Public Health Surveillance and Outbreak Investigation

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Additional Resources

Evolve Website
http://evolve.elsevier.com/Stanhope

- Healthy People 2010 website link
- WebLinks of special note, see the link for these sites:
  — National Notifiable Disease Surveillance System
  — Enhanced Surveillance Project

Objectives

After reading this chapter, the student should be able to do the following:

1. Define public health surveillance.
2. Analyze types of surveillance systems.
3. Identify steps in planning, analyzing, interviewing, and evaluating surveillance.
4. Recognize sources of data used when investigating a disease/condition outbreak.
5. Relate role of the nurse in surveillance and outbreak investigation to the national core competencies for public health nurses.

Key Terms

- algorithms, p. 482
- biological terrorism, p. 481
- BioNet, p. 487
- case definition, p. 483
- chemical terrorism, p. 481
- clusters of illness, p. 480
- common source, p. 488
- disease surveillance, p. 480
- Enhanced Surveillance Project (ESP), p. 487
- endemic, p. 488
- epidemic, p. 488
- event—environmental, occupational exposures, natural, or person induced, p. 480
- holoendemic, p. 488
- hyperendemic, p. 488
- infectivity, p. 489
- intermittent or continuous source, p. 488
- Laboratory Response Network (LRN), p. 487
- mixed outbreak, p. 488
- National Notifiable Disease Surveillance System (NNDSS), p. 486
- outbreak, p. 488
- outbreak detection, p. 488
Disease surveillance has been a part of public health protection since the 1200s during the investigations of the bubonic plague in Europe. During the 1600s John Grant developed the fundamental principles of public health including surveillance and outbreak investigation, and in the 1700s Rhode Island passed the first public health laws to provide for the protection of health and care of the population of the state. In the eighteenth century, Farr introduced the modern version of surveillance and along with the United States, Italy, and Great Britain began required reporting systems for infectious diseases. By 1925 the United States began national reporting of morbidity causes. By 1935 the first national health survey had been conducted, and in 1949 the National Office of Vital Statistics published weekly mortality and morbidity statistics in the Journal of Public Health Reports. This activity was later transferred to the Centers for Disease Control and Prevention, who began publishing the Morbidity and Mortality Weekly Report in 1961. Laws, regulations, reporting mechanisms, and data collections are all essential to surveillance and disease outbreak investigations.

The Constitution of the United States provides for "police powers" necessary to preserve health safety as well as other events (see Chapter 8). These powers include public health surveillance. State and local "police powers" also provide for surveillance activities. Health departments usually have legal authority to investigate unusual clusters of illness as well (USDHHS, 2001).

DISEASE SURVEILLANCE

Definitions and Importance

Disease surveillance is "the ongoing systematic collection, analysis, interpretation and dissemination of specific health data for use in public health" (Teutsch and Churchill, 2000). Surveillance provides a means for nurses to monitor disease trends in order to reduce morbidity and mortality and to improve health (Ching, 2002).

Surveillance is a critical role function for nurses practicing in the community. A comprehensive understanding and knowledge of the surveillance systems and how they work will help nurses improve the quality and the usefulness of the data collected for making decisions about needed community services, community actions, and public health programming (Box 21-1).

Surveillance is important because it generates knowledge of a disease or event outbreak patterns (including...
timing, geographic distribution, susceptible populations). The knowledge can be used to intervene to reduce risk or prevent an occurrence at the most appropriate points in time and in the most effective ways. Surveillance is built on understanding of epidemiologic principles of agent, host, and environmental relationships and on the natural history of disease or conditions (see Chapter 11). Surveillance systems make it possible to engage in effective continuous quality improvement activities within organizations and to improve quality of care (Veennema, 2003).

Surveillance focuses on the collection of process and outcome data. Process data focus on what is done, i.e., services provided or protocols for health care. Outcome data focus on changes in health status. The activities generated by analyses of these data aim to improve public health response systems. An example of process data is collection of data about the proportion of the eligible population vaccinated against influenza in any one year. Outcome data in this case are the incidence rates (new cases) of influenza among the same population in the same year.

Although surveillance was initially devoted to monitoring and reducing the spread of infectious diseases, it is now used to monitor and reduce chronic diseases and injuries, and “environmental and occupational exposures” (Ching, 2002) as well as personal health behaviors. Surveillance systems help nurses and other professionals monitor emerging infections, and bioterrorist outbreaks (Pryor and Veennema, 2003). Bioterrorism is one example of an event creating a critical public health concern that involves environmental exposures that must be monitored. This event also requires serious planning in order to be able to respond quickly and effectively. Biological terrorism is defined as “an intentional release of viruses, bacteria, or their toxins for the purpose of harming or killing . . . citizens” (CDC, 2001a). Chemical terrorism is the intentional release of hazardous chemicals into the environment for the purpose of harming or killing (CDC, 2001a). In the event of a bioterrorist attack, imagine how difficult it would be to control the spread of biological agents such as botulism or anthrax or chemical agents such as sarin or ricin if no data were available about these agents, their resulting diseases or symptoms, and their usual incidence (new cases) patterns in the community. (See Box 21-1 for a summary of the features of surveillance.)

## BOX 21-1 Features of Surveillance
- Is organized and planned
- Is the principle means by which a population’s health status is assessed
- Involves ongoing collection of specific data
- Involves analyzing data on a regular basis
- Requires sharing the results with others
- Requires broad and repeated contact with the public about personal health issues
- Motivates public health action as a result of data analyses to:
  - Reduce morbidity
  - Reduce mortality
  - Improve health

## THE CUTTING EDGE
The United States spent approximately 39 billion dollars in 2005 to assist states in preparing for bioterrorist incidents (Office of Management and Budget, 2005).

## Uses of Public Health Surveillance
Public health surveillance can be used to facilitate the following (CDC, 2004):
- Estimate the magnitude of a problem (disease or event).
- Determine geographic distribution of an illness or symptoms.
- 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.

## Purposes of Surveillance
Surveillance helps public health departments identify trends and unusual disease patterns, set priorities for using scarce resources, and develop and evaluate programs for commonly occurring and universally occurring diseases or events (Box 21-2).

