PUBLIC HEALTH SURVEILLANCE: PREPARING FOR THE FUTURE

CDC's goal for federally supported surveillance activities is to get the right information into the right hands at the right time. A strategic plan to improve surveillance at CDC was launched in February 2014 to better achieve this goal.

Our strategy to improve public health surveillance builds on prior progress inside and outside CDC. It prioritizes rapid improvements that can be made at CDC in the short term, while laying the groundwork for ongoing evaluation and modification of surveillance systems. It challenges CDC to transform and modernize our surveillance systems, demonstrate rapid improvements, and inspire trust with surveillance partners in the field, all using a stepwise approach... Ten specific aims drive three strategic goals:

- Surveillance Leadership Board
- Workforce plan
- Innovation consortium
- HIT policy engagement
- HIT vendor forums
- Informatics integration
- Data availability
- System usability
- Reduced redundancy
- New information technology

Contents

Centers for Disease Control (CDC)

Stakeholder(s):

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Vision

The right information in the right hands at the right time.

Mission

To transform and modernize our surveillance systems.

Values

Data Standards: Our strategic plan for surveillance focused on what CDC must do to make greater use of established data standards, decrease unnecessary redundancies and reporting burdens on state and local health departments, and reduce the number of stand-alone systems.

Partnership: Along with our partners, we continue to address ongoing challenges as well as broader health data issues to meet a changing landscape confronting the agency and public health.

Learning: As this report highlights, our efforts over the last few years to improve public health surveillance have, indeed, moved us forward. We've made progress within a focused, but limited, scope. We've also learned some important lessons that will inform our next steps.

Evolution: Public health surveillance is always evolving. Just in the past 2 decades, we've witnessed public health's evolution from monitoring infectious diseases to tracking the occurrence of many noninfectious conditions, such as injuries, birth defects, chronic conditions, mental illness, illicit drug use, and environmental and occupational exposures to health risks.

Openness: With this widened surveillance lens, we must be open to new data sources and methods and preserve the essential systems in place.

Connectivity: Public health surveillance requires connectivity. It may take time, but the sum of our efforts are greater than the parts. We must connect data locally, nationally, and globally. We must do things electronically and automated whenever we can. We must also find enterprise-wide solutions at CDC that promote efficiency and reduce reporting burden on partners.

Continuous Improvement: Public health surveillance relies on continual improvement. As the topics of surveillance have evolved, so have the methods of surveillance, spurred by rapid advances in information technology. Given the proliferation of data systems, new tools and technologies, and new workforce needs, we must be open to a new way of doing business.

Commitment: Our biggest lesson is that the work is not done. We have an obligation to keep our nation safe, healthy, and secure. We must therefore continue our efforts—and commit to doing much more—to improve what we can, where we can, on a continual basis. We can't afford not to.

Safety

Health
Security

1. Surveillance

Enhance the accountability, resource use, workforce, and innovation for surveillance at CDC and in support of federal and state, territorial, local, and tribal agencies.

Stakeholder(s)

Surveillance Leadership Board :
The Surveillance Leadership Board provides oversight and accountability; the workforce training plan addresses sur-veillance workforce needs in the short and long term; and ...

CDC Health Information Innovation Consortium :
the CDC Health Information Innovation Consortium (CHIIC) promotes innovative solutions to surveillance chal-lenges across CDC programs and in federal and state, tribal, local, and territorial agencies.

Public health surveillance is the cornerstone of public health practice. Surveillance data are crucially important to inform policy changes, guide new program interventions, sharpen public communications, and help agencies assess research investments. Fulfilling our mission to protect the public's health, CDC invests heavily in supporting surveillance expertise inside and outside the agency.

1.1. Data

Collect, analyze, use, and share data to prevent and control disease and injury.

