EPIDEMIOLOGY

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DEFINITIONS…

Public health

The science & art of

Preventing disease,
prolonging life,
promoting health & efficiency
through organized community effort

(Winslow, 1920)

DEFINITIONS

Epidemiology

The science of the mass phenomena of infectious diseases or the natural history of infectious diseases. (Frost 1927)

The science of infective diseases, their prime causes, propagation and prevention. (Stallbrass 1931.)

DEFINITIONS…

Epidemiology

"The study of the distribution and determinants of health related states or events in specified population and the application of the study to control of health problems"

(J.M. Last 1988)

COMPONENTS OF THE DEFINITION

Study: Systematic collection, analysis and interpretation of data

Epidemiology involves collection, analysis and interpretation of health related data

Epidemiology is a science

COMPONENTS OF EPIDEMIOLOGY

Disease frequency:

The core characteristics of epidemiology are to measure the frequency of diseases, disability or death in a specified population. it is always as the rate, ratio and proportion.

This falls in the domain of biostatistics, which is a basic tool of epidemiology.

COMPONENTS…

Distribution: Distribution of an event by person, place and time

Epidemiology studies distribution of diseases

It answers the question who, where and when?

Epidemiology describes health events

COMPONENTS…

Determinants:

Factors the presence/absence of which affect the occurrence and level of an event

Epidemiology studies what determines or influences health events:

- ✓ **It answers the question: how and why?**
- ✓ **Epidemiology analyzes health events**

COMPONENTS…

Diseases & other health related events

Epidemiology is not only the study of diseases.

The focus of Epidemiology is not only patients' health as individuals, but anything that may affect their health and well-being.

- ✓ **It studies all health related conditions**
- ✓ **Epidemiology is a broad science**

COMPONENTS…

Human population

Epidemiology diagnoses and treats communities/populations

- ✓ **Clinical medicine diagnoses and treats patients**
- ✓ **Epidemiology is a basic science of public health**

COMPONENTS…

Application

Epidemiological studies have direct and practical applications for prevention of diseases & promotion of health

- ✓ **Epidemiology is a science and practice**
- ✓ **Epidemiology is an applied science**

BASIC TENETS OF EPIDEMIOLOGY

- ✓ The target of a study in epidemiology is human Population as Geographical area, Age, Sex, Ethnicity, Race etc.: the most common population in epidemiology is the population in a given area or country at a given time. Since the structure of population varies at each time such variations also have to be taken in to consideration during data analysis. All findings must relate to the defined population.
- ✓ Enumeration is not enough in epidemiology, the population at risk of developing that disease need to be enumerated as well.

BASIC TENETS OF EPIDEMIOLOGY

- ✓ Diseases do not occur randomly.
- ✓ Conclusions are based on **comparisons**: comparing the rates of diseases frequency among the exposed and unexposed is an important epidemiological method.
- ✓ Description of events by **time**, **place** and **person**. Getting answer for **when**, **where** and **who** are affected is very important in epidemiology to formulate hypothesis about its causation. Other important aspects are **what**, **why** and **how** of the events.

THE ULTIMATE AIMS OF EPIDEMIOLOGY CAN BE CONCLUDED IN TO TWO FOLLOWINGS POINTS

- ✓ To eliminate or reduce the health problem or its consequences
- ✓ To promote the health and wellbeing of society as a whole.

