Epidemiologic and Research
Applications in Community Nursing
Lecture objectives:

After studying this chapter, you should be able to:

• Interpret and use basic epidemiologic, demographic, and statistical measures of community health.
• Apply principles of epidemiology and demography to the practice of community health.
• Discuss priority areas for research in community and public health nursing.
• Describe the stages of the research process, including methodological considerations.
“the study of the distribution and determinants of disease frequency”
MacMahon, B: Epidemiology: Principles and Methods, 1970.

“the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control of health problems”
Last, 1995.
Epidemiology

Definition:
Study of patterns of disease occurrence in human populations.

Observation of disease under natural conditions in population as a whole rather than of individuals.
Epidemiology has contributed:

1. Understanding the factors that contribute to health and disease;
2. The development of health promotion and disease prevention measures;
3. The detection and characterization of emerging infectious agents;
4. The evaluation of health services and policies;
5. The practice of community and public nursing.
Epidemiology

- The term epidemiology originates from the Greek terms *logos* (study), *demos* (people), and *epi* (upon) that literally means the study of what is upon the people. The focus of study is disease occurrence among population groups; therefore, epidemiology is referred to as *population medicine*. 
Epidemiology

PURPOSE:
To study the characteristics of those people within a community, (populations) who have a particular illness/condition/problem as compared to those without, to try to understand:

* probable cause
* find a cure
* prevent reoccurrence
* prevention
Epidemiology

“distribution of disease” – OUTCOME
MEASURES:
- 5 “w”: what, who, where, when, and why
- Descriptive epidemiology

“determinants of disease” – EXPOSURES
- Association, not causality
- ex: grey hair and myocardial infarction
Epidemiology (cont)

- The determinants are
  - Factors
  - Exposures
  - Characteristics
  - Behaviours
  - Context that determine the patterns
    - How does it occur? Why are some affected more than others?

- Analytic epidemiology
Definition of health

- “A state of complete well-being, physical, social, and mental, and not merely the absence of disease or infirmity”
  
  WHO, IOM, 1988, p.39

- Nursing’s definition: “The diagnosis and treatment of human responses to actual or potential health problems” coincides well with epidemiologic principles.
Demography (literally, writing about the people, from the Greek *demos* [people] and *graphos* [writing]) is the statistical study of human populations with reference to size and density, distribution, and vital statistics.

Demographic statistics provide information about significant characteristics of a population that influence community needs and the delivery of health care services.

Demographic studies (that is, demographic research) provide descriptions and comparisons of populations according to the characteristics of age; race; sex; socioeconomic status; geographic distribution; and birth, death, marriage, and divorce patterns.

Demographic studies often have health implications that may or may not be addressed by the investigators. The census of the U. S. population is an example of a comprehensive descriptive demographic study conducted every 10 years.
Epidemiological Triangle
Changes in one of the elements of the triangle can influence the occurrence of disease by increasing or decreasing a person’s risk for disease.

Risk is understood as the probability an individual will become ill.
Epidemiological Process

Epidemiological Triangle

I. Agent: primary cause of condition
   physical, chemical, nutritive,
   infectious, psychological

II. Host: age, sex, race,
   physical/psychological factors

III. Environment:
   physical, biological, social, cultural
Basic Epidemiological Concepts

Agent: a factor whose presence causes disease or one whose absence causes disease.

Categories of agents include:
* physical agents
* chemical agents
* nutrient agents
* biological agents
* genetic & psychological agents
Agent:

- Infectious agents: bacteria, viruses, fungi, parasites
- Chemical agents: heavy metals, toxic chemicals, pesticides
- Physical agents: radiation, heat, cold, machinery
Host:

- genetic susceptibility
- Immutable characteristics: age/gender
- acquired characteristics: immunology status
- life-style factors: diet, exercise
Environment:

- Climate (temperature, rainfall)
- Plant and animal life (agents, reservoirs, or habitants for agents)
- Human pop distribution (crowding, social support)
- Socioeconomic factors (educ, resources, access to care)
- Working conditions (levels of stress, noise, satisfaction)
Epidemiological Process

Web of Causality Model

*Complex interrelationships of numerous factors interacting to > or < the risk of disease.

