

Introduction to Public Health

**Public Health Basics and
Epidemiology**

Core Functions of Public Health

- **Assessment**
- **Policy Development**
- **Assurance**

- **10 Essential Services comprise these Core Functions**

Core Function: Assessment

- **Essential Services**
- **Assess community health needs**
- **Investigate health hazards and effects**
- **Analyze health factors**

Core Function: Policy Development

- **Essential Services**
- **Advocate for community needs and issues**
- **Prioritize health needs**
- **Plan and develop policies**

Core Function: Assurance

- **Essential Services**
- **Manage resources**
- **Implement programs**
- **Evaluate programs**
- **Inform the public**

Public Health and Bioterrorism

- **Preparedness and prevention**
- **Detection and surveillance**
- **Diagnosis and characterization of agents**
- **Response**
- **Communication**

Public Health and Bioterrorism

- **Preparedness and prevention**
 - Coordinated preparedness plans
 - Coordinated response protocols
 - Performance standards
 - self-assessment, simulations, exercises

Public Health and Bioterrorism

- **Detection and surveillance**
 - Develop mechanisms for detecting, evaluating, and reporting suspicious events
 - Integrate surveillance for illness and injury resulting from WMD terrorism into disease surveillance system

Public Health and Bioterrorism

- **Diagnosis and characterization of agents**
 - **Multilevel laboratory response network**
 - link clinical labs and public health agencies in all states, districts, territories, and selected cities and counties to CDC and other labs
 - **Transfer diagnostic technology from federal to state level**
 - **CDC Rapid Response and Technology Lab**

Public Health and Bioterrorism

- **Response**
 - **Epidemiologic investigation**
 - if requested by state health agency, CDC will deploy response teams to investigate unexplained or suspicious illness
 - **Medical treatment and prophylaxis**
 - vaccine / antibiotic stockpile and transportation
 - **Environmental decontamination**

Public Health and Bioterrorism

- **Communication**
 - **Effective communication with the public**
 - use news media to limit panic and disruption of daily life
 - **Effective communication with health care and public health personnel**
 - coordination of activities
 - access emergency information
 - rapid notification and information exchange

Public Health and Bioterrorism

- **Effective planning and response to a biological terrorist incident will require collaboration with federal, state, and local groups and agencies including:**

-public health organizations	-emergency response units and organizations
-medical research centers	-safety and medical equipment manufacturers
-health-care providers and their networks	-offices of emergency management
-professional societies	-other federal agencies
-medical examiners	

Why Public Health?

- **CHEMICAL**
 - effects immediate and obvious
 - victims localized by time and place
 - overt
 - illicit immediate response
 - first responders are police, fire, EMS
- **BIOLOGICAL**
 - effects delayed and not obvious
 - victims dispersed in time and place
 - no first responders
 - unless announced, attack identified by medical and public health personnel

Why Public Health?

- **Tokyo subway 1995 / Sarin**
 - Effects within minutes
 - Victims self-reported to authorities, self-transported to hospitals
 - First responders
 - fire, police, EMS
 - Agent identified: 3 hrs
 - Event over: 12-24 hrs

Why Public Health?

- **Oregon USA 1984 / Salmonella**
 - **County Health Department**
 - first reports of foodborne illness: several days
 - two waves of illness over 5 weeks
 - **County Health Department and CDC**
 - 751 victims and 10 restaurants identified: weeks - months
 - **Criminal investigation**
 - source identified: 12 months
 - criminal charges: 18 months

Initial Conclusions

- **Preparation for a biological mass disaster requires coordination of diverse groups of medical and non-medical personnel**
- **Preparation can not occur without support and participation by all levels of government**
- **Preparation must be a sustained and evolutionary process**

What is Epidemiology?

- **“Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.” - CDC**

What is Epidemiology?

