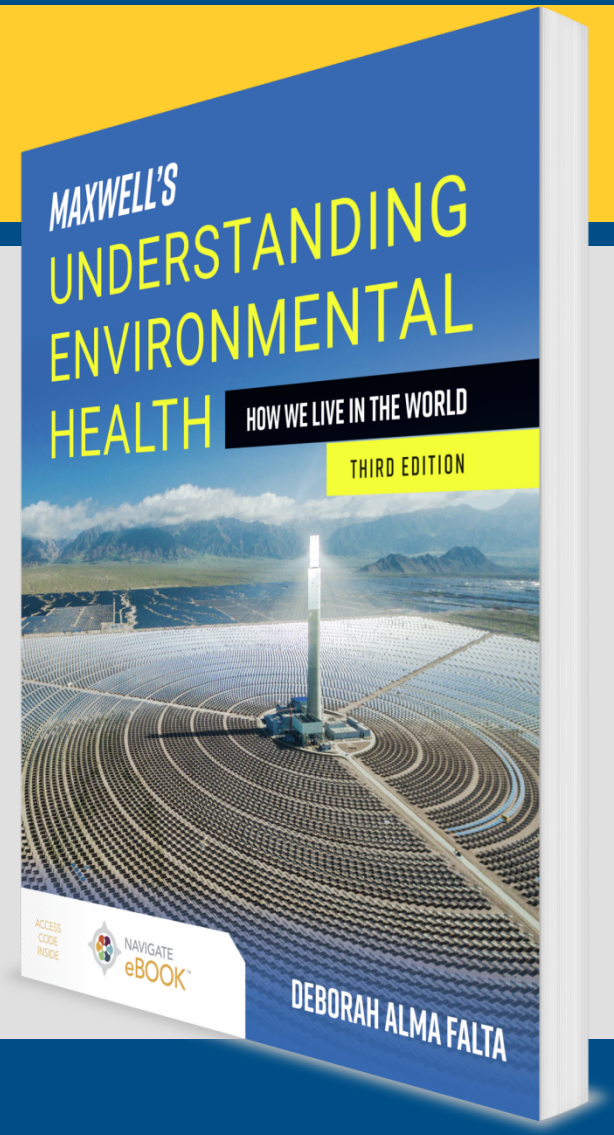
CHAPTER 1

Environmental Hazards to Human Health



Environmental Health

- A subfield of public health, along with other subfields such as health promotion, health administration, maternal and child, etc.
- Goal: **promote health for all through a healthy environment!**
- Objective: **understand how environmental exposures are hazardous to human health**

Defining “Environment” (1 of 2)

- Everything inside compared with exterior to the human body
- *“How do external agents get inside?”*
  - ***Exposure pathways** from outside the body to in*
    - *Ingestion*
    - *Inhalation*
    - *Dermal absorption*
    - *Consider the mental perception route, too*
- Inside vs. exterior of body

Defining “Environment” (2 of 2)

- Outdoor vs. indoor
- Controlled (personal) vs. uncontrolled (ambient)
- Solid, liquid, and gaseous
- Chemical, biological, physical, and socioeconomic

Possible Definitions for “Environmental Health”

- The science of the well-being of humans as related to their environment, including both the effects of humans on their surroundings and the effects of their surroundings on them
- Studying and understanding the environment so as to maximize its benefits to the world-at-large, and to minimize the deleterious effects of humans on the environment and the environment on them
- Subfield of public health concerned with assessing and controlling the impacts of people on their environment and the impacts of the environment on them

Core Concerns of Environmental Health

- Focus on chemical, physical, biological hazards
- Interactions with genetic traits and with social/behavioral stressors
- Emphasis on anthropogenic hazards with primarily involuntary exposure

Key Themes of this Textbook

- We make the world we live in, and we live in the world we make.
- People living a modern Western lifestyle create, use, and dispose of *lots* of "stuff."
- In an ecosystem, nothing ever goes away.[1]
- Therefore, our "stuff" and its byproducts are transported and transformed, but they do not disappear.

Textbook Topical Overview

Chapters 1–3 provide social, scientific and technological principles for assessing environmental health hazards

Chapter 4: *“Living in the Natural World”*

Chapter 5: *“Producing Food”*

Chapters 6–8 focus on aspects of modern life, such as manufacturing durable goods, producing energy, and managing wastes

Key Concepts Associated with Environmental Health Hazards

- Transition in types of environmental health risks
- Environmental Kuznets curves
- Externality and carrying capacity

Environmental Health Hazards Vary Greatly Depending upon Where You Live in this World!