*direct and indirect causes
Epidemiological Process

Dever’s Model

4 Elements

human biology: genetics, physiologic fx, maturation.

life-style: employment, consumption, leisure

environment: physical, psychological, social

health-care system: availability, accessibility, utilization
Dever’s Epidemiological Model

Human Biology
- Genes
- Physiologic Function
- Medication

Environment
- Physical
- Psychological
- Social

Health Status
- Physical Health
- Psychological Health
- Social Health

Life-Style
- Employment
- Consumption
- Leisure

Health-Care System
- Accessibility
- Utilization
Sources of Data

1. Routinely collected data:
   - Census data, vital records (birth and death certificate), surveillance data (systematic collection of data concerning disease occurrence)

2. Data collected for other purposes:
   - Hospital records, cancer registries, occupational exposures

3. Epidemiologic data
   - Original data collected for specific epidemiologic studies
Vital Statistics

- Information about births and death
- Collected, classified, and published since the mid 17th century. (late 1600’s in Massachusetts).
- At present classification is made according to the nomenclature of the International Classification of Diseases (ICD)
- Mortality based on compilation of death certificate data. Accuracy impeded by reporters “biases”, timing, etc.
- Fertility and mortality based on birth statistics & include characteristics such as sex and weight of infant, place of residence, gestation length, and characteristics of parents.
- Morbidity based on actual members of communicable diseases derived from national reporting systems (CDC) operating since 1920. Estimates of non-communicable diseases derived from hospital records (NHDS) registry data, and surveys such as the National Household Health Survey, and the Framingham heart study.
- Disability historically under-reported and computed from insurance industry and Social Security estimates. The 1995 National Household Health Survey will include disability for the first time in more than 30 years.
Measures of Morbidity and Mortality

- Rates in epidemiology
- Risk of disease/death
- Rate adjustment
Calculation of Epidemiologic Rates

Rates are calculated by the formula:

\[
\frac{\text{Number of people experiencing condition}}{\text{population at risk for experiencing condition}} \times K
\]

\(K\) is a constant (usually 1,000 or 100,000) that allows the ratio, which may be a very small number, to be expressed in a meaningful way.
Rates

A way of expressing the frequency of an event as a fraction or part of a whole population.

\[
\frac{\text{# of cases of disease}}{\text{total # population}} \times 100,000
\]
Three Categories of Rates

- **Crude, Specific, and Adjusted**
  - Rates computed for a population as a whole are *crude rates*.
    - *E.g., crude mortality rate*
  - Subgroups of a population may have differences not revealed by the crude rates. Rates calculated for subgroups are *specific rates*.
    - *E.g., age-specific death rate*
  - In comparing populations with different distributions of a factor known to affect the health condition of interest, the use of adjusted rates may be appropriate.
    - *Adjusted rates are helpful in making community comparisons, but they are imaginary: caution is necessary when interpreting.*
Mortality rates

- Crude mortality rate
  - Crude annual mortality rate
- Age-specific rate
- Cause-specific rate
- Case-fatality rate
- Proportionate mortality ratio
- Infant mortality rate
- Neonatal mortality rate
- Postneonatal mortality rate
Crude Rates for Mortality

\[
\frac{\text{total \# deaths for a year}}{\text{mid year or average population}} \times 100,000
\]
Cause Specific

\[
\frac{\text{# deaths from specific disease in year}}{\text{average population in that year}} \times 100,000
\]
Survival rate

- Survival rate = 1 – the CFR
- For example:
  - The 5-year CFR for lung cancer is 86 %, the 5-year survival rate is only 14 %.
Mortality Rates

measure of deaths per disease

US Cancer Mortality rate
Morbidity Rates

measure of occurrence of disease
Prevalence: measure of all (total) existing # of cases present in a population @ a given time. Includes incidence and duration; especially important with conditions that are chronic and have a low mortality rate.

\[
\frac{\text{total # cases of disease}}{\text{total population @ mid year}} \times 1,000
\]
Incidence

