


ENVIR 202: Lesson No. 7

# Epidemiology

January 20, 2006

Gail Sandlin  
University of Washington  
Program on the Environment



ENVIR 202: Lesson 7 1

---

---

---

---


---

---


---

---

# Origins



**John Snow  
(1813-1858)**



John Snow's original 1854 map on the location of 578 deaths from Cholera, from *An Introduction to Visualisation Software for Astronomy*, Starlink Guide 8.1, A C Davenhall, 9th February 1996 CCLRC / Rutherford Appleton Laboratory Particle Physics & Astronomy Research Council

ENVIR 202: Lesson 7 2

---

---

---

---

---

---

---

---

# Definition

❖ Epidemiology is the study of

- > the distribution and
- > determinants of
- > health effects (disease & injuries)
- > in human populations

ENVIR 202: Lesson 7 3

---

---

---

---

---

---

---

---

## Epidemiology

- ❖ Looks for patterns of disease occurrence
  - Geographically
  - Demographically

ENVIR 202: Lesson 7 4

---

---

---

---

---

---

---

---

## Epidemiological Model

ENVIR 202: Lesson 7 5

---

---

---

---

---

---

---

---

## Distribution Factors

- ❖ Person
- ❖ Place
- ❖ Time

ENVIR 202: Lesson 7 6

---

---

---

---

---

---

---

---

## Distribution Factors

---

- ❖ Person
  - Age
  - Race
  - Gender
  - Occupation
  - Education
  - Hobbies

ENVIR 202: Lesson 7 7

---

---

---

---

---

---

---

---

## Population Differences

---

Category	Prevalence (%)
All women	22.0
< 8	16.7
9-11	32.9
12	25.2
13-15	22.8
16+	11.2
AIAN	34.5
White	23.5
Black	21.9
Hispanic	13.8
API	11.2

Source: National Health Interview Survey, 1998. Source: National Health Interview Survey, 1997-1998.

ENVIR 202: Lesson 7 8

---

---

---

---

---

---

---

---

## Distribution Factors

---

- ❖ Person
  - > Age
  - > Race
  - > Gender
- ❖ Time
  - > Episodic
  - > Cyclical
  - > Secular

ENVIR 202: Lesson 7 9

---

---

---

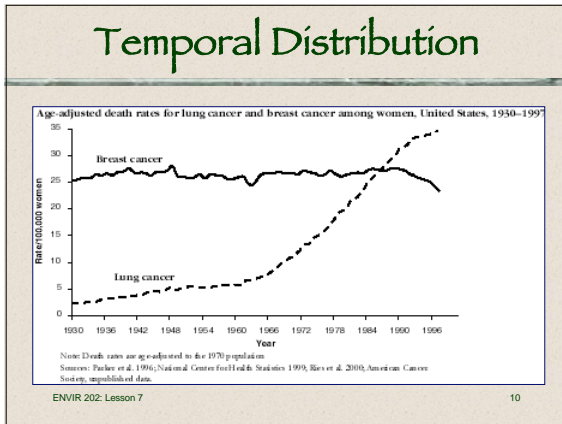
---

---

---

---

---




---

---

---

---

---

---

---

---

- ### Distribution Factors
- ❖ Person
    - > Age
    - > Race
    - > Gender
  - ❖ Time
    - > Episodic
    - > Cyclical
    - > Secular
  - ❖ Place
    - > Geographic
      - Longitude & Latitude
      - Geologic
      - Climatic
    - > Geo-political
      - Urban / Rural
      - Industry
      - Pollution
- ENVIR 202: Lesson 7 11

