DEFINITIONS OF SURVEILLANCE

LANGMUIR, 1963

“The continued watchfulness over the distribution and trends of incidence through the systematic collection, consolidation, and evaluation of morbidity and mortality reports and other relevant data, together with dissemination to those who need to know.”
“Surveillance serves as the brain and nervous system for programs to prevent and control disease.”
DEFINITIONS OF SURVEILLANCE

A Dictionary of Epidemiology, 4th ed, 2001 (J.M. Last (ed))

“Systematic ongoing collection, collation, and analysis of data and the timely dissemination of information to those who need to know so that the action can be taken”

Source: World Health Organization
DEFINITIONS OF SURVEILLANCE

KEY ELEMENTS (Detels, 1989)

1. Collection of health data expressly for use in health planning, disease control/prevention, and/or health promotion
2. Ongoing collection of data
3. Timely analysis
4. Easily understood
5. Dissemination of results
6. Action based on results
7. Periodic evaluation of the system
USES OF SURVEILLANCE SYSTEMS (1)

- To monitor changes or trends in health factors:
  - Prevalence/ incidence of disease and/ or risk factors
  - Emerging diseases
  - Geographic distribution
  - Risk group distribution
USES OF SURVEILLANCE SYSTEMS (2)

- To detect outbreaks/early warning systems
  - Human disease
  - Zoonotic diseases
  - Food safety
  - Drug-resistant organisms (e.g., MDR-TB)
USES OF SURVEILLANCE SYSTEMS (3)

- To provide health information that can be used to design rational intervention programs
- To evaluate the effectiveness of intervention strategies (e.g., vaccines, health education/behavioral programs, legislation)
Major Types of Uses of Public Health Surveillance

- Recognize cases or clusters of cases that require interventions for preventing transmission or reducing morbidity and mortality
- Assess the impact of health events on public health or identify and track trends
- Establish the need for resources and interventions, and allocation of resources in planning
- Monitor interventions and prevention and control programs
- Identify populations or geographical areas at high risk for purposes of targeted interventions and analytic studies
- Develop hypotheses for studies of risk factors

SURVEILLANCE VS. SCREENING

**Surveillance**
- Data collection to measure magnitude, changes, and trends in populations
- The objective is intervention in defined populations

**Screening**
- Testing to identify individuals with infection or disease
- Objective is either:
  - Personal intervention
  - Protection of the public (e.g., blood donors)
- Measurement of prevalence in screened populations
REQUIREMENTS FOR SURVEILLANCE

- Diagnostic algorithm
- Staff members
- Sampling frame
- Access/network
- Competent laboratory
SURVEILLANCE SYSTEMS

SURVEILLANCE VS. FINDING THE RESERVOIR

- For surveillance, want a representative sample
- For finding the reservoir, want to find infected individuals
SURVEILLANCE SYSTEMS

DEFINING A CASE

- Establishing a functional case criteria
  - Quickly and easily defined

- Selecting the right test or definition
  - Easy, specific

- Clinical versus epidemiological diagnostic criteria
  - Function over precision

- Disease versus infection
  - AIDS and HIV infection
**TABLE. Surveillance case definition for human immunodeficiency virus (HIV) infection among adults and adolescents (aged ≥13 years) — United States, 2008**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Laboratory evidence*</th>
<th>Clinical evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Laboratory confirmation of HIV infection and CD4+ T-lymphocyte count of 500 cells/μL or CD4+ T-lymphocyte percentage of ≥29</td>
<td>None required (but no AIDS-defining condition)</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Laboratory confirmation of HIV infection and CD4+ T-lymphocyte count of 200–499 cells/μL or CD4+ T-lymphocyte percentage of 14–28</td>
<td>None required (but no AIDS-defining condition)</td>
</tr>
<tr>
<td>Stage 3 (AIDS)</td>
<td>Laboratory confirmation of HIV infection and CD4+ T-lymphocyte count of &lt;200 cells/μL or CD4+ T-lymphocyte percentage of &lt;14†</td>
<td>or documentation of an AIDS-defining condition (with laboratory confirmation of HIV infection)†</td>
</tr>
<tr>
<td>Stage unknown§</td>
<td>Laboratory confirmation of HIV infection and no information on CD4+ T-lymphocyte count or percentage</td>
<td>and no information on presence of AIDS-defining conditions</td>
</tr>
</tbody>
</table>