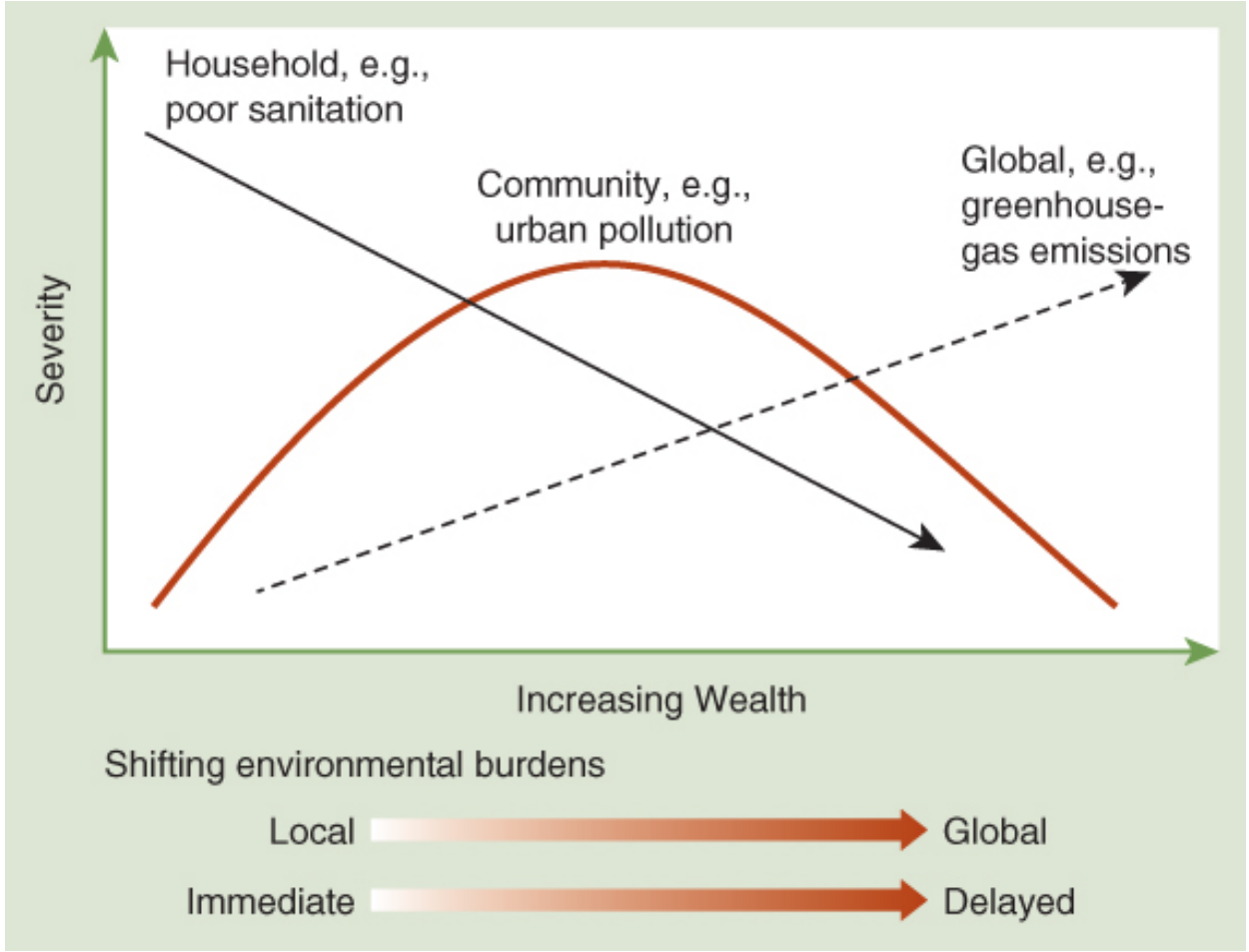


FIGURE 1.1 Relationship between environmental health severity and increasing wealth as depicted by the environmental kuznets curve.

Reproduced from Smith KR, Ezzati M. How environmental health risks change with development: the epidemiologic and environmental risk transitions revisited. *Annu Rev Environ Resour,* 2005;30:291-333. https://sci-hub.ren/10.1146/annurev.energy.30.050504.144424; https://www.annualreviews.org/doi/pdf/10.1146/annurev.energy.30.050504.144424

Household Environmental Hazards

- In least developed and most densely populated homes, acute infections associated with pollution result in deaths from diarrheal diseases, primarily in children.
- Lack of access to safe drinking water, sanitation, and hygiene combined with poor indoor air quality pose real biological risks.