STUDY DESIGN IN EPIDEMIOLOGY

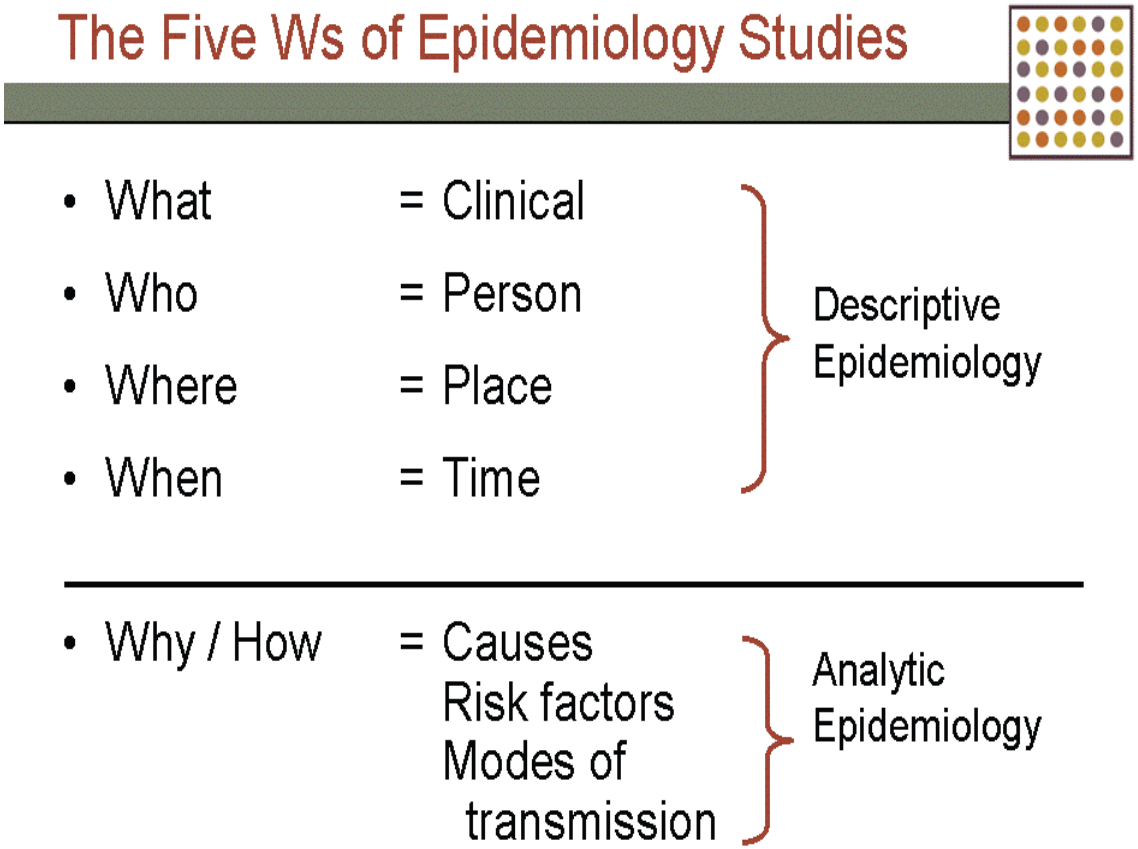
Observational Study

- Descriptive studies
- Analytical Studies
  - ✓ Ecological Study: Correlation Study, unit is a population.
  - ✓ Cross-Sectional Study: prevalence Study, Individual is the unit of study.
  - ✓ Case-Control Study: case-reference, with individual is the unit of study.
  - ✓ Cohort study: Follow up study, with individual is the unit of study.

Experimental Studies

- Randomized Control Trials
- Field Trials
- Community Trials

THE FIVE WS OF EPIDEMIOLOGIC STUDIES



HISTORY OF EPIDEMIOLOGY

Seven land marks in the history of Epidemiology:

1) Hippocrates (460BC): Environment & human behaviors affects health
2) John Graunt (1662): Quantified births, deaths and diseases.
3) Lind (1747): Scurvy could be treated with fresh fruit

HISTORY…

4) William Farr (1839): Established application of vital statistics for the evaluation of health problems
5) John Snow (1854): tested a hypothesis on the origin of epidemic of cholera
6) Alexander Louis (1872): Systematized application of numerical thinking (quantitative reasoning)

HISTORY…

7) Bradford Hill (1937): Suggested criteria for establishing causation

- ✓ Epidemiological thought emerged in 460 BC
- ✓ Epidemiology flourished as a discipline in 1940s

HISTORY OF EPIDEMIOLOGY

John Snow was conducting a series of investigations in London that later earned him the title father of field epidemiology. Snow conducted his classical study in 1854 when an epidemic of cholera developed in the golden square of London. During the time of microscope development, snow conducted studies of cholera outbreak both to discover the causes of diseases and prevent its recurrences.

During that time two men (Farr and snow) had major disagreement about the cause of cholera. Farr adhered to what was the called miasmatic theory of diseases, according to this theory which was commonly held at a time diseases was transmitted by a miasma or cloud that clung low on the earth surface.

