

Environmental Health and Toxicology

DISEASE- a change in health for the worst caused by a number of possible factors.

Illness Factors include diet and nutrition, infectious agents, toxic chemicals, physical factors and psychological stress.

- Pathogens- Disease causing organisms, such as bacteria, viruses, microorganisms or other parasites.

Antibodies are introduced to prevent disease, by introducing a foreign particle

Morbidity- illness

Mortality- death

THE TOP THREE LEADING KILLERS IN WORLD

1. Cardiovascular Disease
2. Cancers and Tumors
3. Infectious and Parasitic diseases (24%)

Higher Death Rates occur in less fortunate countries where conditions are not ideal for human health and survival

Pesticides- used to eliminate insect vectors. Problem: Insects tend to become very resistant to the pesticides being used to destroy them, therefore allowing the insect population to come back and infect others

Currently, death rate is decreasing and life expectancy is increasing

****AIDS****- the largest cause of communicable deaths in the world...killing 3 MILLION people in YEAR 2000!!!

- Over 35 million people are currently living with HIV.
- AIDS- 25 million people have died so far since inception
- Largest occurrence in Africa- in some cases 36% of adult population
- Drug addictions and unprotected heterosexual sex are the two main causes
- Places such as Botswana, Zimbabwe and Zambia tend to have survival only of the very young and very old, as the middle ages of those living in these communities have died due to AIDS

Other Diseases

Viruses

- Ebola- 90% Mortality

Bacteria

- Tuberculosis- 256 cases resistant to drugs

- Anthrax
- Botulism- most recognized in Botox injections (beauty purposes)
- Cholera

Malaria- One million die a year. Greatest disease hazard to travelers from warm climates.

- [DALY or The Disability-Adjusted Life Years](#) measure the total burden of disease on productivity and quality of life.
 - DALY measures are very high in poor countries such as Africa due to lack of sanitation, bad water and polluted drinking water
- Malnutrition makes people more susceptible to many diseases
- Approximately 2 billion people suffer from worms, flukes, protozoa and other internal parasites ...affects the immune system greatly!
- Flu Epidemic of 1918 was LARGEST loss of life from an individual disease in a single year...(between 30 and 40 million)
 - Most flu strains are transmitted by air, or by pigs, birds, monkeys and rodents
 - As population grows, the faster a disease will spread
 - Outbreaks can occur among livestock as well
- Strep is the most common form of hospital-acquired conditions

TOXICOLOGY (TOXIC AND HAZARDOUS MATERIALS)

Hazardous = dangerous, including flammables, explosives, irritants, sensitizers, acids and caustics

Toxins = poisonous- so damaging that they damage living organisms by killing cells

Allergens = substances that activate the immune system, can act directly as antigens

Antigens - foreign white blood cells

FOUR MAIN CATEGORIES OF TOXINS

1. Neurotoxins- kill neurons in the nervous system quickly ...example Mercury, Cadmium, Chromium, Lead, DDT, organophosphates
2. Mutagens- chemicals and radiation that cause mutations by altering DNA. can trigger cancer and is inheritable if in reproductive cells. no safe level. ex. UV light
3. Carcinogens- substances that cause cancer ex. Cigarettes

The Delaney Clause to the US Food and Drug Act states that no known carcinogen causing "reasonable harm" may be added to food and drugs.

1:2 males (mostly prostate) and 1:3 females(mostly lung and breast) in US have cancer

4. Teratogens- toxins that cause abnormal embryonic cell division and result in birth defects

...example alcohol (fetal alcohol syndrome) and thalidomide (sedative causing abnormal fetal development). Many not be toxic to adults.

Diet has a huge impact on your health. Eat real food, not too much, mostly plants.

Measuring Toxicity

The Dose/Response Curves- a graph that shows the dosage that causes death in a population of organisms as the dosage level of a toxin is increased. The percent of organisms dead is measured against the dose in a semi-log graph.

Not always symmetrical, making it difficult to compare toxicity of unlike chemicals

LD50- measures toxicity of a chemical, LD50 is the dose lethal to 50% of a test population; the lower the LD50, the more toxic the chemical

- The established dose curve will determine the dose below which none of the test subjects were harmed.
- The threshold dose is the level at which a negative effect is just starting to occur as the toxin level increases.

Bioaccumulation of a toxin occurs when an organism absorbs and stores the toxin in its tissues

Biomagnification when the toxin becomes increasingly more concentrated higher up the food chain. The best-known examples are the insecticide DDT and mercury. ex. tertiary consumers

Risk Assessment

- Calculating the risk of becoming ill when exposed to a toxin or pathogen
 - probability of harm times the probability of exposure
- Many public health decisions are based on our risk of becoming ill
- The EPA assumes a risk of 1:million is acceptable for most environmental hazards
 - ex. smoking 1.4 cigarettes/day, living in NYC for 2 days, living 2 months in stone building, eating 100 charcoal-broiled steaks and eating 40 tablespoons of peanut butter!Life is dangerous!

Famous Cases:

"Silent Spring" written by Rachel Carson explored the persistence of DDT pesticides in the environment, biomagnification and effect on non-target species

Love Canal- Social Justice, Persistence of toxic wastes and Superfund Site. Canal Buffalo, NY was dug beginning in 1892. When canal failed to be completed, it was used as an industrial dump for several toxic chemicals. The property was sold in order to build several homes and a community school. Many people became ill and when

tests were conducted high toxic levels of chemicals were found and the company who originally sold the property was forced to pay for the removal of the waste found. Today, the people are allowed to move back to their old homes and the site is clean.

Bhopal, India- Pesticide drum exploded spreading toxic gas over shantytown. Many died.

Minamata, Japan- mercury was dumped into bay in Japan. Heavy metal bioaccumulated in fish. Many Japanese died or suffered neurological damage.

Chernobyl, Ukraine- Most horrible nuclear accident in the world. Many are still dying. Site is still devoid of people.

Three Mile Island, Pennsylvania- most serious nuclear accident in US history

Other cases include the Ebola and the Hot Zone, Agent Orange and the Vietnam Conflict and the Flu Vaccine

Acute Toxicity occurs when a large dose inflicts immediate harm on an organism

Chronic Toxicity occurs when a smaller dose is expressed over a long period of time, harder to detect because it may not be seen for years

Chemical Synergism- when two toxins together have a greater effect than the SUM of the effects of the two toxins separately ...example/ small amount of alcohol with small amount of barbiturates can have a severe effect on the central nervous system...or smoking and asbestos can expose a person to cancer ten times greater than if they were exposed to just one of the factors.

Best way to destroy these chemicals and toxins-through neutralization or oxidation...
Incineration, Air Stripping, Carbon Absorption or Flocculation

Waste Disposal ...Landfills and Dumps, Incineration or a huge problem creator, Selling the Waste to Poor Counties, by doing this the people of the country absorb these toxic wastes into their bodies, all so they get more money.

HAZMAT (Hazardous Materials) Alternatives- You can replace your everyday cleaner with the right combination of harmless substances ...things such as Lemon Juice, Vinegar, Water, Club Soda and so much more can replace more hazardous chemicals to make the result safer

Conserve, Recycle and Reduce!