Measure of all new cases arising during a defined period (usually 1 year) in a particular at-risk population.

\[
\frac{\text{# of new cases reported}}{\text{total population @ mid year}} \times 1,000
\]
Variations in Mortality and Morbidity

**AGE:**
- *Death rates with age, after age 40. Doubling with each decade.*
- *Age Pyramids reflect patterns of birth and death.*
- *Rate of chronic illness increases with age (despite age related prevalence, there are wide disparities cross nationally and socio-culturally)*
- *Rates of violence/injury related death decrease with age.*
- *Compression of morbidity is a topic of debate and concern with broad socio-political implication.*
Variations in Mortality and Morbidity

**GENDER:**

*During the 1800’s women died younger than men, but since the 1920’s women have been living longer than men. In 1980: Women: averaged 78.6 years, while Men: averaged 71.8 years (This pattern is not followed in all countries due to maternal mortality.)

*Men die earlier with more life threatening illness, however women display more frequent illness.

*Women have more chronic illness, but they tend to be less severe.

*Women report more episodes of illness and more doctor visits.

*Men are more likely to engage in high-risk behavior such as fast driving, smoking etc.. (These patterns are changing in the US). Research on personality types suggests gender differences that may effect illness patterns.

*Biological factors such as hormones may account for some differences but are not sufficient to explain patterns.
Variations in Mortality and Morbidity

**RACE and ETHNICITY:**
- Differences in patterns of health & illness reflect hereditary factors and sociocultural factors such as poverty, life stress in living conditions, employment, etc.
- The combination of factors leads to disproportionate levels of disease and mortality.
- Examples: sickle cell disease, hypertension, diabetes, lactose intolerance.
- Patterns of Health & illness vary greatly by race/ethnicity in the US. For example: life expectancy of black citizens is 69.6 years, as compared to 76.9 years for whites (1992).
- Infant Mortality skews mortality statistics:
  - Rates of low birth weight infants: Blacks = 12%, Whites = 6%
  - This correlates with receipt of maternal care: in 1992, 36% of black mothers did not receive 1st trimester care in contrast to 20% of white mothers. (more recent studies suggest that maternity care alone does not account for cross racial and ethnic differences in outcomes).
- Native Americans are the most disadvantaged group in the US, with a death rate 30% higher than the general population.
- Distribution of health & illness across the Hispanic cultural groups reflects socioeconomic factors. The term Hispanic reflects great heterogeneity and is “controversial” as a category for analysis.
- Comparative studies of cultural groups in different stages of migration and acculturation suggest that socioeconomic factors such as stress, living conditions and diet are important determinants of disease.
Variations in Mortality and Morbidity

- **SOCIAL CLASS**
- * Generally there is a consistent relationship between social class and health. (class usually measured by income, education, occupation, or a combination of these factors.)
- * The lower the social class, the higher the rates of morbidity and mortality.
- * Infant Mortality & Social Class is clearly linked.
- * In the US differences between socioeconomic groups increased between 1960 and 1986.
- * Data such as individual health behaviors demonstrate clear patterns of socioeconomic variation. For example: a person of lower socioeconomic position is three times more likely to smoke than a person in the highest social class position.
- * Theories suggest that personal control over one’s life is an important factor in differences along with increased susceptibility, and environment.
- * Lack of access to medical care and lower quality of care are important factors.
- * Health care and social welfare policies are inextricably linked.
- * Illness can cause a downward social drift.
Measure of morbidity and mortality

Most accurate: mortality, birth rates.
  Why?
  MANDATORY recorded

Less accurate: morbidity, incidence
  Why?
  - not always recorded
  - collection from registry
  i.e. CA, birth defects, DM
Outcome Measures

- **Prevalence proportion** - proportion of a population with the outcome (disease) at a single point in “time”

- **Incidence** - the number or proportion of individuals developing the outcome (disease) during a period of time
  - incidence proportion (risk)
  - incidence rate → person-time
Obesity Among U.S. Adults 2002

Source: Behavioral Risk Factor Surveillance System, CDC
As discussed previously, rates describe and compare the risks of dying, becoming ill, or developing other health conditions. In epidemiologic studies, it is also desirable to determine if health conditions are associated with, or related to, other factors. The research findings may provide the theoretical foundation by which preventive actions are identified (e.g., the linking of air pollution to health problems has led to environmental controls).