HISTORY OF EPIDEMIOLOGY

- However Snow did not agree he believed that cholera is transmitted through contaminated water. He began his investigation by determining where in this area person with cholera lived and worked. He then used this information to map for distribution of diseases.
- Snow believed that water was the source of infection for cholera. He marked the location and searched the relationship between cases and water sources.
- He found that cholera was transmitted though contaminated water. This was a major achievement in epidemiology.

HISTORY OF EPIDEMIOLOGY

In the 1900s epidemiologists extend their methods to noninfectious diseases and studied the effect of behaviors and life style in human health.

- There were some cornerstone achievements in epidemiology :
  - John Snow and cholera epidemic in London in 1848-1854.
  - Framingham heart study started in 1950 in Massachusetts, USA and still continuing to identify the factors leading to the development of the coronary heart diseases.
  - Smoking and lung cancer by Doll and Hill in 1964.
  - Polio Salk vaccine field trial in 1954 to study the protective efficacy of vaccine in a million school children.
  - Methyl Mercury poisoning 1950s In Minamata .

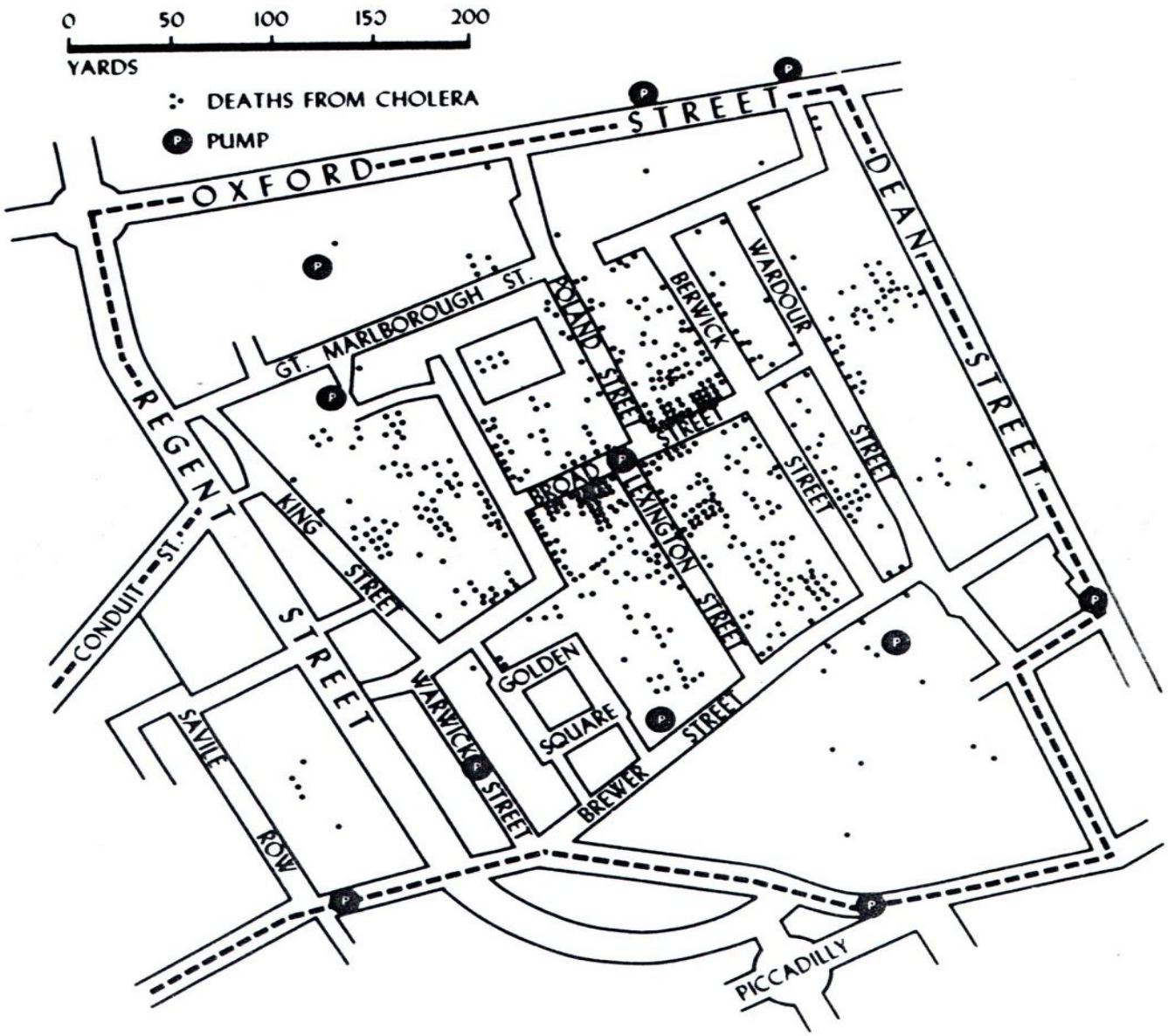


Figure 5-4 John Snow's Map of Cholera Deaths in the Soho District of London, 1848. *Source:* Adapted from *Health Care Delivery: Spatial Perspectives* by G. Shannon and G.E.A. Dever, p. 3, McGraw-Hill Book Company, 1974, and from *Some Aspects of Medical Geography* by L.D. Stamp, p. 16, Oxford University Press, 1964.