Public health surveillance is defined as the regular collection, analysis, use, and sharing of data to prevent and control disease and injury... CDC works around the clock to get the right information into the right hands at the right time. To meet increasing demands for speed and accuracy, we must constantly improve how we track and report illness and other health conditions. In response to recommendations to transform and modernize CDC's surveillance systems and approaches, we are [pursuing the following objectives]

1.1.1. Availability & Timeliness

Improve availability and timeliness of data

1.1.2. Accuracy & Speed

Adopt new technologies to improve accuracy and speed of disease reporting

1.1.3. Reporting Burden

Reduce reporting burden on health departments

Stakeholder(s):
Health Departments

1.1.4. Performance

Maximize performance of agency resources

1.2. Vital Statistics

Provide a picture of the nation's health.

Birth and death data—known as vital statistics—provide a valuable picture of the nation's health. Mortality surveillance tracks the characteristics of those dying in the United States, helps determine life expectancy, and allows comparisons of death trends with other countries. How people die provides insights into health threats encountered when they lived... Death certificates were one of the first sources of public health surveillance data. When we look at mortality data, every death certificate tells a story. When viewed collectively, they uncover health disparities, inform policy and funding decisions, and improve outbreak and disaster response efforts. Information from death certificates is increasingly used to expose and address a national crisis—drug-poisoning deaths. Improving reporting of the specific drug(s) on the death certificate is one way to help save future lives. Mortality data are used routinely to [support the following objectives]

Stakeholder(s):

Local Vital Registrars :
Our federal data assets are only as strong as our state and local resources. Tracking and reporting mortality is a complex and decentralized process with a variety of systems used by more than 6,000 local vital registrars to report death.

Jurisdictions :
State, local, and territorial authorities—known as jurisdictions—are responsible for the legal registration and record of death.

National Center for Health Statistics :
CDC, through the National Center for Health Statistics, finalizes and releases the data once all authorities have reported.

1.2.1. Initial Cases

Detect initial cases of infectious diseases, trauma, and toxicity that might signal a larger public health emergency

1.2.2. Monitoring & Response

Monitor specific preventable deaths, like drug-poisoning deaths, and craft a public health response

1.2.3. Awareness

Raise awareness of issues like heart disease, cancer, diabetes, child nutrition, Alzheimer's disease, and suicide

1.2.4. Insights

Provide insights on what steps can be taken to prevent further lives lost

2. Data

Accelerate the use of emerging tools and approaches to improve the availability of quality and timely surveillance data.

Senior policy and informatics experts at CDC oversee health information technology (HIT) policy engagement, HIT vendor forums, and surveillance-related efforts with the Office of the National Coordinator for HIT and other federal information technology regulators.

2.1. System

Develop a more flexible, adaptive, and timely data system for notifiable diseases.

Developing a more flexible, adaptive, and timely data system for notifiable diseases is an important part of CDC's strategic approach to surveillance

3. Initiatives

Demonstrate early success through four crosscutting surveillance system initiatives to improve public health surveillance outcomes.

These initiatives address specific strategic aims. Two additional strategic priorities were added to improve program and data integration at CDC and facilitate better connectivity between public health and health care.

3.1. MORTALITY REPORTING

Modernize and transform the National Vital Statistics System (NVSS) into a system capable of supporting near-real-time mortality surveillance.

3.2. NOTIFIABLE DISEASES

Enhance surveillance capabilities of the National Notifiable Diseases Surveillance System (NNDSS) by improving data collection, sharing, and analysis across the entire public health community through the NNDSS Modernization Initiative (NMI).

Notifiable Disease Surveillance — Health officials monitor diseases and conditions that can cause serious illness or a significant public health concern. States send data on these notifiable diseases or conditions to CDC. Since 1879, health officials have monitored diseases such as cholera and smallpox. Today, public health tracks infectious diseases like Zika, foodborne outbreaks such as E. coli, and noninfectious conditions such as lead poisoning.

Stakeholder(s):

Local Health Officials :
Local health officials compile information from healthcare providers, laboratories, and other reports.

Healthcare Providers

Laboratories

Local Health Departments :
Local and state health departments use the data to identify and control disease outbreaks. They ensure people are effectively tested, treated, and provided with the care they need to stay healthy.

State Health Departments

States :
States submit data to CDC, where the information is used to guide public health policy and prevention strategies that keep people healthy and defend America from health threats.

