"Blueprint Version 2.0": Updating Public Health Surveillance for the 21st Century

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Rapid changes to the United States public health system challenge the current strategic approach to surveillance. During 2011, the Council of State and Territorial Epidemiologists convened national experts to reassess public health surveillance in the United States and update surveillance strategies that were published in a 1996 report and endorsed by the Council of State and Territorial Epidemiologists. Although surveillance goals, historical influences, and most methods have not changed, surveillance is being transformed by 3 influences: public health information and preparedness as national security issues; new information technologies; and health care reform. Each offers opportunities for surveillance, but each also presents challenges that public health epidemiologists can best meet by rigorously applying surveillance evaluation concepts, engaging in national standardization activities driven by electronic technologies and health care reform, and ensuring an adequately trained epidemiology workforce.

KEY WORDS: epidemiology, health care reform, information technology, public health preparedness, public health surveillance

Public health surveillance provides information critical to protecting the health of local, state, and national populations, forming the foundation for public health action. The term *public health surveillance* encompasses the continuous collection of health information; evaluation, analysis, and translation of data into knowledge about the health of communities; and communication of that knowledge to the public and to public health staff, policy makers, and others positioned to take action.[1]

In 1995, the membership of the Council of State and Territorial Epidemiologists (CSTE) endorsed the "Blueprint for a National Public Health Surveillance System for the 21st Century" (Blueprint).[2] This strategic document featured 3 points. First, surveillance addresses a variety of conditions and comprises a variety of methods—not just disease reporting—for measuring and monitoring them. Second, because the goals of surveillance can differ for different levels of government, resources are needed to support the goals of each, particularly if the needs of one level (eg, federal or state) require data collection at another level (eg, state or local). Third, conditions for which national-level surveillance is needed should be determined collaboratively by the Centers for Disease Control and Prevention (CDC) and the states and coordinated through the CSTE.

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Although many components of the Blueprint remain relevant, the changing public health system has challenged parts of its framework. To assess the current state of surveillance in the United States and update strategies for surveillance, the CSTE convened 2 meetings of practicing public health epidemiologists and experts during February and June 2011. Deliberations at those meetings resulted in updates to the Blueprint, which we report here as "Blueprint, Version 2.0." Here, we review surveillance goals, history, methods, and practice at different levels of government; describe current influences affecting surveillance; and update strategies for surveillance.

The Foundation of Public Health Surveillance

Goals

The Institute of Medicine's 1988 report, *The Future of Public Health*,[3] highlighted the role and goals of surveillance by recognizing that 1 of the 3 core functions of public health—assessment—relies on public health surveillance to identify and describe problems, guide decisions about appropriate actions, and monitor progress. The Blueprint detailed the goals of surveillance,[2] which were updated by participants at the 2011 CSTE meetings as follows:

Overarching goal of surveillance:

- To provide actionable health information to public health staff, government leaders, and the public to guide public health policy and programs.

Specific goals of surveillance:

- To recognize cases or clusters of disease or injury to
  - trigger investigations,
  - trigger interventions to prevent disease transmission or to reduce morbidity and mortality, and
  - help ensure the adequacy of medical diagnosis, treatment, and infection control.
- To measure trends and characterize diseases, injuries, and risk factors and identify high-risk population groups or geographic areas to which needed interventions can be targeted.
- To monitor the effectiveness of public health programs, prevention and control measures, and intervention strategies, which include providing information for determining when a public health program should be modified or discontinued.
- To develop hypotheses leading to analytic studies about risk factors for disease and injury and disease propagation or progression.
- To provide information both to the public to enable individuals to make informed decisions regarding personal behaviors and to health care providers to ensure that they base their care of individual patients on the most current surveillance information available.

History

Knowledge of the history of surveillance in the United States provides a framework for understanding current surveillance practice.

Reporting cases of disease to public authorities predated formation of the United States. The colony of Rhode Island passed legislation in 1741 that required tavern owners to report contagious diseases among their patrons.[4] By 1901, all state laws required reporting of selected infectious diseases to local authorities. These laws reflected the state-based legal authority to mandate reporting of personal health information to public authorities, an authority derived from the Tenth Amendment to the United States Constitution that reserves all powers not expressly granted to the federal government, nor otherwise prohibited by the Constitution, to the states.[5] Matthews et al[6] cited the broad scope of surveillance authority as falling under the umbrella of "police powers of a state," which include laws necessary to preserve the public health. All states have developed public health surveillance systems. These systems share many features, although the conditions tracked and data elements reported vary from state to state.