Surveillance activities can be related to the core functions of public health—assessment, policy development, and assurance. Disease surveillance helps establish baseline (endemic) rates of disease occurrence and patterns of spread. Surveillance makes it possible to initiate a rapid response to an outbreak of a disease or event that can cause a health problem. For example, surveillance made it possible to respond quickly to the anthrax outbreak that occurred shortly after the September 11 attack on the World Trade Centers. Surveillance also made it possible to respond early to the mumps outbreak among college students that occurred in 2006.

Surveillance data are analyzed, and interpretations of these data analyses are used to develop policies that better

## BOX 21-2 Purposes of Surveillance
- Assess public health status
- Define public health priorities
- Plan public health programs
- Evaluate interventions and programs
- Stimulate research

protect the public from problems such as emerging infections, bioterrorist biological and chemical threats, and injuries from problems such as motor vehicle accidents. In 2006 there was a lot of emphasis on developing disaster management policies in health care organizations, industries, and homes so the U.S. population could be prepared in the event of an emergency. Surveillance within individual organizations, such as infection control systems in hospitals, can be used to establish policies related to clinical practice that are designed to improve quality of care processes and outcomes. An example is documented by Santandrea (2002) when a hospital’s outpatients, who had recently received endoscopy, contracted the *Pseudomonas* bacterium. The suspected culprit was a new bronchoscope. The nurse, the medical director, the supply company, the bacterium. the suspected culprit was a new bronchoscope. The nurse, the medical director, the supply company, the CDC, and the Food and Drug Administration worked together to investigate the problem. It was determined that the bronchoscope biopsy port was harboring the bacteria. The company automatically recalled the scope, and new policies were established to protect client safety.

Surveillance makes it possible to have ongoing monitoring in place to ensure that disease and event patterns improve rather than deteriorate. They can also make it possible to study whether the clinical protocols and public health policies that are in place can be enhanced based on current science so disease rates actually decline. For example, the ongoing monitoring of obesity in children in a community may show that new clinical and effective protocols need to be developed to be used in school-based clinics to reduce the prevalence of obesity among the school populations.

Surveillance data are very helpful in determining whether a program is effective. Such data make it possible to determine whether public health interventions are effective in reducing the spread of disease or the incidence of injuries. By determining the change in the number of cases at the beginning of a program (baseline) with the number of cases following program implementation, it is possible to estimate the effectiveness of a program. One could then compare the effectiveness of different approaches to reducing the problem or to improving health. Zahner (1999) compared the NIS (National Immunization Survey) of the CDC and HEIDIS (health plan employee data and information set) to determine which was most effective in improving child immunizations. At the time of the study, NIS appeared to be more effective.

**Evidence-Based Practice**

A study was conducted to identify pediatric age-groups for influenza vaccination using a real-time regional surveillance system. Evidence has shown that vaccination of school-age children significantly reduces influenza transmission. To explore the possibility of expanding the recommended target population for flu vaccination to include preschool-age children, the researchers sought to determine which age groups within the pediatric population develop influenza the earliest and are most strongly linked with mortality in the population.

Using a real-time regional surveillance system, patient visits for respiratory illness were monitored in six Massachusetts health care settings. Data from a variety of health monitoring systems were used: the Automated Epidemiologic Geotemporal Integrated Surveillance system, the National Bioterrorism Syndromic Surveillance Demonstration Project, and the Centers for Disease Control and Prevention US Influenza Sentinel Providers Surveillance Network. Data were retrospectively identified and included patients seen between January 1, 2000, and September 30, 2004.

Study findings indicate that patient age significantly influences timeliness of presenting at the health care facility with influenza symptoms ($p = 0.026$), with pediatric age-groups arriving first ($p < .001$); children ages 3 to 4 years are consistently the earliest ($p = 0.0058$). Age also influences the degree of prediction of mortality ($p = 0.036$). Study findings support the strategy to vaccinate preschool-age children. Furthermore, monitoring respiratory illness in the ambulatory care and pediatric emergency department populations using syndromic surveillance systems was shown to provide even earlier detection and better prediction of influenza activity than the current CDC’s sentinel surveillance system.

**NURSE USE**

It is important to offer the flu vaccine to high-risk populations, such as young children, as recommended by the Centers for Disease Control and Prevention’s Advisory Committee on Immunization Practices. Influenza vaccination is the primary method for preventing influenza and its severe complications.


**Collaboration Among Partners**

A quality surveillance system requires collaboration among a number of agencies and individuals: federal agencies, state and local public health agencies, hospitals, health care providers, medical examiners, veterinarians, agriculture, pharmaceutical agencies, emergency management, and law enforcement agencies, as well as 911 systems, ambulance services, urgent care and emergency departments, poison control centers, nurse hotlines, school, and industry. Such collaboration promotes the development of a comprehensive plan and a directory of emergency responses and contacts for effective communication and information sharing. The type of information to be shared includes the following:

- How to use algorithms to identify which events should be investigated
Nurse Competencies

The national core competencies for public health nurses were developed from the work of the Council on Linkages Between Academia and Public Health Practice (Core Competencies for Public Health Professionals, 2000) and by the Quad Council of Public Health Nursing Organizations (2003). These competencies are divided into eight practice domains: analytic assessment skills, policy/program development, communication, cultural competency, community dimensions of practice, basic public health sciences, financial planning/management, and leadership.

To be a participant in surveillance and investigation activities, the staff nurse must have the following knowledge related to the core competencies:

1. Analytic assessment skills:
   - defining the problem
   - determining a cause
   - identifying relevant data and information sources
   - partnering with others to give meaning to the data collected
   - identifying risks

2. Communication:
   - providing effective oral and written reports
   - soliciting input from others and effectively presenting accurate demographic, statistical, and scientific information to other professionals and the community at large

3. Community dimensions of practice:
   - establishing and maintaining links during the investigation
   - collaborating with partners
   - developing, implementing, and evaluating an assessment to define the problem

4. Basic public health science skills:
   - identifying individual and organizational responsibilities
   - identifying and retrieving current relevant scientific evidence

5. Leadership and systems thinking
   - identifying internal and external issues that have an effect on the investigation
   - promoting team and organizational efforts
   - contributing to developing, implementing, and monitoring of the investigation

While the staff nurse participates in these activities, the nurse clinical specialist should be proficient in applying these competencies.

