

## Epidemiology Kept Simple



### Chapter 1 Epidemiology Past & Present

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## 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)

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## Public Health Defined

- Definition of *public health*
  - organized effort
  - reduction of morbidity & mortality
  - improvements in health
- Public Health competency areas (accreditation)
  - epidemiology
  - biostatistics
  - health administration
  - behavioral
  - environmental health science

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## Epidemiology vs. ...

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

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## Key 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

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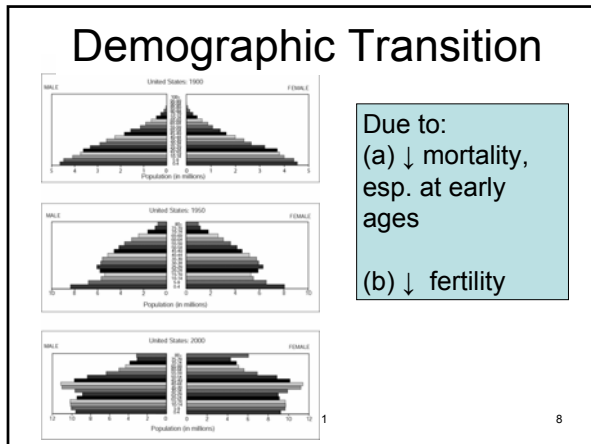
## §1.2 Uses of Epi (pp. 3-4)

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

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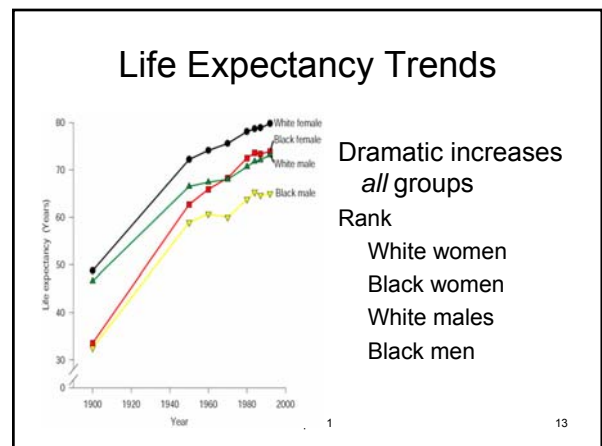
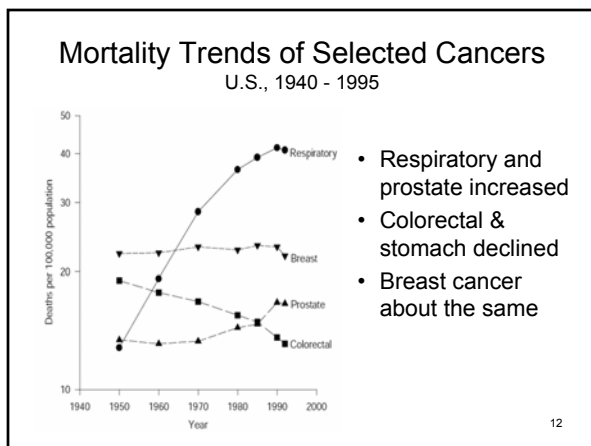
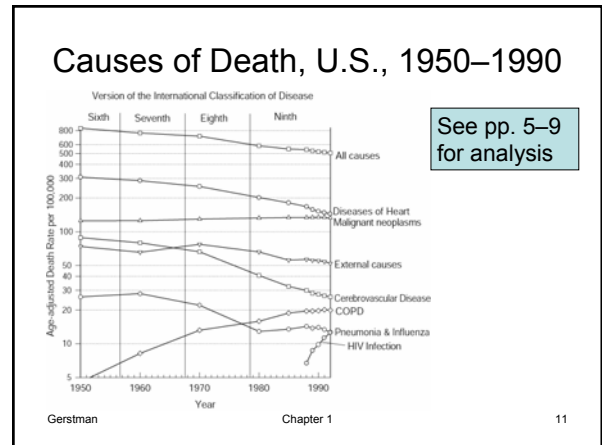
### Epidemiologic Transition

