Using Epidemiology in TB Prevention & Control

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Why learn about epidemiology?

♦ Assist TB program staff to analyze and make practical use of data

♦ Assess current and evolving trends in TB morbidity, identify risk groups, and determine where to allocate staff and resources

♦ Assist all TB program staff in working towards effective TB control

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What is epidemiology?

Epidemiology

"The study of the distribution and determinants of health-related states in specified populations, and the application of this study to control health problems."

Source: http://www.cdc.gov/excite/

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What is Epidemiology?

□ *Descriptive epidemiology* **concentrates on examining the distribution of diseases in the population in terms of person (who gets the disease), place (where they get the disease) and time (when they get the disease)**

□ *Analytic Epidemiology* **is concerned with studying the relationship between risk factors and a disease**

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How do we find descriptive data?

Public Health Surveillance

The systematic, ongoing collection, analysis, interpretation, and dissemination of health data. The purpose of public health surveillance is to gain knowledge of the patterns of disease, injury, and other health problems in a community so that we can work toward controlling and preventing them.

Source: http://www.cdc.gov/excite/
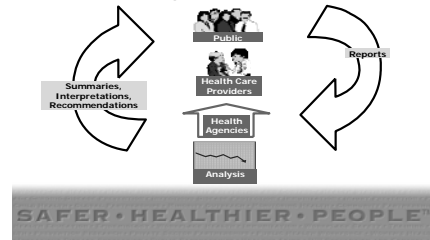
♦ Source: Public Health Surveillance- CDC slide set
♦ http://www.cdc.gov/ncphi/disss/nndss/phs/files/overview.ppt

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Two types of surveillance

Active surveillance **is a system where the health department or other agency initiates the data collection activities.**

Passive surveillance **is used when the health care provider is asked or required to report information to the health department.**

TB Surveillance

♦ Since 1953

♦ Newly reported cases of TB disease

♦ Primarily collected via the expanded TB case report introduced in 1993.

♦ TB case report (Report of Verified Case of Tuberculosis, or RVCT) is submitted electronically to the Division of Tuberculosis Elimination (DTBE), CDC, by 60 reporting areas (the 50 states, the District of Columbia, New York City, Puerto Rico, and seven other jurisdictions in the Pacific and Caribbean).

TB Surveillance Data Reports

♦ Descriptive Statistics
  – Person
  – Place
  – Time
  – Combined with Census Data to generate case rates

    The number of cases that occur
    <u>during a specified time period</u> **x100,000**
    population at risk during that
    time period

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TB Surveillance

http://www.cdc.gov/tb/statistics/surv/surv2009/slides/surv1.htm

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Descriptive Data: person

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Descriptive Data: place

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Descriptive Data: time

Reported TB Cases*
United States, 1982–2009

*Updated as of July 1, 2010.
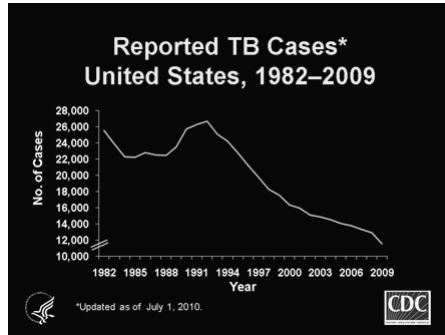
Using TB Surveillance Data

♦ Provide the descriptive epidemiology of local and state TB programs.
  – A description of the gender, race, ethnicity, occupation, nationality and place of residence of TB cases can be summarized for state or local areas
  – Health information such as HIV status, history of substance use, prior diagnosis of TB, site of disease, spear and sputum culture results, initial drug regimen, initial and final drug susceptibility results, type of health care provider and type of therapy received (Directly observed vs. self-administered)

Using TB Surveillance Data

♦ Information related to treatment outcomes that can be used to evaluate program performance and needs
  – E.g., date of treatment initiation may be compared with date that therapy was completed to see how long it takes patients to complete therapy
  – Other program performance goals can be set by the state TB Control Program

♦ Use Surveillance data to develop SMART (Specific, Measurable, Achievable, Relevant and Time Bound) program objectives.