The Minnesota Model of Public Health Interventions: Applications for Public Health Nursing Practice (2001, pp. 15, 16) suggests that surveillance is one of the interventions related to public health nursing practice. The model gives seven basic steps of surveillance for nurses to follow:

1. Consider whether surveillance as an intervention is appropriate for the situation.
2. Organize the knowledge of the problem, its natural course of history, and its aftermath.
3. Establish clear criteria for what constitutes a case.
4. Collect sufficient data from multiple valid sources.
5. Analyze data.
6. Interpret data and disseminate to decision makers.
7. Evaluate the impact of the surveillance system.

Data Sources for Surveillance

Clinicians, health care agencies, and laboratories report cases to state health departments. Data also come from death certificates and administrative data such as discharge reports and billing records (Pryor and Veenema, 2003). The following are select sources of mortality and morbidity data:

1. Mortality data are often the only source of health-related data available for small geographic areas. Examples include the following:
   - Vital statistics reports (e.g., death certificates, medical examiner reports, birth certificates)

2. Morbidity data include the following:
   - Notifiable disease reports
   - Laboratory reports
   - Hospital discharge reports
   - Billing data
   - Outpatient health care data
   - Specialized disease registries
   - Injury surveillance systems
   - Environmental surveys
   - Sentinel surveillance systems

A good example of a process in place to collect morbidity data is the National Program of Cancer Registries. This program provides for monitoring of the types of cancers found in a state and the locations of the cancer risks and health problems in the state.

Each of the data sources has the potential for underreporting or incomplete reporting. However, if there is consistency in the use of surveillance methods, the data collected will show trends in events or disease patterns that may indicate a change needed in a program or a needed prevention intervention to reduce morbidity or mortality. Underreporting or incomplete reporting may occur for the following reasons: social stigma attached to a disease (such as HIV/AIDS); ignorance of required reporting system; lack of knowledge about the case definition, procedural changes in

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HEALTHY PEOPLE 2010

Surveillance Objectives

1-12 Establish a single toll-free number for access to poison control centers on a 24-hour basis throughout the United States.
3-14 Increase the number of states that have a statewide population-based cancer registry that captures case information on at least 95% of the expected number of reportable cancers.
8-28 Increase the number of local health departments or agencies that use data from surveillance of environmental risk factors as part of their vector control programs.
10-2 Reduce outbreaks of infections caused by key foodborne bacteria.
14-31 Increase the number of persons under active surveillance for vaccine safety via large linked databases.
15-10 Increase the number of states (including the District of Columbia) with statewide emergency department surveillance systems that collect data on external causes of injury.
15-11 Increase the number of states (including the District of Columbia) that collect data on external causes of injury through hospital discharge data systems.
23-2 Increase the proportion of federal, tribal, state, and local health agencies that have made information available to the public in the last year on the Leading Health Indicators, Health Status Indicators, and Priority Data Needs.
23-3 Increase the proportion of all major national, state, and local health data systems that use geocoding to promote nationwide use of geographic information systems (GIS) at all levels.
23-4 Increase the proportion of population-based Healthy People 2010 objectives for which national data are available for all population groups identified for the objective.

reporting, or changes in a database; limited diagnostic abilities; or low priority given to reporting (CDC, 2006a).

Mortality data assist in identifying differences in health status among groups, populations, occupations, and communities; monitor preventable deaths; and help to examine cause and effect factors in diseases. Vital statistics can be used to plan programs and to monitor programs to meet Healthy People 2010 goals.

The notifiable disease laboratory and also hospital discharge and billing data provide mechanisms for classifying diseases and events and calculating rates of diseases within and across groups, populations, and communities.

The sentinel surveillance system provides for the monitoring of key health events when information is not otherwise available or in vulnerable populations to calculate or estimate disease morbidity. Registrations monitor chronic disease in a systematic manner, linking information from a variety of sources (health department, clinics, hospitals) to identify disease control and prevention strategies. Surveys then provide data from individuals about prevalence of health conditions and health risks. Such surveys allow for monitoring changes over time and assessing the individual’s knowledge, attitudes, and beliefs. This information can be used for health education and other planned interventions (CDC, 2003).

NOTIFIABLE DISEASES

Before 1990 state and local health departments used many different criteria for identifying cases of reportable diseases. Using different criteria made the data less useful than it could have been because it could not be compared across health departments or states. This is one reason given that some diseases may have been underreported and others may have been overreported. In 1990 the CDC and the Council of State and Territorial Epidemiologists assembled the first list of standard case definitions. This list was revised in 1997, and more information may be found at the Centers for Disease Control and Prevention Division of Public Health Surveillance and Informatics website (CDC, 1997). This site contains information about the National Notifiable Disease Surveillance System.

National Notifiable Diseases

Box 21-3 shows the national notifiable infectious diseases. Reporting of disease data by health care providers, laboratories, and public health workers to state and local health departments is essential if trends are to be accurately monitored. “The data provide the basis for detecting disease outbreaks, for identifying person characteristics, and for calculating incidence, geographic distribution, and temporal trends. They are used to initiate prevention programs, evaluate established prevention and control practices, suggest new intervention strategies, identify areas for research, document the need for disease control funds, and help answer questions from the community” (Cabinet for Human Resources [CHS], 2004). The Centers for Disease Control and Prevention and the Council of State and Territorial Epidemiologists have a policy that requires state health departments to report selected diseases to the CDC, National Notifiable Disease Surveillance System (NNDSS). The data for nationally notifiable diseases from 50 states, the U.S. territories, New York City, and the District of Columbia are published weekly in the Morbidity and Mortality Weekly Report (MMWR). Data collection about these diseases is ongoing and revision of statistics is ongoing. Annual updated final reports are published in the CDC Summary of Notifiable Diseases—United States (CDC, 2006b).