To investigate potential relationships between health conditions and other factors, analytic measures of community health are required. In this section, three analytic measures are discussed:

- relative risk,
- odds ratio,
- and attributable risk.
Measures of Association

- Outcome measures are descriptive characteristics about distribution of the outcome
  - ex: what is the prevalence of lung cancer?

- How do we link exposures to outcomes?
  - how do we quantitate this?
  - ex: is smoking related to lung cancer?
Measures of Association

Difference Measures

- Risk Difference (absolute risk reduction) =

\[ \text{Incidence exposed} - \text{Incidence unexposed} \]

**Risk** refers to the probability that an event will occur within a specified time period, and a population at risk is the population of persons for whom there is some finite probability of that event.
Intensive versus Moderate Lipid Lowering with Statins after Acute Coronary Syndromes

Christopher P. Cannon, M.D., Eugene Braunwald, M.D., Carolyn H. McCabe, B.S., Daniel J. Rader, M.D., Jean L. Rouleau, M.D., Rene Belder, M.D., Steven V. Joyal, M.D., Karen A. Hill, B.A., Marc A. Pfeffer, M.D., Ph.D., and Allan M. Skene, Ph.D., for the Pravastatin or Atorvastatin Evaluation and Infection Therapy—Thrombolysis in Myocardial Infarction 22 Investigators*

NEJM 2004;350:1495-1504

- 4162 subjects with acute coronary syndromes
- randomized to standard dose v. high dose statin therapy
- followed for mean of 24 months
- outcome: incidence of death, MI, revascularization, unstable angina, or stroke

Incidence of outcome in exposure group: 22.4%
Incidence of outcome in control group: 26.3%

absolute risk difference = -3.9%
Measures of Association

**Ratio Measures**
- Risk Ratio
- Incidence Rate Ratio
- Hazard Ratio
- Odds Ratio

Relative Risk

\[ \frac{\text{Incidence exposed}}{\text{Incidence unexposed}} \]
The relative risk (RR)

- RR expresses the risk ratio of the incidence rate of those exposed (e.g., smokers) and those not exposed to the suspected factor (e.g., nonsmokers). The relative risk indicates the benefit that might accrue to the client if the risk factor is removed.

\[
RR = \frac{Incidence \ rate \ among \ those \ exposed}{Incidence \ rate \ among \ those \ not \ exposed}
\]
Sustainability of Reductions in Malaria Transmission and Infant Mortality in Western Kenya With Use of Insecticide-Treated Bednets

4 to 6 Years of Follow-up  JAMA 2004;291

- community randomized trial in Kenya to see if insecticide-treated bednets could reduce childhood morbidity and mortality

Children 1-11 months
Incidence rate of death treatment group: 100/1000 person-years
Incidence rate of death control group: 128/1000 person-years

relative risk (RR) of death = 0.78 in treated group

Relative Risk Reduction = 1 - RR → 22%
Calculation of the relative risk is straightforward when incidence rates are available. Unfortunately, not all studies are prospective as is required for the computation of incidence rates. In a retrospective study, the relative risk is approximated by the odds ratio.

The odds ratio is a simple mathematical ratio of the odds in favor of having a specific health condition when the suspected factor is present and the odds in favor of having the condition when the factor is absent. The odds of having the condition when the suspected factor is present are represented by $a/b$ in the table. The odds of having the condition when not exposed to the factor are $c/d$. The odds ratio is thus:

$$\frac{a/b}{c/d} = \frac{ad}{bc}$$
Measures of Validity

Internal Validity
- Chance- (p-value)
- Bias
- Confounding

External Validity
- Generalizability
Bias - systematic error affecting the results of the study

- **Selection bias** - association between disease and exposure occurs because of the way participants were selected, not by underlying truth
- **Recall bias** - occurrence of outcome results is increased recall of exposures
  - ex: maternal recall bias
- **Informational bias** - differential misclassification of exposure or outcome (MD Behavior Bias)
### Selection Bias

What is the prevalence of depression in patients with congestive heart failure (CHF)?

