PUBLIC HEALTH SURVEILLANCE
PREPARING FOR THE FUTURE

Newer. Faster. Smarter. Better.

Table of Contents

" **There is no human endeavor that is outside the realm of public health.** "

— **William "Bill" Foege, MD, MPH**
Director, Centers for Disease Control
and Prevention, 1977–1983

Introduction

Over the course of my career I've witnessed the progress, power, and untapped potential of public health. I draw inspiration from the quote by Bill Foege—a hero and former CDC director—who believes that nothing is beyond public health's sphere of influence. His legendary leadership in the defeat of smallpox proved that public health strategies and resourcefulness could eliminate an infectious disease for the first time.

Beginning in 2014, at the request of the director, CDC developed and implemented a strategy to improve the agency's public health data surveillance capabilities over 3 to 5 years. I welcomed the opportunity to advance an agency priority and to arrive at a vision of public health surveillance for the 21st century. The directive responded to requests from stakeholders—including Congress, state public health leaders, and federal advisory committees—asking for a strategy to transform and modernize CDC's surveillance systems and approaches. I was advised not to do everything, but rather to do targeted work to show progress and build trust. So that is what we did.

This report is a summary of highlighted results from our work to improve surveillance.

It is impossible to capture all we've done with partnerships, innovation, and interoperability in data systems through this important work. We do know, though, that with the help of a network of more than 3,000 agencies at the federal and state, local, territorial, and tribal levels, we have moved the dial from 2014 to today.

For this progress to continue, however, CDC must go beyond this initial effort and work more broadly as an agency to confront challenges and embrace opportunities that arise as partnerships, processes, data, and technology progress. I hope you will join me in navigating our future with strategies and solutions that are newer, faster, smarter, and better than what we know today.

Chesley Richards, MD, MPH, FACP
CDC Deputy Director, Public Health Scientific Services

Strategy

Improving Public Health Surveillance

Background

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.

The Challenge

In the United States, gathering surveillance data is a shared effort between CDC and thousands of agencies at the federal and state, territorial, local, and tribal levels. States have primary responsibility for disease reporting and share anonymized data with CDC. At the same time, CDC maintains more than 100 surveillance systems for different uses, which creates a reporting burden and duplication of effort for partners, discrepancies among the data elements, and the need to use multiple information technology (IT) systems.

Our Strategy

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. 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.

Moving the Dial

As part of this work, four initiatives were identified as areas for improvement: notifiable diseases, syndromic surveillance, mortality reporting, and electronic laboratory reporting. Real progress has been made in meeting, or exceeding, the metrics that were set in these areas. This progress touches all of CDC, states, and many other partners. Additionally, the strategy prompted new strategic priorities that were developed along the way, including efforts toward building a surveillance data platform and supporting electronic case reporting at the local level.

A Stepwise Approach

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.

Three goals and ten specific aims work as building blocks in the strategy:

Goal 1

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

The Surveillance Leadership Board provides oversight and accountability; the workforce training plan addresses surveillance workforce needs in the short and long term; and the CDC Health Information Innovation Consortium (CHIIC) promotes innovative solutions to surveillance challenges across CDC programs and in federal and state, tribal, local, and territorial agencies.

Goal 2

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.

Goal 3

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.

Ten specific aims drive three strategic goals

Goals

Leadership and accountability

Better processes between systems and programs

Achievable improvements in public health surveillance

Aims

Surveillance Leadership Board

Workforce plan

Innovation consortium

HIT policy engagement

HIT vendor forums

Informatics integration

Data availability

System usability

Reduced redundancy

New information technology

Public Health Surveillance at CDC

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.

Prompted by the efforts to improve surveillance, a profile of CDC's work in surveillance was conducted in 2016 to inform CDC policies and future investments in surveillance-related programs and workforce. Key findings include:

How we track health problems

CDC surveillance systems fall into **four** broad categories covering infectious diseases, noninfectious health conditions, both infectious and noninfectious diseases and health conditions, and risk factors and exposures.

Where surveillance investments go

Surveillance-related grants and funding have increased over time. **Nearly one third** of CDC extramural grant awards and dollars support surveillance-related programs, with the majority of support going to state and local health departments.
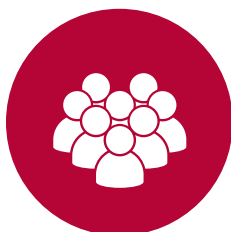
Who focuses on surveillance activities

About one quarter of CDC's staff conduct surveillance-related activities.

How science supports our mission

Nearly half of CDC health scientists (45%) and medical officers (50%) work in surveillance-related units, underscoring the importance of CDC's scientists to the surveillance enterprise.