As states and municipalities developed early reporting systems, the need for national-level health information became evident. National tabulation of health data began in 1850 when the United States first published mortality and decennial census data.[4] In 1878, Congress authorized the federal government to collect data and publish weekly notifications of diseases requiring quarantine, such as cholera, smallpox, plague, and yellow fever.[7] Weekly infectious disease notification to the national level increased and continues today, as reflected in the CDC's *Morbidity and Mortality Weekly Report*.[8]

Because of variations in information collected by the states, development of a national surveillance system required coordination among the states. In 1951, the CDC asked the Association of State and Territorial Health Officials to charge state epidemiologists with determining which diseases should be reported nationally. During that year, a meeting of the state epidemiologists, the forerunner of CSTE, generated a standard list of notifiable diseases—all infectious—for the country.[9] The CSTE was formally established in 1955 and met biennially until 1974 and annually thereafter to vote on updates to the list.

Over the years, surveillance systems for noninfectious diseases were developed as well and now exist in

most states, tracking cancer, congenital malformations, heart disease, stroke, diabetes, asthma, injury, maternal and child health, occupationally and environmentally related diseases, and poisonings. Surveillance of risk factors for noninfectious diseases, which has been in place for more than 30 years, has demonstrated the impact of public health interventions, such as the decreasing prevalence of cigarette smoking[10] and increasing use of seat belts.[11]

Methods

Public health surveillance staff rely on a broad array of methods and data sources (Table 1).[2,13-15] Traditionally, these data sources can be grouped into 5 categories: reportable diseases, vital statistics, registries, surveys, and administrative data systems. Surveillance of reportable diseases encompasses the legislatively mandated reporting of cases of specified diseases, with individual identifying information sent by laboratories and medical care providers to local and state health departments for local surveillance and intervention. For diseases that are nationally notifiable, these reports are de-identified, de-duplicated, and sent to the CDC. Vital statistics data provide information about births and deaths. Typical registries include cancer, immunizations, and congenital malformations. Surveys include public health-conducted telephone and school-based surveys, as well as national clinical surveys such as the National Health and Nutrition Examination and National Health Interview Surveys. Administrative data with disease and injury information include hospital discharge data; emergency department visit data; Medicaid, Medicare, and other insurance billing claims; emergency medical services and trauma center data; pharmacy orders; poison control center call data; and police reports of motor vehicle–related and violence-related injuries.

Additional data sources of use to public health surveillance contain information relevant to health but not directly related to measurements of disease and injury. Examples are marketing data on health-related items (eg, tobacco and fast foods); environmental monitoring (eg, occupational lead measurements, remote sensing of weather conditions for understanding the effects of climate change on health, elements of community design such as availability of walking paths); and census data that provide demographic information relevant to predictors of health (eg, poverty, aging, housing).

Surveillance for any given health condition or risk factor should be conducted for a specific purpose. Surveillance methods and data sources must be matched to the specific goals of each surveillance system in accordance with the need for timeliness, sensitivity, positive predictive value, simplicity, and flexibility of the system for the level of public health agency using the data.[2,14,15]

Public health surveillance at different levels of government

The development of surveillance in the United States has resulted in distinct roles at each level of government. For several reasons, local health department staff play an essential role, particularly in controlling infectious diseases. They are usually the first public officials to receive personal health data on infectious diseases. They know well the members of the local medical community who report cases. Local health department staff are usually best positioned to understand how the data were generated and can best interpret aberrations in the data. They have the lead responsibility for further investigating cases and taking public health action to promote community health and safety. Public health interventions often are best conducted by officials close to the local population.[16] Local-level infectious disease surveillance systems are closely associated with and conducted by local disease control programs.

The primary state-level functions in infectious disease surveillance are to support local health officials, help provide resources and expertise, coordinate statewide surveillance activity and information, compile statewide surveillance reports, coordinate activities with other states and the CDC, and report appropriate surveillance data to the CDC. Although sharing of data by states with the federal government is largely voluntary, federal support for state surveillance systems often requires states to share de-identified data with the CDC.