State Notifiable Diseases

Requirements for reporting diseases are mandated by law or regulation. While each state differs in the list of reportable diseases, the usefulness of the data depends on “uniformity, simplicity, and timeliness.” Because state requirements differ, not all nationally notifiable diseases are
Box 21-3 Infectious Diseases Designated as Notifiable at the National Level—United States, 2006

Acquired immunodeficiency syndrome (AIDS)  
Anthrax  
Botulism, foodborne  
Botulism, infant  
Botulism, other (includes wound and unspecified)  
Brucellosis  
California serogroup virus neuroinvasive disease  
California serogroup virus nonneuroinvasive disease  
Chancroid  
Chlamydia trachomatis genital infection  
Cholera  
Coccidioidomycosis  
Cryptosporidiosis  
Cryptosporiasis  
Diphtheria  
Eastern equine encephalitis virus neuroinvasive disease  
Eastern equine encephalitis virus nonneuroinvasive disease  
Ehrlichiosis, human granulocytic (HGE)  
Ehrlichiosis, human monocytic (HME)  
Ehrlichiosis, human other or unspecified  
Giardiasis  
Gonorrhea

Haemophilus influenzae, invasive disease  
Hansen’s disease (leprosy)  
Hantavirus pulmonary syndrome  
Hemolytic uremic syndrome, postdiarrheal  
Hepatitis A, acute  
Hepatitis B, acute  
Hepatitis B virus infection, chronic  
Hepatitis B virus infection, perinatal acute  
Hepatitis C virus infection, chronic or resolved  
Hepatitis C virus infection, acute  
HIV infection, adult  
HIV infection, pediatric  
Influenza-associated pediatric mortality  
Legionnaires  
Listeriosis  
Lyme disease  
Malaria  
Measles, total  
Meningococcal disease  
Mumps  
Neurosyphilis  
Pertussis  
Plague  
Poliomyelitis, paralytic  
Powassan virus neuroinvasive disease  
Powassan virus nonneuroinvasive disease  
Psittacosis (Orothosis)  
Q fever  
Rabies, animal  
Rabies, human  
Rocky Mountain spotted fever  
Rubella  
Rubella, congenital syndrome  
Salmonellosis  
Severe acute respiratory syndrome–associated coronavirus (SARS-CoV) disease  
Shiga toxin–producing Escherichia coli (STEC)  
Shigellosis  
Smallpox  
St. Louis encephalitis virus neuroinvasive disease  
Streptococcus pneumonia, drug-resistant  
Syphilis, congenital syndrome  
Syphilis, early latent  
Syphilis, late latent  
Syphilis, primary  
Syphilis, secondary  
Syphilis, total primary and secondary  
Syphilis, latent, unknown duration  
Tetanus  
Toxic shock syndrome (other than streptococcal)  
Trichinosis  
Tuberculosis  
Tularemia  
Typhoid fever  
Vancomycin-intermediate Staphylococcus aureus (VISA)  
Vancomycin-resistant Staphylococcus aureus (VRSA)  
Varicella  
West Nile virus neuroinvasive disease  
West Nile virus nonneuroinvasive disease  
Western equine encephalitis virus neuroinvasive disease  
Western equine encephalitis virus nonneuroinvasive disease  
Yellow fever


Legally mandated for reporting in a state. For legally reportable diseases, states compile disease incidence data (new cases) and transmit the data electronically, weekly, to the CDC through the National Electronic Telecommunications System for Surveillance (NETSS).

Ongoing analysis of this extensive database has led to better diagnosis and treatment methods, national vaccine schedule recommendations, changes in vaccine formulation, and the recognition of new or resurgent diseases. Selected data also are reported in such documents as Epidemiologic Notes and Reports. Adverse health data for the calendar year are documented on the reportable disease form (EPID 200, rev. Jan/01) to the local health department or the state department for public health. Local health department surveillance personnel investigate case reports and proceed with recommended public health measures, requesting assistance from the state’s department assigned to monitor the reports when needed. Reports are forwarded by mail or fax or in urgent circumstances may be reported by telephone 24 hours a day, 7 days a week. When reports are received, they are scrutinized carefully and, when appropriate, additional steps.
are initiated to assist local health departments in planning interventions.

**NURSING TIP** To determine which of the national notifiable diseases are reportable in your state, go to your state health department website.

**CASE DEFINITIONS**

**Criteria**

Criteria for defining cases of different diseases are essential for having a uniform, standardized method of reporting and monitoring diseases. A case definition provides understanding of the data that are being collected and reduces the likelihood that different criteria will be used for reporting similar cases of a disease. Case definitions may include clinical symptoms, laboratory values, and epidemiologic criteria (such as exposure to a known or suspected case). Each disease has its own unique set of criteria based on what is known scientifically about that particular disease. Cases may be classified as suspected, probable, or confirmed, depending on the strength of the evidence supporting the case criteria.

While some diseases require laboratory confirmation, although clinical symptoms may be present, other diseases do not have laboratory tests to confirm the diagnosis. Other cases are diagnosed based on epidemiologic data alone, such as exposure to contaminated food. If a case definition has been established by the CDC or another official source, it should be used for reporting purposes. The case definition should not be used as the only criteria for clinical diagnosis, quality assurance, standards for reimbursement, or taking public health action. Action to control a disease should be taken as soon as a problem is identified although there may not be enough information to meet the case definition. For example, following the September 11, 2001, terrorist attacks and subsequent crises, when white powder substances were found in the offices of Congress and select post offices, the offices were shut down and evacuated for safety until the final determination of the presence or absence of anthrax (Dewan, Fry, Laserson et al, 2002).

**Case Definition Examples**

Many examples of case definitions exist in the literature and in government documents. In the October 19, 2001, *MMWR* (CDC, 2001a, p. 889) the case definition for a confirmed case of anthrax was given as: “1) a clinically compatible case of cutaneous, inhalational, or gastrointestinal illness that is laboratory confirmed by isolation of B. Anthracis from an affected tissue or site, or 2) other laboratory evidence of B. Anthracis infection based on at least two supportive laboratory tests.” A suspected case was defined as “1) a clinically compatible case of illness without isolation of B. Anthracis and no alternative diagnosis but with laboratory evidence of B. Anthracis by one supportive laboratory test, or 2) a clinically compatible case of anthrax linked to a confirmed environmental exposure (epidemiology) but without laboratory evidence.”

In a research report of a foodborne gastroenteritis outbreak in Sweden, the following case definition was offered: “a person who attended a center supplied with meals by a (named) caterer on Monday or Tuesday, March 1 or 2, 1999 and who fell ill with at least one of the following symptoms between March 1 and March 12: diarrhea, vomiting, nausea, stomach pain, headache, fever and myalgia” (Gotz et al, 2002, p. 116). It can be noted that this definition of a suspected case is based on epidemiologic data (exposure) and clinical symptoms only.

Schrag et al (2002) provided a case definition for a noninfectious disease, staphylococcal pneumonia, as “the isolation of the bacterium from a normally sterile site (blood or spinal fluid) from a resident in a defined geographic surveillance area.” This case definition relies on laboratory data and the geographic location (epidemiologic-place) of the resident.

