What is Epidemiology?

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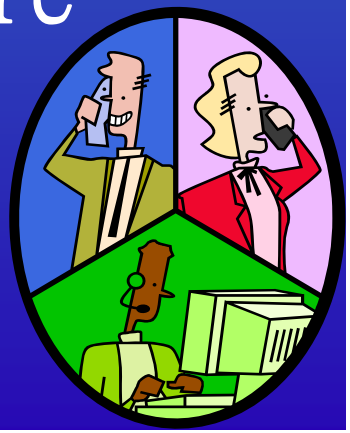
Learning Objectives

- Define epidemiology
- Describe the main use of epidemiology
- Place epidemiology in public health context

We will discuss…

- What is epidemiology?
- What can epidemiology do for me?
- How does epidemiology function?
- Why is epidemiology the core science of public health?



What is epidemiology?

The Pontiac Story

The Pontiac Story

The Pontiac Division of General Motors received a complaint …

The Pontiac Story

- "This is the second time I have written you, and I don't blame you for not answering me, because I kind of sounded crazy, but it is a fact that we have a tradition in our family of ice cream for dessert after dinner each night.
- But the kind of ice cream varies so, every night, after we've eaten, the whole family votes on which kind of ice cream we should have and I drive down to the store to get it.

The Pontiac Story

- " It is also a fact that I recently purchased a new Pontiac and since then, my trips to the store have created a problem.
- You see, every time I buy vanilla ice cream, when I start back from the store my car will not start. If I get any other kind of ice cream, the car starts just fine.

The Pontiac Story

- "I want you to know I'm serious about this question, no matter how silly it sounds:
- 'What is there about a Pontiac that makes it not start when I get vanilla ice cream, and easy to start whenever I get any other kind?'"

The Pontiac Story

- "The Pontiac President was understandably skeptical about the letter, but sent an engineer to check it out anyway.
- The latter was surprised to be greeted by a successful, obviously well educated man in a fine neighborhood.

The Pontiac Story

- "He had arranged to meet the man just after dinner time, so the two hopped into the car and drove to the ice cream store.
- It was vanilla ice cream that night and, sure enough, after they came back to the car, it would not start.

The Pontiac Story

- "The engineer returned for three more nights.
- The first night, the man got chocolate. The car started.
- The second night, he got strawberry. The car started.
- The third night he ordered vanilla. The car failed to start.

The Pontiac Story

- "Was this man's car allergic to vanilla ice cream?
- The engineer, being a logical man, refused to believe that this man's car was allergic to vanilla ice cream.
- He arranged, therefore, to continue his visits for as long as it took to solve the problem.

The Pontiac Story

- "And toward this end he began to take notes: he jotted down all sorts of data, time of day, type of gas used, time to drive back and forth, etc.
- In a short time, he had a clue: the man took less time to buy vanilla than any other flavor.
- Why?

The Pontiac Story

- "The answer was in the layout of the store.
- Vanilla, being the most popular flavor, was in a separate case at the front of the store for quick pickup.
- All the other flavors were kept in the back of the store at a different counter where it took considerably longer to find the flavor and get checked out.

The Pontiac Story

- "Now the question for the engineer was why the car would not start when it took less time.
- Once time became the problem -- not the vanilla ice cream -- the engineer quickly came up with the answer:
- vapor lock.

The Pontiac Story

- " It was happening every night, but the extra time taken to get the other flavors allowed the engine to cool down sufficiently to start.
- When the man got vanilla, the engine was still too hot for the vapor lock to dissipate.

The Pontiac Story

- Is seeing always believing?

Coming to human diseases...

- A lot of time what we experienced are similar to what happened in Pontiac story.
- Human disease has causal and preventive factors that can be identified through systematic investigation.
- Epidemiology offers means and ways for us to conduct systematic investigation.
- How?

What Is Epidemiology?

- The term “epidemiology” is derived from the Greek word meaning epidemic.

epi:	upon
demo:	people
logos:	thought

What Is Epidemiology?