National Notifiable Diseases Surveillance System :
The National Notifiable Diseases Surveillance System (NNDSS) relies on the monitoring and disease control activities performed by local and state public health departments across the country. A modernization initiative is making it faster and easier for state health departments to send data to CDC, and CDC is improving how it delivers these data to our disease programs.

3.2.1. Detection

Detect disease when and where it happens

3.2.2. Transmission

Stop disease before it spreads

3.2.3. Science

Study disease to strengthen the science

3.2.4. Prevention & Control

Improve how we prevent and control disease

3.2.5. Health

Keep people healthy

3.3. ELECTRONIC LABORATORY REPORTING

Accelerate the adoption of electronic laboratory reporting (ELR) through collaboration among clinical laboratories, vendors, and public health agencies.

Electronic Laboratory Reporting — Electronic laboratory reporting provides vital information on reportable conditions—like sexually transmitted diseases, hepatitis, foodborne diseases, and lead poisoning—to local and state public health departments. For decades, reporting was a slow, paper-based process from different laboratories of all sizes. Now, it's an electronic data transmission with a standard process and reporting format that allows faster sharing of critical information... Public health action and medical decisions depend on laboratory results. Fast and accurate laboratory tests and reporting enable communities to track disease trends and identify outbreaks, as well as help diagnose and treat health conditions.

Stakeholder(s):

Clinical Laboratories

Vendors

Public Health Agencies

States :
Varying reporting streams and formats — State laws and regulations require healthcare providers and laboratories to report events of public health importance for specified diseases to 50+ state and local health departments that often have different lists of reportable diseases and laboratory reporting requirements.

Healthcare Providers

State Health Departments

Local Health Departments

Laboratories :
Piles of paper and long processing time — Laboratories generate approximately 20 million reports to send to health departments annually. In the past, these were paper reports that were mailed, faxed, or not sent at all—and took days to arrive and many hours to process.

Hospitals :
Prioritizing speed and standards — Today, through automation, standardization, and partnership, most reports from 11,000 hospital and private and public health laboratories are sent electronically and meet health department requirements.

3.3.1. Transmission

Transmit data electronically.

Electronic transmission improves timeliness, reduces manual data entry errors, and delivers more complete and consistent reports across various data sources to state health departments. It also supports national public health surveillance by improving the timeliness and accuracy of notifiable disease data that states voluntarily share with CDC.

Stakeholder(s):

State Health Departments

3.4. SYNDROMIC SURVEILLANCE

Improve public health ability to analyze, compare, and act on real-time data from emergency departments and other sources by enhancing the National Syndromic Surveillance Program (NSSP) as part of the BioSense Enhancement Initiative.

Syndromic Surveillance — Syndromic surveillance serves as an early alert for health events by tracking symptoms such as respiratory distress, fever, and vomiting—before a diagnosis is confirmed. Emergency departments and other sources send this information as electronic messages to public health agencies. Messages are monitored daily to understand usual levels of illness and to detect changes that require a response.

Stakeholder(s):

Communities :
Following 9/11, initial investments were made in enhancing syndromic surveillance as an early warning system for bioterrorism. This system now allows officials to detect a much wider range of health threats—from opioid overdoses to chemical spills to outbreaks. Equipping communities with diverse, real-time health data that reflect local realities enables faster decision making and better protects Americans.

- *Emerging infectious diseases and outbreaks*
- *Chronic diseases and their complications*
- *Injury issues (drownings, overdoses)*
- *Mass gatherings and their situational needs*
- *Environmental conditions and their impact*
- *Natural and manmade disaster response needs*

3.4.1. Data

Connect local, state, and national public health agencies to data from healthcare facilities.

Using data from emergency departments nationwide to track symptoms has become a model for electronic data exchange between health care and public health. CDC's National Syndromic Surveillance Program helps connect local, state, and national public health agencies to data from more than 4,000 healthcare facilities in 45 states, and Washington, DC. Officials can unite nationwide and act quickly when something unusual happens. They can also monitor how well their response is working and adjust as needed.

