr>
<td>Moderately toxic</td>
<td>500–5,000</td>
<td>1 ounce to 1 pint</td>
<td>Lead salts, DDT, sodium hydroxide, sodium fluoride, sulfuric acid, caffeine, carbon tetrachloride</td>
</tr>
<tr>
<td>Slightly toxic</td>
<td>5,000–15,000</td>
<td>1 pint to 1 quart</td>
<td>Ethyl alcohol, Lysol, soaps</td>
</tr>
<tr>
<td>Essentially nontoxic</td>
<td>15,000 or greater</td>
<td>More than 1 quart</td>
<td>Water, glycerin, table sugar</td>
</tr>
</tbody>
</table>

*Dosage that kills 50% of individuals exposed.

**Amounts of substances in liquid form at room temperature that are lethal when given to a 70-kilogram (150-pound) human.
Are trace levels of toxic chemicals harmful?

- Almost everyone is now exposed to potentially harmful chemicals that have built up to trace levels in their blood and in other parts of their bodies.
- *In most cases*, we do not know if we should be concerned about trace amounts of various synthetic chemicals because there is too little data and because of the difficulty of determining the effects of exposures to low levels of these chemicals.
- Possible potential long-term effects on the human immune, nervous, and endocrine systems.
- The risks from trace levels may be minor.
Potentially harmful chemicals found in many homes

- **Nail polish** Perfluorochemicals and phthalates
- **Perfume** Phthalates
- **Hairspray** Phthalates
- **Food** Some food contains bisphenol A
- **Milk** Fat contains dioxins and flame retardants
- **Frying pan** Nonstick coating contains perfluorochemicals
- **Tile floor** Contains perfluorochemicals, phthalates, and pesticides
- **Fruit** Imported fruit may contain pesticides banned in the U.S.
- **Shampoo** Perfluorochemicals to add shine
- **Teddy bear** Some stuffed animals made overseas contain flame retardants and/or pesticides
- **Clothing** Can contain perfluorochemicals
- **Baby bottle** Can contain bisphenol A
- **Mattress** Flame retardants in stuffing
- **Carpet** Padding and carpet fibers contain flame retardants, perfluorochemicals, and pesticides
- **TV** Wiring and plastic casing contain flame retardants
- **Sofa** Foam padding contains flame retardants and perfluorochemicals
- **Water bottle** Can contain bisphenol A
- **Computer** Flame retardant coatings of plastic casing and wiring
- **Toys** Vinyl toys contain phthalates
- **Tennis shoes** Can contain phthalates
Why do we know so little about the harmful effects of chemicals?

- All methods for estimating toxicity levels and risks have serious limitations.
- Only 10% of the 80,000+ registered synthetic chemicals in commercial use have been thoroughly screened for toxicity, and only 2% have been adequately tested to determine whether they are carcinogens, mutagens, or teratogens.
- Because of insufficient data and the high costs of regulation, federal and state governments do not supervise the use of nearly 99.5% of the commercially available chemicals in the US.
How far should we go in using pollution prevention and the precautionary principle?

• Some are pushing for much greater emphasis on pollution prevention.

• Do not release into the environment chemicals that we know or suspect can cause significant harm.
  – Look for harmless or less harmful substitutes for toxic and hazardous chemicals.
  – Recycle them within production processes to keep them from reaching the environment.
How far should we go in using pollution prevention and the precautionary principle?

• In 2000, a global treaty banned or phased out the use of 12 of the most notorious persistent organic pollutants (POPs), also called the **dirty dozen**. The list includes DDT and eight other pesticides, PCBs, and dioxins.

• In 2007, the European Union enacted regulations known as **REACH** (for registration, evaluation, and authorization of chemicals) that put more of the burden on industry to show that chemicals are safe.
  
  – **REACH** requires the registration of 30,000 untested, unregulated, and potentially harmful chemicals.
  
  – The most hazardous substances are not approved for use if safer alternatives exist.
  