- **Science of Public Health that studies:**
 - Distribution of disease
 - Determinants of health/disease
 - Specific populations
- **Look for patterns of disease**
 - Time, place, personal characteristics
- **Interventions**
 - Prevention is key

What does Epidemiology study?

- **Just about anything**
- **Health-related**
- **Infectious disease**
- **Chronic disease**

How is Epidemiology Used?

- **Population/community health assessment**
- **Personal decision-making**
- **Complete clinical picture**
- **Evaluate interventions**
- **Search for cause**
 - **Exposure and relationship to disease**
 - **Outbreak investigation**

Epidemiologic Information

- **Case definition**
- **Person**
- **Place**
- **Time**

Case Definition

- **Standard set of criteria**
- **Clinical and lab**
- **Allows for comparison**
- **Sensitive vs. Specific**

Case Definition Gradient



Case Definition

- **Smallpox**
 - **Clinical Description**
 - An illness with acute onset of fever $>101^{\circ}\text{F}$ followed by a rash characterized by vesicles or firm pustules in the same stage of development without other apparent cause
 - **Laboratory Criteria for Confirmation**
 - Isolation of smallpox (variola) virus from a clinical specimen, or
 - Polymerase chain reaction (PCR) identification of variola DNA in a clinical specimen, or
 - Negative stain electron microscopy (EM) identification of variola virus in a clinical specimen (Level D laboratory or approved Level C laboratory)

Example: Suspected Case of Smallpox

- A case that meets the clinical case definition but is not laboratory confirmed and does not have an epidemiological link to a confirmed or probable case of smallpox, **OR** a case that has an atypical presentation that is not laboratory confirmed but has an epidemiological link to a confirmed or probable case of smallpox
- Atypical presentations of smallpox include (a) hemorrhagic lesions **OR** (b) flat, velvety lesions not appearing as typical vesicles nor progressing to pustules.

Probable Case of Smallpox

- A case that meets the clinical case definition that is not laboratory confirmed but has an epidemiological link to another confirmed or probable case.

Confirmed Case of Smallpox

- **A case of smallpox that is confirmed through laboratory testing**

Working Case Definition

- **Smallpox Outbreak**
 - **Anyone who meets original case definition**
 - **Anyone with fever (>101 °F) or rash who was in a confirmed exposed area during the BT event or came in contact with a confirmed or probable case should be considered a case**

Person

- **Age**
- **Sex**
- **Race/Ethnicity**
- **Socio-Economic Status**
- **Behaviors**

Place

- **Geographic Distribution**
 - **Natural**
 - **Clustering vs. uniform**
- **Home**
- **Work**
- **School**
- **Hospital room**

Time

- **Onset of symptoms**
- **Incubation Period**
- **Infectious Period**
- **Seasonality**
- **Baseline vs. epidemic**
- **Interval**
 - Long-term trends
 - Shorter for environmental exposure

Incidence

- **Number of new events occurring in a defined population during a specified period of time**
- **Used to measure current disease activity**
- **Allows comparison between areas with different populations**

Contrasts with Prevalence

- **Prevalence is the number of new and existing cases divided by the total population (can be during a period of time or at a given point)**
- **Prevalence =**
 - **(New cases + existing cases)/Total population**
- **Can be expressed as a percent**
- **Can give a picture of disease burden within a population**

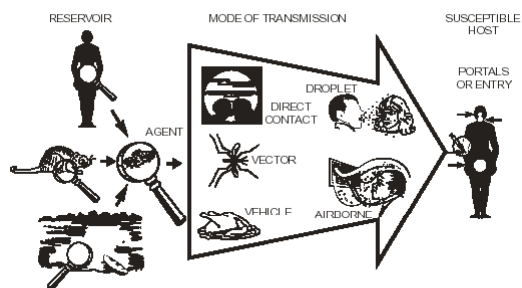
Information for any outbreak

- **Symptom onset date**
- **Symptoms present and agent if known**
- **Suspected exposure date if known**
- **Residence**
- **Age**
- **Gender**
- **Laboratory testing**
- **Outbreak Case Definition**
- **Organized case information in a line list**