<table>
<thead>
<tr>
<th>CHF (exposure)</th>
<th>Depression measured by questionnaire (outcome)</th>
</tr>
</thead>
</table>

**STUDY A**

Patients in a CHF clinic were approached to be involved in the study.

52% were found to have depression.

**STUDY B**

Patients were randomly selected from a population-based study of CHF.

23% were found to have depression.
Confounding - mixing of the effect of an exposure on the outcome with the effect of another exposure. Ex: Down’s Syndrome.
External Validity

Generalizability - how well do these results apply to other populations? Ex: Framingham Heart Study

Ten-Year Prediction of CHD Events in CMCS Men and Women Using the Original Framingham Functions

Study Types

- **Observational**
  - cohort (follow-up)
  - case-control
  - cross-sectional (prevalence)

- **Experimental**
  - randomized trial
Cohort Study

- Cohort study - study that follows or traces any designated group over a period of time

Classify subjects by exposure → Follow for outcome

**Benefits:**
- less bias
- can estimate population rates of disease or exposure specific risk

**Drawbacks:**
- requires large population, especially for rare outcome
- can require long follow-up period
High-risk patients at an urban county hospital
enrolled 190 cocaine exposed infants and 186 non-exposed infants
outcome Wechsler Preschool and Primary Scales of intelligence at 4 years

190 cocaine-exposed infants 4 years outcome

190 non-exposed infants 4 years outcome

RESULTS: no difference in full-scale verbal or performance IQ scores
Case-Control Study

Study in which subjects with the outcome (cases) are compared to those without (controls) to determine different exposure distribution (usually retrospective)

Classify subjects by outcome → Follow for exposure

Benefits:
- good for rare disease (outcomes), long latency
- requires fewer subjects than cohort study

Drawbacks:
- can introduce bias in selection of controls
- cannot estimate population rates of disease or exposure specific risk
HMG-CoA Reductase Inhibitors and the Risk of Hip Fractures in Elderly Patients

JAMA 2004;283:3211-3216

- Reviewed histories from patients enrolled in New Jersey Medicare or Medicaid or Pharmacy Assistance for Aged and Disabled Program
- 1222 patients who had a hip fracture
- 4888 control patients selected without hip fracture (4:1-matched for age and sex)

**RESULTS:**

- Statin use: 2.2% cases v. 4.4% controls
- Odds Ratio of hip fracture with statin use - 0.50
Cross-sectional Study

Study used to assess the prevalence of disease at one point in time

The Distribution of 10-Year Risk for Coronary Heart Disease Among U.S. Adults
Findings From the National Health and Nutrition Examination Survey III

Earl S. Ford, MD, MPH,* Wayne H. Giles, MD, MS, Ali H. Mokdad, PhD

Atlanta, Georgia

JACC 2004;43:1791-1796
Randomized Controlled Trial

Type of cohort study in which the exposures are assigned

Gold standard for epidemiologic trials

Randomization ensures equal distribution of confounders
1. Randomization

2. Assign Exposure

Gender = known confounder

=unknown confounder
Subjects with ACS

Randomized (Exposure Assigned)

Low-dose statin → Outcome
24 months
26.3%

High-dose statin → Outcome
24 months
22.4%
Epidemiology, Demography - Applications in Community Health Nursing.
Lecture objectives

After the lecture, you should be able to:

● Describe theories of causality in health and illness.
● List the major sources of epidemiologic information.
● Distinguish between incidence and prevalence in health and illness states.
● Use epidemiologic methods to describe an aggregate’s health.
● Discuss the types of epidemiologic studies that are useful for researching aggregate health.
● Use the seven-step research process when conducting an epidemiologic study.
Epidemiology is the study of the determinants and distribution of health, disease, and injuries in human populations. It is a specialized form of scientific research that can provide health care workers, including community health nurses, with a body of knowledge on which to base their practice and methods for studying new and existing problems.
Eras of Modern Epidemiology