* The CD4+ T-lymphocyte percentage is the percentage of total lymphocytes. If the CD4+ T-lymphocyte count and percentage do not correspond to the same HIV infection stage, select the more severe stage.

† Documentation of an AIDS-defining condition (Appendix A) supersedes a CD4+ T-lymphocyte count of ≥200 cells/μL and a CD4+ T-lymphocyte percentage of total lymphocytes of ≥14. Definitive diagnostic methods for these conditions are available in Appendix C of the 1993 revised HIV classification system and the expanded AIDS case definition (CDC. 1993 Revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. MMWR 1992;41[No. RR-17]) and from the National Notifiable Diseases Surveillance System (available at http://www.cdc.gov/epo/dphsi/casedef/case_definitions.htm).

§ Although cases with no information on CD4+ T-lymphocyte count or percentage or on the presence of AIDS-defining conditions can be classified as stage unknown, every effort should be made to report CD4+ T-lymphocyte counts or percentages and the presence of AIDS-defining conditions at the time of diagnosis. Additional CD4+ T-lymphocyte counts or percentages and any identified AIDS-defining conditions can be reported as recommended. (Council of State and Territorial Epidemiologists. Laboratory reporting of clinical test results indicative of HIV infection: new standards for a new era of surveillance and prevention [Position Statement 04-ID-07]. 2004. Available at http://www.cste.org/ps/2004pdf/04-ID-07-final.pdf.)

### Table

**TABLE. Comparison of World Health Organization (WHO) and CDC stages of human immunodeficiency virus (HIV) infection,* by CD4+ T-lymphocyte count and percentage of total lymphocytes**

<table>
<thead>
<tr>
<th>WHO stage†</th>
<th>WHO T-lymphocyte count and percentage§</th>
<th>CDC stage‡</th>
<th>CDC T-lymphocyte count and percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1 (HIV infection)</td>
<td>CD4+ T-lymphocyte count of ≥500 cells/µL</td>
<td>Stage 1 (HIV infection)</td>
<td>CD4+ T-lymphocyte count of ≥500 cells/µL or CD4+ T-lymphocyte percentage of ≥29</td>
</tr>
<tr>
<td>Stage 2 (HIV infection)</td>
<td>CD4+ T-lymphocyte count of 350–499 cells/µL</td>
<td>Stage 2 (HIV infection)</td>
<td>CD4+ T-lymphocyte count of 200–499 cells/µL or CD4+ T-lymphocyte percentage of 14–28</td>
</tr>
<tr>
<td>Stage 3 (advanced HIV disease [AHD])</td>
<td>CD4+ T-lymphocyte count of 200–349 cells/µL</td>
<td>Stage 2 (HIV infection)</td>
<td>CD4+ T-lymphocyte count of 200–499 cells/µL or CD4+ T-lymphocyte percentage of 14–28</td>
</tr>
<tr>
<td>Stage 4 (acquired immunodeficiency syndrome [AIDS])</td>
<td>CD4+ T-lymphocyte count of &lt;200 cells/µL or CD4+ T-lymphocyte percentage of &lt;15</td>
<td>Stage 3 (AIDS)</td>
<td>CD4+ T-lymphocyte count of &lt;200 cells/µL or CD4+ T-lymphocyte percentage of &lt;14</td>
</tr>
</tbody>
</table>

* For reporting purposes only.
† Among adults and children aged ≥5 years.
§ Percentage applicable for stage 4 only.
‡ Among adults and adolescents (aged ≥13 years). CDC also includes a fourth stage, stage unknown: laboratory confirmation of HIV infection but no information on CD4+ T-lymphocyte count or percentage and no information on AIDS-defining conditions.

