CHAPTER 2

Surveillance

Philip S. Brachman

1. Introduction

The term surveillance, derived from the French word meaning “to watch over,” may be defined as a system of close observation of all aspects of the occurrence and distribution of a given disease through the systematic collection, tabulation, analysis, and dissemination of all relevant data pertaining to that disease. Although the methodology of surveillance is basically descriptive, its function is more than merely collective and archival. Surveillance must be dynamic, current, and purposeful. It is fundamental to prompt and effective control and prevention of disease. Traditionally, surveillance was first applied to the acute communicable diseases beginning in the early 1950s. The term has been rapidly expanded since then, to embrace not only a wide variety of noninfectious diseases but also other health-related events such as accidents, injuries, immunizations, the distribution of biological products, and health-care delivery.

2. History

The collection of national morbidity data was initiated in 1878 when Congress authorized the Public Health Service (PHS) to collect reports of the occurrence of the quarantinable diseases, that is, cholera, plague, smallpox, and yellow fever. In 1893, Congress passed an act stating that weekly health information should be collected from all state and municipal authorities. In 1902, in an attempt to develop uniformity, the Surgeon General of the PHS was directed to provide forms for collecting, compiling, and publishing surveillance data. In 1913, the state and territorial health authorities recommended that every state send weekly telegraphic summaries reporting the occurrence of selected diseases to the PHS. All states were reporting the occurrences of disease by 1925. In 1949, when the National Office of Vital Statistics (NOVS) was established in the PHS, the communicable-disease-reporting function (morbidity reporting) was merged with the national mortality registration and reporting functions that were the primary responsibility of the NOVS. Until the early 1950s, the communicable-disease reports were published weekly in the official journal Public Health Reports. When this journal became a monthly publication, the NOVS issued a separate weekly bulletin, the Morbidity and Mortality Weekly Report (MMWR), that was distributed to approximately 6500 persons, state health officers, state epidemiologists, county and city health officers, and others concerned with such routine data. In July 1960, the responsibility for receiving morbidity reports from the states and larger cities and the issuing of the MMWR was transferred from Washington to the Communicable Disease Center [now called the Centers for Disease Control (CDC)] in Atlanta.

Actually, the application of the term surveillance to the watchfulness over a nationally important communicable disease (malaria) was begun in the
early 1950s by the CDC. The application of critical epidemiological evaluation to the former rather crude reports revealed that malaria had ceased to be an indigenous disease. Endemic spread of infection had ceased some years before.

In 1955, following the outbreak of vaccine-related poliomyelitis (the so-called “Cutter Incident”), a national surveillance of poliomyelitis was directed by the Surgeon General as an essential step toward a solution of this national disaster.

In 1957, influenza was placed under surveillance because of the impending pandemic of Asian influenza for which a comprehensive national problem of widespread immunization and education of doctors and hospitals to meet such a possible disaster was undertaken by the Surgeon General. The influenza surveillance program has continued, and one of its essential functions is to provide information to guide manufacturers in the preparation of influenza vaccine as concerns its antigenic composition and the amount of vaccine to produce. In 1961, because of the increasing public-health concern with salmonellosis, a special Salmonella surveillance program was developed in conjunction with the states to better define the problem so that appropriate control and prevention measures could be instituted.

At present, the occurrence of 33 diseases is reported weekly, and that of 7 other diseases is reported annually, to the CDC. Additionally, 7 other diseases are reported by either special case-reporting forms or line-listing forms submitted either monthly or annually. These reports are published in the MMWR and are summarized annually in the MMWR Annual Summary. These lists are reviewed annually by the state and territorial epidemiologists and changed as indicated by the occurrence of the diseases. Additionally, more intensive surveillance is maintained over selected diseases by means of special surveillance efforts to develop more specific data concerning these diseases.

3. Use of Surveillance

A surveillance program can be designed to produce a variety of output data depending on the purpose of the program. It can portray the natural history of the disease, including a description of the occurrence of the disease by time, place, and person. Surveillance data should describe the background (or sporadic, endemic, or ongoing) level of the disease, as well as changes in the occurrence of the disease as modified by nonrecurring events such as epidemics or a hyperendemic situation.

Analysis of surveillance data can help to establish priorities for developing or allocating appropriate health resources for approaching a problem. Surveillance can also be used to confirm a hypothesis or indicate the need for further study or additional data.

Analysis of surveillance data can lead to the development and/or institution of control and/or prevention measures such as vaccine, chemotherapy, chemoprophylaxis, new resources or resource allocation (e.g., people, equipment, or monies), or additional training for persons involved in control and prevention activities. Surveillance can be used to evaluate the effectiveness of newly instituted control and/or prevention measures.

In this chapter, surveillance is discussed primarily as it involves bacterial infectious diseases. Surveillance techniques for other infectious diseases differ little, though there may be some variation in the data-collection procedures.

4. Data Sources

The World Health Organization (WHO) in 1968 codified the term surveillance on a truly global basis. Ten “elements” or distinguishable sources of data were identified; one or any combination of the ten can be used to develop a disease-specific surveillance program. The sources used to develop the surveillance data depend on the disease itself, the methods used for identifying the disease, the goals of the program, the personnel and material resources available, the population involved, and the characteristics of the disease’s occurrence. One source of data can be used regularly and other methods utilized as necessary to improve the sensitivity and/or specificity of the data depicting the occurrence of the disease.

4.1. Mortality Data

Mortality registration has been used the longest, but it is useful only for diseases that are associated with fatalities. If the case-fatality ratio is too low, mortality statistics may not provide an accurate assessment of the occurrence of the disease. If the mortality data are accurate and if the proportion of