---

---

---

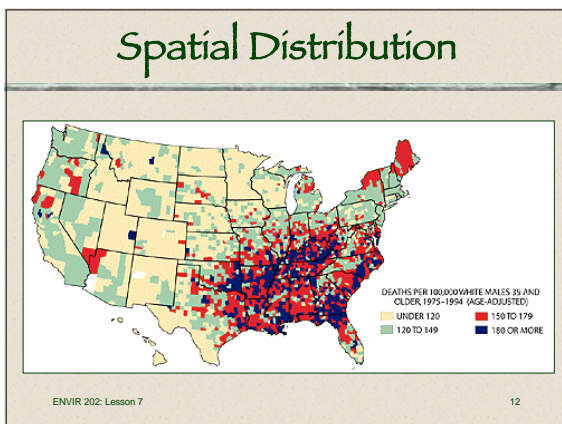
---

---

---

---

---




---

---

---

---

---

---

---

---

### Determinants

- ❖ Determinants
  - Agent
  - Host
  - Environment

ENVIR 202: Lesson 7 13

---

---

---

---

---

---

---

---

### Determinants

- ❖ Agent Factors
  - > Biological
  - > Chemical
  - > Physical
- ❖ Host Factors
  - > Genetic Predisposition
  - > Exposure
- ❖ Environment Factors
  - > Natural Environment
  - > Built Environment
  - > Socio-cultural Environment
  - > Temporal Environment

ENVIR 202: Lesson 7 14

---

---

---

---

---

---

---

---

### Concepts & Methods

- ❖ Disease Prevalence - the proportion of a population with the disease, at a chosen point in time. (*snap shot*)
  - >  $R_p = C_T / P$  (x 100,000) (at that time)
  - > E.g., 10% of the population of King County has respiratory asthma at present.

ENVIR 202: Lesson 7 15

---

---

---

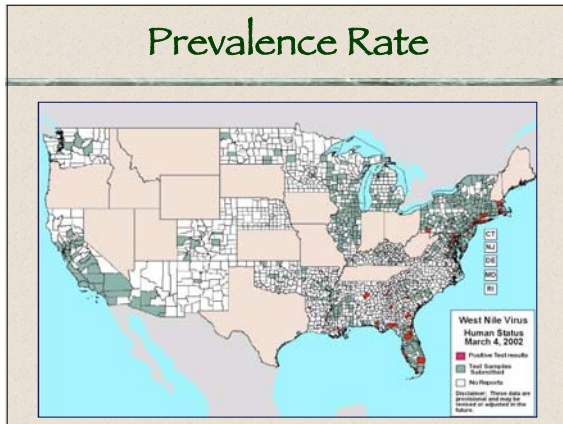
---

---

---

---

---




---

---

---

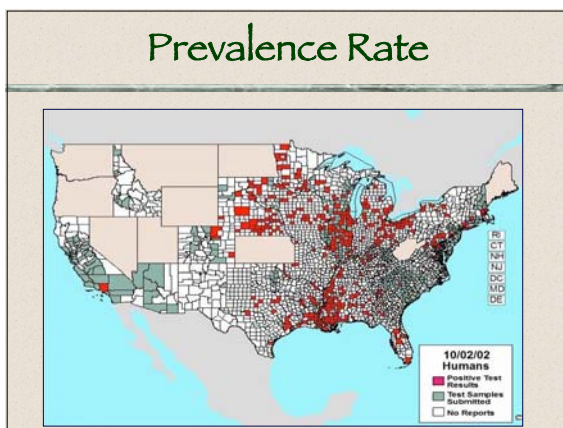
---

---

---

---

---




---

---

---

---

---

---

---

---

### Concepts & Methods Continued

- ❖ **Disease Incidence Rate -**
  - the proportion of a population with newly-diagnosed disease per given unit of time. (*new cases over time*)
  - $R_i = C_n / P \times 100,000$   
(at the midpoint of the unit of time)
  - E.g. the total mortality rate (all deaths) is 0.89% per year among the population of Seattle

ENVIR 202: Lesson 7 18

---

---

---

---

---

---

---

---

### Incidence Rates

- ❖ That is, in a given year there were 4450 deaths reported among residents of Seattle, a population of 500,000.
- ❖ **Incidence rate =**  
 $4450 / (500,000 \times 1 \text{ year})$   
 = 0.0089/year  
 = 890 per 100,000 persons per year  
 = 2.4 per 100,000 persons per day

ENVIR 202: Lesson 7 19

---

---

---

---

---

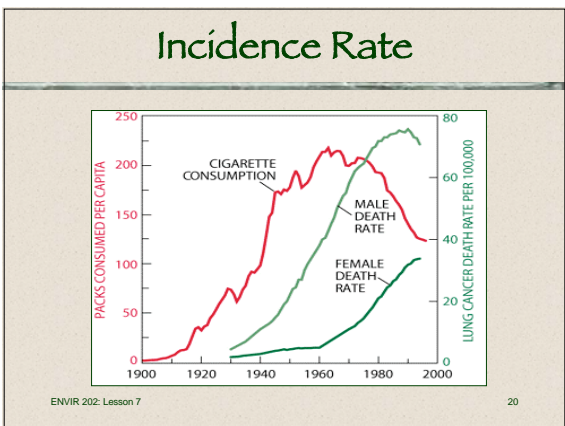
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