**TYPES OF SURVEILLANCE SYSTEMS**

Informatics is essential to the mission of protecting the public’s health. Surveillance systems are designed to assist public health professionals in the early detection of disease/event outbreaks in order to intervene and reduce the potential for morbidity or mortality, or to improve the public’s health status (NEDSS Working Group, 2001; Wagner et al, 2001). Surveillance systems in use today are defined as passive, active, sentinel, and special.

**Passive System**

In the passive system, case reports are sent to local health departments by health care providers (i.e., physicians, public health nurses), or laboratory reports of disease occurrence are sent to the local health department. The case reports are summarized and forwarded to the state health department, national government, or organizations responsible for monitoring the problem, such as the CDC or an international organization such as the World Health Organization.

The National Notifiable Disease Surveillance System (NNDSS) is a voluntary system monitored by the Centers for Disease Control and Prevention and includes a total of 52 infectious diseases or conditions with case definitions that are considered important to the public’s health. In the list of 52 reportable conditions, there are 7 critical biological agents that have potential use in a terrorist attack. Each state determines for itself which of the diseases and conditions are of importance to the state’s health and legally requires the reporting of those diseases to the state health department by health care providers, health care agencies, and laboratories. The passive system may not provide an accurate picture of the problem because of delayed reporting by providers and laboratories and incomplete reporting across providers and laboratories. This system, however, has the ability to provide disease-specific demographic, geographic,
and seasonal trends over time for reported events. An example is a cancer registry system in which cases are required to be reported to the state on the basis of the type of cancer, the demographics of the client, and the geographic location. Because the system has limits, a disease outbreak may be occurring before all reports are received by the state health department (CDC, 2001b; Veenema, 2003).

**Active System**
In the active system, the public health nurse, as an employee of the health department, may begin a search for cases through contacts with local health providers and health care agencies. In this system, the nurse names the disease/event and gathers data about existing cases to try to determine the magnitude of the problem (how widespread it is).

A recent example would be a search for existing cases of severe acute respiratory syndrome (SARS) within a geographic area or a foodborne outbreak of gastroenteritis at the local school. An ongoing tracking system within an occupational setting to monitor work-related injuries/illnesses and symptoms is a process that includes occupational health and infection control personnel in interviewing workers, collecting laboratory data and demographics of workers, and seeking potential agents of exposure (Worthington, 2002). When the active system is used, it is costly and requires a lot of personnel. Because the nurse is actively looking for a case, this system offers a more complete picture of the number of existing cases. Because of limits, the active system is often used on a limited basis for investigation after a disease outbreak has been recognized (Gordis, 2004; Veenema, 2003).

**Sentinel System**
In the sentinel system, trends in commonly occurring diseases or key health indicators are monitored (Healthy People 2010). A disease/event may be the sentinel or a population may be the sentinel. In this system a sample of health providers or agencies is asked to report the problem. Some of the questions that may be asked include the following: What really happened? What are the consequences? What was different in this event? What was the outcome? Could the occurrence have been prevented? Did providers follow procedures? Did providers know what to do? Has this happened before? If so, how was it fixed? Who reported the event? What might prevent it from happening again (CDC, 2003)?

For example, certain providers/agencies in a community may be asked to report the number of cases of influenza seen during a given time period in order to make projections about the severity of the “flu season.” Another example would be monitoring the population of children in the local elementary school to determine the rate of obesity among school-age children. A previously used example referred to an evaluation of laboratory surveillance of the prevalence of antibiotic-resistant pneumonia (sentinel) in communities (Jernigan et al, 2001; Schrag et al, 2002). While much may be learned about diseases and conditions using the sentinel system, because the system data are based on a sample of a problem or a specific population they cannot be used to follow specific clients, or to initiate prevention and control interventions for individuals. The system is useful because it helps monitor trends in commonly occurring diseases/events.

**Special Systems**
Special systems are developed for collecting particular types of data and may be a combination of active, passive, and/or sentinel systems. An example of a special system is the PulseNet system developed by the CDC, the Association of Public Health Laboratories, and federal food regulatory agencies to “fingerprint” foodborne bacteria. This system is designed to provide data for early recognition and investigation of foodborne outbreaks in all 50 states. Similarly, BioNet is a new system being developed by the PulseNet Partners and the Laboratory Response Network (LRN) to detect and determine links between disease agents during terrorist attacks. As a result of bioterrorism, newer systems called syndromic surveillance systems are being developed to monitor illness syndromes or events. For example, data showing increased medication purchases, physician or emergency department visits, or culture orders as well as increased school or work absenteeism may indicate that an epidemic is developing hours or days before disease clusters are recognized or specific diagnoses are made and reported to public health agencies (American Health Consultants, 2003; Buehler et al, 2003). This approach requires the use of automated data systems to report continued (real time) or daily (near real time) disease outbreaks (Broome et al, 2004) (Box 21-4).

Another example of a special system designed to help assess unusual patterns of diseases or conditions is the CDC’s Enhanced Surveillance Project (ESP). The ESP monitors emergency department data to detect unusual patterns (or aberrations) so quick epidemiologic case confirmation and follow-up can be initiated. More information on this system can be found at the WebLinks on the book’s website. Although useful, these systems are designed to be used for disease case detection, case management, and outbreak management; they require good timing. False alarms occur. The systems provide national data to detect, diagnose, and handle disease and the effects of biological and chemical agents resulting from bioterrorism. The systems are intended to be used with more traditional systems. In epidemics or terrorist attacks, there is a network of links for foodborne (PulseNet), chemical (LRN), and biological genetic patterns of disease (BioNet). New systems are being developed and tested to predict epidemics, as in bioterrorism, before they have occurred (CDC, 2006a; Veenema, 2003). The new syndromic systems may also predict naturally occurring epidemics. (See Box 21-4 for a list of special systems available to assess data in the case of a terrorist event).
BOX 21-4 Bioterrorism and Response Networks

Integrating of training and response preparedness can be supported by the following networks:
- Health Alert Network
- Emergency Preparedness Information Exchange (EPIX)
- The Emerging Infections program
- Epidemiology and Laboratory Capacity program
- Assessment initiative
- Hazardous substances
- Emergency events surveillance
- Influenza surveillance
- Local metropolitan medical response systems


While all of the systems are important, the public health nurse is most likely to use the active or passive systems. An example of when one might use a passive system is the use of the state reportable disease system to complete a community assessment or MAPPS (see Chapters 15 and 21). The active system is used when several school children become ill after eating lunch in the cafeteria or at the local hot dog stand, to investigate the possibility of food poisoning, or following up of contacts of a newly diagnosed tuberculosis or sexually transmitted disease (STD) client (Underwood et al, 2003).

