Chapter 17—Human Health and Environmental Risks

Your test on Thursday is over chapter 16. You will have a test over chapters 17 & 18 next. Use your text book to complete these notes. If you finish early, study for your test or work on your reading guide.

Module 56–Human Disease
After reading this module you should be able to
- identify the different types of human diseases.
- understand the risk factors for human chronic diseases.
- discuss the historically important human diseases.
- identify the major emergent infectious diseases.
- discuss the future challenges for improving human health.

There are different types of human diseases
- _____ Any impaired function of the body with a characteristic set of symptoms.
- _____A disease caused by a pathogen.
- _____A disease that rapidly impairs the functioning of an organism.
- _____A disease that slowly impairs the functioning of an organism.

Types of Human Diseases (Fig. 56.1)
Leading causes of death in the world. (a) More than three-quarters of all world deaths are caused by _____, including _____ and _____ diseases, various cancers, cardiovascular diseases, and infectious diseases. (b) Among the world's deaths caused by infectious diseases, _____ percent are caused by only six types of diseases.

Numerous risk factors exist for chronic risk factors in humans
- In low-income countries, the top risk factors leading to chronic disease are associated with _____, including unsafe drinking _____, poor _____, and _____.
- Risk factors for chronic disease in high-income countries include increased availability of _____, and a combination of _____ active lifestyles, poor _____, and _____ that leads to high blood pressure and obesity.

Chronic Risk Factors in Humans (Fig. 56.2)
Leading health risks in the world. If we consider all deaths that occur and separate them into different causes, we can examine which categories cause the highest percentage of all deaths. The leading health risks for low-income countries include issues related to _____ and _____. The leading risks for high-income countries include issues related to _____use, _____, obesity, and urban _____.

Some infectious diseases have been historically important
- Environmental scientists are interested in diseases that have environmental causes, especially those caused by pathogens such as _____.

Infectious Disease
- _____A situation in which a pathogen causes a rapid increase in disease.

- _____An epidemic that occurs over a large geographic region.
- _____An infectious disease caused by a bacterium (*Yersinia pestis*) that is carried by fleas.
- _____An infectious disease caused by one of several species of protists in the genus Plasmodium.
- _____A highly contagious disease caused by the bacterium Mycobacterium tuberculosis that primarily infects the lungs.

Tuberculosis (Fig. 56.6)
Tuberculosis cases and deaths. (a) Due to effective and available _____, tuberculosis has gone from being one of the most deadly diseases in the United States to a disease that rarely kills. (b) Worldwide, however, tuberculosis has continued to infect and kill millions of people, especially in _____- and _____-income countries.

Emergent infectious diseases pose new risks to humans
- _____ An infectious disease that has not been previously described or has not been common for at least 20 years.

Fig. 56.7 **The emergence of new diseases.** Since the 1970s, new diseases, or diseases that have been rare for more than 20 years, have been appearing throughout the world at a rate of approximately _____ per year.

Emergent Infectious Diseases
- Acquired Immune Deficiency Syndrome (_____)
    - An infectious disease caused by the human _____virus (HIV).
- Human Immunodeficiency Virus (_____) A type of virus that causes Acquired Immune Deficiency Syndrome (AIDS).
- Ebola _____fever An infectious disease with high death rates, caused by the Ebola virus.
- _____A disease in which prions mutate into deadly pathogens and slowly damage a cow's nervous system.
- _____A small, beneficial protein that occasionally mutates into a pathogen.
- _____A type of flu caused by the H1N1 virus.
- _____A type of flu caused by the H5N1 virus.
- _____(SARS) A type of flu caused by a coronavirus.
- _____A virus that lives in hundreds of species of birds and is transmitted among birds by mosquitoes.

Human health faces a number of future challenges
- Low-income countries need improvements in _____, wider availability of _____drinking water, and proper _____.
- High-income countries need to promote healthier lifestyle choices such as increased _____activity, a _____diet, and limiting excess food consumption and _____use.
- _____is needed everywhere to reduce the spread of diseases such as HIV and tuberculosis.

