

Epidemiology Kept Simple



Chapter 1 Epidemiology Past & Present

Gerstman

Chapter 1

1

Epidemiology Defined

- Greek roots
 - epi** = upon (as in “epidermis”)
 - demos** = the people (as in demography)
 - ology** = “to speak of”, “to study”
- Modern definitions of *epidemiology* refer to
 - **distributions** in populations (statistical)
 - **determinants** (pathophysiological, environmental, behavioral)
 - **control of health problems** (biological, social, economic, political, administrative, legal)

Gerstman

Chapter 1

2

Public Health Defined

- Definitions of *public health* refer to
 - organized effort
 - reduction of morbidity & mortality
 - improvements in health
- ASPH main public health competency areas
 - epidemiology
 - biostatistics
 - health administration
 - behavioral
 - environmental health science

Gerstman

Chapter 1

3

Epidemiology compared to...

- ... *medicine*
 - Main unit of concern in epi → population
 - Main unit of concern in medicine → individual
- ... *public health*
 - Epidemiology → “study of”
 - Public health → “organized effort”
 - Epi said to be “methodologic backbone” of public health

Gerstman

Chapter 1

4

Health

- There is no single definition of health
- Standard definition → absence of disease
- WHO definition (1948) → “physical, mental, and social well-being” [not merely the absence of disease]
- Newer definitions have not yet withstood the test of time and should be treated with healthy skepticism

Gerstman

Chapter 1

5

Terms

- Morbidity = related to disease or disability
- Mortality = related to death
- Endemic = normal occurrence of a condition
- Epidemic = much greater than normal occurrence of a condition
- Pandemic = an epidemic on multiple continents
- Incidence = rate or risk of developing a condition
- Prevalence = proportion of population with a condition

Gerstman

Chapter 1

6

§1.2 Uses of Epi (Morris, 1957)

1. Historical study
2. Community diagnosis
3. Working of health services
4. Individual chances
5. Completing the clinical picture
6. Identify new syndromes
7. Determine cause (paramount!)

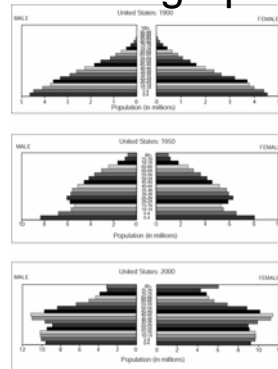
Text pp. 3–4; also see [Smith, 2003](#) (active link)

Gerstman

Chapter 1

7

Demographic Transition



Demographic transition = shift in age distributions over time due to:
(a) decreases in mortality esp. at early ages
(b) decreases in fertility

8

Epidemiologic Transition

- Epidemiologic transition 20th century
- Shift from acute & contagious disease to chronic & life-style diseases
- Decreases in mortality
- Decreases in fertility
- Aging of population w/ shifted in morbidity to older age groups

Leading Causes of Death		
	1900	1990
1	Pneumonia / influenza	Heart disease
2	TB	Neoplasms
3	Diarrhea	Cerebrovascular
4	Heart disease*	COPD
5	Cerebrovascular*	Pneumonia/ influenza

Gerstman

Chapter 1

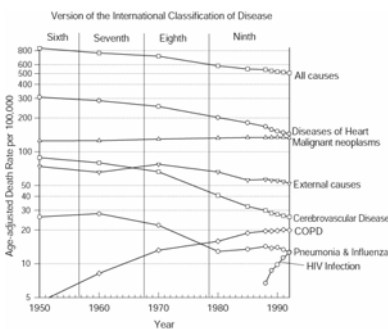
9

Reasons for Epidemiologic Transition

- Medical technology
- Improved standard of living
- Birth control
- Nutrition
- Sanitation and vector control
- Improvements in lifestyle

Avoid *notiones vulgares*, i.e., crudely formed concepts of natural phenomenon without scientific merit that produce only false knowledge.

Causes of Death, U.S., 1950–1990



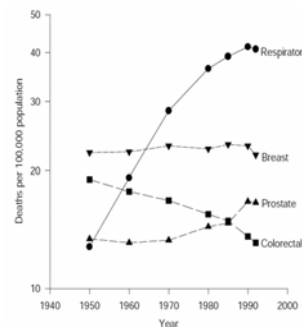
See pp. 5–9 for analysis

Gerstman

Chapter 1

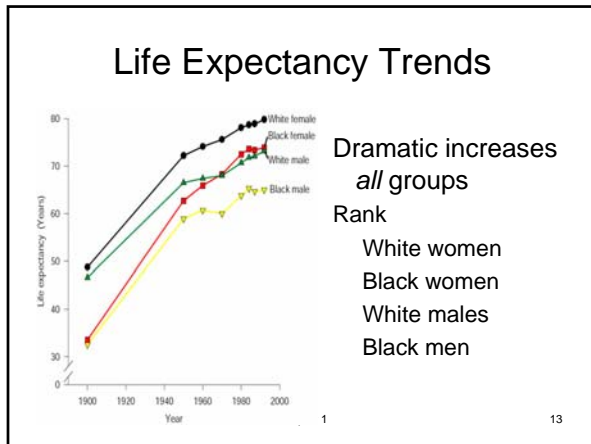
11

Mortality Trends of Selected Cancers U.S., 1940 - 1995



- Respiratory and prostate increased
- Colorectal & stomach declined
- Breast cancer about the same

12



- ### Historical Figures & Events
- See pp. 11–29
 - Selected figures
 - Hippocrates (400BCE)
 - Age of enlightenment (17th & 18th centuries)
 - John Graunt (1620 – 1674)
 - Pierre Charles Louis (1787 – 1872)
 - John Snow (1813 – 1858)
 - Germ Theory (mid 19th century)
 - Modern epidemiology

Enlightenment

The birth of modern medicine and public health must be studied in the context of the Western Enlightenment (pp. 11–12).