The responsibility for most noninfectious disease surveillance rests at the state, rather than local, level for 3 reasons. First, interventions are often long-term and statewide (eg, targeted cancer screenings or obesity educational campaigns) rather than urgent and locally focused (eg, identifying infected persons or the source of an infectious disease outbreak). Second, legal authority for mitigating causes (eg, enforcement of environmental or occupational exposure standards) usually resides in state agencies. Third, many local health departments lack the personnel and expertise to handle the large and complex data sets used for noninfectious disease surveillance.

The CDC and its federal partner health agencies have responsibilities similar to those of the states. These include monitoring national trends, coordinating multistate outbreak response, supporting state-based surveys (eg, Behavioral Risk Factor Surveillance System), conducting national surveillance systems (eg, National Health and Nutrition Examination Survey, National

TABLE 1 Examples of Matching Surveillance Purposes With Methods

Purpose	Method
Provide case management; notify exposed partners; provide prophylaxis to contacts; detect outbreaks; quarantine exposed contacts; isolate cases; take regulatory actions to prevent exposures to others; target interventions to remediate hazards to exposed persons	Case reporting to local/state health departments by clinicians, health care facilities, and laboratories
Monitor common diseases for which detection of every case is not needed (eg, influenza, Lyme disease)	Sentinel surveillance (collection of detailed information about a subset of cases) or sampling of suspected cases for full investigation
Monitor population vital statistics	Birth and death certificate reporting to states
Monitor population cancer incidence	Case reporting to state health department cancer registries by clinicians, health care facilities, and pathology laboratories
Monitor prevalence of childhood vaccination rates	Reporting of all childhood vaccinations by clinicians to state immunization information systems
Monitor population prevalence of risk factors and health-related conditions	Public health telephone, school-based, community, or other self-report surveys; public health examination surveys; analysis of de-identified electronic health record data, hospital data, claims data, and other clinical encounter data
Measure population levels of environmental and occupational risk factors	Public health or community/worker surveys; environmental monitoring and modeling; biomonitoring
Monitor antibiotic resistance in communities	Electronic laboratory reporting
Monitor characteristics and quality of care for health events and conditions (eg, myocardial infarction, stroke, cardiac arrest, diabetes)	Quality improvement registries (eg, Paul Coverdell National Acute Stroke Registry[a])
Detect evidence for an unreported change in community health or track situational awareness during public health emergencies	Analysis of de-identified clinical data by public health to detect changes in population health (syndromic surveillance)
Evaluate effectiveness of public health programs and interventions; monitor health trends in a population	Trend analysis of vital statistics reports, case reports, vaccination prevalence, clinical and/or billing data, population survey data, worksite injury and death reports, law enforcement records; special surveys
Characterize the epidemiology of specific diseases or injuries, and develop hypotheses about and target interventions toward their risk factors	Analysis of population data or case-based data to describe disease/injury characteristics and risk factors

[a]From Centers for Disease Control and Prevention.[12]

Health Interview Survey, Bureau of Labor Statistics' annual survey of work-related injuries and illnesses, or the federal tracking of coal workers' pneumoconiosis), interfacing with the World Health Organization on global health concerns, and using data to generate research hypotheses. Adequate resources to conduct the considerable work of surveillance are usually not available at the local and state levels; accordingly, the federal government also provides needed technological and financial resources to state and local health departments. As of 2009, 75% of support for epidemiology activities in states was federal.[17]

Influences on Public Health Surveillance

Participants at the CSTE meetings identified 3 major influences currently affecting surveillance: public health information and preparedness as national security issues; the introduction of new information technologies; and health care reform. Each is discussed in the following text.

Public health information and preparedness for national security

With the increasing relevance of health information to national security, non–public health agencies and the public urgently want public health data and information delivered consistently and instantaneously. In addition, surveillance activities and reporting are affected by the World Health Organization's revised 2005 International Health Regulations,[18] which require immediate reporting from member nations of initial indicators of possible global health threats. Although the global magnitude and increased visibility of some aspects of public health surveillance have brought resources to enhance surveillance capacity, they have also brought challenges. Some federal authorities not primarily involved in public health (eg, Congress, Department of Homeland Security, and the White House) increasingly

participate in decisions that directly affect the conduct of surveillance.[19] An example of this new influence is the federal BioSense program. BioSense was mandated in the Public Health Security and Bioterrorism Preparedness and Response Act of 2002,[20] which called for a national public health surveillance system for early detection and rapid assessment of potential bioterrorism-related illness. BioSense brought a new approach to surveillance, new technology, and new funding. However, it also introduced an unproven and inadequately evaluated method of surveillance and failed to incorporate existing public health surveillance infrastructure and response partnerships at the state and local levels. It continues to be modified and supplemented so that it can achieve its envisioned objective.[21,22] Another challenge posed by the heightened need for public health preparedness has been balancing public health attention between highly threatening but rare events such as the 2001 anthrax attack[23] and high-impact but less socially threatening issues such as obesity and hypertension.

