Descriptive Epidemiology
"Person-Place-Time"

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Learning objectives:

By the end of this session, students will be able to:

- Define descriptive epidemiology.
- Mention uses of descriptive epidemiology.
- State the characteristics frequently examined in descriptive epidemiology
- Discuss Descriptive epidemiology includes Person, Place, and Time Characteristics

Descriptive epidemiology

- *Descriptive epidemiology* includes investigations that seek to observe and describe patterns of health-related conditions that occur naturally in a population.
- Is concerned with describing the disease or health related phenomena in human population. It answers the following questions:
- Who is getting the disease? (Person distribution).
- Where is the disease occurring? (Place distribution).
- When is it occurring? (Time distribution).

Descriptive Epidemiology

1. Counts
2. Rates
    a. incidence rate
    b. prevalence rate
    c. period prevalence rate
3. Computing Rates
    A. Mortality rate
    B. Morbidity rate
    C. Crude Mortality Rate
    D. Cause-Specific Mortality Rate
    E. Age-Specific Mortality Rate
    F. Case Fatality Rate

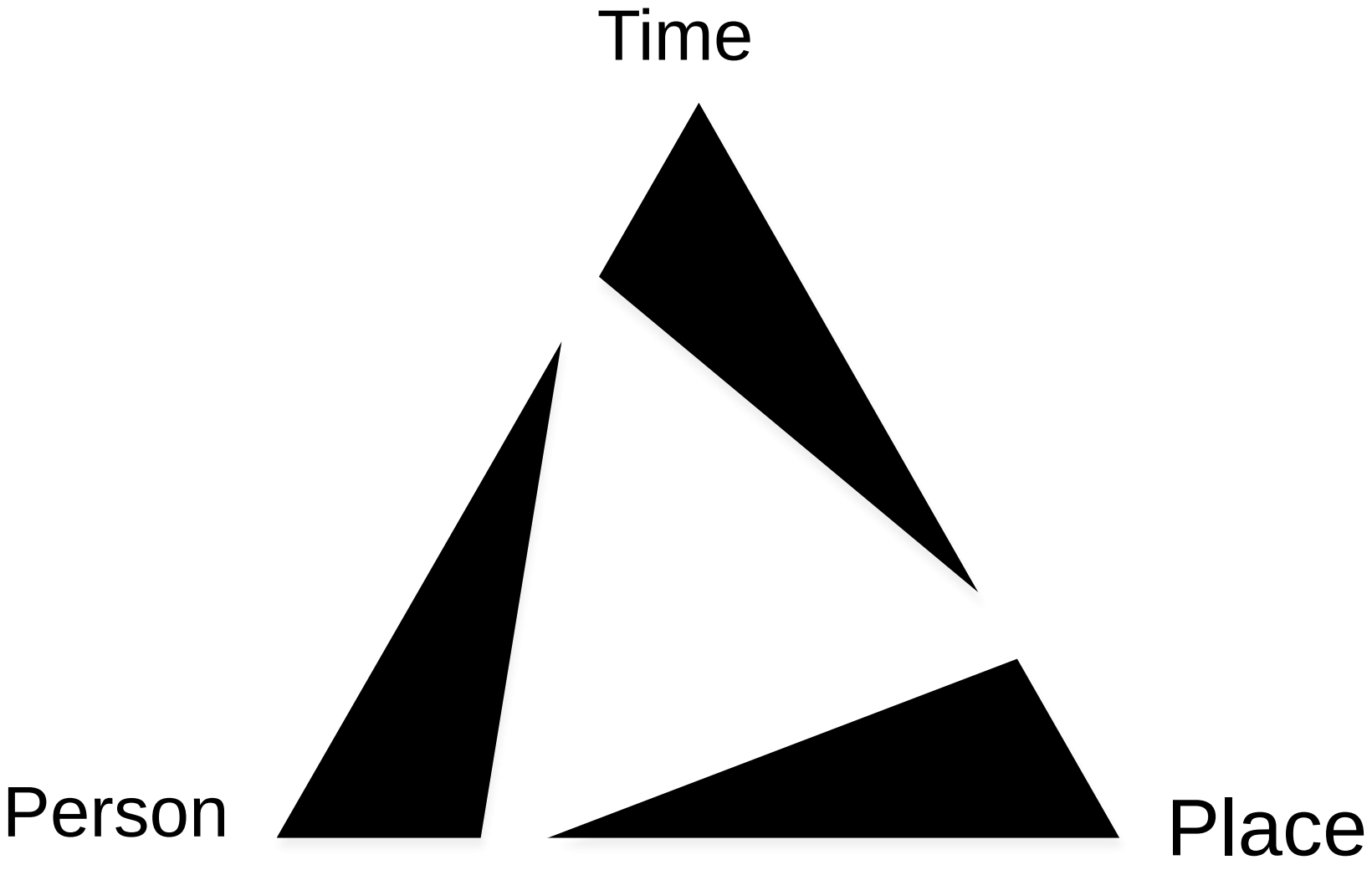
Uses of Descriptive Epidemiology:

- Descriptive epidemiology helps in the formulation (generation) of an etiological hypothesis.
- It provides data for planning, and evaluating preventive and curative services.

Objectives of Descriptive Epidemiology

- To evaluate trends in health and disease and allow comparisons among countries and subgroups within countries
- To provide a basis for planning, provision and evaluation of services
- To identify problems to be studied by analytic methods and to test hypotheses related to those problems

The Basic Triad Of Descriptive Epidemiology



Characteristics Frequently Examined in Descriptive Epidemiology

Person	Place	Time
-Age	- International variations	- Short term Fluctuations
-Gender	- National variations	- Periodic fluctuations
-Marital status	- Rural / Urban variations	- Long term or secular
-Occupation	- Local variations	Trend
-Social class		
-Behaviour		
-Religion		
-Ethnic group		
- Race		

PERSON CHARACTERISTICS

- WHO is getting the disease?
- Many variables are involved and studied, but factors such as sex, age & race often have a major effect.

1- Age

- Age is one of the most important biological variables.
- It's distribution is presented in a table or graphically by a histogram or frequency polygon.
- Age differences are measured by **age specific rates** mortality, morbidity and fertility.

Why do we study age associations?

To understand factors responsible for the occurrence of disease

Note:

As the association is very strong, it is necessary to correct or adjust for any differences in age composition

1- Age cont.

In morbidity surveys use simpler classifications

- **Less than one year**
- **1-4 years**
- **5-9 years**
- **5-14 years**
- **15- 49 years**
- **50- 59 years**
- **60 + years**

1- Age cont.

Morbidity

Is presented by

A- Age specific incidence rates

B- Age specific prevalence rates

Use

A-Tables

B-Graphs

(Histograms- Frequency polygon)

Age cont.

Why does disease pattern differ by age?

- **Stage of development**
- **Degree of exposure, susceptibility and immunity**
- **Hormonal changes**
- **Cumulative effects of exposure to risk factors**

Importance of studying age distribution

It indicates

A. **Severity:** **Salmonella and Pneumococcus infection is severe in the very young or old.**

B. **Clinical type:** **Iodine deficiency; Cretinism among young and Myxidema among adults.**

C. **Mechanism:** Progress of a disease; modality suggests two different mechanism such as Hodgkin's disease and breast cancer

2-Gender "Sex"

Diseases more encountered among Females

- Diabetes
- Hyperthyroidism
- Obesity
- Gall stones
- Psychoneurosis
- Breast cancer

2- Sex cont.

Diseases more encountered among Males

- Lung cancer
- Coronary heart disease
- Peptic ulcer
- Accidents
- Inguinal Hernia
- Bilharzia
- Suicide

2- Sex cont

How do you measure gender differences?

- Sex ratio
- Sex specific morbidity and mortality rates

2- Sex cont.

Causes of sex differences

a) **Anatomical differences**

b) **Sex linked genetic** inheritance

c) **Hormonal factors**

d) **Differences in habits, social relationships**

e) **Differences in the defense mechanism** of the body

f) **Environmental and social factors**

3-Marital status

1- Death rates (from all causes) are lower among married persons than single-divorces or widowed..

2-Suicides and mental illnesses are more likely to affect single individuals.

3-Breast cancer affects more females who remain single or marry late.

4-Cancer cervix is more common among those who marry young or have different partners

cont ..3–Marital status

Why Health status of married people is better than non- married?

- Person who lives dangerously tend to live single.
- Person in poor health tends to remain single.
- There are differences in the way of life of single and married people.

3-Marital status

Test your self

1-Explain why spouses usually develop the same diseases (tuberculosis, heart diseases and arthritis)

Answer

This is because they live under the same dietetic, social, psychological and environmental influences.