Barzun, J. (2001). *From Dawn to Decadence: 500 Years of Western Cultural Life*. New York: HarperCollins.

Demographic Approach

17th Century Life Table

Age	% surviving
6	64
16	40
26	25
36	16
46	10
56	6
60	3
76	1
80	0

John Graunt (1620–74)

- ### Lesson from Graunt (Rothman, 1996)
- Was brief
 - Made reasoning clear
 - Subjected theories to multiple and varied tests
 - Invited criticism
 - Willing to change ideas when confronted with contradictory evidence
 - Avoided simplistic interpretations of data

- ### Germ Theory (Highlights)
- Until the 19th century, germ theory played second fiddle to vague theories of pollution (e.g., miasma theory)
 - Examples of early contagionists
 - Fracastoro (16th century Italian)
 - Henle & Koch (German physiologists)
 - **John Snow** (epidemiologist's hero)
 - Pasteur (1865 experimental proof in silkworms)
 - Daniel Salmon (vector borne transmission)

John Snow, Our Hero

Snow's cholera theory:

- Epidemics follow routes of commerce
- Agent is free-living & multiplies within the host
- Transmission is water-borne, spread via fecal contamination, ingested orally
- Patho-physiology: diarrhea → fluid loss → smudging of blood → asphyxiation → death



John Snow (1813–1858)

Gerstman

Chapter 1

19

Snow's Methods

- **Ecological analysis:** comparison of rates by geographic region
- **Cohort analysis:** comparison of rates in exposed and non-exposed individuals
- **Case-control analysis:** comparison of exposure status in cases and non-cases

Gerstman

Chapter 1

20

Snow's Ecological Analysis

- Southwark Water Company neighborhoods ⇒ high rates
- Mixed service ⇒ intermediate rates
- Lambeth Water Co. neighborhoods ⇒ no cases

Sub-Districts	Popul. (est. in 1851)	Deaths from cholera	Rate per 10,000	Water Supply
St. Saviour, Southwark	19,700	43	227	Southwark and Vauxhall Water Company only.
St. Olave	8,515	19	227	
St. John, Horsleydown	12,560	7	41	
St. James, Horsleydown	18,899	31	111	
St. Mary Magdalen	23,254	27	105	
Leather Market	15,295	35	153	
Boothwall*	17,861	80	112	
Wandsworth	9,811	3	31	
Battersea	10,560	11	104	
Putney	5,280	6	30	
Camberwell	17,744	7	36	Lambeth Water Company, and Southwark and Vauxhall Company.
Peckham	19,444	7	36	
Charltonchurch, Southwark	16,292	7	43	
Leam Road	16,196	37	204	
Borough Road	15,462	36	183	
London Road	17,836	9	50	
Trinity, Newington	20,922	11	52	
St. Peter, Walworth	29,861	25	77	
St. Mary, Newington	14,033	5	35	
Waterloo (1st part)	14,098	1	7	
Waterloo (2nd part)	18,346	7	38	
Lambeth Church (1st part)	18,409	9	48	
Lambeth Church (2nd part)	26,784	11	41	
Kennington (1st part)	24,261	17	49	
Kennington (2nd part)	18,448	6	31	
Brixton	14,610	0	13	
Craydon	16,090	10	61	
St. George, Camberwell	13,849	6	37	
Norwood	3,977	—	—	Lambeth Water Company only.
Streatham	9,028	—	—	Lambeth Water Company only.
Dulwich	1,632	—	—	Lambeth Water Company only.
First 12 sub-districts	167,654	192	114	Southwark & Vaux.
Next 16 sub-districts	301,749	192	60	Both Companies.
Last 3 sub-districts	14,632	—	—	Lambeth Comp.

Gerstman

CI

Snow's Cohort Analyses

Water Source	Cases	Homes	Rate per 10,000
Southwark	1263	40,046	315*
Lambeth	98	26,107	37
Both	1422	256,423	59

* Rate, Southwark = 1263 / 40,046
= .0315 = 315 / 10,000

Gerstman

Chapter 1

22

Snow's map



Gerstman

Snow's Case-Control Studies

- Map shows high concentration of cases near Broad Street pump
- Among cases: 61 used Broad St. water, 6 did not, and 6 were uncertain
- Among noncases, use Broad St. water was rare
 - e.g., Among non-cases at the Brewery “the men ... were allowed a certain quantity of malt liquor, and [the proprietor] believes they do not drink water at all”
 - e.g., non-cases at workhouse had separate water source

Gerstman

Chapter 1

24

Modern Epidemiology

- Epidemiologic transition of the 20th century caused shift in focus from acute infectious diseases to chronic “life style” diseases
- Several exemplar studies are discussed in the chapter
 - The British Doctors Study
 - The Framingham Heart Study