  – When there is no alternative, producers must present a research plan aimed at finding one.
Section 14-5

HOW DO WE PERCEIVE RISKS AND HOW CAN WE AVOID THE WORST OF THEM?
What do you feel is one of the greatest risks you take…

Why do you take said risk?
<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Annual deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty/malnutrition/disease cycle</td>
<td>11 million</td>
</tr>
<tr>
<td>Tobacco</td>
<td>5.4 million</td>
</tr>
<tr>
<td>Pneumonia and flu</td>
<td>3.2 million</td>
</tr>
<tr>
<td>Air pollution</td>
<td>2.4 million</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>2 million</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>1.6 million</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>1.5 million</td>
</tr>
<tr>
<td>Automobile accidents</td>
<td>1.2 million</td>
</tr>
<tr>
<td>Work-related injury and disease</td>
<td>1.1 million</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>1 million</td>
</tr>
<tr>
<td>Measles</td>
<td>800,000</td>
</tr>
<tr>
<td>Malaria</td>
<td>780,000</td>
</tr>
</tbody>
</table>
The greatest health risks come from poverty, gender, and lifestyle choices.

- The best ways to reduce one’s risk of premature death and serious health problems are to:
  - avoid smoking and exposure to smoke
  - lose excess weight
  - reduce consumption of foods containing cholesterol and saturated fats
  - eat a variety of fruits and vegetables
  - exercise regularly
  - drink little or no alcohol
  - avoid excess sunlight
  - practice safe sex
How key risks can shorten an average life span

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Shortens average life span in the United States by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty</td>
<td>7-10 years</td>
</tr>
<tr>
<td>Born male</td>
<td>7.5 years</td>
</tr>
<tr>
<td>Smoking</td>
<td>6-10 years</td>
</tr>
<tr>
<td>Obese (35%)</td>
<td>6 years</td>
</tr>
<tr>
<td>Unmarried</td>
<td>5 years</td>
</tr>
<tr>
<td>Overweight (15%)</td>
<td>2 years</td>
</tr>
<tr>
<td>Spouse smoking</td>
<td>1 year</td>
</tr>
<tr>
<td>Driving</td>
<td>7 months</td>
</tr>
<tr>
<td>Air pollution</td>
<td>5 months</td>
</tr>
<tr>
<td>Alcohol</td>
<td>5 months</td>
</tr>
<tr>
<td>Drug abuse</td>
<td>4 months</td>
</tr>
<tr>
<td>Flu</td>
<td>4 months</td>
</tr>
<tr>
<td>AIDS</td>
<td>3 months</td>
</tr>
<tr>
<td>Drowning</td>
<td>1 month</td>
</tr>
<tr>
<td>Pesticides</td>
<td>1 month</td>
</tr>
<tr>
<td>Fire</td>
<td>1 month</td>
</tr>
<tr>
<td>Natural radiation</td>
<td>8 days</td>
</tr>
<tr>
<td>Medical X rays</td>
<td>5 days</td>
</tr>
<tr>
<td>Oral contraceptives</td>
<td>5 days</td>
</tr>
<tr>
<td>Toxic waste</td>
<td>4 days</td>
</tr>
<tr>
<td>Flying</td>
<td>1 day</td>
</tr>
<tr>
<td>Hurricanes, tornadoes</td>
<td>1 day</td>
</tr>
<tr>
<td>Living lifetime near nuclear plant</td>
<td>10 hours</td>
</tr>
</tbody>
</table>
Difference between a healthy lung and one with emphysema
Estimating risks from technologies is not easy

• The more complex a technological system, and the more people needed to design and run it, the more difficult it is to estimate the risks of using the system.