4- SOCIOECONOMIC STATUS

It is measured by using the following factors :

- Educational level
- Occupation
- Income
- Residency
- Housing
- Living standards

4- Socioeconomic status cont.

Problems among the lower social classes

- Tuberculosis- rheumatic heart disease- chronic bronchitis- stomach ulcer - nutritional deficiency diseases
- High Maternal mortality, infant and preschool mortality
- High fertility rates

4- Socioeconomic status cont.

Problems among the upper social classes

- Obesity
- Gout
- Atherosclerosis
- Coronary heart disease
- Paralytic poliomyelitis (before the era of vaccination)

5. Occupation

- Employed populations tend to have lower mortality than general population
- Workers tend to be healthier than those who do not work
- Workers who are sick or with delicate health tend to leave the work environment or retire
- Unemployed workers are not exposed to occupational hazards

5. Occupation

Why occupation is an important epidemiologic variable?

a- Is the most sensitive measure of social class

b- Measures the influence of working conditions and exposure to chemical, physical or biological agents

c- Identifies groups of people whose general patters of life differ by virtue of their occupation

d- Some occupations select certain types of workers

5. Occupation

Relation of occupation to disease frequency

1- Occupation is associated to exposure of special risks

Examples

- Heat causes exhaustion-cramps- stroke-cataract
- Abnormal pressure causes caisson disease
- Cotton causes Byssinosis

2- Occupation is associated with social classes

Example

-Unskilled workers are more prone to Tuberculosis and malnutrition

3- Occupation may entail selection of certain types of workers

Example

-Police and army select workers who are in perfect health

5. Occupation cont.

How do you interpret associations between occupation and disease?

1- Better diagnosis and reporting of diseases

2- Discharge of those not healthy

3- Selection of workers

4- Pattern of work

5- Exposure to work environment and risk factors

6- Education

It is one of the social parameters

Why persons with higher educational levels have better health status?

- Know more about health matters
- More prevention oriented
- Have higher income so can afford better nutrition, housing and medical care
- Utilize healthcare services.
- Communicate better with medical team

7- Religion

Religion is part of culture

Each religion has its code of behavior that can affect health

Behaviors that are against Islamic health codes

Smoking

Homosexuality

Eating pork

Personal Hygiene

etc

Drug and Alcohol abuse

Extramarital relations

Polluting water resources

Suicide

8- Ethnicity - Race

1. **Race** refers to the physical characteristics and can range from skin, eye, and hair color to facial structure.
2. **Ethnicity** refers to the cultural characteristics of someone. It includes their language, nationality, heritage, religion, dress, and customs.
3. Ethnicity can be displayed or hidden, depending on individual preferences, while racial identities are always on display, to a greater or lesser degree.

8- Ethnicity – Race cont.

How do you interpret variations between different ethnic groups?

A- Genetics

B- Susceptibility due to environmental factors

C- Culture-social behaviors- religion

D- Food habits

E- Socioeconomic and emotional stresses

Place Characteristics

Place Characteristics

Why it is important to study geographical distribution of a disease?

- The information is fundamental to planning of health services
- Variations may provide important clues to etiology of diseases
- Serves as stimulus to further fruitful investigations

Classification of variations in place distribution of diseases:

1. International variations
2. National variations
3. Rural urban variations
4. Local variations

A- International variations Cancer

Marked differences in the incidence of cancer by type:

- Breast cancer is more encountered in western countries
- Primary carcinoma of the liver is more observed in African countries
- Colon cancer is less frequent in Japan
- Stomach cancer is more observed in Japan

Infectious Diseases

-The endemic zone of Yellow fever includes the area between 15N and 10S of the equator

- Epidemics of Meningococcal meningitis occur more in Mid-African countries (meningitis belt)

- Bilharzias is more encountered in the Nile Valley and Japan

- Rift Valley Fever in Saudi Arabia

Nutritional diseases

-Endemic goiter prevails in areas with iodine deficiency

- Beriberi is more seen in far east

Why do we have international variations?