Sources of TB Surveillance Information

Reported Tuberculosis in the United States, 2009
http://www.cdc.gov/tb/statistics/reports/2009/default.htm

Tuberculosis in the United States, 2009 (Slide Set)
http://www.cdc.gov/tb/statistics/surv/surv2009/

Online Tuberculosis Information System (OTIS)
OTIS is a query-based system containing information on TB cases reported to CDC. http://wonder.cdc.gov/tb.html

Online Tuberculosis Information System (OTIS)

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Key epidemiologic measures: Incidence Rate

# of NEW cases of disease
during a specified time period
-- **x 1,000**
Population <u>at risk</u> of disease
during the same time period
(also measured as person-time)

Key epidemiologic measures: Prevalence Ratio

Total # of (new and old)
cases of disease during a
time period (or at one point in time)
--- **x 1,000**
total (usually mid-period) population
during the same time period

Comparing Incidence Rates and Prevalence Ratios

INCIDENCE RATE	PREVALENCE RATIO
Numerator	**Numerator**
New Cases during a time period	NEW and OLD Cases At one point in time or during a time period
Denominator	**Denominator**
Population at risk or Person-Time	Total Population
Excluding pre-existing cases during a specified time period	At one point in time or during a time period
Use : Estimate of risk	**Use:** Burden of disease
Study Design: Cohort Study	**Study Design:** Cross-Sectional

What is a TB Case Rate? An **incidence rate** or a **prevalence** ratio?
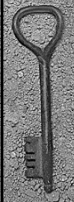
The number of cases that occur
<u>during a specified time period</u>   **x 100,000**
population at risk during that
time period

Note: cases are verified cases of TB. If TB recurs or if more
than 12 months has elapsed since the person was
discharged or lost to follow-up, then the person is counted
as a new case.

Sample Problem:
Calculating Incidence and Prevalence

- A county TB Controller would like to know how many people
  currently living in a local homeless shelter are TST positive

- A nurse administers and reads the TST test results. Out of 100
  homeless shelter residents, 40 had a positive TST result.

- All 100 residents remained in this shelter for the next year at
  which time only those who did not have an initial positive TST
  result were tested again. Among these 60 residents, 20 had a
  positive test result.

Calculate:

a. the baseline prevalence of TB infection at this homeless shelter

**b. an estimate of the risk of developing TB infection in this
population**

Sample Problem: Solution
Calculating Incidence and Prevalence

- A nurse administers and interprets the TST test results. Out of
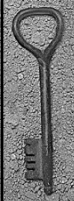 100 homeless shelter residents, 40 had a positive TST result.

Baseline Prevalence is 40/100 or 40%

- All 100 residents remained in this shelter for the next year at
  which time only those who did not have an initial positive TST
  result were tested again. Among these 60 residents, 20 had a
  positive test result.

**b. an estimate of the risk of developing TB infection in this
population**

Incidence Rate = 20/60 or 33%

TB Control

- Assume that these two figures are good representations of
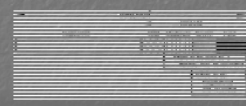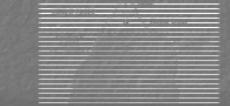 the TB occurrence. What does it tell us about TB Control?

TB Control

Severity of illness and reporting of disease statistics

Iceberg Phenomenon

♦ Assume that these two figures are good representations of the TB occurrence. What does it tell us about TB Control?

"Since TB has a long period of latent infection, these new infections added to the pool of existing infections, which represents a source for potential TB cases in the years, and even decades, to come. One strategy for global TB control would be to implement an effective screening program in high-risk populations that would identify individuals with latent TB infection and treat them to prevent disease."

Source: Whalen, JAMA, June, 8, 2005, p. 2785

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Quality of Morbidity Data

♦ Subjective

♦ Type of surveillance used (active vs passive)

♦ Only available if someone seeks care and the information about that care is recorded

♦ The most severe cases of disease are more likely to be reported than less severe cases of disease

♦ Validity of a test to identify infection and disease

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Mortality

♦ Is easier to define than morbidity

♦ Main source of mortality data in the United States is the standard US death certificate

♦ Collected by states and is kept by the National Center for Health Statistics

♦ Since TB death rates are so low in US, less likely to see published mortality figures for the US

♦ TB is a major cause of death in developing countries

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Molecular Epidemiology

♦ TB epidemiology enhanced by molecular strain typing

♦ Used to differentiate between the different TB mycobacterial isolates

♦ DNA fingerprinting could be used during contact investigations to confirm (or disprove) known epidemiological links between cases and determine connections among cases where obvious epidemiological links do not exist

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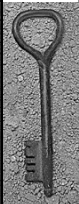
Closing

♦ Epidemiologic methods can help us to identify local, state, and national patterns of disease and their impact on local control of tuberculosis

♦ Can use epidemiological methods to find ways to improve both patient care outcomes and effectiveness of individual TB Programs