- The study of the **distribution** and **determinants** of disease (health-event) **frequency** in human population.

John Last

What Is Epidemiology?

- **Two fundamental assumptions**
  - **Diseases do not occur by change**
  - **Disease are not randomly distributed**
  - **Disease distribution indicating something:identify "something" causes and factors through systematic investigation is the epidemiologists' job**

What Is Epidemiology?

- **Three key components**
  - **Frequency**: a prerequisite for any systematic investigation of pattern of disease.
  - **Distribution**: Who, where, and when to describe the pattern.
  - **Determinants**: Use the first two to test epidemiological hypothesis.

Is Epidemiology the Application of Statistics?

- Epidemiology is a scientific discipline with roots in biology, logic, and philosophy of science.
- Statistics is an important tool but not foundation for epidemiology.

What Is Epidemiology?

- A primarily a method of reasoning.
- Use a set of ideas (epidemiological thinking) to make sense of events occurred in population.
- The simplest and most direct method to study the causes of health events.
- The diagnostic discipline of public health.

What can epidemiology do for me?

Use of Epidemiology

- **Establish causation of a disease**
  Genetic factors+environmental factors=disease
- **Study the natural history of a disease**
  Health – sub-clinical changes - clinical disease - death or recovery
- **Assess the health status of a population**
  Health planning and prioritization
- **Evaluate the impact of intervention**
  Effective and efficiency of health services

How does epidemiology function?

Types of Epidemiology

- **By Method**
  - Descriptive epidemiology
  - Analytic epidemiology
- **By Subject**
  - Infectious disease epidemiology
  - Environmental and occupational epidemiology
  - Clinical epidemiology
  - Genetic and molecular epidemiology
  - Social epidemiology
  - Applied epidemiology
  - Field epidemiology
  - Managerial epidemiology

Descriptive Epidemiology

- **Person**

Who is getting disease?

- **Time**

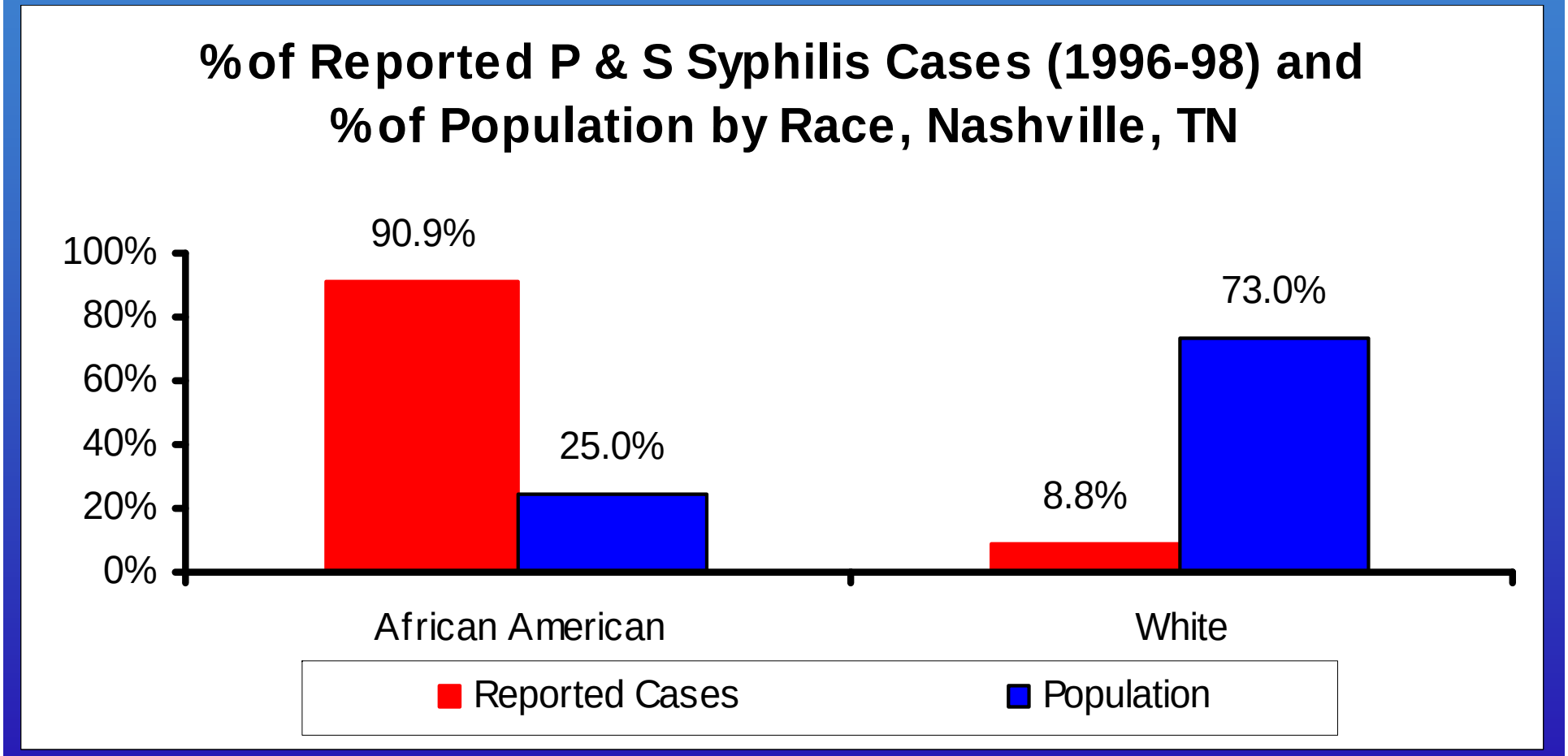
When does disease occur?

