Basic Facts about Environmental Health

By Eva Kunseler

Terminology

Environment and Health

- The term "environment" logically refers to air, water, and soil. A broader definition includes the manmade environment created by a society.
- Health is defined in WHO's Constitution as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. In more recent years, this statement has been modified to include the ability to lead a "socially and economically productive life".

Four types of environments

- The inner versus outer environment
- The personal versus ambient environment
- The gaseous, liquid and solid environments
- The chemical, biological, physical and socio-economic environments
  - Chemical constituents and contaminants include toxic wastes and pesticides in the outer environment, chemicals used in inner environments (private and occupational), preservatives used in food.
  - Biological contaminants include various disease mechanisms that may be present in food and water and can be transmitted.
  - Physical factors range from injuries and deaths occurring as a result of accidents, to excessive noise, heat, and cold, to harmful effects of ionizing and non-ionizing radiation.
  - Socio-economic factors, such as quality of housing or lifestyle, significantly affect people's lives and health.

Definition Environmental Health

- According to the World Health Organization, "In its broadest sense, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes the study of both the direct pathological effects of various chemical, physical, and biological agents, as well as the effects on health of the broad physical and social environment, which includes housing, urban development, land-use and transportation, industry, and agriculture."
- A supportive environment for health is free from major health hazards, satisfies the basic needs of healthy living, and facilitates equitable social interaction. Creation of supportive environments for health depends on cooperative action between sectors.

Environmental health

- Protection of the environment for health reasons has been a mainstay of public health practice since late 19th century.
- Public's awareness of the environment's role in health is more recent.
  - Publication of Rachel Carson's *Silent Spring* in the early 1960s.
  - Love Canal scandal (1978) in western New York; a significant toxic waste disposal site.

History of Environmental Health

- Traditional versus modern environmental health hazards.
  - John Snow 1855: Cholera epidemics.
  - EU-wide Anti-smoking campaign 2002.
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Definition Public Health

- The approach to medicine that is concerned with the health of the community as a whole
- The mission of public health is to "fulfill society's interest in assuring conditions in which people can be healthy"

The three core public health functions are:
- The assessment and monitoring of the health of communities and populations at risk to identify health problems and priorities
- The formulation of public policies designed to solve identified local and national health problems and priorities
- To assure that all populations have access to appropriate and cost-effective care, including health promotion and disease prevention services, and evaluation of the effectiveness of that care

Determinants of Health

Environmental and Occupational health

- Environmental health is the segment of public health that is concerned with assessing, understanding and controlling the impacts of people on the living and global environment and the impacts of the environment on them
- Occupational health is the segment of public health that is concerned with protection of health and well-being of people engaged in work or employment from hazardous factors in the occupational environment
- Similar source-to-effect approach but huge differences in study population, exposures and the variety of sources and pollutants

Models of environment and public health

- Public health intervention model: Prevention of development of disease
- Environmental stewardship model: Prevention of environmental degradation and resulting impacts on health

Definition of Risk

- A hazard is a factor or circumstance that may under some circumstances be harmful
- Risk includes the probability of harm times consequences
  - "What can go wrong?" is usually answered in the form of a "scenario"
  - "How likely is it?" can be answered in terms of the available evidence to quantify the probability and its uncertainties involved. In other situations, there may be no immediate approach for analyzing probability and uncertainty will be required.
  - "What are the consequences?" can be answered for each scenario by assessing the probable range of outcomes given the uncertainties
- Different types of risks
  - Real future risk as disclosed by the fully matured future circumstances when they
  - Statistical risk, as determined by currently available data
  - Projected risk, as analytically based on predictive models
  - Perceived risk, as intuitively seen by individuals
- In the context of public health, risk assessment is the process of quantifying the probability of a harmful effect to individuals or populations from certain human activities

Types of environmental health risks

- Environment and health causal link supported with evidence: Passive smoking and occurrence of lung cancer
- Environment and health causal link supported with ambiguous evidence: BSE (bovine spongiform encephalopathy or mad cow disease) and variant Creutzfeldt-Jakob disease
- Newly identified environment and health causal link not supported with evidence: GMO (genetically modified organism) and adverse health effects
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Environmental cause-and-health effect framework

Action can be taken at each step in the framework

Powerful guide to designing cost-effective and timely interventions

EH Framework explained

- Driving Forces: Human activities create conditions in which EH threats can develop or be averted
- Environmental pressure may increase or decrease
- State of the environmental quality influences human exposures and health effects
- Exposure
  - Concentration of the pollutant in the exposure medium
  - The length of exposure time
  - Questionnaire surveys
  - The available dose inside the body, depending e.g. on activity pattern, exposure circumstances (temperature, humidity)
  - Biomonitoring data
- Effect: Specific health effects are caused by exposure to mixtures of pollutants and psychosocial factors

Environmental health in practice

- Environmental Health experts aim to understand the various ways in which humans interact with their environment
  - Determination of the source and nature of each environmental pollutant or stressor
  - Assessment of how and in what form that pollutant comes into contact with people
  - Measurements of the resulting effects
  - Application of controls when and where appropriate
- Causality between a certain pollutant and particular health effect is difficult to detect / assess:
  - Infinite variety of pollutants and stressors
  - Possible synergistic effect of different pollutants and stressors

Importance of EH hazards

- More information is available through advances in data collection and surveillance systems, leading to a growing concern about the health effects of environmental factors
- Two topics of particular interest:
  - Vulnerability to EH hazards: variation with age and health status, genetic make up, diet and well-being
  - Inequity: Human exposure is not evenly distributed, depending on population density and related presence of human and natural activities