CDC Surveillance Strategy:
Notable Milestones

2014 PUSH FOR MODERNIZATION

Strategy begins in response to requests from Congress, CDC director, and key stakeholders

Within 2 months of launch, a new forum to enhance surveillance through innovation begins

SUPPORT FOR NEW APPROACHES **2015**

First ever CDC Hackathon showcases programming talent using open data

Enhancements to cloud-based platform designed to identify bioterrorism events help monitor much wider range of health threats

New data visualization hub for birth, death, and infant death statistics improves user experience

2016 PROGRESS ON DATA EXCHANGE

Faster reporting of vital statistics data on influenza-related deaths replaces longstanding, siloed mortality reporting

Ten states, representing approximately 25% of the U.S. population, begin using new electronic messaging to simplify notifiable disease reporting to CDC

CDC supports development of shared services to streamline data submission and routing

CDC joins partnership bridging data exchange between public health and health care

SUPPORT FOR OPIOID EMERGENCY **2017**

Online monthly release of provisional drug overdose death counts begins

CDC staff explore data-driven solutions to prevent opioid-related overdoses and deaths at first-of-its-kind HHS Opioid Code-a-Thon

Experts across CDC analyze the timeliest data available on emergency department visits for opioid overdoses across multiple states

2018 MOVING FORWARD

CDC solicits broader insight and recommendations from staff and external stakeholders to inform a new public health data strategy

Initiatives

Taking the Initiative

To demonstrate early success, CDC pursued crosscutting initiatives based on their importance to state and local health departments, potential for quick results, and foundational importance to CDC centers and programs. These initiatives are charting the course for newer, faster, smarter, and better ways to use and connect data for public health needs today—such as tracking diseases like the flu and tackling the opioid epidemic—as well as the public health needs of tomorrow.

MORTALITY REPORTING

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

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).

ELECTRONIC LABORATORY REPORTING

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

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.

PUBLIC HEALTH SURVEILLANCE ATCDC

Newer. Faster. Smarter. Better.

sur·veil·lance
/sər'vāləns/

Public health surveillance is defined as the regular collection, analysis, use, and sharing of data to prevent and control disease and injury.
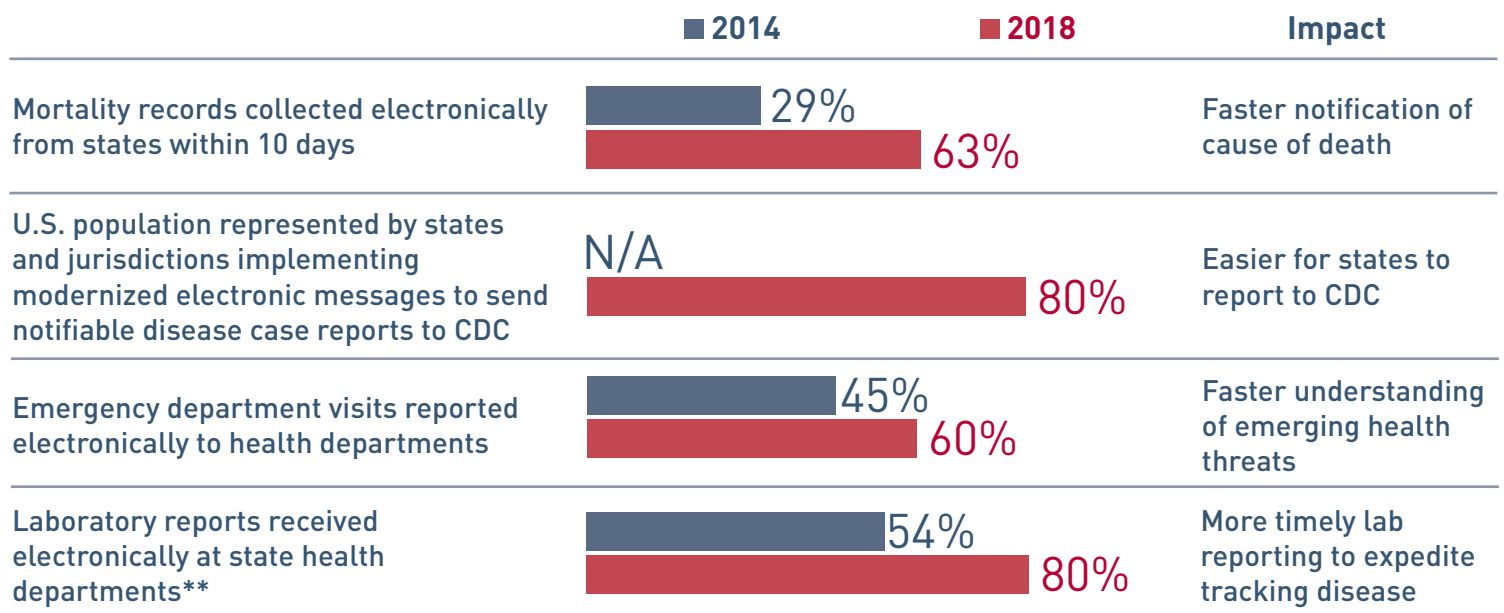
Source: MMWR. 2012;61(Suppl):1–40.

Why It Matters

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:

▶ Improving availability and timeliness of data

▶ Adopting new technologies to improve accuracy and speed of disease reporting

▶ Reducing reporting burden on health departments

▶ Maximizing performance of agency resources

Pulse Check: Our Progress
System Improvements in Public Health Surveillance*

	2014	2018	Impact
Mortality records collected electronically from states within 10 days	29%	63%	Faster notification of cause of death
U.S. population represented by states and jurisdictions implementing modernized electronic messages to send notifiable disease case reports to CDC	N/A	80%	Easier for states to report to CDC
Emergency department visits reported electronically to health departments	45%	60%	Faster understanding of emerging health threats
Laboratory reports received electronically at state health departments**	54%	80%	More timely lab reporting to expedite tracking disease

* Percentage change furthered by CDC Surveillance Strategy (as of September 2018); provisional data represented
** Approximately 20 million laboratory reports are received annually at health departments

HOW TRACKING DEATHS PROTECTS Health

Data We Count On

Vital Statistics

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.