Commonly or rarely?

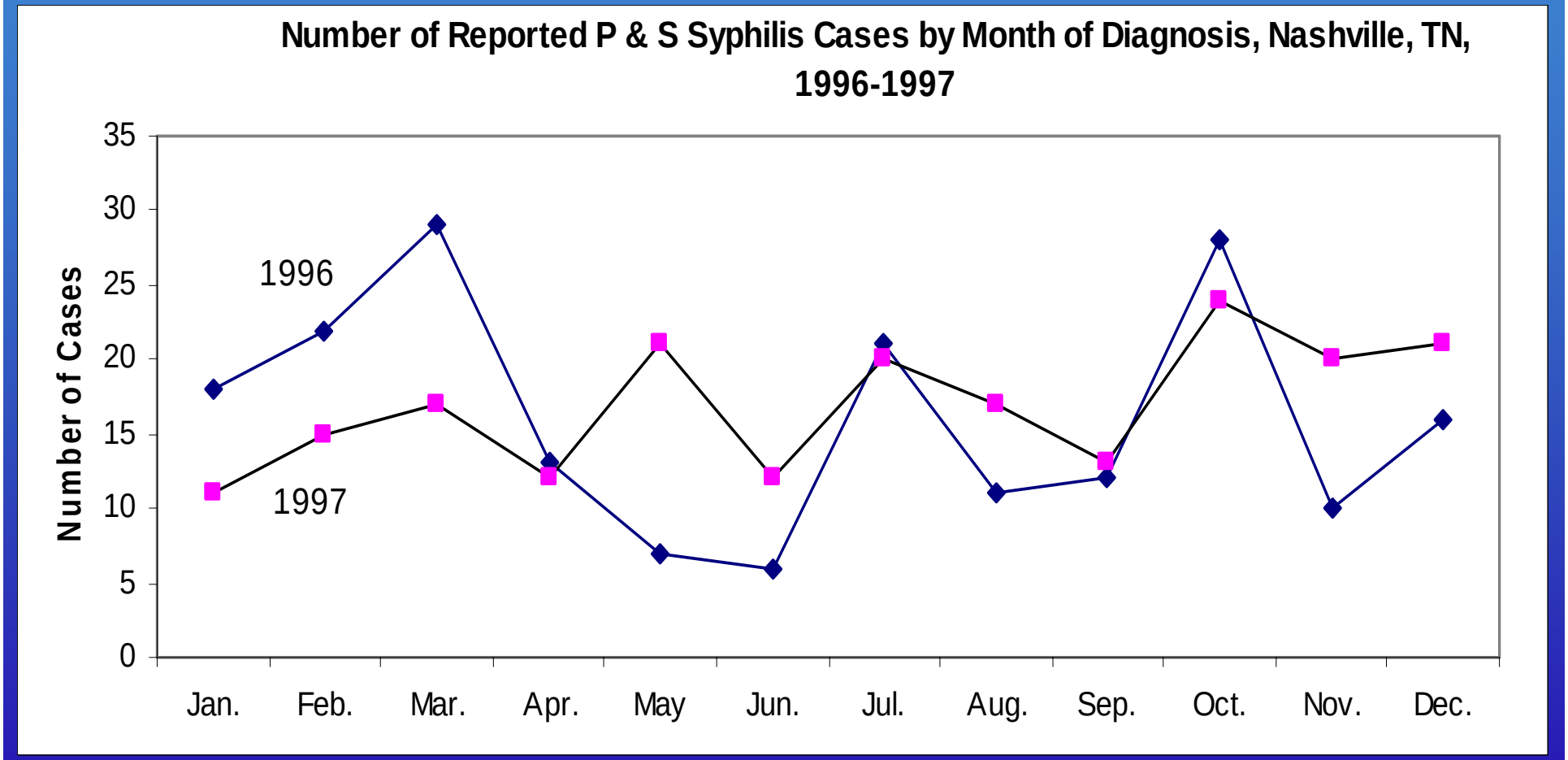
- **Place**

Where are the rate of disease highest and lowest?