Children’s environmental health

- Vulnerable group
  - Developing biological system
  - Greater exposure
  - Toddler behaviour
  - Immature metabolism
  - Early exposures
  - Incomplete understanding about children’s risks

Outdoor Air Quality and Health

- Adverse health effects from air pollution
  - Lung cancer and chronic lung disease
  - Decreased lung function
  - Respiratory infections, asthma
  - Allergies
- Air pollutants
  - Sulfur dioxide (SO₂)
  - Particulate matter (PM₂.₅ and PM₁₀)
  - Nitrogen oxides (NOₓ, NO₂)
  - Volatile organic compounds (VOCs)
  - Metals: cadmium, mercury, lead, copper
**Outdoor Air Quality and Health**

- **Sources of air pollution**
  - Stationary: Fossil fuel power plants (SO$_2$), combustion plants and industrial processes (PM, NO$_x$)
  - Mobile: Road traffic (NO$_x$ and VOCs)
- **Exposure**
  - Outdoor air: PM, NO$_x$, VOCs, SO$_2$
  - Food chain: cadmium and mercury from soils to food chains
  - Water: lead and copper from water supply systems

**Water and Sanitation**

- **Health effects from polluted drinking and bathing water**
  - Water-borne disease, e.g. acute gastrointestinal disease, cholera
  - Water-contact disease, e.g. worms
  - Water-insect related disease, e.g. malaria
  - Water-wash disease e.g. lack of hygiene
- **Water pollutants**
  - Microbial contaminants
  - Nitrates
  - Pesticides
  - Other chemicals

**Solid wastes and Soil pollution**

- **Sources**
  - Industrial waste
  - Municipal waste
  - Medical or radioactive waste
- **Exposure through leaking / inadequate landfills**
  - Contaminated ground water
  - Hand-mouth behaviour of children

**Noise and Health**

- **Health effects**
  - long-term sleep disturbance
  - cardiovascular problems
  - pain and hearing fatigue and impairment
  - annoyance
  - hormonal responses (stress hormones) and their possible consequences on human metabolism (nutrition) and immune system
  - performance at work and/or school decrements
- **Excessive noise levels**
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Noise and Health (2)

• Sources
  – Road traffic
  – Aircraft
  – Neighbourhood (school, work)

• Exposure
  – Daytime
  – Nighttime

Radiation – UV, radon, non-ionizing

• Health effects
  – Ionizing radiation: chemical and biological changes, e.g. fever, nausea, skin cancer, thyroid cancer
  – Non-ionizing radiation: ambiguous, e.g. headache, brain cancer, leukemia

• Radiation pollutants
  – Ionizing radiation
    • Natural background cosmic and terrestrial radiation
    • Ultraviolet radiation
    • Nuclear power production – processing uranium
    • Medical and dental care – X ray and radioactive material
  – Non-ionizing radiation
    • Infrared Laser, Microwave radiation
    • Electric Magnetic Fields

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Food safety

• Sources
  – Throughout the foodchain: growing, processing, preparation, storage
  – Foodborne parasites, bacterial infections (e.g. salmonella), viral infections (e.g. hepatitis A), natural toxins or toxins produced by bacteria or viruses
  – Natural chemical components or chemical deposition or uptake from air, water and soil

• Exposure
  – Consumption of contaminated food or water
    • Inadequate cooking
    • Improper storage or holding temperature
    • Poor personal hygiene

Transport and Health

• Health effects
  – Injuries and deaths
  – Respiratory disease
  – Obesity / overweight
  – Annoyance

• Hazards / Sources / Exposure
  – Air pollutants: NOx, PM
  – Accidents
  – Road traffic noise

EH Training
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### Housing and Health

- **Health effects**
  - Loss of physical, social and mental well-being
    - Lack of privacy, disturbance (noise, waste)

- **Hazards / Sources / Exposure**
  - Indoor air quality, violence, home safety, noise, humidity, mold growth, indoor temperatures, asbestos, lead, radon, volatile organic compounds (VOCs), lack of hygiene and sanitation equipment, crowding, household chemicals in consumer products and equipment (e.g. furniture)

### Indoor Air and Health

- **Health effects**
  - Lung cancer
  - Sick building syndrome
  - Allergy / Irritation / Discomfort

- **Pollutants**
  - Outdoor origin
  - Indoor origin: NO₂, tobacco smoke (carcinogens), lead, asbestos, VOC, formaldehyde, radon

- **Sources**
  - Outdoor sources e.g. traffic exhaust
  - Combustion by-products from gas cooking or unvented gas heaters
  - Micro-organisms and allergens from pets, humidifiers etc.
  - Formaldehyde and other organic compounds from building materials, furnishings, wood combustion, tobacco products
  - Asbestos fibres from building and insulation materials
  - Tobacco smoke
  - Radon

- **Exposure**
  - Public buildings / work places
  - Private homes
  - Transport

### EH Priority-setting in Estonia

- **EH problems and priorities**
  - Indoor air
    - High radon levels
    - Use of gas ranges and wood stoves
    - Inadequate heat in winter
    - Noise
    - Pollutants from smoking
    - Bad ventilation
  - Drinking water
    - Contaminations or excessive natural content of minerals
    - Consumption of soft (insufficiently mineralized) drinking water
  - Food
    - Presence of toxic heavy metals
    - Deficiencies of vitamins and essential minerals

- **EH data in Estonia**
  - Available data on
    - Drinking and bathing water
    - Environmental monitoring
    - Food safety
    - Indoor air quality

  - In general, actual health monitoring data from exposure to environmental hazards is lacking
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Discussion

- Linkage between EH, public health and health care
- Priority-setting from a public health (policy) perspective
- Data and information needs