

BioSense — A National Initiative for Early Detection and Quantification of Public Health Emergencies

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Abstract

BioSense is a national initiative to enhance the nation's capability to rapidly detect, quantify, and localize public health emergencies, particularly biologic terrorism, by accessing and analyzing diagnostic and prediagnostic health data. BioSense will establish near real-time electronic transmission of data to local, state, and federal public health agencies from national, regional, and local health data sources (e.g., clinical laboratories, hospital systems, ambulatory care sites, health plans, U.S. Department of Defense and Veterans Administration medical treatment facilities, and pharmacy chains).

Introduction

BioSense is a national initiative to support the advancement of early detection capabilities by promoting greater and timelier acquisition of relevant data and by advancing technologies associated with near real-time reporting, automated outbreak identification, and analytics. It is one of three initiatives recently advanced by the President of the United States to improve national preparedness; others include BioShield, which focuses on rapid development of vaccines and therapeutics, and BioWatch, which places environmental air samplers in key locations.

To enhance consistency of public health surveillance nationally, BioSense will facilitate the sharing of automated detection and visualization algorithms and approaches by promoting national standards and specifications developed by such initiatives as the Public Health Information Network (PHIN) (1) and the eGov activities of Consolidated Health Informatics (2). Finally, the initiative will encourage integration of early detection systems with outbreak management and response systems. Because the benefits of early detection emanate from early response, standards for early detection systems will help them share data and integrate with information systems that support the management of possible and confirmed cases, laboratory results, isolation, prophylaxis, and vaccination.

BioSense is a component of PHIN, which seeks to use industry data and technical standards to develop specifications and software elements, allowing for a national electronic network to support public health needs. In addition to inclusion of functional and technical specifications for early event detection, PHIN also provides routine public health surveillance (e.g., the National Electronic Disease Surveillance System [NEDSS]), secure communications, analysis and visualization, information dissemination and knowledge man-

agement, health alerting, outbreak management, laboratory information systems, and vaccine and prophylaxis administration (Figure 1).

BioSense will include an Internet-based software-system implementation to enable public health officials in major cities to view data for their communities (Figure 2). The software system will implement identified industry standards and provide a platform for integrating and evaluating different outbreak-detection approaches. The BioSense software system includes both spatio-temporal and temporal analysis algorithms and approaches to visualizing unusual events in data (Figure 2). Phase I of the BioSense system is operating in >20 cities nationally.

Supporting Early Event Detection

Discussion around early event detection over recent years has focused on the relative value of data sources that are prediagnostic or syndromic in nature. BioSense seeks to advance public health capabilities for both prediagnostic and diagnostic data sources in near real time. Given the ongoing controversy about prediagnostic surveillance, BioSense will support rigorous evaluation of these data sources. Where available, BioSense will prioritize early detection data on the basis of diagnostic skills of clinical personnel. Frequently, tension exists between getting data early and having them be inclusive of clinical judgment, but progress can be made in advancing real-time reporting of diagnostic and prediagnostic data that emanate from settings in which an experienced medical professional originates the data.

At the same time, BioSense will seek to minimize reporting burden by extracting early detection information from data sources that exist for purposes other than public health

FIGURE 1. Public Health Information Network (PHIN) component functions and initiatives

