Measures of Morbidity
www.cdc.gov/mmwr

Morbidity and Mortality Weekly Reports
Terms Related to Morbidity

• Morbidity
  ✓ The extent of illness, injury or disability in a defined population

• Incidence of a disease (Incidence rate)
  ✓ The number of new cases of a disease that occur during a specified time period (numerator) in a population at risk for developing the disease (denominator)

• Prevalence of a disease (Prevalence rate)
  ✓ The number of total cases of disease present at a particular time (numerator) in a specific population (denominator)

• Risk
  ✓ The likelihood that an individual will contract a disease
## Characteristics

<table>
<thead>
<tr>
<th>RISK</th>
<th>PREVALENCE</th>
<th>INCIDENCE RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of disease</td>
<td>% of pop. with the disease</td>
<td>Rapidity of disease occurrence</td>
</tr>
<tr>
<td>No units</td>
<td>No units</td>
<td>Cases per person-time</td>
</tr>
<tr>
<td>Newly diagnosed</td>
<td>Existing</td>
<td>Newly diagnosed</td>
</tr>
<tr>
<td>“Cumulative incidence”</td>
<td></td>
<td>“Incidence density”</td>
</tr>
</tbody>
</table>
Problems with Numerators

- Who has the disease?
- Who to include in numerator?
- Interview errors

Problems with Denominator

- Selective undercounting
- Everyone in denominator must have potential to enter numerator group
Problems with Hospital Data

- Selective (many reasons)
- Data may be unavailable, etc
Incidence

The two forms of incidence are:

- **Cumulative incidence**
  - "risk of disease"
  - measures the proportion of persons who develop a disease in a known span of time

- **Incidence rate**
  - "rate of disease"
  - measures the rate of new disease occurrence over time
Incidence per 1000

Incidence rate = \frac{\text{Number of new cases of a disease within a population in a given time period}}{\text{Number of persons exposed to risk of developing the disease in the same time period}} \times 1,000

What’s wrong with this formula?
Incidence Rate

• Measures the rapidity with which newly diagnosed cases of the disease of interest develop
  ✓ observe a population
  ✓ count # of new cases
  ✓ measure net time
    • individuals in population at risk of developing disease

• person-time
  ✓ person-years
  ✓ patient-days
Incidence Rate (Attack Rate) (cont.)

- Can be used for specific exposures
- Also used for multiple exposures
- Other terms:
  - primary case
  - secondary attack
    - secondary cases
When comparing disease rates and proportions, it is essential to distinguish between actual differences and what appears to be the basis of differences or apparent differences. When assessing differences the following guidelines are suggested:

Differences in Disease Rates and Proportions That Occur in Study Groups or Exposed Populations. What are the

1. differences in classification of the diseases, conditions, disorders, disabilities or deaths between the study groups?
2. differences in levels of the diseases, conditions, disorders, disabilities or deaths between the study groups, which result from varying levels of exposure across the population?
3. differences in distributions of age in or between study groups?
4. differences in the quality of the measures used in the denominator between the study groups? (Denominator issues and differences)
5. differences in diagnosis between study groups that are used in the numerator? (Numerator issues and differences)

Time Related Differences. What are the

1. differences in the classification of diseases, conditions, disorders, disabilities or deaths over time?
2. differences in the levels of diseases, conditions, disorders, disabilities or deaths over time, that result from varying levels of exposure across the population?
3. differences in distributions of age over time or in different time periods?
4. differences in the quality of the measures used in the denominator over time? (Denominator issues and differences)
5. differences in the quality of diagnoses or the influence of diagnosis trends over time that are used in the numerator? (Numerator issues and differences)
Principles of Incidence Rate

• Estimate probability
• Incidence kinetics
• Seasonal variation
• Place
• Person
Attack rates

CRUDE ATTACK RATE
(general)

ATTACK RATE
(more specific)

FOOD-SPECIFIC ATTACK RATE
(very specific)
Incidence and Attack Rates

- **Primary Attack rates**

\[
\text{Crude attack rate} = \frac{\text{Number of persons ill with the disease}}{\text{Number of persons attending the event}} \times 100
\]

\[
\text{Attack rate} = \frac{\text{Number of persons ill (new cases) within the time period}}{\text{Number of persons/population at risk within the time period}} \times 100
\]

\[
\text{Food-specific attack rate} = \frac{\text{Number of persons who ate a specific food and became ill}}{\text{Total number of persons who ate a specific food}} \times 100
\]
Incidence and Attack rates (cont’d)

- Secondary Attack rates

Secondary attack rate = \( \frac{\text{Number of exposed persons developing the disease within incubation period}}{\text{Total number of persons exposed to the primary case}} \) \times 100

\[ \frac{\text{Number of cases among contacts of primary cases during the period}}{\text{Total number of contacts}} \times 100 \]
Incidence Rates

OSHA

Incidence rate (total recordable cases) = \( \frac{\text{Number of injuries and illness} \times 200,000}{\text{Total hours worked by all employees during the time period}} \times 100 \)

Incidence rate (work days lost) = \( \frac{\text{Number of lost workdays}}{\text{Number of hours worked by all employees during the time period}} \times 100 \)
Prevalence

• Measure of the number (or proportion) of cases in a given population

• What is the difference between prevalence and incidence?
  ✓ Prevalence → a slice thru a population at a given point in time that determines who has the disease and who does not, while Incidence only looks at new cases

• In steady state situation (no change in rate or net population)
  ✓ Prevalence = Incidence X Duration of disease
Prevalence

• Point prevalence - point in time
• Period prevalence - during a defined range of time
Comparative Factors Affecting Prevalence Rates

• Rates are INCREASED by
  ✓ Immigration of ill cases
  ✓ Emigration of healthy persons
  ✓ Immigration of susceptible cases or those with potential of becoming cases
  ✓ Prolongation of life cases w/o cure
    • Increase of duration of disease
  ✓ Increase in occurrence of new cases
    • Increase in incidence
Comparative Factors Affecting Prevalence Rates

- Rates are DECREASED by
  - Immigration of healthy persons
  - Emigration of ill cases
  - Improved cure rate of cases
  - Increased death rates from diseases
  - Decrease in occurrence of new cases
  - Shorter duration of disease
  - Death
Prevalence Rates

Prevalence rate 1 = \frac{\text{Number of existing cases of the disease}}{\text{Total population}} \times 1,000

At a point in time

Prevalence rate 2 = \frac{\text{Total number of cases of the disease at a given time}}{\text{Total population at risk at a given time}} \times 1,000
## Prevalence Rates (cont’d)

### Point

Point prevalence rate = \[
\frac{\text{Number of existing cases of the disease}}{\text{Total study population}}
\] At a point in time \( \times 1,000 \)

### Period

Period prevalence rate = \[
\frac{\text{Number of existing cases of the disease}}{\text{Average study population}}
\] Within a time period \( \times 1,000 \)
FIGURE 5.6 Graph of period and point prevalence.
Rates of Morbidity

Breast Cancer Incidence in White Women and Distribution by Age

Note change in slope – menopause??
Case Distribution

Spot Map of Residence Distribution of Rheumatic Fever Cases in Baltimore

1960-1964

1977-1981
Sources of Morbidity Statistics

- Clinical and hospital
- Managed care
- Registries
- Vital statistics
- Surveys
- Disease reporting
- Insurance and pre-paid med. care plans
- Absenteeism records