" Specificity about a death today could help save a life tomorrow. For example, a death certificate needs to say more than something vague like 'opioid intoxication' to help both law enforcement and public health officials curb the distribution—and hopefully abuse—of opioids. "

— **James Gill, MD**
Chief Medical Examiner, state of Connecticut

Why It Matters

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:

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

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

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

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

Putting Data to Work: Numbers Tell the Story

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. State, local, and territorial authorities—known as jurisdictions—are responsible for the legal registration and record of death. CDC, through the National Center for Health Statistics, finalizes and releases the data once all authorities have reported.

CDC and local authorities are working together as part of CDC's strategy to improve surveillance data to advance how quickly deaths are recorded and reported

Newer
Paper-based systems are being replaced with modern Web-based technologies, and outdated electronic systems are being upgraded

Faster
More timely data are being made available through the early release of information from death certificates through quarterly and special reports
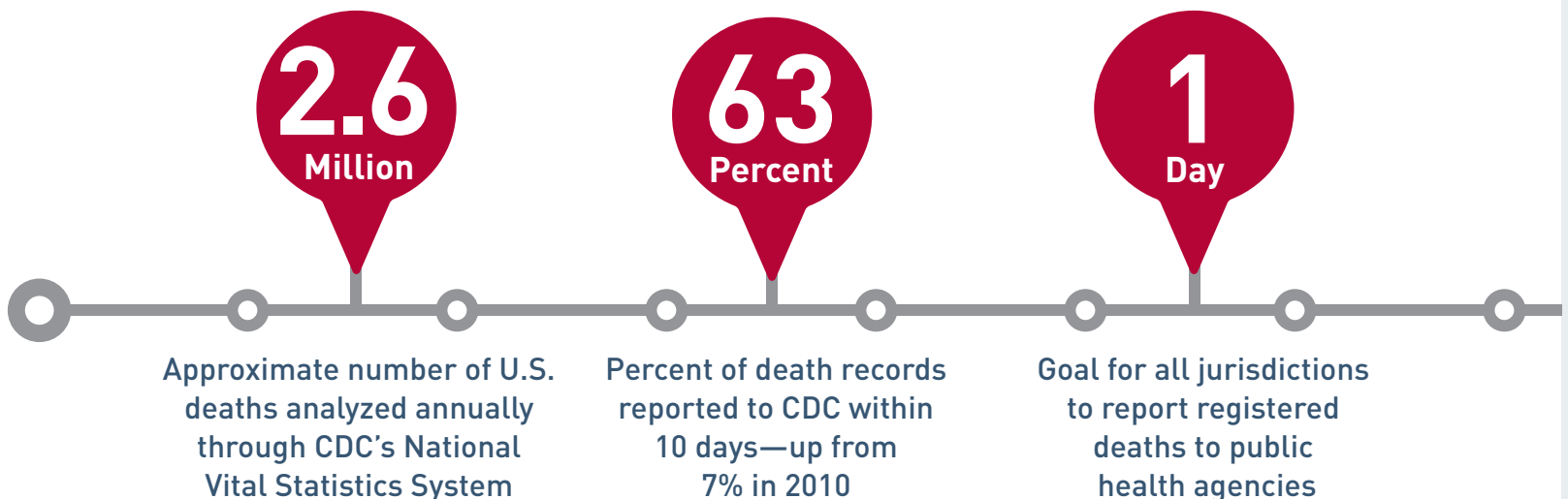
Smarter
Electronic health records and other tools are being leveraged to integrate death reporting into physicians' daily workflows

Better
Systems are being developed to validate mortality data before they are sent to the states

Moving the Dial: Improved Reporting, More Answers

2.6 Million
Approximate number of U.S. deaths analyzed annually through CDC's National Vital Statistics System

63 Percent
Percent of death records reported to CDC within 10 days—up from 7% in 2010

1 Day
Goal for all jurisdictions to report registered deaths to public health agencies

HOW COUNTING DISEASE CASES PROMPTS Action

Better Data, Better Decisions

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.

Why It Matters

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

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.

Notifiable disease data are critical to:

Detect disease when and where it happens

Stop disease before it spreads

Study disease to strengthen the science

Improve how we prevent and control disease

Keep people healthy

" The whole goal of what we do in public health is to make these nonissues. We don't want to have an outbreak. "

— **Sarah Park, MD**
State Epidemiologist and Chief of the Disease Outbreak Control Division, state of Hawaii

Putting Data to Work: Numbers Tell the Story

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.

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

Newer
Modernized systems will make it possible for public health to use one data standard to exchange disease monitoring data

