Introduction to Epidemiology
in the Community

Jill Gallin, CPNP
Assistant Professor of Clinical Nursing

Definitions

Epidemiology
– is “the study of the distribution and determinants of diseases and injuries in human populations.” Mausner & Kramer, 1985

Endemic Diseases
– a disease that occurs regularly in a population

Epidemic
– an unexpectedly large number of cases of disease in a particular population

Recent Epidemics in the United States

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cases/Prev. yrs</th>
<th>Period</th>
<th># of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Louis encephalitis</td>
<td>5-72</td>
<td>1975</td>
<td>1,815</td>
</tr>
<tr>
<td>Legionnaires'</td>
<td>Unknown</td>
<td>1976</td>
<td>235</td>
</tr>
<tr>
<td>AIDS</td>
<td>Unknown</td>
<td>1981-1999</td>
<td>733,374</td>
</tr>
<tr>
<td>Lyme Disease</td>
<td>Unknown</td>
<td>1990-1999</td>
<td>121,000</td>
</tr>
</tbody>
</table>

Definitions

Epidemiologist
– one who practices epidemiology

Epizootiologist
– one who studies disease outbreaks in animals

Pandemic
– an outbreak of disease over a wide geographical area such as a continent
– influenza pandemic of 1918-1919 killed 25 million people worldwide

3 Important Kinds of Rates

Natality (birth) rate = \( \frac{\text{# of live births to residents in an area in a calendar year}}{\text{Population in the area in the same year}} \)

Morbidity (disease) rate = \( \frac{\text{# of cases of residents with illness in an area in a calendar year}}{\text{Population in the area in the same year}} \)

Mortality (fatality) rate = \( \frac{\text{# of deaths to residents in an area in a calendar year}}{\text{Population in the area in the same year}} \)

3 Important Types of Rates

Incidence rate = \( \frac{\text{# of new cases of a disease in a certain time period}}{\text{Population at risk in same time period}} \)

Prevalence rate = \( \frac{\text{# of new and old cases of a disease in a certain time period}}{\text{Population at risk in same time period}} \)

Attack rate = \( \frac{\text{# of new cases in a narrowly defined population during a specific time period}}{\text{Population at risk in same time period}} \)
Crude & Specific Rates

Crude death rate = \( \frac{\text{Number of deaths (all causes)}}{\text{Estimated midyear population}} \)

Age-specific death rate = \( \frac{\text{Number of deaths (35-44)}}{\text{Estimated midyear population (35-44)}} \)

Cause-specific death rate = \( \frac{\text{Number of deaths (specific cause)}}{\text{Estimated midyear population}} \)

Reporting Births, Deaths, & Diseases

Doctors

Clinics

Local Health Department

State Health Department

Centers for Disease Control and Prevention (CDC)

Sources of Standardized Data

• U.S. Census
  – conducted every 10 years, enumeration of population
• Statistical Abstract of the U.S.
  – statistics on social, political, & economic organization
• Vital Statistics
  – statistical summaries of records of major life events

Sources of Standardized Data

• Morbidity & Mortality Weekly Reports (MMWR)
  – lists cases of notifiable diseases in the U.S.
• National Health Surveys
  – health interviews of people
  – clinical tests, measurement, and physical examinations
  – survey of places where people receive medical care
  • NHIS, NHANES, BRFSS, YBRS, NHCS

Standardized Measurements of Health Status

• Mortality Statistics
• Life Expectancy
• Years of Potential Life Lost
• Disability-Adjusted Life years
• Disability-Adjusted Life Expectancy

Measures Epidemiological Study

Epidemiological Studies

Epidemiological Studies

Types of Diseases

Examples

<table>
<thead>
<tr>
<th>Acute Diseases</th>
<th>Communicable</th>
<th>Common cold, pneumonia, mumps, measles, pertussis, typhoid fever, cholera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncommunicable</td>
<td>Appendicitis, poisoning, trauma</td>
<td></td>
</tr>
<tr>
<td>Chronic Diseases</td>
<td>Communicable</td>
<td>Tuberculosis, AIDS, Lyme disease, syphilis, rheumatic fever</td>
</tr>
<tr>
<td>Noncommunicable</td>
<td>Diabetes, coronary heart disease, osteoarthritis, cirrhosis of the liver</td>
<td></td>
</tr>
</tbody>
</table>
Causative Agents for Diseases & Injuries

**Communicable Disease Model**

<table>
<thead>
<tr>
<th>Biological Agents</th>
<th>Chemical Agents</th>
<th>Physical Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viruses</td>
<td>Pesticides</td>
<td>Heat</td>
</tr>
<tr>
<td>Rickettsiae</td>
<td>Food additives</td>
<td>Light</td>
</tr>
<tr>
<td>Bacteria</td>
<td>Pharmacologics</td>
<td>Radiation</td>
</tr>
<tr>
<td>Fungi</td>
<td>Industrial chemicals</td>
<td>Noise</td>
</tr>
<tr>
<td>Protozoa</td>
<td>Air pollutants</td>
<td>Vibration</td>
</tr>
<tr>
<td>Metazoa</td>
<td>Cigarette smoke</td>
<td>Speeding objects</td>
</tr>
</tbody>
</table>

**Chain of Infection**

A model to conceptualize the transmission of a communicable disease from its source to a susceptible host.

**Chain of Infection**

- Pathogen
  - is the disease causing agent

- Reservoir
  - is the habitat in which an infectious agent normally lives & grows
  - Human: symptomatic or asymptomatic
  - Animal: called zoonoses
  - Environmental: plants, soil, and water

- Portal of exit
  - is the path by which an agent leaves the source host

**Modes of Transmission**

- Direct
  - Direct contact
  - Droplet spread
- Indirect
  - Airborne
  - Vehicleborne
  - Vectorborne

- Transmission
Chain of Infection

Pathogen > Reservoir > Portal of exit > Transmission > Portal of entry
- Final link is a susceptible host

Respiratory
Oral
Skin
Intravenous
Gastrointestinal

Noncommunicable Disease Model

Your genetic endowment

Noncommunicable Disease Model

Your genetic endowment

Personality
Beliefs
Behavioral choices

Prioritizing Prevention & Control Efforts

- Leading Causes of Death
- Years of Potential Life Lost
- Economic Cost to Society

Environment
Economics
Health Care System
Healthcare
Waste Quality
Air Pollution
Behavioral choices
Prevention, Intervention, Control, and Eradication of Diseases

- Prevention
  - primary
  - secondary
  - tertiary
- Intervention
  - which is defined as taking of action during an event
- Control
  - general term used in the containment of disease
- Eradication
  - total elimination of the disease

Levels of Prevention

- Primary Prevention
  - is the forestalling of the onset of illness or injury during the pre-pathogenesis period (before the disease process begins)
- Secondary Prevention
  - is the early diagnosis and prompt treatment of diseases before the disease becomes advanced and disability becomes severe
- Tertiary Prevention
  - is to retrain, reeducate, and rehabilitate the patient who has already incurred disability