Leading Causes of Death		
	1900	1990
1	Pneumonia / influenza	Heart disease
2	Tuberculosis	Neoplasms
3	Diarrhea	Cerebrovascular

Shift from acute, contagious diseases to chronic & noncontagious ("lifestyle") diseases

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- ### Reasons for Epi. Transition
- Medical technology
  - Improved standard of living
  - Birth control
  - Improved nutrition
  - Sanitation and vector control
  - Improvements in lifestyle
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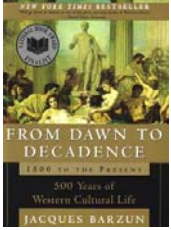
### Historical Figures & Events

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

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### 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.

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### Demographic Approach



John Graunt (1620–74)

17 <sup>th</sup> Century Life Table	
Age	% surviving
6	64
16	40
26	25
36	16
46	10
56	6
60	3
76	1
80	0

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### 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

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### Germ Theory (Highlights)

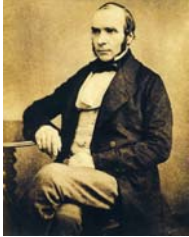
- Until the 19<sup>th</sup> century, germ theory played second fiddle to vague theories of pollution (e.g., miasma theory)
- Examples of early contagionists
  - Fracastoro (16<sup>th</sup> century Italian)
  - Henle & Koch (German physiologists)
  - **John Snow** (epidemiologist's hero)
  - Pasteur (1865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

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### 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)

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## 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

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## Snow's Ecological Analysis

- Southwark Water Company neighborhoods  $\Rightarrow$  high rates
- Mixed service  $\Rightarrow$  intermediate rates
- Lambeth Water Co. neighborhoods  $\Rightarrow$  no cases

Sub-Districts	Popul. in 1851	Deaths from cholera	Deaths per 10,000	Water Supply
St. Saviour, Southwark	19,709	45	227	Southwark and Vauxhall Water Company only.
St. Olave	8,015	19	237	
St. John, Horsleydown	11,360	7	61	
St. James, Bermondsey	19,809	91	111	
St. Mary Magdalen	13,034	27	165	
Leather Market	15,793	23	123	
Botherhithe*	17,803	30	117	
Wandsworth	9,611	2	21	
Battersea	10,560	11	104	
Pimlico	3,390	—	—	
Camberwell	17,742	9	50	
Peckham	19,444	7	36	
Chislehurst, Southwark	16,023	7	43	Lambeth Water Company, and Southwark and Vauxhall Company.
Ken Road	18,119	37	204	
Borough Road	15,882	36	145	
London Road	17,836	9	50	
Trinity, Newington	20,922	11	52	
St. Peter, Walworth	39,861	23	77	
St. Mary, Newington	14,033	5	35	
Waterloo (1st part)	14,068	1	7	
Waterloo (2nd part)	18,348	7	38	
Lambeth Church (1st part)	18,409	9	48	
Lambeth Church (2nd part)	36,784	11	41	
Kensington (1st part)	24,201	12	49	
Kensington (2nd part)	18,448	6	31	
Brixton	14,619	2	13	
Clapham	16,390	10	61	
St. George's, Camberwell	15,848	6	37	
Norwood	3,977	—	—	Lambeth Water Company only.
Streatham	9,023	—	—	Lambeth Water Company only.
Dulwich	1,632	—	—	Lambeth Water Company only.
First 19 sub-districts	107,624	192	114	Southwark & Vaux.
Next 19 sub-districts	301,179	163	60	Both Companies.
Last 3 sub-districts	14,632	—	—	Lambeth Comp.

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## 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 =  $1263 / 40,046$   
 $= .0315 = 315 / 10,000$

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## Snow's map



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## 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

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## Modern Epidemiology

- Epidemiologic transition of the 20<sup>th</sup> 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

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