Exposure

- Possible Cause of illness
- Know your agent/disease
 - Clinical picture
 - Pathogenesis
 - Mode of transmission
 - Natural Reservoir
 - Common Vehicle or Vector

Chain of Infection



Transmission

- **Direct**
 - Contact
 - Droplet
- **Indirect**
 - Airborne
 - Vehicle
 - Vector
 - Mechanical vs. biologic
- **Portal of Exit**
- **Portal of Entry**

Types of Outbreaks

- **Propagated**
 - Indicative of person to person transmission
- **Point-source**
 - Indicative of a common exposure to a contaminated vehicle or reservoir

Public Health Surveillance

- **Ongoing, systematic collection, analysis, and interpretation of health-related data and dissemination for use in the planning, implementation, and evaluation of public health practice**

Uses of Public Health Surveillance

- **Estimate magnitude of the problem**
- **Portray the natural history of a disease**
- **Determine distribution and spread of illness**
- **Detect outbreaks**
- **Generate hypotheses, stimulate research**
- **Evaluate control measures**
- **Monitor changes in infectious agents**
- **Detect changes in health practices**
- **Facilitate planning**

Surveillance for Outbreak Detection

- **Convergence of technology, volumes of electronic data, and new priority for early detection**
- **Increase timeliness and completeness of routine data**
- **Capture nontraditional data that signify a condition before a diagnosis is made**
- **Analytic methods to detect smaller signals**

Surveillance for Outbreak Detection: Experience

- **Laboratory specificity to detect clusters**
- **Sentinel systems with resources to monitor and investigate**
- **Syndrome surveillance where outbreaks are substantial and predictable**
- **Case reports trigger outbreak investigation**

Surveillance for Outbreak Detection: Exploration

- **Enhanced reporting from clinical sites (ED, EMS, 911, offices)**
- **Health care transaction warehouses (pharmacy, patient encounters, lab orders)**
- **Novel data sources (retail sales, veterinary encounters, environmental indicators, absenteeism)**
- **Signal detection methods**

Surveillance for Outbreak Detection: Reality

- **Human “technology” is key**
 - **Single case detection depends on clinical acumen and reporting relationships**
 - **Epidemiologic judgment in evaluating volumes of data**
 - **Follow-up of system signals**
- **Tolerance for false alarms will vary**

Surveillance Research Needs

- **Achieving the National Electronic Disease Surveillance System (NEDSS) architecture**
- **Data fusion (linkage)**
- **New data sources**
- **Case definitions (automation/validation)**
- **Geographic Information System (GIS) indices**
- **Forecasting**
- **Evaluation and quality control**