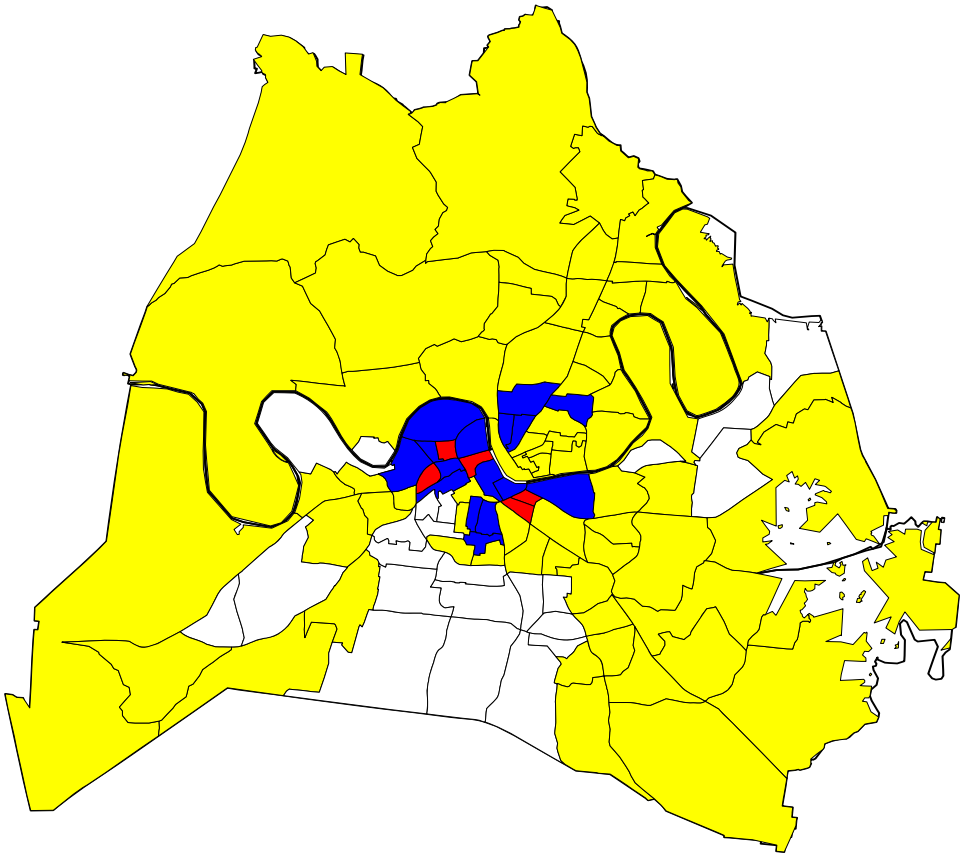
An Example of Person



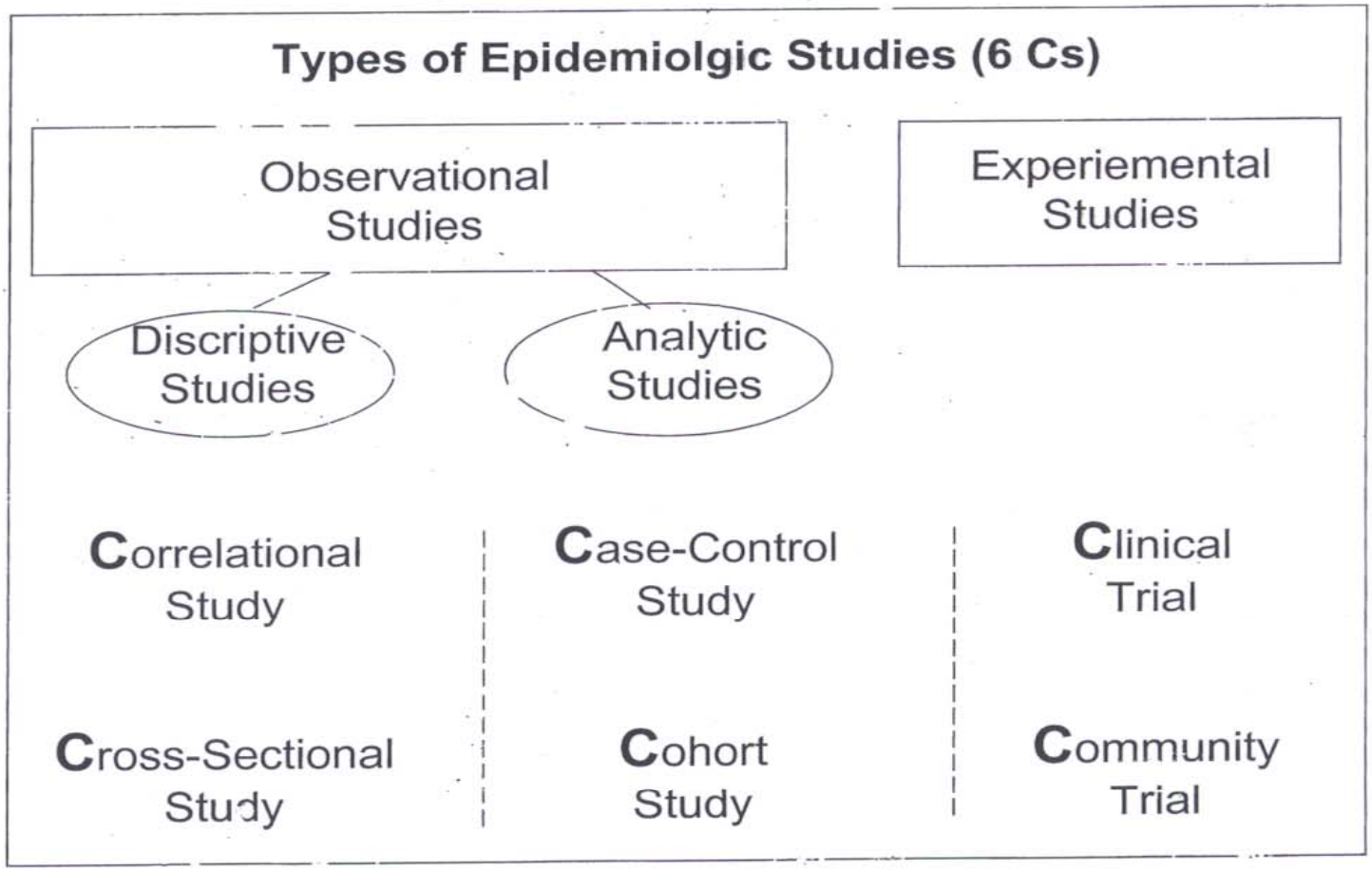
An Example of Time



An Example of Place



Type of Epidemiological Studies (6 Cs)



流行病学研究方法分类

- 临床试验Clinical trial
- 社区试验Community trial
- 队列研究Cohort study
- 病例对照研究Case-control study
- 横截面研究Cross-sectional study
- 相关性研究Correlational study

Relative Ability of Different Types of Study to "Prove" Causation

- Clinical trial
- Community trial
- Cohort study
- Case-control study
- Cross-sectional study (Survey)
- Correlational study

不同流行病学研究方法证明因果关系的能力

强

弱

- 临床试验Clinical trial
- 社区试验Community trial
- 队列研究Cohort study
- 病例对照研究Case-control study
- 横截面研究Cross-sectional study
- 相关性研究Correlational study

Why is epidemiology the core science of public health?

Why is Epidemiology the Core Science of Public Health?

Institute of Medicine defines public health as”organized community efforts aimed at the prevention of disease and promotion of health. **It links many disciplines and rest upon the scientific core of epidemiology.”**

Future of Public Health, 1988

Why is Epidemiology the Core Science of Public Health?

Public health, from information age perspective, is about information transfer.

Public health uses health related information to educate/empower community, and to organize community efforts aimed at the prevention of disease and promotion of health.

Why is Epidemiology the Core Science of Public Health?