New information and communication technologies

The increasing use of electronic health records (EHRs) and laboratory systems is enabling electronic automated reporting of public health information, and this promises to improve the speed, ascertainment, and reusability of surveillance information. In addition, these technologies enable public health agencies to receive and process huge quantities of data—such as EHR and emergency medical services information, insurance claims, poison control hotline call data, antibiotic resistance laboratory test results, and pharmacy antibiotic and other medication orders—in near real time. Technology is also generating new sources of data, such as social networking and contributed ("crowdsourced") information, for possible use by public health programs. Although many of these data have not been fully evaluated for surveillance use, they may offer expanded opportunities for public health surveillance and intervention. For example, automated EHR information may facilitate monitoring of clinical measures, such as blood pressure, cholesterol, and hemoglobin A_{1c}, and use of preventive services at the population level in ways that have not been possible. Technology also provides new ways of using data, such as the syndromic surveillance model, which uses de-identified medical encounter data to provide situational awareness in monitoring the impact on the population of widespread events, such as influenza outbreaks. In instances in which large numbers of electronic laboratory reports require investigation (eg, for Lyme disease), electronic sampling can make surveillance more efficient. Data can also be shared both instantaneously and simultaneously with multiple public health agencies. Furthermore, new technology enables public health agencies to rapidly communicate surveillance information to broad audiences through online news, messaging, search engines, social networking, and point-of-care prompting.

Despite its many advantages, technology complicates the conduct of surveillance in several ways. Increasingly, public health agencies use electronic data collected by non–public health staff for patient care, not surveillance, purposes, and electronic messaging, increasingly involves intermediary processors (eg, health information exchanges [HIEs]) between data sources and public health. The result is that public health has less control over data content and quality, and validating data quality and troubleshooting problems must now involve these third parties. In addition, the capability of sharing data efficiently and simultaneously at the local, state, and federal levels results in less time for local data review to ensure accuracy of and context for the information. Electronic data sharing also raises the issues of who and what levels of government have authority to collect and release surveillance information, prompting public health agencies at all levels to develop written protocols for sharing data with each other and/or the media. Technology also challenges public health jurisdictions to use uniform data standards; as a result, in recent years, the CSTE has standardized the criteria used by states to report the approximately 80 notifiable conditions[24] to the CDC. In addition, the public's use of new technologies, such as cell phones, affects collection of survey data because people with landlines might no longer be representative of the entire population. Technology also has enabled non–public health entities to generate information related to public health, such as Google's indirect monitoring of influenza activity by using queries of its search engine for related topics[25]; the validity and usefulness of such information require more evaluation. Finally, technology-enabled sharing of data poses challenges to protecting individual privacy. One remedy—giving patients the option whether to share personal information via HIEs—provides some personal control over one's privacy but threatens the value of using such incomplete information for surveillance purposes.

Surveillance and US health care reform

The Health Information Technology for Economic and Clinical Health (HITECH) Act (a section of the American Recovery and Reinvestment Act) provides for incentives for developing EHRs capable of reporting clinical information to public health agencies under the "meaningful use" requirements.[26] Also, electronic HIEs are being built with the intent of supporting public

health surveillance, although HIE architectures vary in meeting surveillance needs. These changes are driving the public health sector to rapidly adapt to national electronic capability and standards. These incentives are hastening the transition to electronic information exchange with public health agencies and have the potential to make vast amounts of data on large populations available to public health and non–public health entities, such as health care systems and the Centers for Medicare & Medicaid Services. As a result, entities other than public health agencies, such as the Centers for Medicare & Medicaid Services, will be collecting and releasing information on measures of community health. Another result of HITECH's "meaningful use" incentives is the need for most states to update their existing costly electronic surveillance systems to accommodate new national standards so that these systems can receive and process case reports from EHRs. Limited public health resources make this change challenging.[27]

Updating the Strategic Approach to Surveillance

The United States public health surveillance system has strengths and weaknesses. Its multifaceted diversity, with a variety of data sources, methods, uses, and stakeholders, is a major strength. But a weakness is its insufficient resources to meet current surveillance needs.[17] About 75% of funding for public health epidemiology, most of which supports surveillance, is distributed by the CDC to state and local health departments through cooperative agreements; state and local governments also provide some limited, variable support. Federal funding, which is often directed at specific diseases or program activities, can change over time and therefore result in unsustainable surveillance activity at the state/local level.