### Analytic Techniques

- ❖ **Stratification** - dividing the sample according to some characteristic,
- ❖ e.g. age:
  - Age-specific deaths from heart disease among non-smoking British male doctors

Age	Deaths/10 <sup>4</sup> persons per year
35-44	1.064
45-54	11.23
55-64	49.04
65-74	96.71
75-84	212.04
Total	25.75

ENVIR 202: Lesson 7 21

---

---

---

---

---

---

---

---

---

---

### Analytic Techniques Continued

- ❖ **Confounding factor:**
  - a factor that is associated both with exposure and outcome, and thus
  - interferes in determining the relationship between exposure and outcome.
  - Ethanol in this case is a confounder

ENVIR 202: Lesson 7 22

---

---

---

---

---

---

---

---

### Limitations

- ❖ Most environmental diseases have multiple contributing causes - e.g. lung cancer, heart disease - so multiple exposures must be measured.
- ❖ Smoking, age, diet, and genetic make-up are powerful interfering factors

ENVIR 202: Lesson 7 23

---

---

---

---

---

---

---

---

### Limitations Continued

- ❖ **Latency** of many (most?) environmental diseases is years to decades.
  - Thus exposures from the distant past are most relevant, and least likely to be known quantitatively.
- ❖ **Longitudinal** epidemiology, in which exposed persons are followed over years, is most precise.

ENVIR 202: Lesson 7 24

---

---

---

---

---

---

---

---



### Limitations Continued

- ❖ Examples of longitudinal studies:
  - Framingham, Mass. heart disease;
  - Fluoridation of water and dental caries;
  - Salk vaccine and polio incidence;
  - Smoking and several diseases.

ENVIR 202: Lesson 7 25

---

---

---

---

---

---

---

---

### Prevention & Control

- ❖ Modify the environment
  - Engineering Controls
- ❖ Modify Behavior
  - Legal/Regulatory Controls
  - Administrative Controls
  - Education