Faster
CDC and public health will be able to understand disease trends and emerging health events more quickly
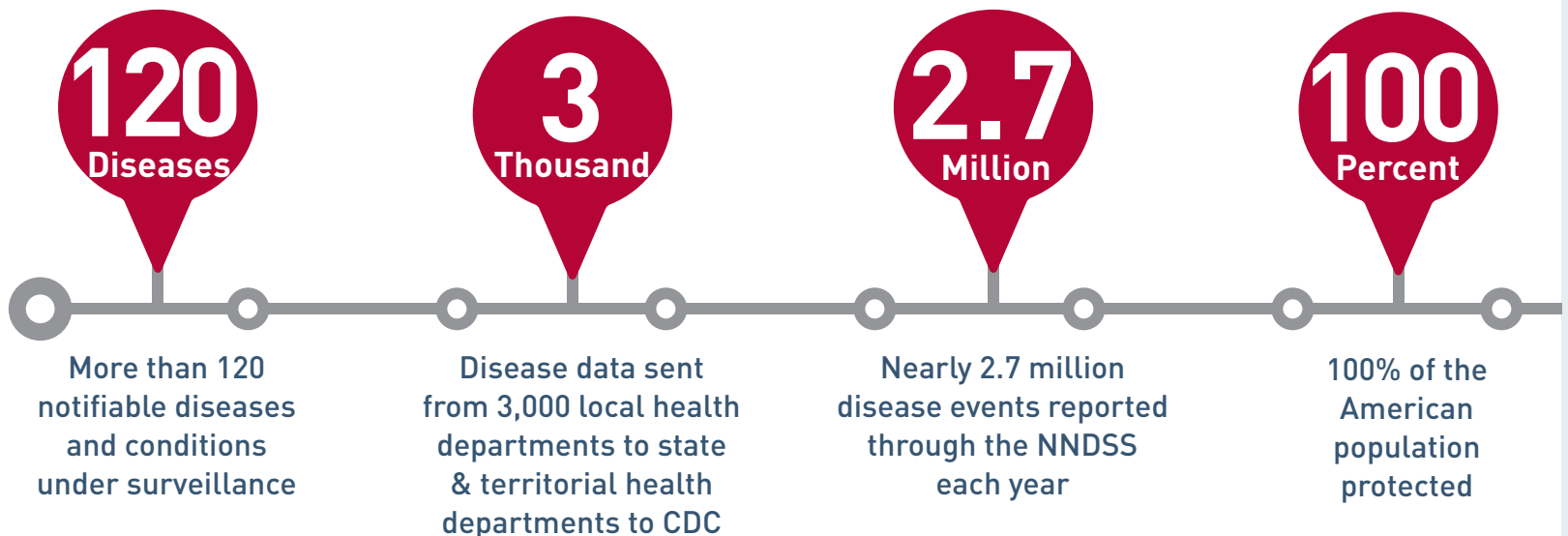
Smarter
Data that the health department receives from multiple sources, such as the clinic and the laboratory, can be delivered to CDC in one message

Better
Richer, more complete data drive public health action

Moving the Dial: Modernized System, Improved Timeliness

120 Diseases

3 Thousand

2.7 Million

100 Percent

More than 120 notifiable diseases and conditions under surveillance

Disease data sent from 3,000 local health departments to state & territorial health departments to CDC

Nearly 2.7 million disease events reported through the NNDSS each year

100% of the American population protected

LAB REPORTING AT THE SPEED OF Light

Partnerships Push Progress

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.

"A portion of our public health laboratory reporting was manual, making it difficult to comply with state electronic requirements. We welcomed the opportunity to be part of the solution through partnering with APHL, health departments, and other stakeholders."

— **Virginia Sturmfels, Corporate Manager**
Laboratory Regulations & Public Health Reporting
Quest Diagnostics

Why It Matters

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.

The Path to Progress

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.

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.

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.

Putting Data to Work: Numbers Tell the Story

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.

Electronic laboratory reporting has accelerated CDC's strategy to improve surveillance data

Newer
A standardized electronic reporting format is being widely adopted by national, regional, reference, and public health laboratories, and by hospital systems. CDC offers technical assistance for implementation.

Faster
Electronic laboratory reporting prompts faster public health action in outbreaks. Data can be used to identify sources of contamination, notify providers about the disease, and reach those most at risk.

Smarter
Automated electronic laboratory reporting requires no manual data entry, saving valuable staff time to conduct frontline disease investigation and response using the data.

Better
Electronic laboratory reporting is pointing the way for the exchange of critical health information between electronic health records (EHRs) and public health agencies.

Moving the Dial: Faster Reporting, Saving Time

100 Diseases
Nearly 100 reportable diseases and conditions are tracked by state and local health departments using electronic laboratory reporting

44 States
Number of states adopting electronic laboratory reporting for the majority of their reports—up from 9 in 2012

20 Million
Approximate number of laboratory reports received annually at health departments

80 Percent
Percent of laboratory reports received electronically—up from 54% in 2012

WHEN SYMPTOMS SEND A Signal
Health Security Starts Locally

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.

"Building strong health security infrastructure takes innovation and partnerships at all levels of public health, coordination across government agencies, and multiple public-private partnerships."

— **Paula Yoon, ScD, MPH**
Director, Division of Health Informatics and Surveillance, CDC

Why It Matters

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

Putting Data to Work: From Signal to Response

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.

Enhancing syndromic surveillance and linking multiple data sources is one focus area of CDC's strategy to improve surveillance data

Newer
Cloud-based technology and analysis tools allow local and state users to visualize and share information from an increasing number of health facilities