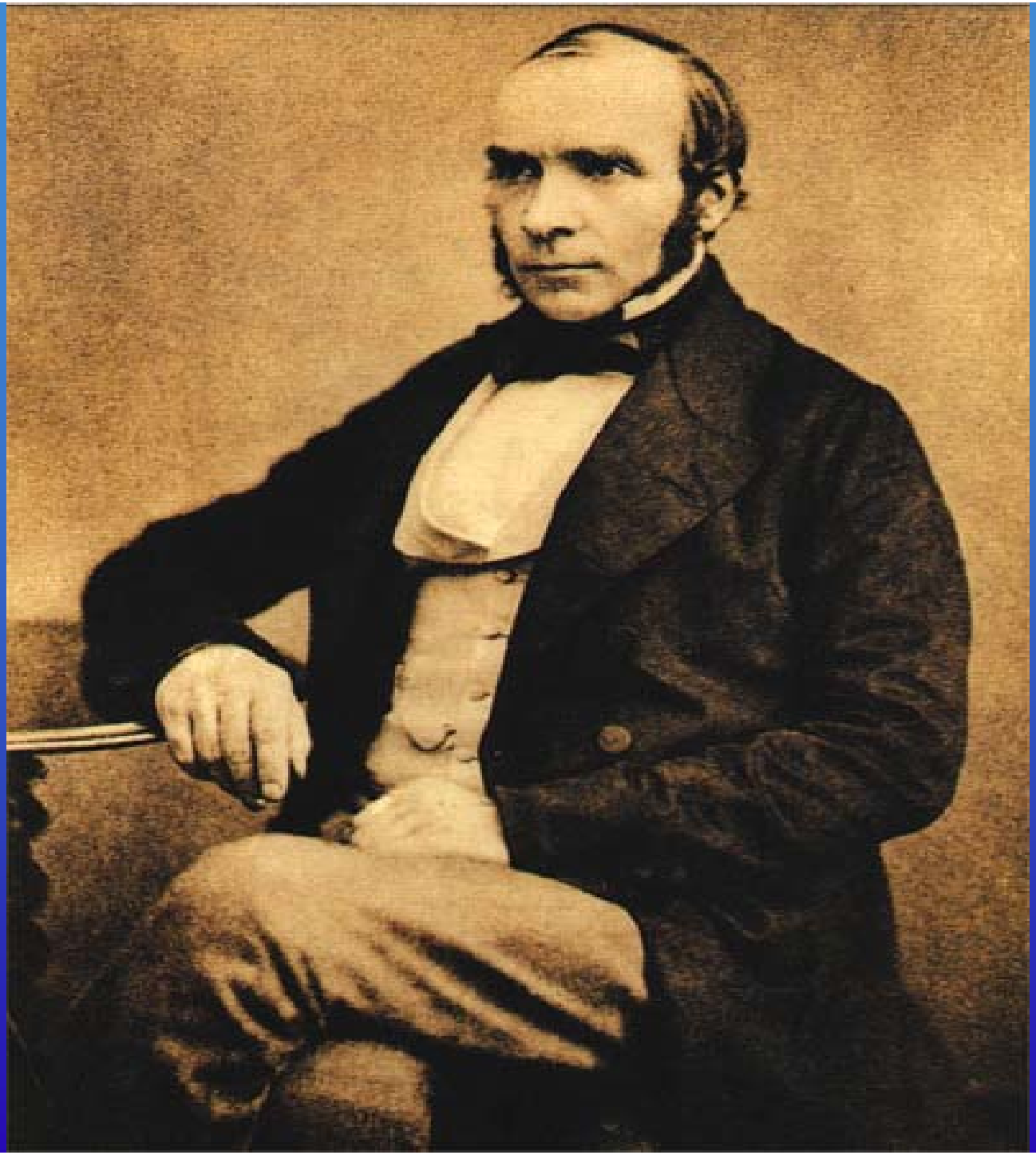
Throughout its history, epidemiology has provided an information basis for understanding the underlying causes of many diseases and health conditions.

John Snow and cholera outbreak control
Framingham Heart Study
Smallpox elimination
AIDS
Smoking and lung cancer

Why is Epidemiology the Core Science of Public Health?

John Snow and cholera outbreak control

- John Snow is a medical doctor in London, England in 19th century.
- In 1854, there was a big cholera outbreak in London.
- Within a week, in Golden Square nearby the Broad Street, many people died of cholera.



It was photographed by an anonymous person some time during 1857 when Dr. Snow was 44 years old, one year before his death. Sources:

John Snow, Photograph, 1857. Wellcome Historical Medical Museum and Library, London in Gordis L. *Epidemiology*, WB Saunders, Philadelphia, 1996.


WORK HOUSE
BENTINCK STREET
MARSHALL ST
MARSHALL STREET
WEST STREET
CARNABY STREET
DUFOURS PLACE
BROAD STREET
PUMP
SOUTH ROW
CROSS ST
CROSS STREET
CAMBRIDGE ST
NEW STREET
BREWERY
STREET
SILVER STREET
LITTLE WINDMILL STREET
GREAT PULTENEY STREET
BRIDLE STREET
UP JAMES ST
UP JOHN ST
BEAK ST.
OLDEN

Why is Epidemiology the Core Science of Public Health?

John Snow and cholera outbreak control

- The outbreak really scare people, many people begin to move out the area.
- John Snow tried to find out what was the problem.
- What he did?

Why is Epidemiology the Core Science of Public Health?

John Snow and cholera outbreak control

- He was trying to find a pattern.
- First, he reviewed the morbidity and mortality data.
- He did find a pattern, sudden increase of cases and deaths.

Why is Epidemiology the Core Science of Public Health?