Module 57—Toxicology and Chemical Risks
After reading this module you should be able to
- identify the major types of harmful chemicals.
- explain how scientists determine the concentrations of chemicals that harm organisms.

Chemicals that Harm Organisms
- _____A chemical that disrupts the nervous systems of animals.
- _____A chemical that causes cancer.
- _____A type of carcinogen that causes damage to the genetic material of a cell.
- _____ A chemical that interferes with the normal development of embryos or fetuses.
- _____A chemical that causes allergic reactions.
- _____A chemical that interferes with the normal functioning of hormones in an animal's body.

Scientists can determine the concentrations of chemicals that harm organisms.
- To assess the risk of a chemical, we need to know _____that cause harm.

There are three ways to determine the harmful concentration of a chemical:
- _____studies
- _____studies
- _____studies

Dose Response Studies
- _____ A study that exposes organisms to different amounts of a chemical and then observes a variety of possible responses, including mortality or changes in behavior or reproduction.
- _____An experiment that exposes organisms to an environmental hazard for a short duration.
- _____An experiment that exposes organisms to an environmental hazard for a long duration.
- _____The lethal dose of a chemical that kills 50 percent of the individuals in a dose-response study.

- Dose Response Studies (Fig. 57.5)
  LD50 studies. To determine the dose of a chemical that causes a _____percent death rate, scientists expose animals to different doses of a chemical and determine what proportion of the animals die at each dose. Such an experiment typically produces an _____-shaped curve.

- _____The effect of an environmental hazard that is not lethal, but which may impair an organism's behavior, physiology, or reproduction.
- _____The effective dose of a chemical that causes 50 percent of the individuals in a dose-response study to display a harmful, but nonlethal, effect.

Retrospective versus Prospective Studies
- _____A study that monitors people who have been exposed to an environmental hazard at some time in the past.
- _____A study that monitors people who might become exposed to harmful chemicals in the future.
- _____A situation in which two risks together cause more harm than expected based on the separate effects of each risk alone.

Factors that Determine the Concentrations of Chemicals that Organisms Experience
- To identify and understand the effects of chemical concentrations that organisms experience, we need to know something about how the chemicals behave in the _____.
- _____The way in which an individual might come into contact with an environmental hazard.

Routes of Exposure (Fig. 57.7)
Routes of exposure. Despite a multitude of potential routes of exposure to chemicals, most chemicals have a _____ number of major routes.

Solubility Of Chemicals, Bioaccumulation, and Biomagnifications
- The movement of a chemical in the environment depends in part on its _____.
- _____How well a chemical dissolves in a liquid. A water-soluble chemical can be washed off surfaces, percolate into groundwater, and runoff into surface waters including rivers and lakes.
- _____soluble chemicals are not very soluble in water and are found in higher concentrations bound to _____, including the _____soils that underlie bodies of water.

Solubility Of Chemicals, Bioaccumulation, and Biomagnifications
- _____An increased concentration of a chemical within an organism over time.
- _____The increase in chemical concentration in animal tissues as the chemical moves up the food chain.
- _____The length of time a chemical remains in the environment.

Bioaccumulation, and Biomagnification (Fig. 57.8)
The biomagnification of DDT. The initial exposure is primarily in a low trophic group such as the _____in a lake. Consumption causes the upward movement of the chemical where it is accumulated in the bodies at each _____. The combination of bioaccumulation at each trophic level and upward movement by consumption allows the concentration to _____to the point where it can be substantially more _____in the top predator than it was in the water.

Table 57.1
_____ has a very long persistence; _____ is only one day.

Quick Review

What are the three major categories of risk for human health?

- _____—natural disasters and excessive exposure to uv
- _____—diseases
- _____—exposure to toxic chemicals like arsenic or pesticides

What's the difference between acute disease and chronic disease?

- _____ disease—A disease that rapidly impairs the functioning of an organism
- _____disease—A disease that slowly impairs functioning of an organism

What are the top three leading causes of death in the world?

- _____disease (29%)
- _____diseases (26%)
- _____ (13%)

What are the two leading health risks for high-income nations and low-income nations?