A- Genetic factors

B- Life style including diet

C-Environmental factors

D- Population structure

B- National variations

Variations in disease occurrence exist within all countries

Example

- In Egypt there are: Bilharzia and hepatitis C
- In KSA there are: Sickle cell anemia and malaria

C- Rural- Urban variations

Diseases more encountered in urban areas

- Chronic bronchitis
- Accidents (injuries)
- Lung cancer
- Cardiovascular diseases
- Mental illness
- Drug dependence .....etc

C- Rural- Urban variations

Health problems more encountered in rural areas

- High fertility
- High mortality
- Bilharzia
- Zoonotic diseases
- Soil transmitted diseases

D- Local variations

Diseases more encountered in slums

- Filth diseases
- Rheumatic heart
- Tuberculosis
- Scabies
- Nutritional deficiency diseases
- Drug abuse

How to present place variations in a pictorial manner?

Use Spot Maps that indicates the location of cases of disease or areas of varying frequencies

Plot cases in relation to

- Residence (population at large)
- Place of employment (workers)
- Class room (pupils)

- Maps are used to identify risk areas particularly in the start of
  - Epidemics
  - New disease
- The clustering of cases may indicate the source of infection

Test yourself

Give examples of the relation between chemical environment and disease occurrence

-Dental flourosis (mottled teeth) is seen in areas with high fluorine concentration in water

-Endemic goiter is encountered in areas where iodine deficient in soil and water

- Lung cancer is more seen in areas of high air pollution and related to certain industries

Social and psychological environment and health

This is important in mental health

Time Characteristics

Time pattern of disease is very important. It addresses two main questions:

Q.1 When does the disease occur?

Q.2 Is the frequency of the disease differs from the present to the past?

Types of time trend

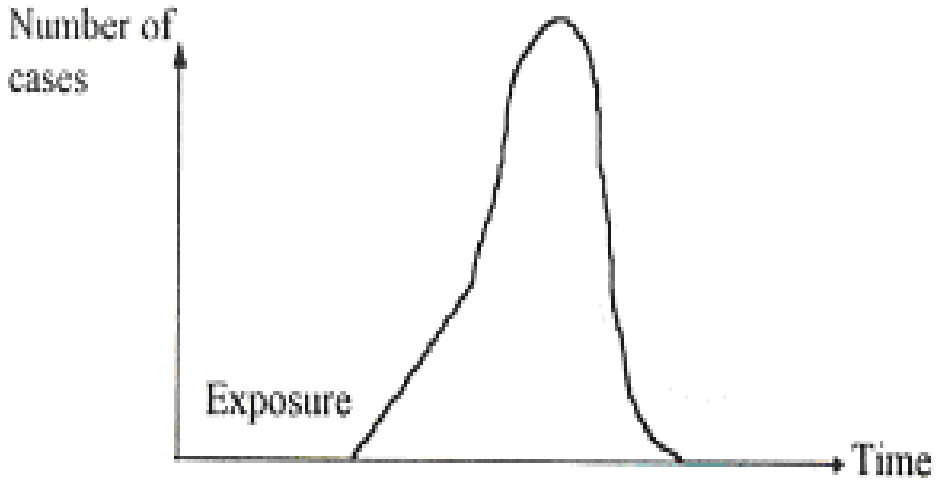
- Short term (epidemics):
  - Point source (water and milk born epidemic)
  - Propagative (communicable diseases e.g. measles)
- Periodic (rhythmic) example:
  - Asthma
  - Allergy
- Long term (Secular) example:
  - Infectious diseases (discovery of antibiotics and vaccination)
  - Malignancies (cumulative exposure)

1- Point-source Epidemic

- In this type of epidemic:
  - The exposure of susceptible to the disease agent is brief and essentially simultaneous.
  - The resultant cases are explosive in number.
  - All cases develop within a short period of time e.g. water borne epidemic of cholera or typhoid. A graph of the time distribution of epidemic cases is called "epidemic curve".

Main features of a point source epidemic

- The epidemic curve rises and falls rapidly with no secondary waves.
- The epidemic tend to be explosive, there is clustering of cases within a short period of time.
- All cases develop within one incubation period of disease (Fig).