Stakeholder(s):

Healthcare Facilities

State Public Health Agencies

Local Public Health Agencies

National Public Health Agencies

3.4.1.1. Opioid Epidemic

Combat the opioid epidemic.

Connecting Data Helps Combat the Opioid Epidemic — Each day, more than 115 Americans die of opioid overdoses. Each year, almost 12 million Americans misuse opioids. How can harnessing the power of surveillance data help reverse the trajectory of this epidemic? Connecting scientists, data, and insights can help.

Stakeholder(s):

CDC Scientists :
To keep up with this fast-moving epidemic, CDC scientists from different centers work together to examine the timeliest data available to the agency on emergency department visits for opioid overdoses across multiple states. They integrate information from two unique CDC surveillance programs—the Enhanced State Opioid Overdose Surveillance Pro-

gram and the National Syndromic Surveillance Program—to get a clearer picture of fatal and nonfatal opioid overdose data, respectively, and a better understanding of the public health impact of this crisis across states.

Emergency Departments :
Some important results from this ongoing analysis were published in the March 2018 MMWR's Vital Signs: Trends in Emergency Department Visits for Suspected Opioid Overdoses—United States, July 2016–September 2017. Data from 16 states shows quarterly trends on emergency department visits by state and by rural/urban differences. Overall, emergency department visits for suspected opioid overdoses showed sharp increases and variation across these states, pointing to opportunities for action.

Public Health Decision Makers :
Insights gleaned from this report can help guide resource and response decisions locally and nationally.

3.4.2. Innovation

Find new tools and ideas to enhance the collection and use of health data.

Enhancing Surveillance Through Innovation — Finding new tools and ideas to enhance the collection and use of health data is a key part of improving surveillance. CDC is embracing innovation in a host of ways.

Stakeholder(s):

CDC Health Information Innovation Consortium :
PROGRAMS — The CDC Health Information Innovation Consortium (CHIIC) was launched to foster and promote creative solutions to surveillance challenges unique to public health.

CDC Partners :
PRIORITIES Two additional strategic priorities have expanded the strategy's innovation efforts: the Surveillance Data Platform, which is working toward shared tools and services to reduce the burden of data reporting on CDC and our partners; and the Digital Bridge, a collaborative effort among partners in health care, public health, and health information technology that focuses on electronic case reporting of health data.

Innovators :
TECHNOLOGY — Working with the latest innovations is key to being part of the health data landscape at large. CDC informatics projects have focused on new tools, including electronic health records; modern data visualization techniques; and the use of Fast Healthcare Interoperability Resources, or FHIR (pronounced "fire"), a suite of open source, web-based technology that centers on enhancing data interoperability.

Georgia Tech :
PARTNERSHIPS — Innovation at CDC also focuses on partnerships within government, private, and academic sectors to advance progress in public health. These include tapping into the HHS Entrepreneurs-in-Residence Program; collaborating with universities, such as Georgia Tech; and engaging established and rising data experts to learn from each other in novel ways through events like code-a-thons.

3.4.3. New Approaches

Stimulate and test new approaches to traditional public health surveillance..

To improve surveillance and advance our mission, CDC created a forum for innovation to stimulate and test new approaches to traditional public health surveillance...

Stakeholder(s):

CDC Health Information Innovation Consortium :
The forum, CHIIC, funds select informatics and health information technology (HIT) projects, makes them available as reproducible tools and models, and shares lessons widely. It also helps CDC stay well-informed about current national HIT standards and policies.

3.4.3.1. Data

Improve timeliness and accuracy of data collection.