Faster
Near-real-time data allows users to quickly detect and monitor health impacts in their local communities and across the country
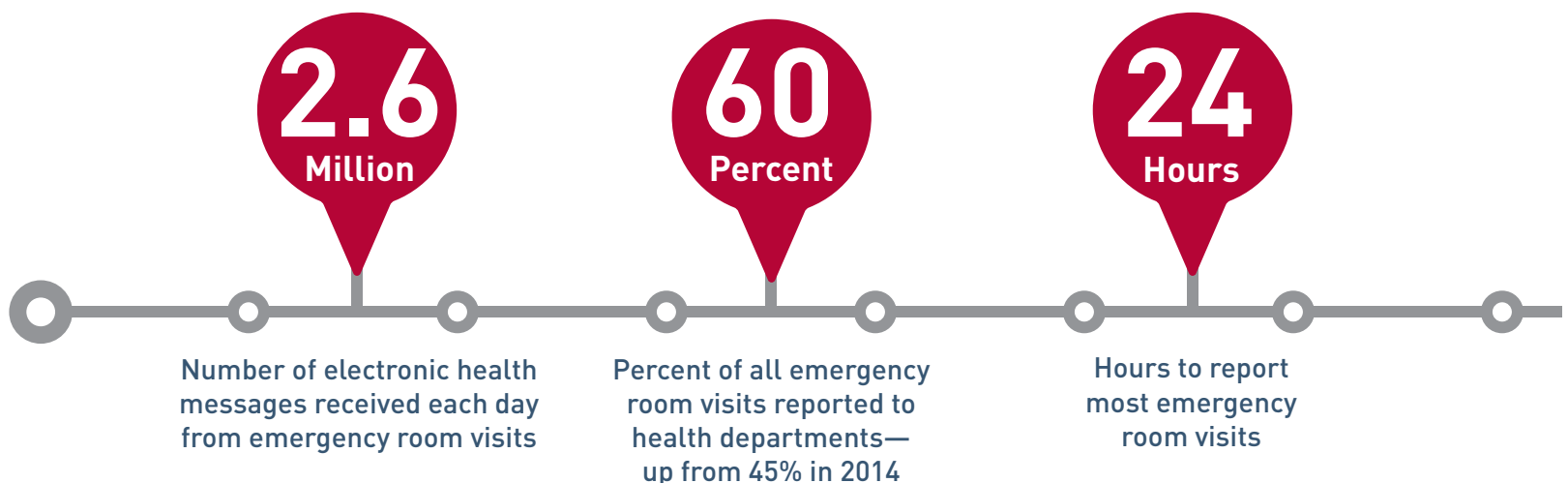
Smarter
As new health threats emerge, such as Zika infections and opioid overdoses, syndrome definitions can be quickly developed and standardized

Better
As new analytic methods are added and participation increases, data sources can be expanded and integrated with other systems, including electronic death records