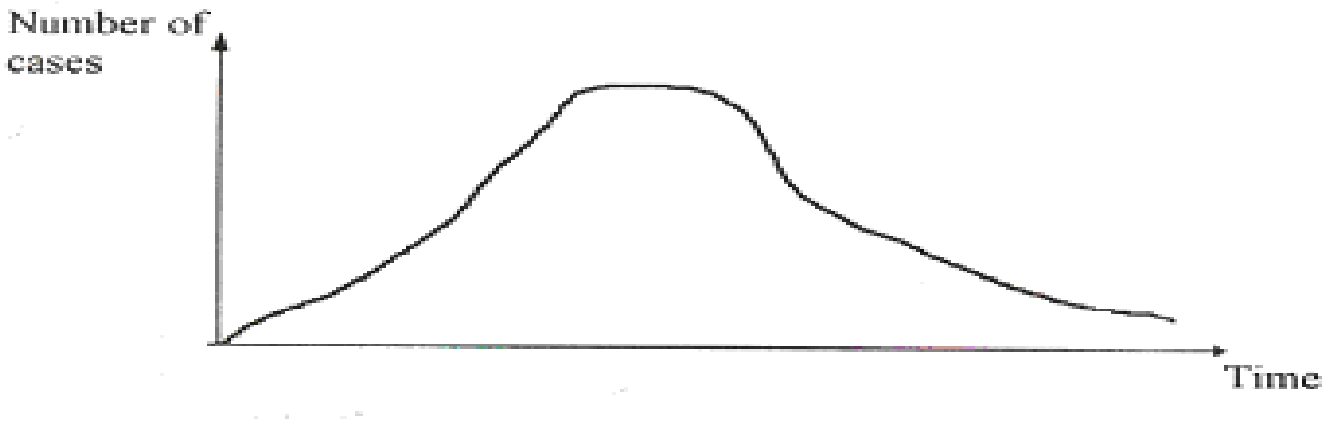


2- Propagated or contagious epidemic

- This is an epidemic in which an infectious agent is propagated in a community by passing from person to another e.g. epidemic of measles.
- Transmission continues until the number of susceptible is depleted or susceptible individuals are no longer exposed to infected persons.

features of contagious epidemic

- Epidemic curve rises and falls gradually.
- Cases occur over a much longer period.
- Cases occur within more than one incubation period of the disease (Fig.)



1- Daily Variations:

- The onset of hay fever tends to occur at certain time of the day, in relation to the diurnal rhythm of household activities such as sweeping of houses or going to the field.

2- Weekly Variations:

- Automobile accidents show the highest rates at weekends. This may be due to an increased exposure of the population to the moving vehicles, or may be due to reckless driving or alcohol or drug consumption during the weekends.

3- Seasonal Variations:

- **It is a well known characteristic of many communicable diseases.**

a- Upper respiratory infections frequently show a seasonal rise in winter.

b- Gastro intestinal infections are prominent in summer because of warm weather and rapid multiplication of flies.

- **The seasonal variations of disease occurrence may be related to environmental conditions**

e.g. temperature, life cycle of vectors, etc.

4- Yearly Variations:

- Yearly variations of diseases are also observed. **Measles in the pre-vaccination era appeared** in cycles with a major peak every 2-3 years. This was due to naturally occurring variations in herd immunity.
- A build up of susceptiblity is again required in the herd before there can be another attack.

Long term or Secular trend

- **The term "secular trend" implies changes in the occurrence of disease** (i.e. progressive increase or decrease) over a long period of time, generally several years or decades.
- For example: coronary heart disease, lung cancer and diabetes have consistent upward trend in the developed countries during the past 50 years. On the other hand, puerperal sepsis, diphtheria, polio and other infectious diseases have a long term downward trend.

Note: puerperal sepsis is an abnormal condition that results from infection of the placental site following delivery or abortion and characterized by fever

Descriptive Studies

- A descriptive study involves the systematic collection and presentation of data to give a clear picture of a particular situation without drawing conclusion about causality
- Can be carried out on a small or large scale.

Descriptive Research

- Case Study
  - Accrual of detailed information from an *individual*
- Survey
  - Cross-sectional: Status of a various groups at a given point in time
  - Longitudinal: Status of a given group at various points in time
  - Correlational: Relationships between variables

Cross-sectional Surveys

- Aims at quantifying the distribution of certain variables of interest in the study population at one point in time.
- They may cover
  - Physical and Socio-economic characteristics of people.
  - Knowledge, Attitudes, beliefs , Opinions.
  - Events that occurred in the population
  - Cover a selected sample of the population
  - Census--Covers the whole population.

Cross-Sectional Studies
Advantages

- Can study several outcomes at the one time.
- Researcher has control over selection of subjects.
- Control over measurements.
- Relatively short duration.
- Provide prevalence estimates.
- Step towards cohort study.

Cross-Sectional Studies
Disadvantages

- Cannot establish temporal sequence of events (cannot determine causality)
- Susceptible to bias.
- Not ideal for rare conditions.
- Does not yield incidence or true relative risk.