To improve timeliness and accuracy of data collection, we need forums like CHIIC that foster creative solutions to public health challenges. Since 2014, CHIIC projects have driven informatics advances in cancer control, reporting of stroke cases, and tracking antibiotic resistance in food-borne pathogens. Many of the tools from

these projects can be reused or extended to other surveillance systems or activities. They are paving the way for greater interoperability within the agency and beyond. CHIIC's priority areas include:

3.4.3.1.1. Services, Interoperability & APIs

Shared services, interoperability, and application programming interfaces (API)

3.4.3.1.2. Collaboration & Communication

Collaboration and communication tools and processes

3.4.3.1.3. Management, Analysis & Visualization

Data management, analysis, and visualization

3.4.3.1.4. Standards

Emerging data and HIT standards

3.4.3.1.5 . Privacy & Security

Privacy and security

3.4.3.1.6. Decisions, Algorithms & ML

Decision support, algorithms, and machine learning

3.4.3.1.7. Acquisition, Transfer & Use

Revolutionize the way public health gets, transfers, and uses data.

CDC is revolutionizing the way public health gets, transfers, and uses data. Currently, busy state health departments that track and report illness, injuries, and outbreaks must submit information to more than 100 different CDC surveillance systems and programs. The Surveillance Data Platform will enable health departments to send data to one place. A shared information technology service, working behind the scenes, will automatically examine data and securely send it to the correct CDC programs.

Stakeholder(s):

Federal Agencies :

Surveillance Data Platform — Public health surveillance relies on information collected by more than 3,000 federal, state, and local agency partners. Data are submitted from states to CDC programs in many ways through numerous systems, increasing the workload of state and local public health staff. CDC is developing shared surveillance tools that can be

plugged into multiple surveillance systems to improve efficiency...

State Agencies

Local Agencies

3.4.3.1.8. Efficiency

Improve efficiency

People — Improving efficiency at CDC benefits federal, state, and local public health experts

Stakeholder(s):
Public Health Experts

3.4.3.1.9. Task & Workload

Eliminate redundant tasks and reduce workload

Process — Streamlining data submission and routing eliminates redundant tasks and reduces workload

3.4.3.1.10. Deployment & Scalability

Ensure rapid deployment and on-demand scalability

Building shared disease surveillance services ensures rapid deployment and on-demand scalability

3.4.3.1.8. Technology & Standards

Implement cutting-edge technology and apply industry standards to critical public health challenges

Putting Data to Work: A New Solution on the Horizon — CDC is implementing cutting-edge technology and applying industry standards to critical public health challenges—from infectious diseases to chronic health conditions. The Surveillance Data Platform benefits the people, processes, and technology that inform and support our nation's public health system. The new platform is being released in stages beginning in 2017.

3.4.4. Electronic Case Reporting

Automate sharing of critical health information.

Improving how data flows between public health and health care using health information technology is critical to making health data more useful. Electronic case reporting is the automated sharing of critical health information between electronic health records and public health agencies for review and action. The Digital Bridge—an exciting new partnership in which CDC is collaborating—is addressing this... Eighty-five percent of all health data is now electronic. With the proliferation of disease outbreaks and the need for fast access to patient healthcare data, bridging the electronic exchange of information between public health and health care is essential for timely, accurate, and accessible disease surveillance... New technology is addressing the gap through a decision tool that automatically sends needed case data to public health. This allows for better and quicker exchange of data between public health and health care, prompting earlier disease detection and intervention.

Stakeholder(s):

Hospitals :
Hospitals and doctors use electronic information to make well-coordinated decisions to improve population health

Doctors

State Public Health Departments :
State public health departments vary in their data reporting requirements, presenting a challenge for health care

3.1.4.1. EHRs

Make it easier to extract data from EHRs to unite health care and public health.

Putting Data to Work: Connecting Data for Action — Much can be gained by improving the use and exchange of electronic health record (EHR) data to enhance individual health and take public health action when needed. The Digital Bridge partnership is making it easier to extract data from EHRs to unite health care and public health... The first five reportable conditions being shared are chlamydia, gonorrhea, pertussis, Salmonella, and the Zika virus.

Stakeholder(s):

California :
The first initiative—electronic case reporting—is being tested at seven sites in California, Houston, Kansas, Massachusetts, Michigan, New York City, and Utah.

Houston

Kansas

Massachusetts

Michigan

New York City

Utah

3.1.4.2. Data Flow

Make electronic health data flow quickly and seamlessly.