ENVIR 202: Lesson 7 26

---

---

---

---

---

---

---

---

### Engineering Controls Tactics

- ❖ Substitution
- ❖ Treatment
- ❖ Isolation
- ❖ Shielding

ENVIR 202: Lesson 7 27

---

---

---

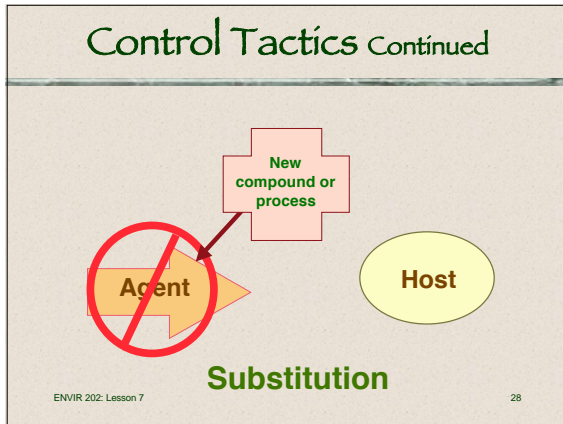
---

---

---

---

---



---

---

---

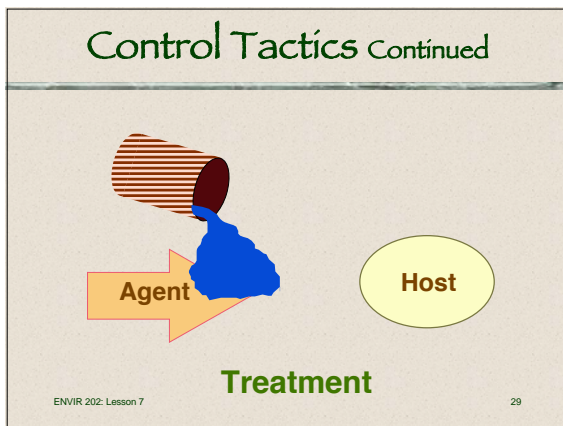
---

---

---

---

---



---

---

---

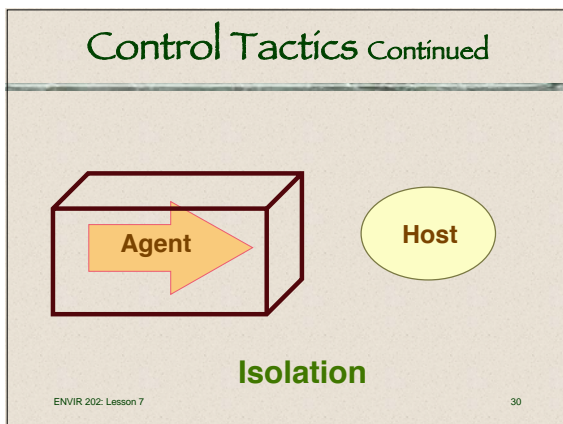
---

---

---

---

---



---

---

---

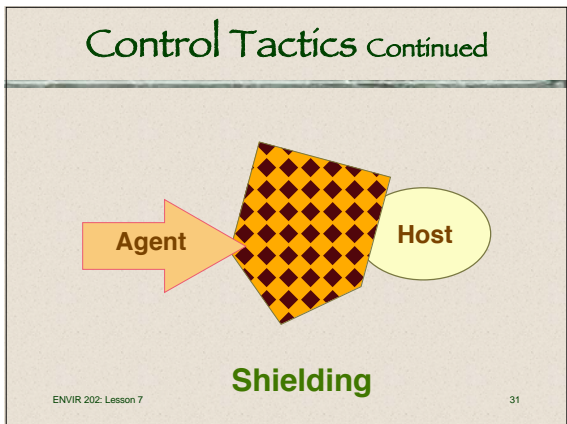
---

---

---

---

---



---

---

---

---

---

---

---

---

- ### Regulatory Controls
- ❖ Statutes
  - ❖ Rules and Regulations
  - ❖ Enforcement Programs
  - ❖ Private Sector Control
- ENVIR 202: Lesson 7 32

---

---

---

---

---

---

---

---

- ### Administrative Controls
- ❖ Planning
  - ❖ Supervision
  - ❖ Biological Monitoring
  - ❖ Work Scheduling
- ENVIR 202: Lesson 7 33

---

---

---

---

---

---

---

---

### Education

- ❖ Education
- ❖ Training
- ❖ Safety campaigns
- ❖ Administrative priority

ENVIR 202: Lesson 7 34

---

---

---

---

---

---

---

---

### Control Strategies *Continued*

- ❖ In order of effectiveness
  - 🔧 Engineering Control Tactics
  - 🔧 Legal / Regulatory Controls
  - 🔧 Administrative Controls
  - 🔧 Education

ENVIR 202: Lesson 7 35

---

---

---

---

---

---

---

---

### Summary

❖ **Epidemiology** is the study of the **distribution and determinants** of health effects in human populations

<p>➤ <b>Distribution</b></p> <ul style="list-style-type: none"><li>● Person</li><li>● Place</li><li>● Time</li></ul>	<p>➤ <b>Determinants</b></p> <ul style="list-style-type: none"><li>● Agent</li><li>● Host</li><li>● Environment</li></ul>
--	---

ENVIR 202: Lesson 7 36

---

---

---

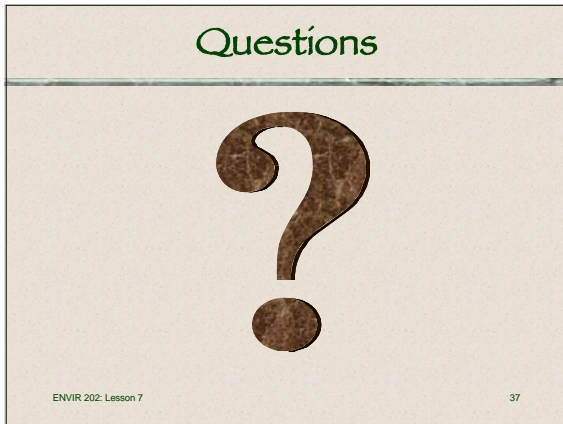
---

---

---

---

---



---

---

---

---

---

---

---

---