Correlational Studies

- **Examines the strength of relationship between variables. X is related to Y or the relationship between more than two variables.**
- **Correlation coefficient reported through statistics such as Pearson's product-moment correlation *r* and or the Spearman *rho*.**
- **Magnitude and direction of relationship are indicated by a correlation coefficient**

  It can be positive (+) or negative (-) and ranges between -1.00 - +1.00 (negative to positive correlation).

Surveys

A survey may be defined as a collection of information from all individuals or a sample of individuals chosen to be representative of the population from which they are drawn

Types of Information Collected by Survey

- **Morbidity: prevalence**
- **Morbidity: incidence (if time window clear: memory)**
- **Mortality**
- **Detailed risk factors or behavioral information**
- **Knowledge, attitudes, and practices**
- **Physical signs (paralysis, spleenomegaly, malnutrition)**
- **Serological or laboratory tests**

Characteristics of Survey

- Sample is representative if chosen correctly
- Single point in time –snapshot
- Provide more in depth information than surveillance or record reviews
- Usually performed by a limited number of personnel specially trained to perform surveys
- Can sometimes be expensive, time consuming to perform
- Cannot be used to monitor change unless repeated at a later time therefore may be better for situation analysis than for ongoing monitoring of a problem or a program

When to do a Survey

- When accurate population-based data are needed to determine the magnitude of the problem
- When more detailed or recent information is needed than is available from record reviews or surveillance (demography, examination, laboratory)
- When information is needed on health problems that may not be routinely seen by health providers
- When information is needed on health behaviors or health knowledge and attitudes not routinely available through existing mechanisms

Steps in Conducting Survey

Step 1: Determine the objectives of your study

- What question(s) are you trying to answer?
- Who will be using your findings?
- How will these findings be used?

Step 2: Determine the exposure and outcome variables and decide how you will define them

- Sources: literature, experts, focus groups, preliminary interviews
- Be able to justify the inclusion of each variable
- Avoid temptation to include variables that “might be interesting”
- Realize you may need more than one study
- Decide how variables to be classified

Step 3: Develop preliminary “skeleton” tables

- Begin with simple descriptive characteristics
- Develop shells for two way tables
- Develop shells for any stratified tables

Step 4: Determine

- Who will be the study subjects
- Methodology
- Sample size

Step 5: Design a questionnaire

- To fill in the blanks in the skeleton tables
- The analysis should drive the questionnaire rather than vice-versa!

Step 6: Establish a sampling plan for data collection and work out the logistics

- Establish the methodology for collecting the information,
  - Types of questionnaire
  - Plans for specimens

Step 7: Determine the personnel needs

- Types of people and necessary person-hours
- Develop appropriate descriptions of responsibilities for each level of personnel
  - Supervisors
  - Surveyors
  - Drivers/guides
  - Translators

Step 8: Field test the questionnaire in the population in which it is to be used and determine whether there are operational problems

- Revise the questionnaire / methods
- Develop other necessary forms
  - Record-keeping forms for interviewers to keep track of sites visited

Step 9: Develop instruction manuals for survey personnel

- To detailing how questionnaires are to be filled
- How the sample is to be selected
- How field supervision will be performed

Step 10: Select and train the personnel to be used to collect the data

- Keys to the training are:
  - Information
  - Examples
  - Practice

Step 11:Develop check list of materials needed for field work

- Forms
- Papers
- Pencils
- Clipboards
- Paperclips
- Sleeping (bags) material
- Tents
- Per diems
- Payment schedule
- Review of data forms

Step 12: Collect the data

- **Assuring:**
  - **Quality**
  - **Completeness (through supervisory visits and review of data forms)**

Step 13:Edit your data to determine errors in collection, coding, transcription, or data entry

- **If field entry, build in edit checks**
- **Look for abnormal values, unexpected population distribution**
- **Perform plausibility edits**
  - **Go back to the source whenever possible**
  - **Avoid second-guessing**
  - **Be consistent**
  - **Fix errors as soon as it occurs**
  - **Document the fix**

Step 14: Do the data analysis

- Calculate the response rates
- Fill out the skeleton tables
- Collapse categories
- Think about what your data means
- Measures of association and statistical tests keeping in mind:
  - Study design (matching, design effect)

Step 15: Interpret your data

- Meaning of the results
- Significance testing

Step 16:Writing up

- Immediately
- Disseminate to the appropriate people

THANK YOU