Types of Surveillance Systems

by Carolina on January 4, 2010

Public health departments at local, state, and national levels routinely use different surveillance systems. Here is an overview of some of these systems, including vital statistics, disease reporting, and surveys. There are more specialized surveillance systems, including sentinel surveillance, zoonotic disease surveillance, adverse events surveillance, syndromic surveillance, disease registries, and laboratory surveillance. Some of them are more useful for certain diseases than others, but each fills a specific need. All these systems can be used to monitor disease trends and plan public health programs for a wide variety of conditions.

Vital Statistics

This surveillance system consists on records of birth and death and it is a critical component for public health practice. Mortality data and infant mortality rate (the number of deaths among infants per 1,000 births) have long been used as indicators of overall population health. Birth data is also used to monitor the incidence of preterm birth, a risk factor for a variety of adverse health outcomes.

In the United States, vital statistics are available from the National Center for Health Statistics and from state vital records offices. The Centers for Disease Control and Prevention (CDC) also operates an online system, CDC WONDER, containing data on births, deaths, and many diseases.

Disease Reporting (Morbidity Data)

Disease reporting involves the required reporting of certain diseases to public health authorities. It is required internationally by the World Health Organization (WHO), through International Health Regulations (IHR). Under IHR, countries are also required to report any public health emergency of international concern (WordHealthAssembly 2005). This surveillance system captures any disease, condition, or event that could represent an international risk. In the United States, disease reporting is mandated by state law, and the list of reportable diseases which is updated regularly by the Council of State and Territorial Epidemiologists and the CDC vary by state. States report nationally notifiable diseases to the CDC on a voluntary basis (MMWR 2008).

Surveys
Routine surveys are surveillance tools especially useful for monitoring chronic diseases and health-related behaviors. Two of the national surveys conducted in the U.S. are the Youth Risk Behavior Survey (YRBS), and the Behavior Risk Factor Surveillance System (BRFSS). The YRBS and the BRFSS ask high school students and adults respectively, about health-related behaviors such as substance use, nutrition, sexual behavior, and physical activity. Results from these surveillance systems can be used to monitor trends in health behaviors, plan public health programs, and evaluate public health policies at national and state levels. For example, YRBS results have shown a decline in youth smoking from 36% in 1997 to 20% in 2007 (MMWR 2008).

Sentinel Surveillance

This is a population-based surveillance that involves collecting data from a sample of reporting sites (sometimes called sentinel sites). For example, one of the most common sentinel surveillance systems used in the United States is for influenza. Selected health care providers report the number of cases of influenza-like illness to their state health department on a weekly basis. This surveillance allows states to monitor trends using a relatively small amount of information.

Zoonotic Disease Surveillance

Zoonotic surveillance system (diseases found in animals that can be transmitted to humans) involves a system for detecting infected animals. For example, in 2001, the Florida health department conducted surveillance for West Nile Virus (WNV) using a variety of strategies such as the provision of a Web site and a telephone hotline for the public to report dead birds. Mosquitoes and blood were collected and tested for WNV in 10 counties. In addition, veterinarians were asked to test horses with neurologic symptoms consistent with WNV. Health care providers were reminded of reporting and diagnostic criteria for possible human cases of WNV (Blackmore 2003). As a result, detection of WNV led to public health control measures, such as advising the public to protect against mosquito bites and intensifying mosquito abatement efforts.

Adverse Event Surveillance

Some examples of adverse events surveillance are Adverse Events Reporting System (AERS), the Vaccine Adverse Events Reporting System (VAERS). AERS is a type of surveillance system focusing on patient safety, and it is operated by the Food and Drug Administration (FDA) (FDA 2002). The purpose of this system is to gather information about negative effects experienced by people who have received approved drugs and other therapeutic agents. Reports came from health care providers, including physicians, pharmacists, and nurses, as well as members of the general public, such as patients or lawyers, and manufacturers.

Like AERS, the Vaccine Adverse Events Reporting System (VAERS) is focused on patient safety. This system is operated by the CDC with the FDA, operates like AERS, but focuses on negative effects experienced by people who have received licensed vaccines (Zhou W 2003). Because AERS and VAERS are passive surveillance systems, they may be limited by underreporting or biased reporting, and they cannot be used to determine whether a drug or
vaccine caused a specific adverse health event. Instead, these systems are used as early warning signals.

**Syndromic Surveillance**

This surveillance system is a relatively new surveillance method that uses clinical information about disease signs and symptoms before a diagnosis is made. It is an active or passive system that uses case definitions that are based entirely on clinical features without any clinical or laboratory diagnosis (for example collecting cases of diarrhea, rather than cases of cholera). This syndromic surveillance system uses electronic data from hospital emergency rooms, and provides the health department with early notification of the outbreak.

**Registries**

Registries are a type of surveillance system used for particular conditions, such as cancer and birth defects. They are often established at a state level to collect information about persons diagnosed with the conditions. This information can be used to improve prevention programs.

**Laboratory Data**

Public health laboratory data is another source of surveillance data which routinely conduct tests for viruses, bacteria, and other pathogens. Laboratory serotyping provides information about cases that are likely to be linked to a common source. For this reason, serotypes are useful for detecting local, state, or national outbreaks (Swaminathan 2006). For example, in the US, public health laboratories participate in the National Salmonella Surveillance System through electronic reporting of Salmonella isolates. In 2006, more than 40,000 isolates from the US were reported through this system (Center of Disease Control and Prevention 2006). Other laboratory system that plays an important role in surveillance is PulseNet, developed by the CDC and the Association of Public Health Laboratories to monitor foodborne illness outbreaks. This system enables public health laboratories across the US to compare pulsed-field gel electrophoresis (PFGE) patterns of bacteria isolated from ill persons and determine whether they are similar. This allows scientists to determine whether an outbreak is occurring, even at geographically distant locations, and can decrease the time required to identify outbreaks of food borne illness and their causes (Center of Disease Control and Prevention 2008).

Having this variety of surveillance systems, public health practitioners have abroad sources of data ready to be analyzed and distributed at local, state, and national levels for public health action. However, these surveillance systems might increase with the range of health-related events that are associated with public health action and are under surveillance. This issue highlights the importance of having different methods of collecting data and the usefulness that these data means in public health actions including guiding prevention strategies and targeting resources, detecting disease outbreaks of local, national, and international significance, and evaluating public health control measures. Therefore, knowing where to look for different types of data can save valuable time and resources.

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Her most recent research is titled: Assessment and Comparison of Behavior Risk Factor Surveillance Systems for the U.S., Canada, and Italy.

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