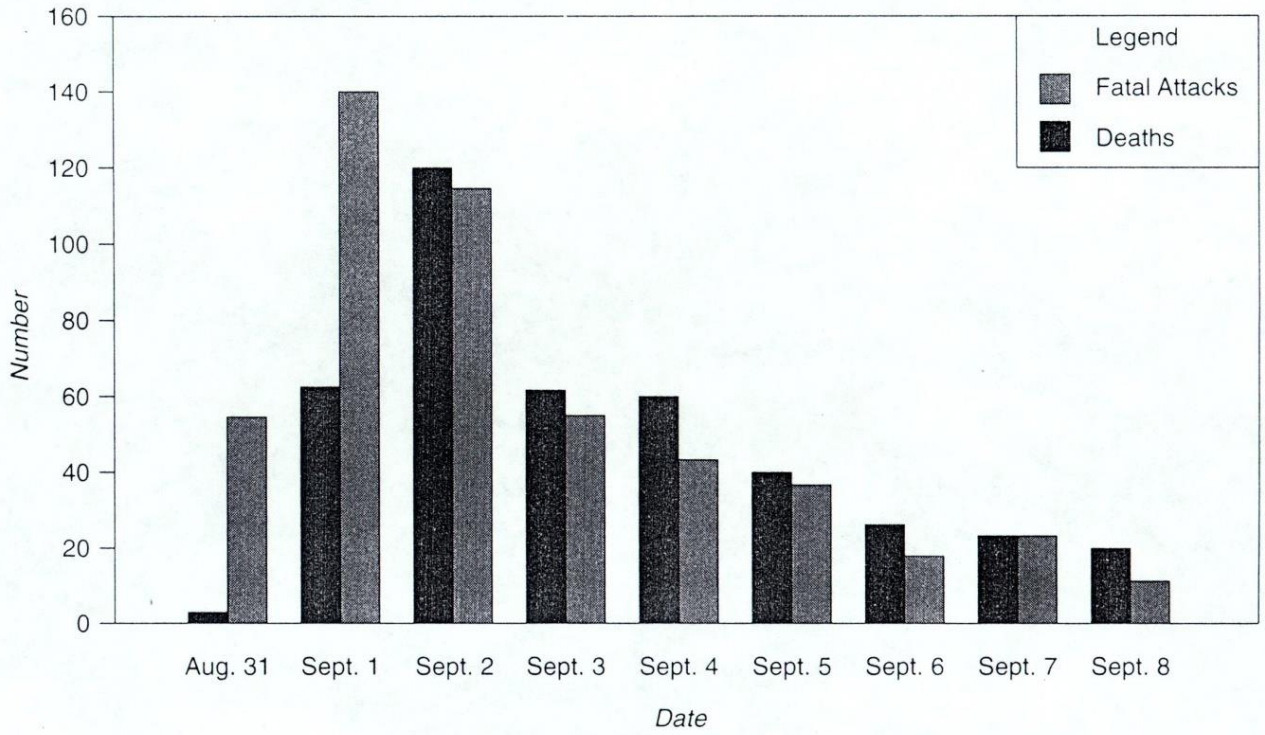
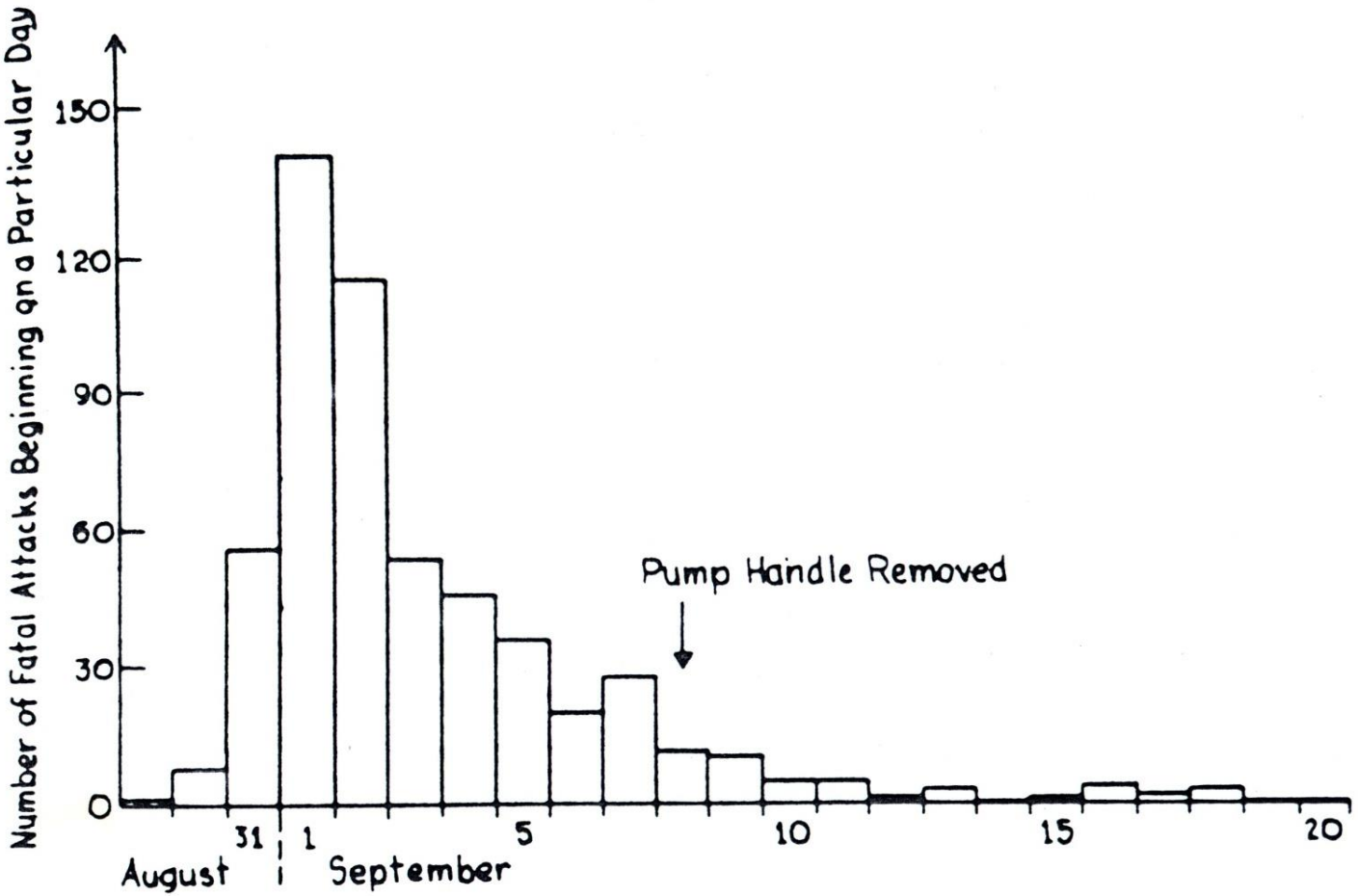


Figure 1–5 The 1849 cholera outbreak in Golden Square district, London. Fatal attacks and deaths, August 31–September 8. *Source:* Data from *Snow on Cholera*, by J Snow, p 49, Harvard University Press, © 1965.