- High-income—
- Low income—

Why has the number of tuberculosis cases in the US dropped to record lows while the number of TB cases around the world has remained at very high levels?

- The availability of _____in the US and the lack of access to _____in other countries

What is an emergent infectious disease?

- An infectious disease that has not been described or common for at least _____ years.
  - Examples:

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Type of Chemical	Sources	Examples	Effects
	Paint, gasoline, burning coal, fish consumption		Impaired learning, nervous system disorder, damage to the brain, kidneys, liver
	Mines, groundwater, building materials, soil, industry		Cancer, impaired breathing
	Alcoholic beverages, pharmaceuticals, tobacco		Reduced fetal growth, brain and nervous system damage
	Food, latex, pharmaceuticals,		Breathing difficulties, hives

	pollutants		
	Herbicides, insecticides, cosmetics, pharmaceuticals		Feminization of males, early onset of puberty, low sperm count, thin eggshells of birds

What is solubility and how does it relate to bioaccumulation?

- A measure of how well a substance _____ in a solvent
- Oil-soluble chemicals are readily stored in the _____ tissues of animals—continued exposure to oil-soluble chemicals can cause _____ (increased concentration of a chemical over time)

How is bioaccumulation different from biomagnification?

- _____ occurs within a single organism; _____refers to the accumulation of a toxin as it moves up the food chain

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Module 58—Risk Analysis
After reading this module you should be able to

- explain the processes of qualitative versus quantitative risk assessment.
- understand how to determine the amount of risk that can be tolerated.
- discuss how risk management balances potential harm against other factors.
- contrast the innocent-until-proven-guilty principle and the precautionary principle.

Risk assessment estimates potential harm

- _____ Anything in the environment that can potentially cause harm.

The process of risk analysis. Risk analysis involves risk _____, risk _____, and risk _____.

Risk Assessment 1. 2. 3.	→	Risk Acceptance	→	Risk Management

Risk Assessment (Fig. 58.2)
 The probabilities of death in the United States. Some causes of death that people perceive as having a high probability

of occurring, such as dying in an _____crash, actually have a low probability of occurring. In contrast, some causes of death that people rate as having a low probability of occurring, such as dying from _____disease, actually have a very high probability of occurring.

Qualitative Risk Assessment
- There are two types of risk assessment—_____ and _____.
- In a qualitative assessment, we make judgments that are based on our _____ but that are not based on actual data.
- Because our personal risk assessments are not _____, they often do not match the actual risk.

Quantitative Risk Assessment
- A quantitative assessment uses actual _____.
- Risk = probability of being exposed to a hazard × probability of being harmed if exposed

Risk acceptance determines how much risk can be _____
- Some people are willing to live with risk and others are not.
- Even among those people who are willing to accept some risk, the precise amount of _____ risk is open to heated disagreement.
- Environmental scientists, economists, and others can help us weigh options as objectively as possible by providing accurate estimates of costs and benefits.

Worldwide standards of risk can be guided by two different philosophies
- A key factor determining the type of chemical regulation is whether the regulations are guided by the innocent-until-proven-guilty principle or the precautionary principle.
- _____ principle A principle based on the belief that a potential hazard should not be considered an actual hazard until the scientific data definitively demonstrate that it actually causes harm.
- _____principle A principle based on the belief that action should be taken against a plausible environmental hazard.

Philosophies of Risk Management (Fig. 58.4)
The two different approaches to managing risk. The innocent-until-proven-guilty principle requires that researchers _____ _____before the chemical is restricted or banned. The precautionary principle requires that when there is scientific evidence that demonstrates a _____risk, the chemical must then be further tested to demonstrate it is _____before it can continue to be used.

International Agreements on Hazardous Chemicals
- _____ A 2001 agreement among 127 nations concerning 12 chemicals to be banned, phased out, or reduced.
- REACH (R_____ E_____ A_____C_____H_____)A 2007 agreement among the nations of the European Union about regulation of chemicals; the acronym stands for registration, evaluation, authorization, and restriction of chemicals.
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