• The overall reliability or the probability that a person, device, or complex technological system will complete a task without failing is the product of:
  – Technology reliability.
  – Human reliability.
Most people do a poor job of evaluating risks

- Many people deny or shrug off the high-risk chances of death (or injury) from voluntary activities they enjoy, such as:
  - Motorcycling (1 death in 50 participants).
  - Smoking (1 in 250 by age 70 for a pack-a-day smoker).
  - Hang gliding (1 in 1,250).
  - Driving (1 in 3,300 without a seatbelt and 1 in 6,070 with a seatbelt).
Most people do a poor job of evaluating risks

- Some of these same people may be terrified about their chances of being killed by:
  - A gun (1 in 28,000 in the United States).
  - Flu (1 in 130,000).
  - Nuclear power plant accident (1 in 200,000).
  - West Nile virus (1 in 1 million).
  - Lightning (1 in 3 million).
  - Commercial airplane crash (1 in 9 million).
  - Snakebite (1 in 36 million).
  - Shark attack (1 in 281 million).
Most people do a poor job of evaluating risks

• Five factors can cause people to be being more or less risky than experts judge.
  – Fear.
  – Degree of control we have.
  – Whether a risk is catastrophic instead of chronic.
  – Some people suffer from optimism bias, the belief that risks that apply to other people do not apply to them.
  – Many risky things are highly pleasurable and give instant gratification.
Several principles can help us evaluate and reduce risk

- Compare risks.
- Determine how much risk you are willing to accept.
- Evaluate the actual risk involved.
- Concentrate on evaluating and carefully making important lifestyle choices.
Three big ideas

• We face significant hazards from infectious diseases, and from exposure to chemicals.

• An ounce of (pollution) prevention is worth a pound of cure.

• Becoming informed, thinking critically about risks, and making careful choices can reduce the major risks we face.
The End…

Following is **SUPPLEMENTAL!!!**
Some diseases can spread from one person to another

• Viruses are smaller than bacteria and work by invading a cell and taking over its genetic machinery to copy themselves. They then multiply and spread throughout one’s body, causing a viral disease such as flu or AIDS

• A transmissible disease is an infectious bacterial or viral disease that can be transmitted from one person to another.
Some diseases can spread from one person to another

• A nontransmissible disease is caused by something other than a living organism and does not spread from one person to another.
  – Examples include cardiovascular (heart and blood vessel) diseases, most cancers, asthma, and diabetes.

• In 1900, infectious disease was the leading cause of death in the world.

• Greatly reduced by a combination of better health care, the use of antibiotics to treat infectious diseases caused by bacteria, and the development of vaccines.
Infectious diseases are still major health threats

- Infectious diseases remain as serious health threats, especially in less-developed countries.
- Spread through air, water, food, and body fluids.
- A large-scale outbreak of an infectious disease in an area is called an epidemic.
- A global epidemic such as tuberculosis or AIDS is called a pandemic.
- Many disease-carrying bacteria have developed genetic immunity to widely used antibiotics and many disease-transmitting species of insects such as mosquitoes have become immune to widely used pesticides that once helped to control their populations.
We face many types of hazards

- Biological hazards from more than 1,400 pathogens that can infect humans.
  - A pathogen is an organism that can cause disease in another organism.
    - Bacteria.
    - Viruses.
    - Parasites.
    - Protozoa.
    - Fungi.
We face many types of hazards

• Chemical hazards from harmful chemicals in air, water, soil, food, and human-made products.
• Natural hazards such as fire, earthquakes, volcanic eruptions, floods, and storms.
• Cultural hazards such as unsafe working conditions, unsafe highways, criminal assault, and poverty.
• Lifestyle choices such as smoking, making poor food choices, drinking too much alcohol, and having unsafe sex.
Some diseases can spread from one person to another

- An infectious disease is caused when a pathogen such as a bacterium, virus, or parasite invades the body and multiplies in its cells and tissues.
  - Tuberculosis, flu, malaria, and measles.
- Bacteria are single-cell organisms that are found everywhere. Most are harmless or beneficial. A bacterial disease results from an infection as the bacteria multiply and spread throughout the body.
Viral diseases and parasites kill large numbers of people

- Viruses evolve quickly, are not affected by antibiotics, and can kill large numbers of people.
  - The biggest killer is the influenza, or flu, virus, which is transmitted by the body fluids or airborne emissions of an infected person.
  - The second biggest viral killer is the human immunodeficiency virus (HIV).
    - HIV infects about 1.8 million people each year, and the complications resulting from AIDS kill about 1.8 million people annually.
Viral diseases and parasites kill large numbers of people

- The third largest viral killer is the hepatitis B virus (HBV), which damages the liver and kills about a million people each year.
  - Transmitted by unsafe sex, sharing of needles by drug users, infected mothers who pass the virus to their offspring before or during birth, and exposure to infected blood.