- Four distinct eras, each based on causal thinking:
  - sanitary statistics (1800–1850),
  - infectious-disease epidemiology (1850–1950),
  - chronic-disease epidemiology (1950–2000),
  - eco-epidemiology – emerging now.
Major Uses of Epidemiology

1. Historical study: Is community health getting better or worse?
2. Community diagnosis: What actual or potential health problems are there?
3. Working of health services
   - * Efficacy
   - * Effectiveness
   - * Efficiency
4. Individual risks and chances
   - * Actuarial risks
   - * Health hazards/risk appraisal
5. Completing the clinical picture: Different presentation of the disease.
6. Identification of syndromes: “lumping and splitting”
7. Search for causes: case control and cohort studies.

Other uses include: Evaluation of presenting signs and symptoms, and clinical decision analysis.
Basic Methods in Epidemiology:

Sources of Data

- Data collected for other purposes
  - census, birth & death cert, surveillance data by CDC
- Routinely collected data
  - medical and insurance records
- Data collected for specific epi studies
  - original data
Vital Statistics

- Information about births and death
  - * collected since mid 17th century

- Fertility and natality include characteristics such as sex, weight, place of residence, gestational length, characteristics of parents.
  - * collected since mid 17th century

- Classification according to International Classification of Diseases (ICD)
Demography

Demography (literally, writing about the people, from the Greek *demos* [people] and *graphos* [writing]) is the statistical study of human populations with reference to size and density, distribution, and vital statistics.

Demographic statistics provide information about significant characteristics of a population that influence community needs and the delivery of health care services.
Demographic studies (that is, demographic research) provide descriptions and comparisons of populations according to the characteristics of age; race; sex; socioeconomic status; geographic distribution; and birth, death, marriage, and divorce patterns.

Demographic studies often have health implications that may or may not be addressed by the investigators. The census of the U. S. population is an example of a comprehensive descriptive demographic study conducted every 10 years.
Demographics

- total # of people, i.e. in the country, state, localities.

- These are done q 10 yr. via census.

- May be presented as raw data or as in Frequency of Events.
Essential Concepts of Epidemiology

- Causality
- Risk
- Rates of Occurrence
Theories of causality in health and illness.

- **Causality** refers to the relationship between a cause and its effect.

- A purpose of epidemiologic study has been to discover causal relationships, so as to understand why conditions develop and offer effective prevention and protection.
Criteria for Causality

- 1. Consistency of findings
- 2. Strength of association
- 3. Specificity of association
- 4. Temporal sequence
- 5. Dose/response relationship
- 6. Coherence/biological plausibility *
Single cause/single effect theory

Chain of causation in infectious disease.
Concept of multiple causation

- has emerged to explain the existence of health and illness states and to provide guiding principles for epidemiologic practice.

- Example: Dever’s Epidemiological model
Dever’s Epidemiological Model

- It considers the health status of the host and how it is impacted by human biology, life-style, environment, and the health care system.

- Sometimes referred to as a “web of causation,” this model attempts to identify all possible influences on the health and illness processes.
Dever’s Epidemiological Model
Dever’s Model

- **4 Elements**
  - **human biology:**
    - genetics, physiologic fx, maturation.
  - **life-style:**
    - employment, consumption, leisure
  - **environment:**
    - physical, psychological, social
  - **health-care system:**
    - availability, accessibility, utilization
Web of causation for myocardial infarction.
Recognition of multiple causes provides many points of intervention for prevention, health promotion, and treatment.

For example, previous Figure suggests interventions such as directly attacking significant coronary atherosclerosis (bypass surgery), reducing the incidence of obesity, helping people stop smoking, developing an exercise program, and making dietary modifications.
It is a concept that is helpful in determining multiple causality.

Events are said to be associated if they appear together more often than would be the case by chance alone. Such events may include risk factors or other characteristics affecting disease or health states.