Moving the Dial: More Reporting, Improved Response

2.6 Million
Number of electronic health messages received each day from emergency room visits

60 Percent
Percent of all emergency room visits reported to health departments— up from 45% in 2014

24 Hours
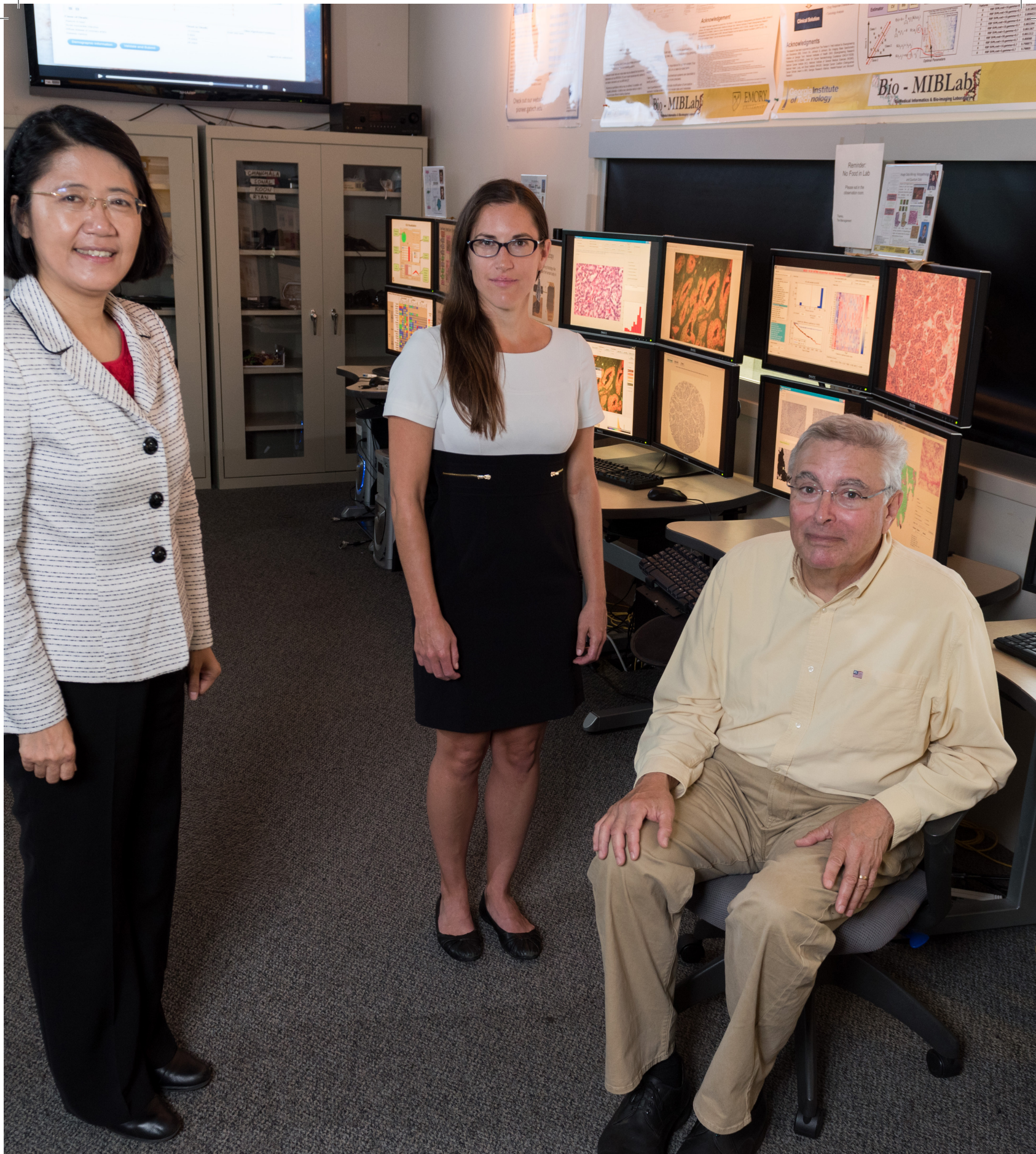Hours to report most emergency room visits

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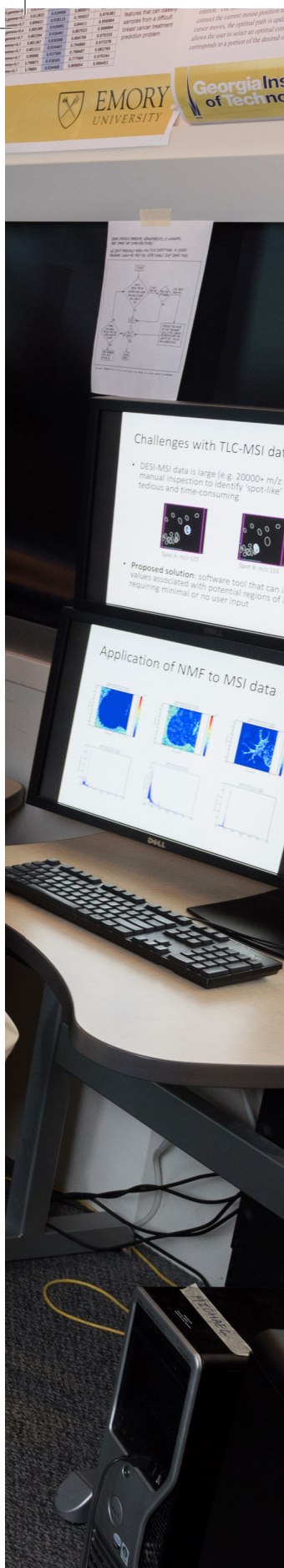
To keep up with this fast-moving epidemic, CDC scientists from different centers work together to examine the timeliest data available to the agency on emergency department visits for opioid overdoses across multiple states. They integrate information from two unique CDC surveillance programs— the Enhanced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

Connecting data between existing surveillance systems is more efficient than creating new ones. It also avoids duplicate data collection by states and saves money.

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. Insights gleaned from this report can help guide resource and response decisions locally and nationally.

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.

PROGRAMS

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

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.

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.

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.
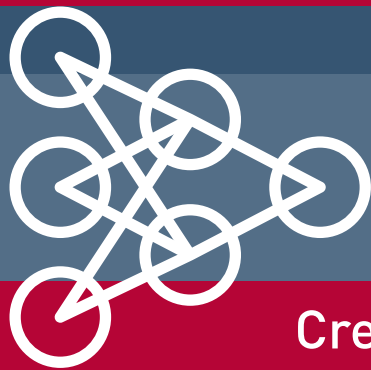
WHEN INFORMATICS PROMOTES Innovation

Creative Solutions to Public Health Surveillance

CDC Health Information Innovation Consortium

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

" *What is most important about technical innovations and use cases for CDC is that they are enterprise-wide and can be adopted by different programs. Interoperability must start within CDC.* "

— **Brian Lee, MPH**
Chief Public Heath Informatics Officer
Office of Public Health Scientific Services, CDC

Why It Matters

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 foodborne 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:

Shared services, interoperability, and application programming interfaces (API)
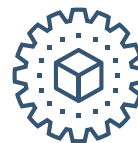
Collaboration and communication tools and processes

Data management, analysis, and visualization

Emerging data and HIT standards

Privacy and security

Decision support, algorithms, and machine learning

HOW SHARING ADVANCES
Surveillance

Technology Trims Tasks and Time

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.

Why It Matters

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.

People
Improving efficiency at CDC benefits federal, state, and local public health experts
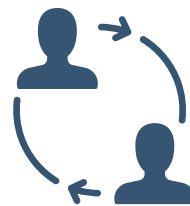
Process
Streamlining data submission and routing eliminates redundant tasks and reduces workload

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

"*We want to advance public health's critical data infrastructure and pipeline. We are moving from dirt roads to a superhighway to bring data to CDC.*"

— **Teresa Kinley, MSCS**
Lead, Surveillance Data Platform, CDC

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.

The streamlined shared services being developed as part of CDC's strategy to improve surveillance data will transform data collection, sharing, and use

Newer
A secure, cloud-based platform will centralize and share common information technology services

Faster
Officials respond collaboratively to a health threat as data flows more rapidly between local, state, and federal disease detectives

Smarter
Health experts more quickly spot changes in data as a result of systems that improve efficiency and save time

Better
Repetitive requests to health departments are reduced through better coordination across multiple disease surveillance systems

Moving the Dial: Reduced Redundancy, Improved Efficiency

2014	2016	2017	2018

CDC launches Surveillance Strategy

Surveillance Data Platform continues onboarding

CDC leaders agree to develop shared surveillance services to increase efficiency

Design sessions conducted with external stakeholders

First shared service— vocabulary—is launched

Jan — May — Sept — June — July — Aug

16 design principles and 28 service priorities selected

Cloud security set up for new container technology

Second shared service—content-based routing—is launched

HOW SHARING DATA DIGITALLY BENEFITS Health

Bridging Public Health and Health Care

Electronic Case Reporting

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.