- Emergent diseases are illnesses that were previously unknown or were absent in human populations for at least 20 years.
  - One is the West Nile virus, which is transmitted to humans by the bite of a common mosquito that is infected when it feeds on birds that carry the virus.
Viral diseases and parasites kill large numbers of people

– Greatly reduce your chances of getting infectious diseases by practicing good, old-fashioned hygiene.
  • Wash your hands thoroughly and frequently.
  • Avoid touching your face.
  • Stay away from people who have flu or other viral diseases.
We can reduce the incidence of infectious diseases

- The percentage of global death rate from infectious diseases decreased from 35% to 17% between 1970 and 2006, and is projected to drop to 16% by 2015.
- From 1971-2006, immunizations of children in developing countries to prevent tetanus, measles, diphtheria, typhoid fever, and polio increased from 10% to 90%—saving about 10 million lives each year.
- An important breakthrough has been the development of simple oral rehydration therapy—administering a simple solution of boiled water, salt, and sugar or rice.
- Philanthropists have donated billions of dollars toward improving global health, with special emphasis on infectious diseases in less-developed countries.
Some chemicals may affect our immune and nervous systems

- The EPA estimates that about 1 in 12 women of childbearing age in the US has enough mercury in her blood to harm a developing fetus.
  - The greatest risk from exposure to low levels of methylmercury is brain damage in fetuses and young children.
  - Methylmercury may also harm the heart, kidneys, and immune system of adults.
  - EPA advised nursing mothers, pregnant women, and women who may become pregnant not to eat shark, swordfish, king mackerel, or tilefish and to limit their consumption of albacore tuna.
  - In 2003, the UN Environment Programme recommended phasing out coal-burning power plants and waste incinerators throughout the world as rapidly as possible.
  - Other recommendations are to reduce or eliminate mercury in the production of batteries, paints, and chlorine by no later than 2020.
There are other ways to estimate the harmful effects of chemicals

- Case reports provide information about people suffering some adverse health effect or death after exposure to a chemical.

- Epidemiological studies, which compare the health of people exposed to a particular chemical (the experimental group) with the health of a similar group of people not exposed to the agent (the control group), but limited by:
  - Too few people have been exposed to high enough levels of a toxic agent to detect statistically significant differences.
There are other ways to estimate the harmful effects of chemicals

– Usually takes a long time.
– Closely linking an observed effect with exposure to a particular chemical is difficult because people are exposed to many different toxic agents throughout their lives and can vary in their sensitivity to such chemicals.
– Cannot evaluate hazards from new technologies or chemicals to which people have not yet been exposed.
How far should we go in using pollution prevention and the precautionary principle?

- The precautionary principle advocates when there is reasonable but incomplete scientific evidence of significant or irreversible harm to humans or the environment from a proposed or existing chemical or technology, we should take action to prevent or reduce the risk instead of waiting for more conclusive scientific evidence.
  - New chemicals/technologies would be assumed to be harmful until scientific studies could show otherwise.
  - Existing chemicals/technologies that appear to have a strong chance of causing significant harm would be removed from the market until their safety could be established.
The greatest health risks come from poverty, gender, and lifestyle choices

- Risk analysis involves identifying hazards and evaluating their associated risks.
  - Risk assessment.
  - Ranking risks (comparative risk analysis).
  - Determining options and making decisions about reducing or eliminating risks (risk management).
  - Informing decision makers and the public about risks (risk communication).
The greatest health risks come from poverty, gender, and lifestyle choices

• The greatest risk by far is poverty.
  – The high death toll ultimately resulting from poverty is caused by malnutrition, increased susceptibility to normally nonfatal infectious diseases, and often-fatal infectious diseases transmitted by unsafe drinking water.

• The second greatest risk is gender.