Community Environmental Hazards

- As economies develop:
  - Sanitary conditions improve at the household level.
  - Urbanization and industrialization associated with improving economies bring about new risks, such as:
    - Increased traffic risks
    - Ambient air pollution increases, especially particulate matter
    - Chemical air and water pollution increases
- More chronic diseases and noninfectious disorders dominate

Specific Community-Level Environmental Health Concerns

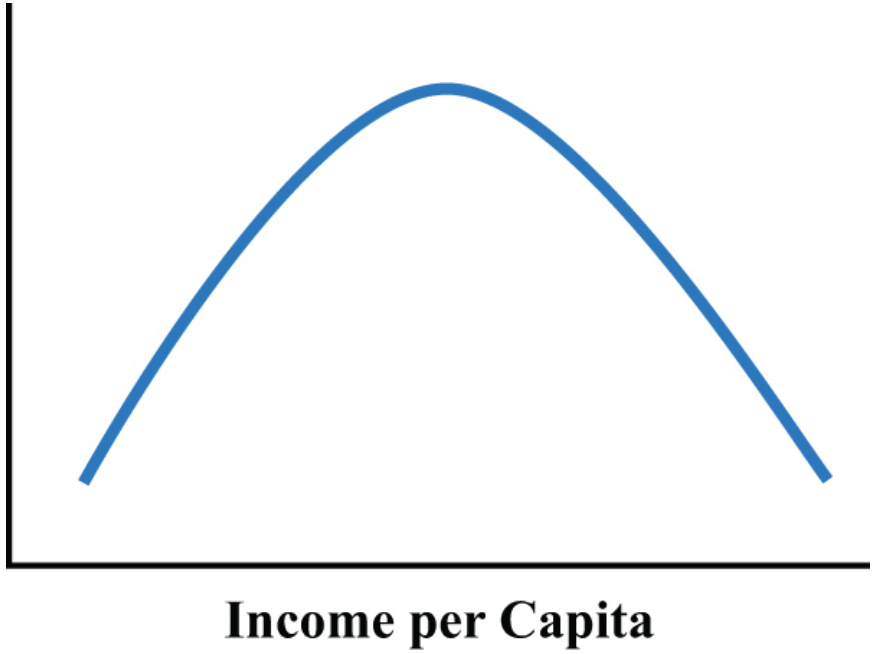
- Asthma
- Cancers
- Reproductive disfunction (infertility, birth defects, miscarriage)
- Developmental problems (autism spectrum disorders, dietary allergies)

Case Study: From Cholera to Chloroform

- Provides example of environmental risk transition from household-level to community-level concerns
- Household-level: millions of people have died from infectious diseases spread through contaminated drinking water, such as cholera
- Disinfection of drinking water supplies viewed as one of the greatest public health achievements of our times
- Community-level: new concerns with Disinfection Byproducts (DBPs), such as chloroform associated with chlorinated drinking water supplies, include bladder cancer, miscarriage and birth defects, or the aggravation of existing respiratory conditions

Environmental Kuznets Curve (EKC)

- Initially, people feared that richer, more developed economies would damage and destroy natural resources at a faster rate than poorer economies.
- But economists noticed a link between environmental quality and income changes that had an inverted-U shape



Explanation of EKC and the Inverted U

- As country develops, no real concern with impact on environmental resources
  - Especially during early stages of economic industrialization, some environmental degradation is inevitable
- With further development, communities begin to have more awareness of their impact on environmental resources as well as have funds to begin to reduce polluting impact.
- When certain level of per capita income is reached, economic growth further helps to undo the damage done earlier.
- For example, in the United States, profound number of federal environmental laws enacted during the 1960s–1980s
  - Refer to Appendix with table of several of these enacted laws

Specific Examples where EKC Applies

- Levels of SO_2 improve as incomes and levels of consumption go up
- Particulate matter concentrations improve with rising economies
- BOD in waterways reflect this curve

However …

- Kuznets curve don't apply to all environmental types of degradation.
  - Examples: global warming (release of greenhouse gases); landfills; extinct species and the loss of biodiversity
- Why?
  - Global-level health impacts of pollution too distally connected from their cause compared to diseases associated with household or community-level exposures
- Fact that economies benefitting from polluting (such as release of CO_2 with burning fossil fuel) have not (*yet*) experienced the adverse health impacts

Significance of the Externality Concept

- Individual self-interest “wins” over group ideals
  - Point: the grazing field was free!
  - Terms: utility and externality
    - Utility: benefit of use of resource
    - Externality: a cost associated with the use of a resource not captured in the price the user pays (*i.e., user gets more benefit or utility without paying full cost of his or her use)*
- As long as use of a resource is free, rational behavior will prevail even if the individually rational choice is detrimental to group overall

Our Planet Has only a Finite “Carrying Capacity”

- The environmental threats from urbanization and industrial processes, combined with high population growth, mean we must view our actions within the context of a global community.
- There exists an *ecological interconnectedness* between all of us!
- **Sustainable development**: meets the need of the present without compromising the ability of future generations to meet their own needs

Key Components of Any Sustainable Development Effort

- Limit population growth
- Maximize benefit for the greatest number
- Resource use should:
  1) Sustain yield for renewable resources
  2) Conserve nonrenewable resources
  3) Prevent pollution