Appendix A

AIDS-Defining Conditions

- Bacterial infections, multiple or recurrent
- Candidiasis of bronchi, trachea, or lungs
- Candidiasis of esophagus
- Cervical cancer, invasive
- Coccidiodomycosis, disseminated or extrapulmonary
- Cryptococcosis, extrapulmonary
- Cryptosporidiosis, chronic intestinal (>1 month's duration)
- Cytomegalovirus disease (other than liver, spleen, or nodes), onset at age >1 month
- Cytomegalovirus retinitis (with loss of vision)
- Encephalopathy, HIV related
- Herpes simplex: chronic ulcers (>1 month's duration) or bronchitis, pneumonitis, or esophagitis (onset at age >1 month)
- Histoplasmosis, disseminated or extrapulmonary
- Isosporiasis, chronic intestinal (>1 month's duration)
- Kaposi sarcoma
- Lymphoid interstitial pneumonia or pulmonary lymphoid hyperplasia complex
- Lymphoma, Burkitt (or equivalent term)
- Lymphoma, immunoblastic (or equivalent term)
- Lymphoma, primary, of brain
- *Mycobacterium avium* complex or *Mycobacterium kansasii*, disseminated or extrapulmonary
- *Mycobacterium tuberculosis* of any site, pulmonary, disseminated, or extrapulmonary
- *Mycobacterium*, other species or unidentified species, disseminated or extrapulmonary
- *Pneumocystis jirovecii* pneumonia
- Pneumonia, recurrent
- Progressive multifocal leukoencephalopathy
- *Salmonella* septicemia, recurrent
- Toxoplasmosis of brain, onset at age >1 month
- Wasting syndrome attributed to HIV

* Only among children aged <13 years. (CDC. 1994 Revised classification system for human immunodeficiency virus infection in children less than 13 years of age. MMWR 1994;43[No. RR-12]).

† Condition that might be diagnosed presumptively.

§ Only among adults and adolescents aged ≥13 years. (CDC. 1993 Revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. MMWR 1993;42[No. RR-17]).
SURVEILLANCE SYSTEMS

SELECTING THE POPULATION

- Defining the selection criteria
  - Human populations
  - Zoonotic populations
- Gaining access to target populations
  - NGOs/support groups
- Obtaining and maintaining compliance
SURVEILLANCE SYSTEMS

SELECTING THE APPROPRIATE STRATEGY

- Need for cultural sensitivity
- Understanding the implications and limitations of different strategies
- Selecting the appropriate surveillance strategy
SURVEILLANCE SYSTEMS

OTHER CONSIDERATIONS

- Timely data processing
- Results and action
  - Interpretation
  - Facilitating appropriate action based on surveillance results
Surveillance Systems

Evaluation and Revisions

- Importance of ongoing evaluation
- Revising the surveillance program
  - When and why
  (e.g., Thailand 1993)
SURVEILLANCE SYSTEMS

SURVEILLANCE STUDY DESIGNS

- Cohort studies
- Cross-sectional studies/surveys
- Serial cross-sectional studies
- Mortality surveillance
- Sentinel surveillance
- Syndromic (early outbreak detection)
SURVEILLANCE SYSTEMS

ACTIVE VS. PASSIVE SURVEILLANCE

- Passive = reporting
  - Hospitals
  - Laboratories
  - Clinics
  - Physicians

- Active = searching
SURVEILLANCE SYSTEMS

TESTING STRATEGIES TO REDUCE SELECTION BIAS

- Unlinked anonymous
- Voluntary anonymous
- Voluntary confidential
- Routine confidential
- Mandatory
- Compulsory
SURVEILLANCE SYSTEMS