The sustainability and governance of surveillance are overarching challenges. Both require that public health surveillance be guided by sound strategy and widely embraced principles. Public health epidemiologists are the logical choice to lead surveillance activities because they have the expertise to evaluate surveillance methods, data, and analysis; prioritize resources for surveillance; and advise national leaders on specific data that need to be tracked and what conditions are trackable. To successfully meet challenges posed by current influences on surveillance, public health epidemiologists must rigorously evaluate surveillance systems, engage in national standardization activities driven by electronic technologies and health care reform, and focus on guiding principles and training that address 21st-century demands.

Evaluation

Ongoing evaluation of surveillance is the domain of public health epidemiologists and is fundamental to the development of a sound strategic approach.[28] Surveillance evaluation can be grouped into the following 4 major areas:

1. *Deciding which conditions to place under surveillance*. Public health agencies are responsible for deciding what conditions to place under surveillance and for evaluating the scope, appropriateness, and importance of existing surveillance systems. Such decisions can guide priority setting for the development of new surveillance methods and data sources. Opportunities for surveillance of conditions not currently under surveillance will increase as technology matures and enables automated detection of likely cases of diseases of public health relevance in EHR systems. Ongoing evaluation is critical to determine which conditions need to be placed under surveillance or which surveillance should continue and what resources will be needed. Recommending the conditions to place under surveillance in all states and in the nation, and establishing consensus on surveillance case definitions, will continue to be key CSTE functions.
2. *Assessing the value of different data sources for surveillance.* The availability of new and massive amounts of electronic data and the technical capability of transferring data to public health agencies present tremendous opportunities to improve and expand surveillance. Even when there is legal authority to collect information and the means to protect patient confidentiality, public health should not make surveillance decisions based merely on the technical capability of receiving large amounts of clinical data; prior critical evaluation of the data is essential to avoid wasting resources and processing unnecessary, incomplete, or irrelevant information, nor should new data sources replace proven data sources until the new sources have been assessed and deemed an improvement. Considerations should include the timeliness of data acquisition; their reliability and validity; and the quantity and cost of managing the data. When possible, new surveillance systems should be built into existing surveillance infrastructure. Evaluation of potential surveillance data should be based on whether the information leads to knowledge and action to protect and improve the public's health at an acceptable cost.
3. *Measuring the effectiveness, including costs, of each surveillance system and the techniques used.* Existing surveillance techniques and systems should

periodically be assessed[28] for modification and, when warranted, discontinuation. Assessments should consider the prevalence, severity, and availability of preventive measures for the condition under surveillance; system cost; data security; and for national systems, standards and flexibility to address needs of states and localities. Public health agencies should evaluate new surveillance techniques for their usefulness. As appropriate, new techniques should be used to improve population health and, if not found to be useful, changed substantially or abandoned.

4. *Assessing the usefulness of surveillance data for prevention and policy development.* Public health agencies are also responsible for assessing how well surveillance data are translated into information for action. They should ensure that surveillance information is used for planning, implementation, and evaluation of interventions. Publicizing surveillance information is also necessary. The peer review process for publishing surveillance results is one method. However, technical capabilities, such as public Web sites, new visualization tools, and social network sites, offer ways to rapidly disseminate information. Also, point-of-care bidirectional communication between public health staff and clinicians can facilitate clinical decision making based on the most current public health information. Epidemiologists must hone their skills in disseminating their messages and assess how well surveillance information is used for public action.

Surveillance standardization

Information technology increasingly demands standardization of surveillance systems. The CDC and state/local public health agencies must embrace and participate in national standardization when variation is unnecessary. Jurisdictions must eliminate needless differences in surveillance systems. However, because public health action often occurs locally, states and localities will need to customize their information collection and systems need to accommodate such flexibility. Similarly, where feasible, CDC staff should unify their various systems to receive data from states. Currently, for example, different programs at the CDC have developed their own unique systems to meet their specific program needs for receiving infectious disease case information from states. Such systems can be costly to maintain and burdensome to states and localities. In addition, as data from electronic medical records are increasingly used for monitoring health and health care, the various federal health agencies (eg, CDC, Agency for Healthcare Research and Quality, Food and Drug Administration) that collect data derived from medical records should coordinate activities and reporting standards to simplify requirements on data providers and avoid duplication of effort.