Why It Matters

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.

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

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

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

> *Health care, public health and electronic health record vendors are working together to build a system that makes reporting easier for clinicians while enabling public health to respond more effectively.*

— **John R. Lumpkin, MD, MPH**
Senior Vice President–Program,
Robert Wood Johnson Foundation

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 initiative—electronic case reporting—is being tested at seven sites in California, Houston, Kansas, Massachusetts, Michigan, New York City, and Utah. The first five reportable conditions being shared are chlamydia, gonorrhea, pertussis, *Salmonella*, and the Zika virus.

As part of CDC's strategy to improve surveillance data, the Digital Bridge partnership is expediting the flow of disease surveillance information and associated outcomes

Newer
Electronic case reporting reduces the burden of infectious disease reporting and enables a more cost-effective information exchange between health care and public health

Faster
Automated mandatory reporting of certain diseases and conditions from EHRs results in faster information from surveillance and improved response times

Smarter
Any EHR vendor can adopt this electronic case reporting solution that results in less work for healthcare professionals at the point of care

Better
Working to standardize tools and reporting between public health and health care improves data flow, benefitting both individual and population health

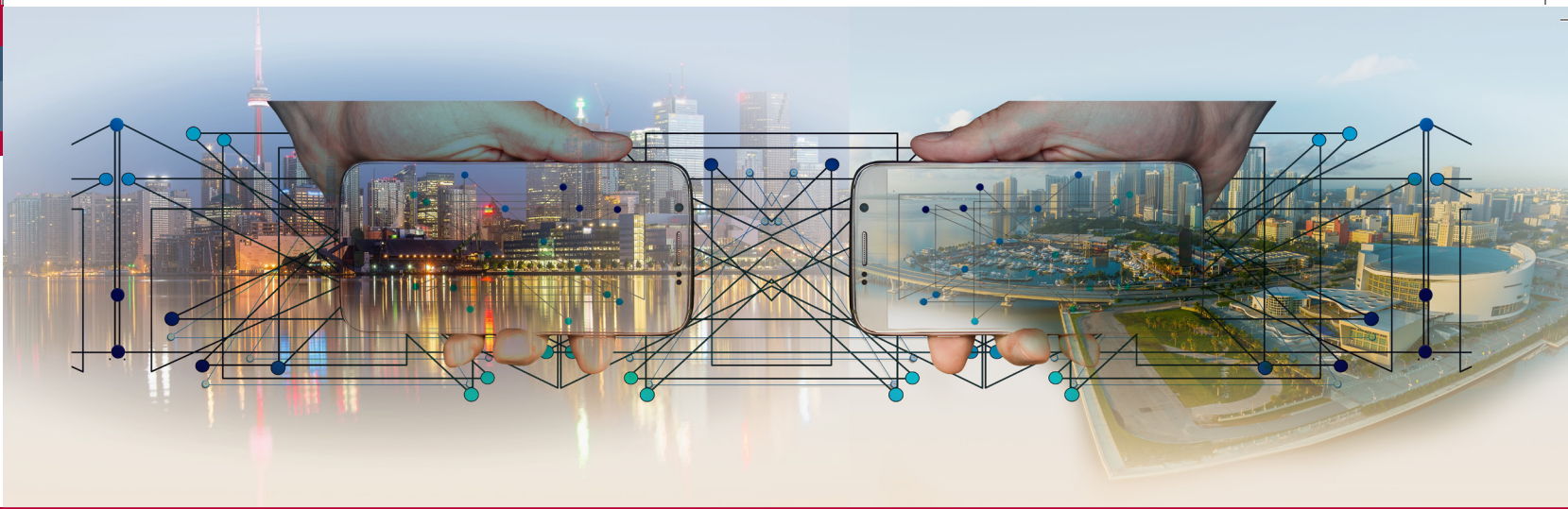# Moving the Dial: Faster Reporting, Saving Time

~87 Percent
Percent of office-based physicians using any electronic medical record/ EHR system in 2016

42 Members
Number of governance members, including CDC, driving the Digital Bridge

7 Sites
Number of public health departments implementing the Digital Bridge approach to electronic case reporting in 2018

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.

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.
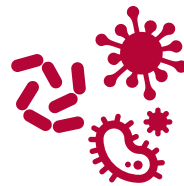
Germ data dashboard informs health officials

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.

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 readmissions.

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.

HOW A FORWARD-THINKING WORKFORCE DRIVES Progress

Recruiting the Right Talent

If we are to capitalize on new data opportunities, we need to deepen the data science skills in the public health workforce.

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:

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

Revolutionizing 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
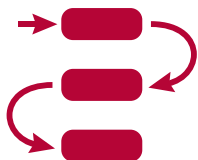
Using enterprise architecture to simplify, standardize, and automate clinical case reporting for notifiable diseases

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

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.

> **"This event and the work of the team is a true testament of how transformative thinking can empower our public health workforce to create solutions to some of our most complex public health concerns."**
>
> **—Michael F. Iademarco, MD, MPH**
> Rear Admiral, U.S. Public Health Service
> Director, Center for Surveillance,
> Epidemiology, and Laboratory Services

DATA

Moving Ahead

Moving Ahead

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.

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

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.