CONFIDENTIALITY

- Need
- Strategies
- Selection and training of personnel
SURVEILLANCE SYSTEMS
OPTIMAL VS. FEASIBLE

Recognizing what is optimal versus what is feasible for the specific culture
The Global Outbreak Alert and Response Network contributes towards global health security by:

- Combating the international spread of outbreaks
- Ensuring that appropriate technical assistance reaches affected states rapidly
- Contributing to long-term epidemic preparedness and capacity-building
SURVEILLANCE SYSTEMS

EVENT-BASED REPORTS

Global Public Health Intelligence Network: Websites, news wires, newspapers

Health Map Project: Mapping of outbreaks from reservoirs and monitoring of electronic sources; and Official alerts and surveillance reports

EpiSPIDER: Merging of relevant data from Health Map, the Data Disaster Alert Coordinator System and ProcMED mail

Regional (e.g., Mekong infectious disease reporting)
### TABLE I. Provisional cases of infrequently reported notifiable diseases (<1,000 cases reported during the preceding year) — United States, week ending January 4, 2014 (1st week)*

<table>
<thead>
<tr>
<th>Disease</th>
<th>Current week</th>
<th>Cum 2014</th>
<th>5-year weekly average †</th>
<th>Total cases reported for previous years</th>
<th>States reporting cases during current week (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthrax</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Arboviral diseases§,¶</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California serogroup virus disease</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>Eastern equine encephalitis virus disease</td>
<td>—</td>
<td>—</td>
<td>0</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Powassan virus disease</td>
<td>—</td>
<td>—</td>
<td>0</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>St. Louis encephalitis virus disease</td>
<td>—</td>
<td>—</td>
<td>0</td>
<td>—</td>
<td>3</td>
</tr>
<tr>
<td>Western equine encephalitis virus disease</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Botulism, total</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>131</td>
<td>168</td>
</tr>
<tr>
<td>foodborne</td>
<td>—</td>
<td>—</td>
<td>0</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>infant</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>115</td>
<td>123</td>
</tr>
<tr>
<td>other (wound and unspecified)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>93</td>
<td>114</td>
</tr>
<tr>
<td>Chancroid</td>
<td>—</td>
<td>—</td>
<td>0</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Condition</td>
<td>Year 1</td>
<td>Year 2</td>
<td>Year 3</td>
<td>Year 4</td>
<td>Year 5</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Cholera</td>
<td>2</td>
<td>17</td>
<td>40</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Cyclosporiasis§</td>
<td>2</td>
<td>663</td>
<td>123</td>
<td>151</td>
<td>179</td>
</tr>
<tr>
<td>Diphtheria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Haemophilus influenza</em>, <strong>invasive disease (age &lt;5 yrs):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>serotype b</td>
<td>1</td>
<td>19</td>
<td>30</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>nonserotype b</td>
<td>4</td>
<td>172</td>
<td>205</td>
<td>145</td>
<td>200</td>
</tr>
<tr>
<td>unknown serotype</td>
<td>3</td>
<td>213</td>
<td>210</td>
<td>226</td>
<td>223</td>
</tr>
<tr>
<td>Hansen disease§</td>
<td>2</td>
<td>52</td>
<td>82</td>
<td>82</td>
<td>98</td>
</tr>
<tr>
<td>Hantavirus pulmonary syndrome§</td>
<td>0</td>
<td>12</td>
<td>30</td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>Hemolytic uremic syndrome, postdiarrheal§</td>
<td>5</td>
<td>229</td>
<td>274</td>
<td>290</td>
<td>266</td>
</tr>
<tr>
<td>Hepatitis B, virus infection perinatal</td>
<td>2</td>
<td>46</td>
<td>40</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Influenza-associated pediatric mortality§, ++</td>
<td>3</td>
<td>164</td>
<td>52</td>
<td>118</td>
<td>61</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>0</td>
<td>NN</td>
<td>NN</td>
<td>NN</td>
<td>NN</td>
</tr>
<tr>
<td>Listeriosis</td>
<td>15</td>
<td>647</td>
<td>727</td>
<td>870</td>
<td>821</td>
</tr>
<tr>
<td>Measles§§</td>
<td>1</td>
<td>184</td>
<td>55</td>
<td>220</td>
<td>63</td>
</tr>
<tr>
<td>Meningococcal disease, invasive††</td>
<td>6</td>
<td>115</td>
<td>161</td>
<td>257</td>
<td>280</td>
</tr>
<tr>
<td>A, C, Y, and W-135</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SENTINEL
SURVEILLANCE
SURVEILLANCE SYSTEMS