John Snow and cholera outbreak control

- Then, he visited epidemic area, talked to people.
- Several very interesting things come to his attention.
- People working in a brew never get sick.
- Someone far from Golden Square drink the well water died.

Why is Epidemiology the Core Science of Public Health?

John Snow and cholera outbreak control

- He suspect the water from well at the Broad Street was the source of outbreak.
- He recommended removing handle of pump, the outbreak stopped.
- What John Snow did was to use common sense to look at numbers, logic thinking based on numbers. Sounds simple, he did save a lot of life since cholera at that time was a no-cure disease.

Source: The Broad Street Pump, *Safe & Sound*, Penguin, 1971 **in** English MP. *Victorian Values -- The Life and Times of Dr. Edwin Lankester*, 1990.


JOHN SNOW
JOHN SNOW
Width Limit
100 yards
ahead
San Marco Ba


JOHN SNOW


PRET A MANGER
JOHN
PRET

Why is Epidemiology the Core Science of Public Health?

Framingham Heart Study

- In 1940s, researchers under the direction of National Heart Institute (now the National Heart, Lung, and Blood Institute) planed the study.
- The study conducts a medical history, physical exam, lifestyle interview, and lab test every two years since 1948. It is still going on now.
- Over 50 years, 1,000 articles has been published, identify CVD risk factors now we all know.

Why is Epidemiology the Core Science of Public Health?

Smallpox Elimination

- Provided theoretical basis for WHO to launch smallpox elimination campaign (natural history of smallpox).
- Provided planning information re: distribution of cases and model, mechanism and level of transmission, and mapping of outbreaks.
- Evaluated control measures.
- 1967: 10-15 million new cases/2 million deaths, 1978: no naturally occurring cases.
- Saving: million life and 1,500 million USD a year

Why is Epidemiology the Core Science of Public Health?

AIDS

- **Between Oct. 1980 and May 1981, 5 cases of pnuemocystis carinii pneumonia were reported among young, previously healthy, homosexual men in Los Angeles.**
- **This was very unusual because this type of pneumonia only in older cancer patients whose immune system were suppressed.**

Why is Epidemiology the Core Science of Public Health?

AIDS

- **Similarly in early 1981, a number of Kaposi sarcoma were disgonosed in young homesexual men.**
- **Again, this was unusual because this tumor previously was only seen exclusively in old men and women.**

Why is Epidemiology the Core Science of Public Health?

AIDS

- **Epidemiologists at CDC initiated a surveillance system to quantify the magnitude of the problem and pattern of the disease.**
- **Frequency and distribution of AIDS and risk factors of AIDS are identified by epidemiological surveillance and investigation.**

Why is Epidemiology the Core Science of Public Health?

Smoking and lung cancer

- Doll and Hill started the study of smoking and lung cancer in 1950
- Which has led a 1964 US surgeon general report on smoking and health
- Marked the beginning of a series of public health effort to control smoking.

Jesse's List of Recommended Epi Books

1. Hennekens CH and Buring JE. Epidemiology in medicine. Little, Brown and Company, Boston, 1987.
2. Rothman KJ, Epidemiology: An introduction, Oxford University Press, New York, 2002.
3. Gordis L. Epidemiology. W.B. Saunders Company, Philadelphia, 1996.
4. Mausner JS and Bahn AK. Epidemiology: a introductory text. W.B. Saunders Company, Philadelphia, 1974.
5. Gregg MB Field Epidemiology. Oxford University Press, New York, 1996.
6. Lilienfeld DE and Stolley PD. Foundations of epidemiology (3rd ed). Oxford University Press, New York, 1994.
7. Beaglehole R, Bonita R, and Kjellstrom T. Basic Epidemiology, WHO, Geneva, 1993.
8. Brownson RC and Petitti DB. Applied epidemiology, Oxford University Press, New York, 1998.
9. Friis RH and Sellers TA. Epidemiology for public health practice (2nd ed). Aspen Publishers, Inc, Gaithersburg, MD, 1999.

Thank You