Public Health Surveillance

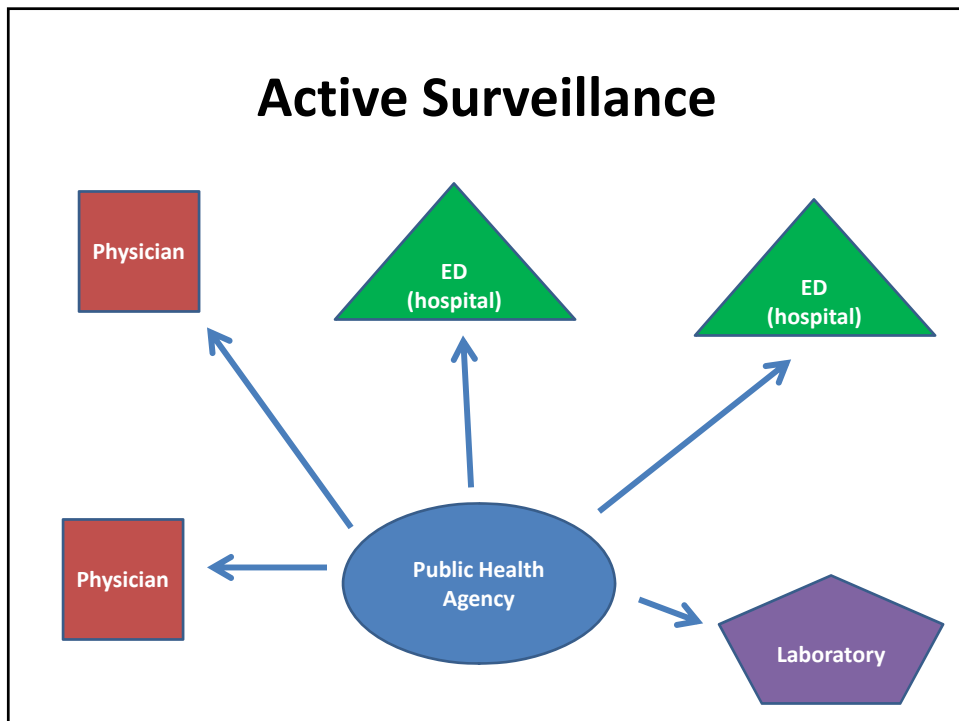
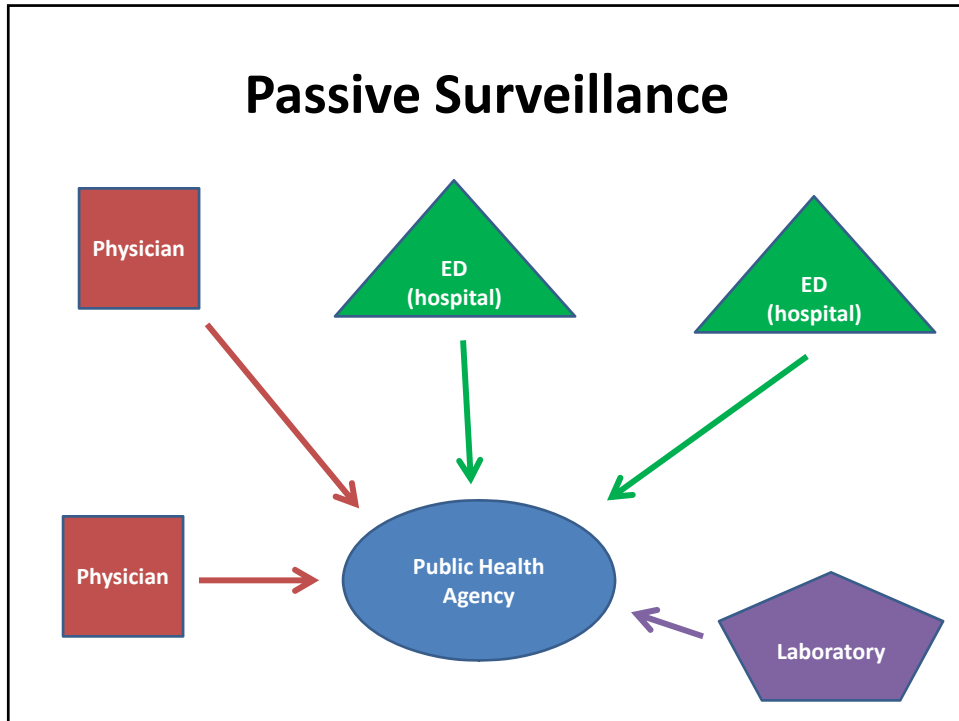
- **An ongoing, systematic process of:**
 - **Information collection**
 - **Data analysis**
 - **Interpretation**
 - **Feedback and dissemination**
 - **Linkage to public health practice**