Snow's Epidemic Curve

Dr. John Snow (1813-1858) was the first man to link Cholera with water-supply. His research, and subsequent action in disabling a Soho water pump, helped end the massive 'King Cholera' outbreak of 1854. The John Snow pub stands adjacent to the pump's location on Broadwick St. in Soho, London.


Dr John Snow and the Broad Street Pump
DEATH


★ POET A NANCER

Measurement of Disease Occurrence

Morbidity rates

Morbidity rates are rates that are used to quantify the magnitude/frequency of diseases

Two common morbidity rates:

Incidence rates(Cumulative incidence, incidence density)

Prevalence (Period prevalence, point prevalence)

INCIDENCE RATE

- ✓ The proportion of a population that develops a disease overtime
- ✓ The risk/probability of an individual developing a disease overtime
- ✓ The rapidity with which new cases of a disease develop overtime
- ✓ The proportion of unaffected individuals who on average will contract the disease overtime

CUMULATIVE INCIDENCE

$$\text{Cumulative Incidence} = \frac{\text{Number of new cases of a disease during a specified period}}{\text{Population at risk in the same Period of time}}$$

PRACTICAL CHALLENGES IN MEASURING INCIDENCE RATE

1. Identification of population at risk

   Population at risk constitutes all those free of the disease and susceptible to it

2. Population is not static/it fluctuates/as a result of births, deaths and migration

3. People are at risk only until they get the disease and then no more at risk

PREVALENCE RATE

It measures the proportion of a population with a disease during a specified period or at a point in time

Two types

1. Point prevalence rate
2. Period prevalence rate

POINT PREVALENCE RATE

Measures the proportion of a population with a disease at a point in time

Point prevalence rate=All persons with a disease at a point in time/Total population

It is not a rate, but a true proportion

PERIOD PREVALENCE RATE

Measures the proportion of a population with a disease in a specified time period

Period prevalence rate=All persons with a disease overtime period/Average(mid-year)population in the same period

INCIDENCE VS PREVALENCE

Prevalence measures all of the current cases of the disease in the community.

- ✓ It depends on the duration of the disease process
- ✓ It depends on the incidence of the disease
- ❖ It can be used to determine the health care needs of a community.

$$P = I \times D$$

where **P** = Prevalence rate, **I** = Incidence rate, **D** = Duration of the disease.

- ✓ **Prevalence rate is equal to Incidence rate in case of diseases with short duration or highly fatal such as Rabies.**

RELATIONSHIP BETWEEN PREVALENCE & INCIDENCE RATES

An increase in prevalence rate may not necessarily be due to an increase in incidence rate, it could be due to an increase in average duration of a disease due to decrease in death and/or recovery rates.

Calculation …

A survey of respiratory disease was conducted and the results are presented in the table below. Calculate the prevalence of chronic bronchitis in each age group and in the total group.

Prevalence of chronic bronchitis, by age, in a sample of 2383 employed men: , 1981.			
Age (years)	Number Surveyed	Frequency	Prevalence (%)
45-49	496	18	3.6
50-54	672	18	2.7
55-59	1215	18	1.5
Total	2383	54	2.3
$\chi^2 = 0.983$, p = 0.612			

Prevalence = 54 / 2383 = 0.0226 x 100% = 2.3%

= 0.0226x 1000= 22.6 cases/ 1000 pop.

A study was conducted to examine the incidence of Carpal Tunnel Syndrome (CTS) among computer operators in a certain corporation. An initial survey was given to 12 administrative assistants. Two of the 12 administrative assistants had symptoms and 10 did not reveal signs or symptoms equivalent to CTS. The administrative assistants who did not reveal signs or symptoms equivalent to CTS were then recruited into a study and followed for 4 years. The findings are listed below:

3 of the 10 administrative assistants developed CTS during the 4 year follow-up period

Subjects	Follow-up Time(yrs)	CTS
1	1	yes
1	2.5	yes
1	3	yes
2	2	fired
1	1	transferred
4	4	no

Calculate: Cumulative Incidence (per 1,000)

Cumulative Incidence= 3/ 10 = 0.3 = 30%

= 0.3 x 1000 = 300 cases per 1,000 population