THE INVESTIGATION

Investigation Objectives

Any unusual increase in disease incidence (new cases) or an unusual event in the community should be investigated. The system used for investigation depends on the intensity of the event, the severity of the disease, the number of people/communities affected, the potential for harm to the community or the spread of disease, and the effectiveness of available interventions (Sistrom and Hale, 2006). The objectives of an investigation are as follows:
- To control and prevent disease or death
- To identify factors that contribute to the disease outbreak/event occurrence
- To implement measures to prevent occurrences

Defining the Magnitude of a Problem/Event

The following definitions provide a way to describe the level of occurrence of a disease/event for purposes of communicating the magnitude of the problem. A disease/event that is found to be present (occurring) in a population is defined as endemic if there is a persistent (usual) presence with low to moderate disease/event cases. The endemic levels of a disease/event in a population provide the baseline for establishing a public health problem. For example, foodborne botulism is endemic to Alaska. One would need to know the baseline to determine the existence of a change or increase in the number of cases from the baseline. If a problem is considered hyperendemic, there is a persistently (usually) high number of cases. An example is the high cholera incidence rate among Asians/Pacific Islanders. Sporadic problems are those with an irregular pattern with occasional cases found at irregular intervals. Epidemic means that the occurrence of a disease within an area is clearly in excess of expected levels (endemic) for a given time period. This is often called the outbreak. Pandemic refers to the epidemic spread of the problem over several countries or continents (such as the SARS outbreak). Holoendemic implies a highly prevalent problem found in a population commonly acquired early in life. The prevalence of this problem decreases as age increases (Chang et al, 2003). Outbreak detection, or identifying an increase in frequency of disease above the usual occurrence of the disease, is the function of the investigator (Broome et al, 2004).

Patterns of Occurrence

Patterns of occurrence can be identified when investigating a disease or event. These patterns are used to define the boundaries of a problem to help investigate possible causes or sources of the problem. A common source outbreak refers to a group exposed to a common noxious influence such as the release of noxious gases (for example, ricin in the Japanese subway system several years ago). A point source outbreak involves all persons exposed becoming ill at the same time, during one incubation period. A mixed outbreak (which was described by Gotz et al [2002] while investigating a foodborne gastroenteritis caused by a Norwalk-like virus) is a common source followed by secondary exposures related to person to person contact, as in the spreading of influenza. Intermittent or continuous source cases may be exposed over a period of days or weeks, as in the recent food poisonings at a restaurant chain throughout the United States as a result of the restaurant’s purchase of contaminated green onions. A propagated outbreak does not have a common source and spreads gradually from person to person over more than one incubation period, such as the spread of tuberculosis from one person to another.

WHAT DO YOU THINK? In today’s environment of tight budgets, how would nurses know which programs should be developed and continued without good data to indicate what are the most commonly occurring public health problems? How would one know if programs were effective without a source of valid and reliable ongoing data?

Causal Factors From Epidemiologic Triangle

Factors that must be considered as causes of outbreak are categorized as agents, hosts, and environmental factors (see Chapter 11). The belief is that these factors may interact to cause the outbreak and therefore the potential interac-
tions must be examined. Box 21-5 presents definitions used to classify agents in an attack. Box 21-6 lists the type of agent factors that may be present. The host factors associated with cases may be age, sex, race, socioeconomic status, genetics, and lifestyle choices (for example, cigarette smoking, sexual practices, contraception, eating habits). The environmental factors that may be related to a case are physical (for example, weather, temperature, humidity, physical surroundings) or biological (such as insects that transmit the agent). Some of the socioeconomic factors that might affect development of a disease/event are behavior (could be terrorist behaviors), personality, cultural characteristics of group, crowding, sanitation, availability of health services.

When to Investigate
An unusual increase in disease incidence should be investigated. The amount of effort that goes into an investigation depends on the severity or magnitude of the problem, the numbers in the population who are affected, the potential for spreading the disease, and the availability and effectiveness of intervention measures to resolve the problems. Most of the outbreaks of diseases (or increased incidence rates) occur naturally and/or are predictable when compared with the consistent patterns of previous outbreaks of a disease, like influenza, tuberculosis, or common infectious diseases. When a disease/event outbreak occurs as a result of purposeful introduction of an agent into the population, then the predictable patterns may not exist. Treadwell et al (2003) provide clues to be used when trying to determine the existence of bioterrorism. These clues are simplified and appear in Box 21-7 (from USDHHS, 2001).

Steps in an Investigation
In determining whether a real disease/condition outbreak exists or if there has been a false alarm, first confirm that an occurrence/outbreak exists. Review the information available about the situation. Determine the nature, location, and severity of the problem. Verify the diagnosis and develop a case definition to estimate the magnitude of the problem. This may change as new information is made available. Compare current incidence (number of new cases) with usual or baseline incidence. Use local data if available and compare it to the literature, or call the state health department. Assess the need for outside consultation. Report the situation to state public health authorities if required. Check the state reportable disease list. Early

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**Box 21-5 Classification of Agents**
- **Infectivity:** Refers to the capacity of an agent to enter a susceptible host and produce infection or disease
- **Pathogenicity:** Measures the proportion of infected people who develop the disease
- **Virulence:** Refers to the proportion of people with clinical disease who become severely ill or die

**Box 21-6 Types of Agent Factors**
1. Biological
   - Bacteria (e.g., tuberculosis, salmonellosis, streptococcal infections)
   - Viruses (e.g., hepatitis A, herpes)
   - Fungi (e.g., tinea capitis, blastomycosis)
   - Parasites (protozoa causing malaria, giardiasis; helminths [roundworms, pinworms]; arthropods [mosquitoes, ticks, flies, mites])
2. Physical
   - Heat
   - Trauma
3. Chemical
   - Pollutants
   - Medications/drugs
4. Nutrients
   - Absence
   - Excess
5. Psychological
   - Stress
   - Isolation
   - Social support

