Rationale

• To meet changing needs of society and the public health communities.

• To understand & response to those needs, an organized approach to planning, developing, implementing, & maintaining surveillance systems is necessary.

• To obtain information for action.

Steps in Planning

• Establish objectives
• Develop case definitions
• Develop data collection system
• Develop data collection instruments
• Develop and test analytic approach
• Filed test methods
• Determine dissemination mechanism and ensure access at different levels
• Determine evaluation methods
Establishing Objectives

- What do you need to know?
- Criteria for determining high-priority
- **Quantitative and qualitative approach:**
  - frequency: incidence, prevalence, mortality, YPLL
  - severity: case-fatality ratio, hosp. rate, disability rate
- Direct and indirect costs
- Preventability
- Communicability
- Public interest
- Emerging issue
- Criteria based on consensus process
- Other programmatic considerations
- Impact, effectiveness, political, evaluate control/prevention measures

Developing Case Definitions

- Purpose: determine what is to be reported for uniformity of procedures, comparability
- Elements of a clear case definition:
  - Clinical and laboratory diagnosis (if relevant)
  - Epidemiologic criteria: person, time, place; contacts
  - Categories: confirmed, suspected, possible.
  - High sensitivity and specificity
- Factors influencing changes
  - Better understanding of the disease
  - Different criteria for diagnosis (DM, HIV)

Data collection systems

- Passive data collection systems
  - Most routine notifiable-disease s.s. are passive
  - Health care providers report
  - Limited by variability and incompleteness
  - Provide data that portrays trends
- Active data collection systems
  - Conditions of particular importance
  - Regular outreach to potential reporters to stimulate r.
  - Due to limited resource is often used for brief period for discrete purposes (measles elimination efforts, TB)
- Sentinel surveillance systems (limited #s & rep.)
Data collection instruments

- Standardization:
  - Use recognized computerized formats for each element
  - Instrument should facilitate analysis and comparison with data collected in other systems
  - Census
  - Other surveillance data
- Ability to link:
  - Additional assurances of confidentiality and privacy considerations are required.
  - Limit data to only those data needed

Field Testing

- Purpose of field testing:
  - Facilitate implementation of feasible systems
  - Avoid making changes after systems are implemented
  - Demonstrate how readily the information can be obtained and transferred
  - Detect difficulties in data collection
  - Detect difficulties in content of specific questions
  - Identify problems with the information collected
  - Facilitate examination and comparison
  - Identify methods suitable for other conditions

Data analysis, Interpreting and disseminating

- Data analysis: intended/anticipated uses
- Analysis may be simple (review all cases of a rare disease) or complex (data for county, state or national level).
- Interpretation: presented in a compelling manner to facilitate use, data according to context (trends over time/comparison other data)
- Dissemination:
  - Routine, public access (consistent w/privacy constraints)
  - Tailored for decision makers
  - Clear, simple tables, graphs (nontechnical can understand)
  - Use media to amplify messages to broader populations
Surveillance Systems
Evaluating a Surveillance System

Purpose of evaluation

• Determine whether purposes have been met
• Whether system generated data needed to provide answers to problems
• Determine if information was timely
• Determine usefulness for researchers, PHW
• Determine if development of systems was worth effort
• Determine if participants wish to continue
• Determine ways to enhance attributes of system

Attributes of a surveillance system

• Useful surveillance system has ATTRIBUTES that should be periodically evaluated:
  • Simplicity
  • Flexibility
  • Acceptability
  • Timeliness
  • Sensitivity
  • Positive Predictive Value
  • Representativeness
  • Cost
Attributes of a surveillance system

• Simplicity:
  • It refers to both structure and ease of operation of systems.
  • Systems are often too complex (too much data gathered, too much time, too many resources, etc)
  • Or well organized, uniform systems but there is a lack of computers or lack of statistical analysis of data

• Flexibility:
  • Describes the extent to which the system can adapt to changing information needs or operating conditions with little additional cost in time, personnel or allocated funds.

• Acceptability:
  • Reflects the willingness of individuals and organizations to participate in the Surveillance System.

• Timeliness:
  • Can be evaluated in terms of availability of information for immediate disease control efforts or for long-term planning.

• Sensitivity:
  • Refers to a system’s ability to account for all incidents of a condition that occur. It is the ratio of the total number of cases detected by a system over total determined by gold standard.

• Positive predictive value:
  • The likelihood that a case report of a disease does, in fact, constitute a true case of that disease (ratio of all true cases from gold standard over total identified by the system.)

• NOTE: When there is a lack of codification of case definition and a lack of ‘gold standards’ for diagnosis, the evaluation of the sensitivity and PPV.

• Representativeness:
  • Accurately describes the occurrence of health event and the distribution of it in the population by place and person. Where completeness of reporting is high data tend to be representative (measles in US)

• Cost. To meet goals within the budget allocated:
  • SS should be minimized w/ respect to number of diseases reported, frequency of reporting .