SENTINEL GROUPS (HIV)

- Homosexual/bisexual
- Commercial sex workers
- Returning overseas workers
- Intravenous drug users
- Males at STD clinics
- Other groups
SURVEILLANCE SYSTEMS

CRITERIA FOR SELECTION OF SENTINEL SITES

- Previous reports of high prevalence
- Exposure to high-risk individuals
- Suspected concentration of high-risk groups
- Susceptible/vulnerable groups
THE MAJOR PRODUCTS OF A SENTINEL SURVEILLANCE PROGRAM

- The identity and location of the core transmitters (reservoirs) of HIV
- Trends of prevalence in risk groups, the surrogates of the general population and geographic areas (spread)
- Trends in incidence (e.g., estimated from prevalence in the youngest age groups; i.e., those who have the shortest cumulative exposure interval, or laboratory strategies - detuned ELISA)
THE MAJOR PRODUCTS OF A SENTINEL SURVEILLANCE PROGRAM (continued)

- Estimates that can be used for "advocacy" messages to recruit support and educate the public
- Estimates of the number, location and characteristics of HIV-infected and AIDS cases that can be used to anticipate future needs to cope with the epidemic
1. Early warning of HIV epidemic
   - HIV prevalence in high-risk groups

2. Identification of size and scope of HIV epidemic
   - HIV prevalence in high- and low-risk groups, by time and geographic region

3. Short-term evaluation of HIV/AIDS control efforts
   - Change in EFFECT variables (i.e., risk factors) in high- and low-risk groups

4. Long-term evaluation of HIV/AIDS control efforts
   - HIV prevalence in high- and low-risk groups

5. Stimulate political and social action
1. Early warning of HIV epidemic

- HIV incidence/prevalence in high-risk groups

Presence of HIV infection in high-risk groups warns local people that unless control measures are taken, HIV infection will soon spread throughout the general community.
2. Identification of size and scope of HIV epidemic

- HIV prevalence in high- and low-risk groups, by time and geographic region

Once the magnitude of the HIV epidemic is recognized, political leaders will be able to unite the people in their efforts to control the disease.
3. Short-term evaluation of HIV/AIDS control efforts

- Change in prevalence
- Change in EFFECT variables (i.e., risk factors) in high- and low-risk groups

After the HIV control program is underway, the surveillance system is used to measure changes in factors leading to infection
4. Long-term evaluation of HIV/ AIDS control efforts

- HIV incidence in high- and low-risk groups

After many years, the surveillance system will be able to evaluate if control programs have reduced the size and scope of the HIV epidemic.
5. Stimulate political and social action

Information on HIV puts pressure on political system to provide additional resources for stimulating action in the community.
EVALUATION OF A SURVEILLANCE SYSTEM

- Sensitivity
- Timeliness
- Representativeness
- Predictive value positive
- Acceptability
- Flexibility
- Simplicity
- Cost/benefit
- Dissemination of results
- Appropriate action taken
EVALUATION OF A SURVEILLANCE SYSTEM

SENSITIVITY

- What proportion of “cases” are identified?
- Does the system give an accurate picture of trends and magnitudes?
EVALUATION OF A SURVEILLANCE SYSTEM

TIMELINESS

- Is information disseminated rapidly enough to permit timely action based on the surveillance system?
EVALUATION OF A SURVEILLANCE SYSTEM