Twenty-first-century demands on public health epidemiologists

The public health epidemiologist of the 21st century is called on to address numerous challenges (Table 2) within the context of likely tighter future public funding for surveillance and continued distributed governance involving federal, state, territorial, and local officials. The Blueprint[2] included guiding principles that for the most part remain relevant but were updated by the attendees of the CSTE meetings as shown in Table 3. The public health environment of today calls on public health epidemiologists to focus anew on these principles. In addition to expertise in epidemiology, surveillance, and good communication skills, they must have a basic understanding of informatics to help ensure access to electronic information. They must be open to new technologies, approaches, and perspectives while adhering to the core principles and purposes that have successfully guided public health surveillance in the past. Also, within the epidemiology workforce, a cadre of highly trained informaticians is essential to meet the challenges of new health information technologies.

TABLE 2 ● Twenty-First Century Challenges for Public Health Epidemiologists

Determine what conditions (illnesses, risk factors, exposures, hazards) should be under surveillance in a uniform way across the nation.
Define the most valuable information and data for public health agencies to collect from new data sources and make them available to public health staff, the public, government leaders, and clinicians while protecting the confidentiality of individually identifiable health information.
Evaluate and promote new surveillance methods based on these data sources, including advising the CDC on best practices and systems for national surveillance.
Advocate for public health needs by developing recommendations for information technology specifications for local, state, territorial, and national surveillance systems and assess cost.
Define the technical data specifications (ie, develop technical implementation guides) for exactly what information public health agencies want to receive from electronic health records and laboratory information systems.
Encourage states to standardize methods and decrease needless variation in surveillance practices once goals and methods of surveillance using these new data sources have been determined.

Abbreviation: CDC, Centers for Disease Control and Prevention.

TABLE 3 ● Guiding Principles for Public Health Surveillance

1. Public health surveillance is the ongoing collection, analysis, interpretation, and dissemination of data for a stated public health purpose.
2. The primary goal of surveillance is to provide actionable health information to public health staff, government leaders, and the public to guide public health policy and programs.
3. All surveillance activities should be periodically evaluated. Because of limited resources, surveillance and assessment efforts must be intentional and prioritized to address the highest priority problems and problems most amenable to intervention.
4. Adequate and stable resources must be made available for public health surveillance and assessment, based on realistic goals for surveillance capacity within state and local health departments.
5. All levels of government need to collaborate in designing and operating surveillance systems to meet differing priorities, maximize the value of data collected, and minimize toll on public health partners.
6. Surveillance methods should match surveillance goals, and data should be collected in the least expensive manner possible, consistent with objectives. Accordingly, surveillance data should flow in a most efficient, timely, and secure manner, given the relationships among public health agencies and their partners, and public health roles and responsibilities as defined by local, state, and federal laws.
7. High-quality data are needed if surveillance information is to be relied on, but data quality needs to be only as good as its purpose. Because no data are perfect and perfecting data can be costly, matching data quality to its use is imperative.
8. Confidentiality of surveillance data must be ensured.
9. To achieve the most public health good, surveillance data should be shared among public health partners in ways consistent with law and protection of personal confidentiality and privacy.
10. Public health data ownership must be clear, and explicit data use agreements should be established among all levels of government sharing data.

Moving forward, all private and public organizations, as well as individuals, involved in collecting information likely to be used for public health purposes should collaborate with public health epidemiologists during development of their systems to ensure that the systems are designed to facilitate multiple anticipated uses. Public health epidemiologists must involve themselves in the design process and make their needs known when they anticipate data use from clinical and other health systems. In addition, public health epidemiologists must critically evaluate the data from new sources and determine their usefulness for public health surveillance, as well as actively collaborate with other public health experts, such as communication specialists, who can help improve surveillance. Above all, they must promote the importance of surveillance to policy makers, the clinical care sector, and the public by articulating its valuable and essential contributions to the whole health enterprise and the need for adequate funding and support. A collective vision of and active involvement in public health surveillance can ensure that public health agencies harness the potential of recent technological and health care developments for the public good.

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