Examples:
- frequent association of cigarette smoking with lung cancer,
- frequent association of obesity with heart disease.
Any disease or health condition follows a progression known as its **natural history**; this refers to events that occur before its development, during its course, and during its conclusion.
Natural History Model

- Course of Disease Process

  I. Prepathogenesis State
  - Incubation Period:
    - time of exposure to an infectious organism, until one develops the symptoms.
  - Induction or Latency Period: (noninfectious diseases)
    - The time during which agent-host-environment interact before symptoms appear, (years to decades) i.e., ca, ulcers, ht dis, etc.
  - Mode of transmission
II. Pathogenesis
- signs & symptoms of disease appear
- illness can be detected until recovery, disability, or death.

III. Resolution
- death, disability, recovery
Levels of Prevention

- **Primary ........... Prepathogenesis**
  - immunization, diet & exercise

- **Secondary ........... Pathogenesis**
  - pap smear; screening for HIV

- **Tertiary ................. Resolution**
  - physical therapy, surgery, medical rx
Levels of Prevention

- **I. Primary Prevention** = *Health Promotion and Education*
  
  - Improving Host, Agent, Environment conditions
  
  - Adequate provision for basic needs

- **Anticipatory action** = *Health Protection*
  
  - Improved housing and sanitation for waterborne Ds
  
  - Removal of environmental hazards – accidents
II. Secondary Prevention

- **Detection** = *Early Diagnosis*
  - Screening programs
- **Intervention** = *Prompt Treatment*
  - Initiate prompt treatment
  - Arrest progression
- **Rehabilitation**
  - Prevent associated disability
Levels of Prevention

III. Tertiary Prevention:

- Functional adaptation & Rehabilitation
- Reducing degree of disability/damage from crisis
- Reducing risk of future crisis
The four stages of the natural history of disease can apply to an understanding of any health condition, including wellness states.

In stage one, susceptibility, people can become amenable to healthier practices and improved health system organization.

In stage two, adaptation/exposure, a community can learn about these health-promoting behaviors.

Stage three, early onset, could be a period of trying out the beneficial policies and activities.

Stage four, culmination, could encompass full adoption and a higher level of well-being for the community.

This approach has important implications for community health nursing preventive and health-promotion practice.
Types Of Epidemiologic Studies

- **Descriptive epidemiology**
  - describes disease according to person, place, time ..

- **Analytic epidemiology**
  - understand etiology of disease .......... case-control, cross-sectional study, cohort studies (development of disease)

- **Experimental studies**
  - clinical trials, screening
The simplest measure of description is a **count**.

For example, an epidemiologic study of varicella deaths among all age groups tracked varicella deaths through hospital discharge records and death certificates in New York State.
Rates are statistical measures expressing the proportion of people with a given health problem among a population at risk.

Rates: Way of expressing the frequency of an event as a fraction or part of a whole population.

The total number of people in the group serves as the denominator for various types of rates.
Risk

Risk: probability that a given individual will develop a specific condition

1. Populations are at risk
   ● because they do or do not have contributing factors.

2. Risk factors
   ● predisposing factors that make a person/population more susceptible to a disease or event.
Rates In Epidemiology

- the prevalence rate,
- the period prevalence rate,
- the incidence rate.
The prevalence rate

- **Prevalence** refers to all of the people with a particular health condition existing in a given population at a given point in time.

\[
\text{Prevalence rate} = \frac{\text{Number of persons with a characteristic}}{\text{Total number in population}}
\]
The prevalence rate

- If a nurse discovers 50 cases of measles in an elementary school, that is a simple count.

- If that number is divided by the number of students in the school, the result is the prevalence of measles.

- For instance, if the school has 500 students, the prevalence of measles on that day would be 10% (50 measles/500 population).
The period prevalence rate

- The prevalence rate over a defined period of time is called a *period prevalence rate*:

\[
\text{Period prevalence rate} = \frac{\text{Number of persons with a characteristic during a period of time}}{\text{Total number in population}}
\]
The incidence rate

- Not everyone in a population is at risk for developing a disease, incurring an injury, or having some other health-related characteristic. The incidence rate recognizes this fact.

- **Incidence** refers to all new cases of a disease or health condition appearing during a given time.