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.

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.

" In public health, we can't do anything without surveillance. That's where public health begins. "

— **David Satcher, MD, PhD**
Director, CDC, 1993–1998

Preparing for the Future

Public health in the United States is never static. It must be sensitive enough to signal a new health threat. It must be specific enough to pinpoint problems and focus resources. It must be flexible and connected enough to protect people locally, nationally, and globally. That means public health surveillance in the United States must be responsive to change—and so must we.

Over the lifetime of the surveillance strategy, we've stretched our surveillance systems and our workforce to track and contain some of the most complex and deadly public health outbreaks and emergencies in our history, from Ebola and Zika, to the health effects of hurricanes Harvey, Irma, and Maria.

In October 2017, HHS declared the opioid overdose crisis a nationwide public health emergency. The health effects from this fast moving epidemic are so great, it has decreased our overall life expectancy as a nation. As leaders in the field of public health, we must work together if we are to turn the tide. One of the most powerful tools we have to understand the problem and target resources is strong surveillance and reliable data.

The progress we make now could mean thousands of lives saved each year. It can also equip us to be even more capable of handling the next health crises that will inevitably come.

To finish what we started and get to a future where data drives action in real time—efficiently, flexibly, rapidly, and with lifesaving impact—we have to keep moving in strategic ways. We need to work within modernized and legacy health IT systems and integrate the workflows of clinicians and public health agencies. We need to better harness information contained in electronic health records and health care information technology systems. And we need to better understand data we already have.

We must get our best ideas out there. We must wrestle with the big decisions. We must strive to do the harder things. Most importantly, we must be ready to embrace the changes that will make us better. When we do, we can truly make a difference in the world of public health.

" We are at the dawn of a new era for data and surveillance, and we must never underestimate the possible. As public health leaders, we must be prepared to handle the challenges of today and, at the same time, to make real the potential of the new innovation of tomorrow. We must work together to bring new approaches into daily operation as we strive to achieve our highest aims — to improve and protect the health of our Nation. **"**

— **Robert R. Redfield, MD**
Director, CDC, and Administrator, ATSDR

KEY SOURCES

A full list of sources is available at www.cdc.gov/surveillance/index.html.

Centers for Disease Control and Prevention. CDC Health Information Innovation Consortium. https://www.cdc.gov/ophss/chiic/overview.html.

Centers for Disease Control and Prevention. Improving public health surveillance data. https://www.cdc.gov/surveillance/index.html

Centers for Disease Control and Prevention. Surveillance strategy. 2014. https://www.cdc.gov/ophss/docs/CDC-Surveillance-Strategy-Final.pdf.

Lee B, Martin T, Khan A, Fullerton K, Duck W, Kinley T, et al. Modernizing Centers for Disease Control and Prevention informatics using surveillance data platform shared services. Public Health Reports. 2018;133(2):130–35. http://journals.sagepub.com/eprint/PvG3fGB8F4yAixPv7pHT/full.

Moolenaar RL, Casey CG, Rutledge TF, eds. CDC's vision for public health surveillance in the 21st century. MMWR Suppl. 2012;61(3):1–40. https://www.cdc.gov/mmwr/pdf/other/su6103.pdf.

Richards CL, Iademarco MF, Anderson TC. A new strategy for public health surveillance at CDC: improving national surveillance activities and outcomes. Public Health Reports. 2014;129(6):472–76. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4187298/.

Richards CL, Iademarco MF, Atkinson D, Pinner RW, Yoon P, Mac Kenzie WR, et al. Advances in public health surveillance and information dissemination at the Centers for Disease Control and Prevention. Public Health Reports. 2017;132(4):403–10. http://journals.sagepub.com/doi/full/10.1177/0033354917709542.

Vivolo-Kantor AM, Seth P, Gladden RM, Mattson CL, Baldwin GT, Kite-Powell A, et al. Vital Signs: trends in emergency department visits for suspected opioid overdoses — United States, July 2016–September 2017. MMWR 2018; 67(9):279–85. https://www.cdc.gov/mmwr/volumes/67/wr/mm6709e1.htm.

Wagner RM, Eblen MK, Mann LM, Richards CL. Evaluating the surveillance-related programs and workforce of the U.S. Centers for Disease Control and Prevention (CDC). Presentation at: 2016 American Evaluation Association Conference; October 28, 2016; Atlanta, GA. http://comm.eval.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=14a48938-79c6-7109-12c3-0af800c4f61f&forceDialog=0.

Yoon PW, Ising AI, Gunn JE. Using syndromic surveillance for all-hazards public health surveillance: successes, challenges, and the future. Public Health Reports. 2017;132(1 Suppl):3s–6s. http://journals.sagepub.com/toc/phrg/132/1_suppl.

Photo Credits and Captions

Page 6: An Epidemic Intelligence Service (EIS) officer collects ticks for tick-borne disease surveillance. *Photo provided by Victoria Hull.*

Page 9: An EIS officer performs field work to support CDC epidemiology. *Photo by James Gathany.*

Page 12: An EIS officer shares Zika materials at a District of Columbia Department of Health community event. *Photo provided by Janet Kuramoto-Crawford.*

Page 24: A CDC Entrepreneur-in-Residence (center) and professors from Georgia Tech are examining death certificate data to determine what can be learned from these records. *Photo by Rob Felt.*

Page 33: Select CDC staff took part in the first-of-its-kind HHS Opioid Code-a-Thon. *Photo courtesy of CDC Connects.*