**Box 21-7 Epidemiologic Clues That May Signal a Covert Bioterrorism Attack**
- Large number of ill persons with similar disease or syndrome
- Large number of unexplained disease, syndrome, or deaths
- Unusual illness in a population
- Higher morbidity and mortality than expected with a common disease or syndrome
- Failure of a common disease to respond to usual therapy
- Single case of disease caused by an uncommon agent
- Multiple unusual or unexplained disease entities coexisting in the same person without other explanation
- Disease with an unusual geographic or seasonal distribution
- Multiple atypical presentations of disease agents
- Similar genetic type among agents isolated from temporally or spatially distinct sources
- Unusual, atypical, genetically engineered, or antiquated strain of agent
- Endemic disease with unexplained increase in incidence
- Simultaneous clusters of similar illness in noncontiguous areas, domestic or foreign
- Atypical aerosol, food, or water transmission
- Ill people presenting at about the same time
- Deaths or illness among animals that precedes or accompanies illness or death in humans
- No illness in people not exposed to common ventilation systems, but illness among those people in proximity to the systems
and continuing changing control measures should be used on the basis of the magnitude and nature of the condition (infectious disease, chronic disease, injuries, personal behaviors, environmental exposure). Control measures may include eliminating a contaminated product, modifying procedures, treating carriers, or immunizing those who might contract the infectious disease. A request should be made that laboratory specimens be saved until the investigation is completed (if applicable to the case definition).

As the investigation continues, seek additional cases and collect critical data and specimens. Encourage immediate reporting of new cases from laboratory reports (e.g., radiology in cases of pneumonia) and physicians/other health care providers, including public health nurses, health care agencies, and others in the community as appropriate. In addition, search for other cases that may have occurred in the past or are now occurring by reviewing laboratory reports, medical records, and client charts and questioning physicians, other health providers and agencies, and others in the community. Use a specific data collection form such as a questionnaire or a data abstract summary form. Characterize the cases by person, place, and time. Evaluate the client characteristics (i.e., age, sex, underlying disease, geographic location) and possible exposure sites. The place the outbreak occurs provides clues to the population at risk. Did the problem occur in a community, school, or homes? Drawing tables or spot maps helps to visualize the clusters of the disease condition in specific areas of the community. The exact time period of the outbreak/occurrence is important (be sure to go back to the first case or first indication of outbreak/occurrence activity). Given the diagnosis, describe what appears to be the period of exposure. Record date of onset of morbidity/mortality cases and draw an epidemic curve. Determine whether the outbreak/condition originates from a common source or is propagated. The following table suggests factors to monitor and explains the reasons for their use. It provides clues to the use of time, place, and person (Table 21-1).

As the investigation continues develop a tentative hypothesis (the best guess about what is happening). Do a quick evaluation of the outbreak by assessing previous findings. Record, tabulate, and review data collected from the previously described activities to summarize common agent, environment, host factors, and exposures. On the basis of this analysis (and literature review if necessary), develop a hypothesis (best guess) on (a) the likely cause, (b) the source(s), and (c) the mode of transmission of the disease. The hypothesis should explain the majority of cases. Frequently there will be concurrent cases not explained by the hypothesis that may be related to endemic or sporadic cases, a different disease or condition (similar symptoms), or a different source or mode of transmission.

Test your hypothesis with other public health team members (e.g., epidemiologist). Many investigations do not reach this stage because of lack of available personnel, lack of severity of the problem, and lack of resources available. Situations that should be studied include disease/events associated with a commercial product, disease/events associated with considerable morbidity and/or mortality, and disease/events associated with environmental exposures (e.g., terrorist attack). Analyze data collected to

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**TABLE 21-1 Potential Epidemiological Factors That Call for Increased Investigation or Monitoring**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease located in one geographic area</td>
<td>Might indicate a point source of a disease agent that can be discovered and controlled</td>
</tr>
<tr>
<td>Severe symptoms/diagnoses such as encephalitis or death</td>
<td>Indicates disease process that needs rapid investigation because of severity</td>
</tr>
<tr>
<td>Rapid rise to very high numbers of illness two to three times normal baseline with steep epidemic curve</td>
<td>Potential for continuing rapid rise in numbers; requires immediate investigation to institute control measures</td>
</tr>
<tr>
<td>Outbreak detected and confirmed in multiple data sources</td>
<td>Unlikely to be attributable to error; possibly widespread</td>
</tr>
<tr>
<td>Outbreak occurring at an unusual time or place (e.g., respiratory/influenza-like symptoms in summer)</td>
<td>Might indicate targeted population or early signs in a susceptible population (e.g., very young or very old)</td>
</tr>
<tr>
<td>Outbreak confined to one age or gender group</td>
<td>Might indicate targeted population or early signs</td>
</tr>
<tr>
<td>Number of cases continuing to rise over time</td>
<td>Indicates sustained outbreak that might continue to grow</td>
</tr>
</tbody>
</table>

determine sources of transmission and risk factors associated with disease/condition. Determine how this problem differs in incidence or exposure for other population groups. Refine the hypothesis (best guess) and carry out additional studies if necessary.

Evaluate the effects of control measures. Cases may cease to occur or return to endemic level. If the control interventions do not produce change, return to the beginning and start the investigation over or reevaluate cases. Use the opportunity of an outbreak to review and correct practices related to the current situation that may contribute to an outbreak in the future.

Communicate findings to those who should be notified. Communication of findings may take two forms: an oral briefing for local authorities or a written report. Describe the problem, the data collected, the case definition with verification of the diagnosis, data sources, the hypothesis, and testing of the hypothesis. Present only the facts of the situation, the data analysis, and the conclusions.

**Displaying of Data**

Reporting of data in an investigation needs to be valid: Does the event reported reflect the true event as it occurs? It must also be reliable: Is the same event reported consistently by different observers? There are a number of tools that can be used to display data according to time, place, or person. The spatial map shows where the event is occurring and allows prevention resources to be targeted. Figure 21-1 provides a map of the location of reported cases of hepatitis A in the United States. From looking at this map, it can be seen that priority prevention target areas would be Georgia, the District of Columbia, California, New Mexico, Kansas, and Florida. Table 21-2 shows the number of cases of an infectious disease compared by month and year over 4 years. In this table, cases have increased by year with a serious outbreak in October 2003. When cases are reported by person, they are usually reported by a person’s characteristic. Data displays are a step in analysis that shows graphically what is happening. It reduces the assumptions made about the event and provides a means for describing the event using quantitative data. Data help in stating your hypothesis or your best guess about what is happening.