REPRESENTATIVENESS

Do reported cases differ from unreported cases?
EVALUATION OF A SURVEILLANCE SYSTEM

PREDICTIVE VALUE POSITIVE

What proportion of those identified actually have the disease or factor?
EVALUATION OF A SURVEILLANCE SYSTEM

ACCEPTABILITY

- Does the system stimulate the cooperation of respondents?
- Does the process discourage participation?
EVALUATION OF A SURVEILLANCE SYSTEM

FLEXIBILITY

Can changes be easily made in the system to reflect changes in trends, magnitude, and other relevant factors?
EVALUATION OF A SURVEILLANCE SYSTEM

SIMPLICITY

Can the system be simplified and still obtain the necessary information?
EVALUATION OF A SURVEILLANCE SYSTEM

COST/ BENEFIT

- Is the system worth the cost?
- Can costs be reduced without sacrificing the essential quality of the system (e.g., each 12 vs each 6 months)?
EVALUATION OF A SURVEILLANCE SYSTEM

DISSEMINATION OF RESULTS

- To decision-makers
- To data collectors
- To the general public
EVALUATION OF A SURVEILLANCE SYSTEM

APPROPRIATE ACTION TAKEN

- Are appropriate actions taken in response to the surveillance data?
- Does surveillance lead to effective intervention?
BEHAVIORAL SURVEILLANCE
OBJECTIVE

TO DETECT CHANGES IN RISK BEHAVIORS OF A POPULATION

- Measure increasing/decreasing risk
- Evaluate effectiveness of intervention efforts
Likelihood of spread of infection is related to prevalence of high-risk behavior; e.g., number and frequency of different sexual partners or needle sharing partners.

Changing trends in risk behavior predict changes in spread of infection.
BASELINE SURVEY

- Necessary to establish current levels and need for surveillance
- Provide baseline in order to establish future changes
### Sentinel Groups

<table>
<thead>
<tr>
<th>Suspected core transmitting groups</th>
<th>General population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sex workers</td>
<td>1. Proxies</td>
</tr>
<tr>
<td>2. Clients of sex workers</td>
<td>a. military draftees</td>
</tr>
<tr>
<td>3. Injecting drug users</td>
<td>b. antenatal clinic</td>
</tr>
<tr>
<td>4. Men who have sex with other men</td>
<td>attendees</td>
</tr>
<tr>
<td>5. Others specific to population and culture</td>
<td>c. blood donors</td>
</tr>
<tr>
<td></td>
<td>d. civil servants</td>
</tr>
<tr>
<td></td>
<td>2. Probability samples of general population</td>
</tr>
</tbody>
</table>
SENTI NEL SITES

- Select for representativeness
- Advisable to include multiple sites
DATA COLLECTION

INFORMATION

- Frequency of different sexual partners
- Specific activities in which engaged
- Use of condoms
- Injecting behavior and sharing practices
- Other exposures
- Use of antiretrovirals
DATA COLLECTION

COLLECTION PROCEDURES

Limit information collected to key indicators
NEED TO ASSURE COMPLIANCE

- Must guarantee confidentiality or anonymity
- Participant must trust the confidentiality/anonymity
- Need for sensitive, trained interviewers
- Strategies to assure anonymity
  - CD player and ear phones
  - Computer-administered “ACASI”
  - Palm pilot
  - Self-administered
  - Cell phone
METHODOLOGY

- Serial cross-sectional surveys
- Survey interval
  - Allow sufficient time for change to occur
  - Interval differs for different sentinel groups; e.g. shorter for high-risk groups, longer for general population
SAMPLE SIZE DETERMINATION

- Suspected level of change
- Desired level of power and confidence limits
- Feasibility
- Resources available
Change in frequency of risk activities

- Number of different partners
- Use of condoms
- Specific risk behaviors

Consistency of trends
DI SSEMI NATI ON

- Decision-makers
- Staff (motivation)
- Public