• Costs are judged relative to benefits
Recommendations

- Data collection:
  - Limit the number of reportable diseases
  - Simplify reporting procedures and forms
  - Develop standardized case definitions
  - Computerize data
- Data analysis and reporting:
  - Use analytic statistical methods
  - Consider the effectiveness and cost-effectiveness of current practices
  - Improve feedback to reporting sources

Surveillance Systems
Historical Development of Public Health Surveillance and its future.

History of surveillance before and during the Middle Ages

- Hypocrites’ ideas laid foundation for surveillance
- Idea of observing and recording facts, analyzing, reasoning.
- Bubonic plague - 1st real PH action resulting from surv.: ships
- Evolution of current concepts of PH surveillance
- Evolved from PH act. To control and prev. disease
- In late middle ages, governments in Western Europe assumed responsibilities for both: health prot. and care
- Rudimentary system of monitoring illness led to regulations against polluting streets and public water, instructions for burial and food handling, provision of some types of health care.
History of surveillance in the 17th century

- Semblance of organized health care systems in a stable government (1st. In Roman empire).
- Sydenham worked classification system for disease
- Measurement methods developed in 17th century
- Von Leibnitz (1680): numerical analysis in mortality statistics.
- John Graunt (late 17th century) published Natural and Political Obs. Made Upon the Bills of Mortality and developed fundamental principles (disease-specific death counts, death rates, concept of disease patterns).

History of surveillance in the 18th century

- Development of concepts of PH surveillance
- Achenwall (1740's-50's) introduced term statistics
- US development: Rhode Island passed an act requiring tavern keepers to report contagious disease among patrons (1741). In 1743 passed a broader law: smallpox, yellow fever, cholera.
- Johann P. Frank (1766) developed system of police medicine in Germany (covering school health, injury prevention, maternal and child health, public water and sewage delineating gov. measures to protect PH)

History of surveillance in the 19th century

- William Farr (1807-1883):
  - Registrar General' office of England and Wales
  - Collected Vital Statistics
  - Provided vital statistics data to J. Snow (cholera)
  - Thurnam (1845):
  - Published mental health statistics. (London)
- Semmelweis (1833-1840):
  - Hospital data puerperal fever
  - Instituted hand washing
  - Maintained a surveillance to prove effectiveness
History of surveillance in the 19th century

- **Lemuel Shattuck (1850):** Massachusetts Sanitary Commission in a publication, related death, infant and maternal mortality and communicable diseases to living conditions, recommending:
  - Decennial census
  - Standardization of nomenclature of causes of disease & death
  - Collection of health data by age, gender, occup, SES, locality.
  - Events in reporting
  - National disease monitoring (US 1850, mortality st. & census)
  - Systematic reporting of disease in US 1874 (weekly voluntary)
  - Collection of morbidity data (Congress: forerunner PHS 1878 & data used in quarantine meas.: cholera, smallpox, p & y.f.)
  - Compulsory reporting on inf. D.: Italy 1881, GB 1890, US 1893

History of surveillance in the 20th century US

- Required communication of selected d. (1901)
- PHS epidemiologist started weekly report (1914)
- All states participating national morbidity r. (1925)
- First National Health Survey of US citizens (1935)
- National Office of Health Statistics resp. (1948)
- NOHS: began publishing weekly statistics (1949)
- Added mortality (1952) and called MMWR
- Functions transferred to Comm.Dis.Center (1961)
- Continue evolution of MMWR and PHS directed by events: polio, influenza, salmonella after epid.

History of surveillance in the 20th century

- Authority to required notification:
  - Resides in respective state legislatures:
  - What conditions and diseases are reported
  - Time frames for reporting
  - Agencies to receive reports
  - Amount of information reported
  - Council of State and Territorial Epidemiologist
  - Authorized in 1951, meets annually, collaborates with CDC in changes, including diseases reported in MMWR, develop reporting procedures.
History of surveillance in the 20th century

- Role of the Centers for Disease Control & Prev.
- Support the states
  - Collect, collate, analyze, and report data
  - Prepare & distribute regular comprehensive reports
  - Prepare and distribute special reports as data are available
  - Provide computer services
  - Provide training in all aspects of public health surveillance
  - Suggest changes to be considered in PHS activities
  - Report to the WHO as required and appropriate

Overview of the future of PH surveillance

- Contributing factors to future of PHS
  - Role of computer:
    - National Electronic Telecommunications System for Surveillance (NETSS) links all state health departments to report.
  - Increasingly more sophisticated statistical analysis
  - Increased used of electronic media for dissemination of data

Overview of the future of PH surveillance (cont.)

- Increased applications of surveillance concepts to new areas of PH practice:
  - chronic diseases,
  - environmental and occupational, and
  - injury control.
- Increased used of surveillance by policymakers
  - Decentralization allowing access to and use of data at all levels including communities, counties, states, etc.