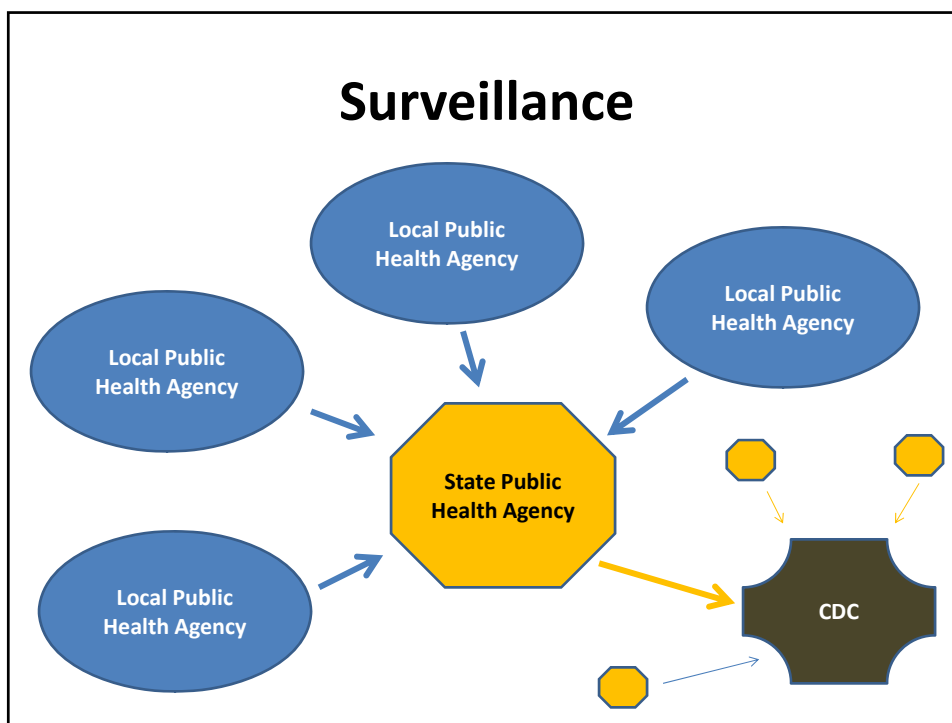
Public Health Surveillance: Data Sources and Approaches

- **Notifiable diseases**
- **Sentinel surveillance**
- **Syndromic surveillance**
- **Laboratory-based surveillance**
- **Active vs. passive**

Notifiable Diseases

- **A notifiable disease is one for which regular, frequent, and timely information regarding individual cases is considered necessary for the prevention and control of the disease**





Public Health Surveillance: Data Sources and Approaches

- National or regional surveys
- Vital records, hospital discharge data
- Disease registries
- Administrative/medical records data systems

Syndromic Surveillance

- **Syndromic surveillance began in 1999 in King County**
- **Traditional Public Health surveillance depends on labs and doctors reporting confirmed diseases (usually laboratory confirmed)**
- **Syndromic surveillance identifies disease syndromes prior to confirmation**
- **Goal is to identify an increase in disease syndromes, not confirmed case reports**

RODS – Syndromic Surveillance

- **Real-time Outbreak and Disease Surveillance (RODS)**
- **Computer-based biosurveillance**
- **Monitors**
 - ED visits
 - Retail stores
 - EMS calls
 - Other

Public Health Surveillance Purposes

- **Assess public health status**
- **Define public health priorities**
- **Evaluate programs**
- **Stimulate research**

Uses of Public Health Surveillance

- **Estimate magnitude of the problem**
- **Determine geographic distributions**
- **Portray the natural history of a disease**
- **Detect epidemics/define a problem**
- **Generate hypotheses, stimulate research**
- **Evaluate control measures**
- **Monitor changes in infectious agents**
- **Detect changes in health practices**
- **Facilitate planning**

Outstanding Issues

- **Existing local, regional, and national surveillance systems**
 - Adequate to detect traditional agents
 - Inadequate to detect potential biowarfare agents
- **Specific training for health care professionals**
 - clinical personnel will be “first responders”