**TABLE 21-2 Example of Ways to Display Data**

<table>
<thead>
<tr>
<th>Number of Patients With Diagnosis A, by Month, 2000-2003</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>12</td>
<td>20</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>February</td>
<td>14</td>
<td>19</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>March</td>
<td>7</td>
<td>21</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>April</td>
<td>12</td>
<td>10</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>May</td>
<td>5</td>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>June</td>
<td>4</td>
<td>11</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>July</td>
<td>5</td>
<td>5</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>August</td>
<td>5</td>
<td>9</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>September</td>
<td>6</td>
<td>7</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>October</td>
<td>15</td>
<td>8</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>November</td>
<td>?</td>
<td>8</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>11</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>129</td>
<td>153</td>
<td>174</td>
</tr>
</tbody>
</table>


*This table shows the number of persons who match a case definition of a select infectious disease over a 4-year period. Note that for 2003 there were overall more cases, especially in March and October, with a serious outbreak in October.
INTERVENTIONS AND PROTECTION

Remember that disease and event surveillance systems exist to help improve the health of the public through the systematic and ongoing collection, distribution, and use of health-related data. A nurse can contribute to such systems and best use the data collected through such systems to help manage endemic health problems and those that are emerging, such as evolving infectious diseases and bioterrorist (human-made) health problems. Functions of surveillance and investigation are detecting cases, estimating the impact of disease or injury, showing the national history of a health condition, determining the distribution and spread of illness, generating hypotheses, evaluating prevention and control measures, and facilitating planning (Broome et al, 2004). Response to bioterrorism or large-scale infectious disease outbreak may require the use of emergency public health measures such as quarantine, isolation, closing public places, seizing property, mandatory vaccination, travel restrictions, and disposal of the deceased. In 2006 in preparation for a projected avian flu epidemic, information was distributed about the use of several of the above interventions including isolation and closure of public places (see Appendix F-4).

LEVELS OF PREVENTION for Surveillance Activities

| PRIMARY PREVENTION                           |
| Develop a community security plan to reduce the potential for a terrorist attack. |

| SECONDARY PREVENTION                        |
| Investigate an outbreak of food poisoning in a local community. |

| TERTIARY PREVENTION                         |
| Provide health care and treatment for those infected by SARS. |

Suggestions for protecting health care providers from exposure including use of standard precautions when coming in contact with broken skin or body fluids, use of disposable nonsterile gowns and gloves followed by adequate handwashing after removal, and use of a face shield (USDHHS, 2001).

CHAPTER REVIEW

PRACTICE APPLICATION

As a clinical project the health department asked the public health nursing class at the university to develop a community service message to air on local radio about the potential of a pandemic flu. What does the message need to contain to help the community prepare?

Answers are in the back of the book.

KEY POINTS

- Surveillance activities can be related to the core functions of public health of assessment, policy development, and assurance.
- A quality surveillance system requires collaboration among a number of agencies and individuals.
- The Minnesota Model of Public Health Interventions: Applications for Public Health Nursing Practice (2001) suggests that surveillance is one of the interventions related to public health nursing practice.
- Clinicians, health care agencies, and laboratories report cases to state health departments. Data also come from death certificates and administrative data such as discharge reports and billing records.
- Each of the data sources has the potential for underreporting or incomplete reporting. However, if there is consistency in the use of surveillance methods, the data collected will show trends in events or disease patterns that may indicate a change needed in a program or a needed prevention intervention to reduce morbidity or mortality.
- The notifiable disease laboratory, hospital discharge data, and billing data provide mechanisms for classifying diseases and events and calculating rates of diseases within and across groups, populations, and communities.
- The sentinel surveillance system provides for the monitoring of key health events when information is not otherwise available or in vulnerable populations to calculate or estimate disease morbidity.

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- A quality surveillance system requires collaboration among a number of agencies and individuals.
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- Clinicians, health care agencies, and laboratories report cases to state health departments. Data also come from death certificates and administrative data such as discharge reports and billing records.
- Each of the data sources has the potential for underreporting or incomplete reporting. However, if there is consistency in the use of surveillance methods, the data collected will show trends in events or disease patterns that may indicate a change needed in a program or a needed prevention intervention to reduce morbidity or mortality.
- The notifiable disease laboratory, hospital discharge data, and billing data provide mechanisms for classifying diseases and events and calculating rates of diseases within and across groups, populations, and communities.
- The sentinel surveillance system provides for the monitoring of key health events when information is not otherwise available or in vulnerable populations to calculate or estimate disease morbidity.
• In 1990 the CDC and the Council of State and Territorial Epidemiologists assembled the first list of standard case definitions.
• Reporting of disease data by health care providers, laboratories, and public health workers to state and local health departments is essential if trends are to be accurately monitored.
• Requirements for reporting diseases are mandated by law or regulation.
• Criteria for defining cases of different diseases are essential for having a uniform, standardized method of reporting and monitoring diseases. A case definition provides understanding of the data that are being collected and reduces the likelihood that different criteria will be used for reporting similar cases of a disease.
• Surveillance systems in use today are defined as passive, active, sentinel, and special.
• Any unusual increase in disease incidence (new cases) or an unusual event in the community should be investigated.
• Patterns of occurrence can be identified when investigating a disease or event. These patterns are used to define the boundaries of a problem to help investigate possible causes or sources of the problem.

• Factors that must be considered as causes of outbreak are categorized as agents, hosts, and environmental factors.
• An unusual increase in disease incidence should be investigated.
• Functions of surveillance and investigation are detecting cases, estimating the impact of disease or injury, showing the national history of a health condition, determining the distribution and spread of illness, generating hypotheses, evaluating prevention and control measures, and facilitating planning.

CLINICAL DECISION-MAKING ACTIVITIES
1. Call the local health department and attend an emergency response team planning meeting. How many agencies are involved? Determine the roles of each agency. Does the nurse have a role on the team? Explain.
2. Go to the Health Hazard Evaluation program website (see WebLinks). What is the purpose of this program? How would information from the website be used in a disease investigation?
3. Explain the purpose of the application of the sentinel system to improve population health outcomes.

References


Veenema TG: Disaster nursing and emergency preparedness for chemical, biological, and radiological terrorism and other hazards, New York, 2003, Springer.