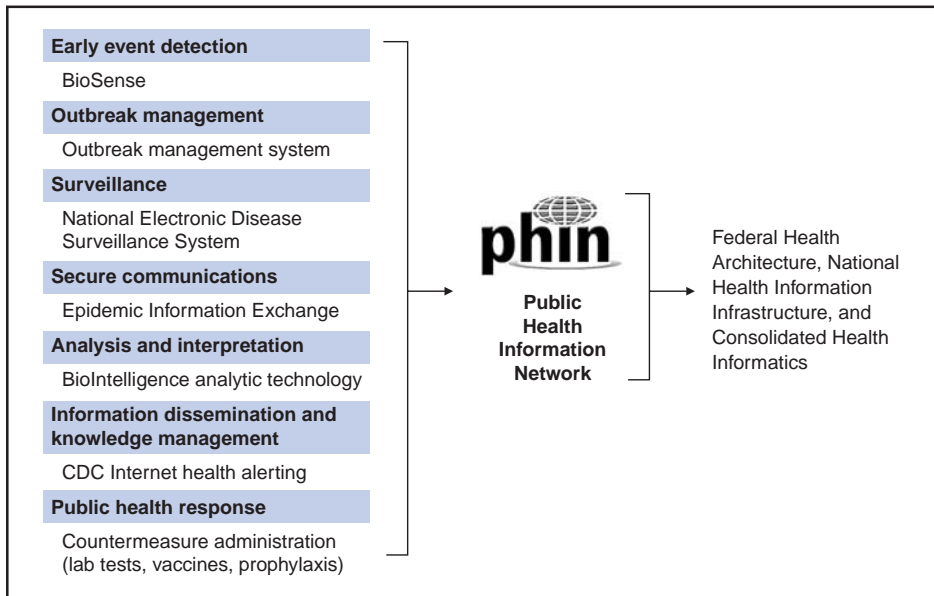
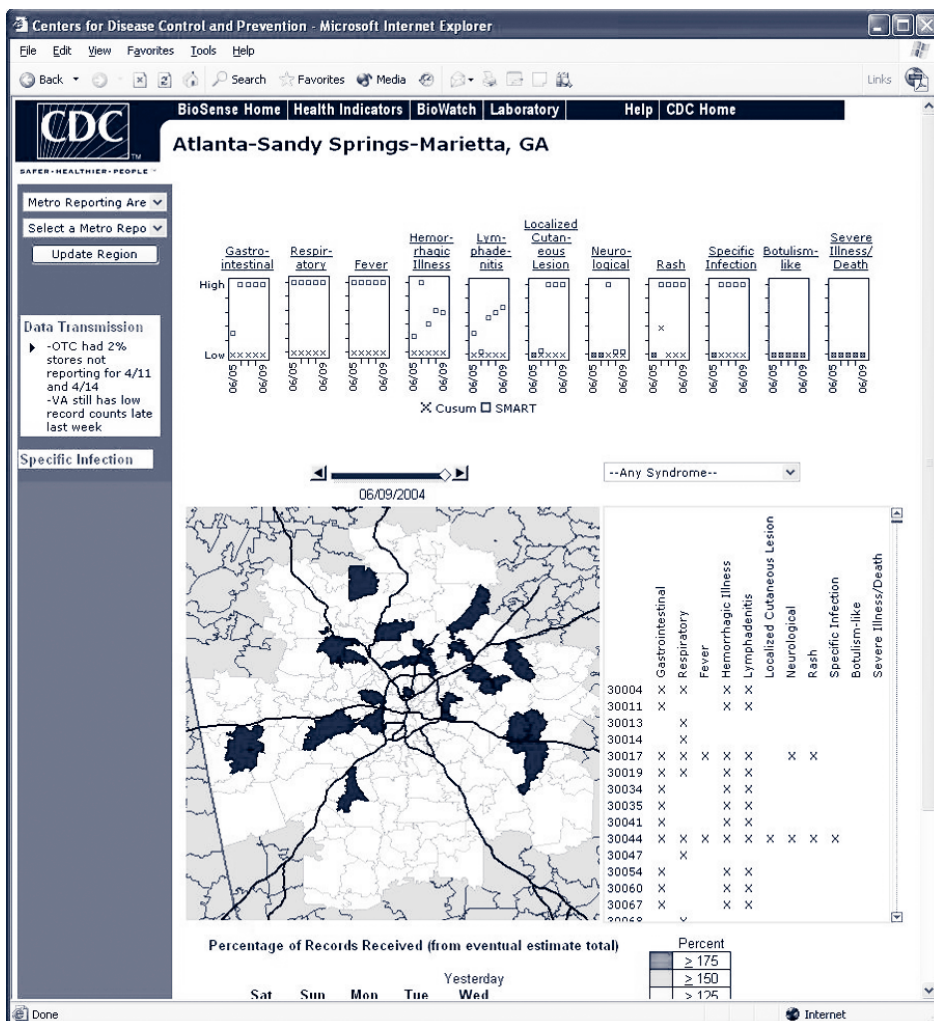


FIGURE 2. Demonstration data displayed on the BioSense software system



reporting. For example, it will use clinical-care information-system data rather than asking medical personnel to enter data manually for the sole purpose of detecting an outbreak.

BioSense will support early event-detection capabilities at the local, state, and national levels. Because routine public health reporting systems are inconsistent across the United States, early detection is usually implemented, if at all, at only one of these levels for any given area. To maximize national ability to detect and manage events early, to leverage expertise at local, state, and national levels, and to take advantage of data sources that are aggregated locally, regionally, and nationally, capabilities need to be advanced at all three levels and data need to flow rapidly and easily among them.

Guiding Investigation Decisions

Consequence management is a key concern for public health, and although electronic detection systems might be useful in assisting public health professionals, they can also create a tremendous burden. BioSense seeks to address these concerns in the short term by avoiding the forced consequence management of predetermined alerts. Instead of necessitating a series of responses to an alert that is identifying only a possible occurrence, BioSense seeks to capitalize on the analytic capabilities of public health professionals, including their abilities to compare and interpret multiple data sources and determine the likelihood of an event. It should also enable them to create and manage thresholds and circumstances for alerting to avoid forced consequence management. To support these capabilities of public health professionals, BioSense should coordinate viewing of multiple data sources and leverage these sources into greater sensitivity and greater specificity.

Addressing Privacy Concerns

Although prediagnostic data sources remain to be rigorously evaluated, researchers using such data sources should anticipate concerns about privacy from the public. To address such concerns, BioSense promotes the use of data that do not contain direct patient identifiers, even though public health authorities are eligible under the Health Insurance Portability and Accountability Act of 1996 (HIPAA) to receive identified data under certain circumstances. All BioSense data will be securely managed for access by authorized public health professionals with appropriate jurisdictional access controls, and data providers will retain any directly identifiable information. An anonymous data linker will enable an authorized public health investigation in the event of a potential outbreak.

Supporting Public Health Needs

Finally, BioSense seeks to pursue early detection in the context of the multiple needs of public health. Initial detection of an event by identifying patterns of health-seeking behavior should be followed by case identification and quantification of the number, locations, and density of cases. Identifying a possible outbreak requires investigating symptoms across

multiple cases, travel history, and possible environmental exposures, and then tracing contacts relative to people and disease vectors. These capabilities should be integrated with early detection systems and with systems for isolation, prophylaxis, accelerated vaccination, and adverse-event follow-up and management.

Conclusion

The initial focus of BioSense has been to advance early detection and management technologies and capabilities in a way that considers public health needs and ongoing efforts to use and evaluate early detection technology and data sources. It intends to support this work at national, regional, and local levels and provide a test bed for further evaluation and implementation.

References

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2. eGov. Government to business portfolio: consolidated health informatics. Washington, DC: eGov, 2003. Available at http://www.whitehouse.gov/omb/egov/gtob/health_informatics.htm.