- Incidence rate describes a proportion in which the numerator is all new cases appearing during a given period of time and the denominator is the population at risk during the same period.
The incidence rate

Example,

- some childhood diseases give lifelong immunity. The children in a school who have had such diseases would be removed from the total number of children at risk in the school population. Three weeks after the start of a measles epidemic in a school, the incidence rate describes the number of cases of measles appearing during that period in terms of the number of persons at risk:

\[
\frac{200}{1000} \quad \text{or} \quad \frac{200 \text{ new cases}}{1000 \text{ persons at risk}}
\]
The health literature is not always consistent in the use of the term \textit{incidence}; sometimes, this word is used synonymously with \textit{prevalence rates}.

The incidence rate

\[
\text{Incidence rate} = \frac{\text{Number of persons developing a disease}}{\text{Total number at risk per unit of time}}
\]
The incidence rate

Example

- Incidence of TB in Salem, MA in 1995:

  20 new cases
  
  \[
  \frac{20}{40,000 \text{ total population @ midyear}} \times 1,000 = (\text{Standard measure})
  \]

  40,000
Another rate that describes incidence is the **attack rate**.

An **attack rate** describes the proportion of a group or population that develops a disease among all those exposed to a particular risk.

This term is used frequently in investigations of outbreaks of infectious diseases such as influenza.
Computing Rates

- To make comparisons between populations, epidemiologists often use a common base population in computing rates.

- For example, instead of merely saying that the rate of an illness is 13% in one city and 25% in another, the comparison is made per 100,000 people in the population.

- This population base can vary for different purposes from 100 to 100,000.
To describe the **morbidity rate**, which is the relative incidence of disease in a population, the ratio of the number of sick individuals to the total population is determined.
The **mortality rate** refers to the relative death rate, or the sum of deaths in a given population at a given time.

\[
\text{Number of Reported Deaths During 1 Year} \times 100,000
\]
\[
\frac{\text{Estimated Population as of July 1 of Same Year}}{}
\]
Variations in Mortality and Morbidity

- AGE:
  - *Death rates/with age, after age 40. Doubling with each decade.
  - *Age Pyramids reflect patterns of birth and death.
  - *Rate of chronic illness increases with age (despite age related prevalence, there are wide disparities cross nationally and socio-culturally)
  - *Rates of violence/injury related death decrease with age.
  - *Compression of morbidity is a topic of debate and concern with broad socio-political implication.
Variations in Mortality and Morbidity

- **GENDER:**

  - *During the 1800’s women died younger than men, but since the 1920’s women have been living longer than men. In 1980: Women: averaged 78.6 years, while Men: averaged 71.8 years* (This pattern is not followed in all countries due to maternal mortality.)
  - *Men die earlier with more life threatening illness, however women display more frequent illness.*
  - *Women have more chronic illness, but they tend to be less severe.*
  - *Women report more episodes of illness and more doctor visits.*
  - *Men are more likely to engage in high-risk behavior such as fast driving, smoking etc.. (These patterns are changing in the US). Research on personality types suggests gender differences that may effect illness patterns.*
  - *Biological factors such as hormones may account for some differences but are not sufficient to explain patterns.*
Three Categories of Rates

- **Crude, Specific, and Adjusted**

  - Rates computed for a population as a whole are crude rates.
    - *E.g.*, crude mortality rate
  
  - Subgroups of a population may have differences not revealed by the crude rates. Rates calculated for subgroups are specific rates.
    - *E.g.*, age-specific death rate
  
  - In comparing populations with different distributions of a factor known to affect the health condition of interest, the use of adjusted rates may be appropriate.
    - *Adjusted rates are helpful in making community comparisons, but they are imaginary: caution is necessary when interpreting.*
CONDUCTING EPIDEMIIOLOGIC RESEARCH

1. Identify the problem.
2. Review the literature.
3. Design the study.
4. Collect the data.
5. Analyze the findings.
6. Develop conclusions and applications.
7. Disseminate the findings.
Thinking epidemiologically can significantly enhance community health nursing practice.

Epidemiology provides both the body of knowledge — information on the distribution and determinants of health conditions — and methods for investigating health problems and evaluating services.
The end