Better Data Connections — Today's technology demands more connectivity than ever before. This is prompting public health to explore new ways to make electronic health data flow quickly and seamlessly to improve health outcomes. To enhance surveillance, we are utilizing interactive data dashboards, bioinformatics in the cloud, application programming interfaces (APIs), Fast Healthcare Interoperability Resources (FHIR, pronounced "fire"), and SMART (Substitutable Medical Apps, Reusable Technology) on FHIR apps. CDC is testing and applying these open source, more Internet-like approaches to connecting and sharing health data to increase what is known as interoperability.

3.1.4.2.1. Mortality Data

Use open source, web-based tools to modernize mortality data reporting.

More timely data on death improves health — Exploring and using open source, web-based tools to modernize mortality data reporting provides newer, faster insights on what steps can be taken to prevent further lives lost.

3.1.4.2.2. Food-Borne Bacteria

Find out how antibiotic resistance has changed for bacteria transmitted through food.

Germ data dashboard informs health officials — The NARMS Now: Human Data web dashboard, an interactive tool from CDC, makes it easier and quicker to find out how antibiotic resistance has changed over the past 20 years for 4 bacteria transmitted commonly through food.

3.1.4.2.3. Stroke

Gather and share patient information that can reduce stroke re-admissions.

App benefits stroke patients and healthcare workers — An electronic health records app developed for healthcare professionals can aid in gathering and sharing hard-to-track patient information that can reduce stroke re-admissions.

3.1.4.2.4. Hepatitis

Stop hepatitis infections.

Cloud-based processing can help stop hepatitis infections — Harnessing the power of cloud computing can improve detection of hepatitis C outbreaks and assist health officials with coordinating a response.

3.5. Recruiting

Recruit the Right Talent.

CDC relies on a dedicated and forward-thinking workforce to serve our public health mission. By combining the talent and experience of our veteran health professionals with fresh perspectives from experts bringing knowledge from other disciplines, we can maximize our innovation potential. That is the idea behind the HHS Entrepreneurs-in-Residence (EIR) Program, an initiative to recruit talented people— mainly private-sector tech experts and startup founders—to help solve the nation's most critical health challenges. Since 2014, five entrepreneurs have worked alongside seasoned CDC staff to advance many innovative projects, including:

Stakeholder(s):

CDC Experts :
Connecting Talent to Save Lives — Connecting the right talent, technology, and teamwork is a powerful way to advance solutions to modern health challenges. It's also one way that CDC is enhancing surveillance through innovation. In December 2017, experts from crosscutting CDC offices with diverse skill sets joined more than 300 computer programmers, public health advocates, and innovators for the first-of-its-kind HHS Opioid Code-a-Thon. At the event, 50 teams worked for more than 24 hours to create data-driven solutions that can have immediate and practical impact on the opioid crisis. The projects were judged on innovation, design, potential for *impact, and technical achievement. One team that included a CDC EIR advanced to the finals with a project showing how real-time social media feeds and machine learning could be used to track illicit online pharmacies. The Code-a-Thon proved we need more communities that combine skills, resources, data, and technology to save lives.*

Computer Programmers

Public Health Advocates

Innovators

3.5.1. Mortality Data Reporting

Bring stakeholders together to design tools and enhance existing electronic data systems to improve the nation's mortality data reporting infrastructure.

3.5.2. Shared Services

Revolutionize the way epidemiologists and public health professionals get, transfer, and use data by developing reusable shared services that can be plugged into multiple different surveillance programs within the agency.

Stakeholder(s):

Epidemiologists   **Public Health Professionals**

3.5.3. Clinical Case Reporting

Use enterprise architecture to simplify, standardize, and automate clinical case reporting for notifiable diseases.

3.5.4. Blockchain

Explore the potential of blockchain technology to improve data sharing between public health partners.

Administrative Information

Start Date: 2014-02-28
End Date:

Publication Date: 2020-03-13
Source: https://www.cdc.gov/surveillance/pdfs/Surveillance-Series-Bookleth.pdf

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