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Work & Accomplishments

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National Center for Emerging and Zoonotic Infectious Diseases
Office of the Director



-genome sequencing has become a powerful new weapon for scientists chasing deadly bug
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bacteria Monocytogenes — Food Safety News 11/27/13 US chikungunya cases reach 1,2



In Fiscal Year (FY) 2014, the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) received 37 requests from states and other countries to assist in the investigation of local, national, and international outbreaks of infectious diseases, known as Epi-Aids. NCEZID supported health departments' responses to a variety of other outbreaks of infectious diseases through epidemiological investigations, phone consultations, and technical assistance. Examples of some of the outbreaks NCEZID responded to in FY 2014 are included here.



Multistate outbreak of *Salmonella*

In June 2013, NCEZID and state health department experts identified a small cluster of [multidrug-resistant *Salmonella* Heidelberg](#) infections, which ultimately grew to an outbreak sickening 634 people in 29 states and Puerto Rico. Data from [PulseNet](#) and the [National Antimicrobial Resistance Monitoring System](#), interviews of ill persons conducted by state and local health officials, and information collected by the US Department of Agriculture's Food Safety Inspection Service (FSIS) allowed investigators to identify the source—Foster Farms chicken. Multiple recalls in 2013 and 2014 of chicken processed by Foster Farms occurred as a result of the investigation. Foster Farms consulted with FSIS and CDC about strategies to dramatically reduce rates of *Salmonella* contamination and has become a leading example for the poultry industry.



Environmental mold infections in hospitals

NCEZID experts responded to an outbreak of *Bipolaris* infections in cardiothoracic surgery patients at hospitals in Texas and Arkansas. *Bipolaris* is an environmental mold. Following the investigation, NCEZID identified two strategies that are likely to be most effective in reducing illness and death associated with this infection: for hospitals to follow infection prevention practices and for clinicians to consider *Bipolaris* as a possible diagnosis for infection in their cardiothoracic surgery patients.



Q fever at a dairy

NCEZID investigated the largest [Q fever](#) outbreak ever linked to a single farm, involving 47 cases of illness, and identified a large goat and cattle dairy farm in Missouri as the source of the outbreak. Q fever is an infection caused by inhaling barnyard dust that contains bacteria shed by farm animals like cattle, sheep, and goats. NCEZID provided farm managers with prevention measures and local health care providers with education to help them quickly identify and treat new infections.



Monkeypox investigation uses new technology

In December 2013, a team from NCEZID assisted health authorities in the Democratic Republic of the Congo with an investigation of [monkeypox](#). Monkeypox is a rare viral disease that occurs mostly in central and western Africa. However in 2003, monkeypox was reported in the United States for the first time among people who had had contact with sick pet prairie dogs. The NCEZID team in Africa used a new [point-of-care assay \(test\)](#) for monkeypox virus, developed with two companies (BioGX and Cepheid), to assess and confirm infection in 13 of 60 suspected cases. This new test is a powerful tool that can be administered in the field, provides results in an hour, and requires limited skill to perform.



Contaminated equipment in hospitals

NCEZID worked alongside the state and local public health authorities in Washington State as they investigated a cluster of multidrug-resistant [E. coli](#) infections in seven patients who had recently undergone a gastrointestinal procedure performed with an endoscope called a duodenoscope. NCEZID experts helped the state assess duodenoscope cleaning and disinfection practices (reprocessing) and conduct sampling to evaluate contamination following reprocessing. Findings from this investigation added evidence to previous concerns that the design of the duodenoscopes makes it difficult to ensure that they are free of contamination after being reprocessed. It is clear that reprocessing guidelines need to be reevaluated, and interim guidelines are being developed.



Investigating infections in a California NICU

NCEZID worked with the California Department of Public Health in an onsite investigation of [Pseudomonas aeruginosa](#) infections in a California neonatal intensive care unit (NICU) that resulted in 31 illnesses and 3 deaths. NCEZID experts observed infection control practices, conducted a case-control study, and performed environmental sampling to determine the source, which was the hospital tap water. Recommendations were provided for infection control and water remediation strategies to prevent new infections. No additional cases have been identified and additional remediation efforts are ongoing.



Outbreak of botulism in Texas

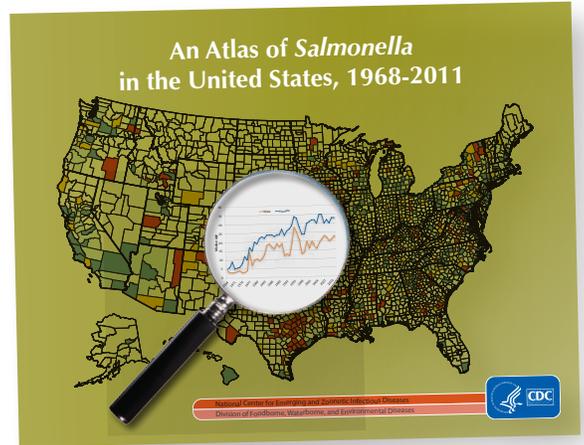
NCEZID investigated an outbreak of [botulism](#) in Texas that caused four people to become ill after eating turshi, a traditional Middle Eastern pickled vegetable dish. Foodborne botulism is caused by eating foods that contain botulinum toxin. NCEZID assisted state and local public health authorities in Texas and Georgia (where one patient traveled) to investigate and discovered that the contamination in the homemade turshi likely occurred during fermentation. The investigation confirmed that no remaining turshi was in circulation, and no additional people became ill.



First-time access to *Salmonella* data

Each year in the United States, *Salmonella* infections cause an estimated 1.2 million illnesses, 23,000 hospitalizations, and 450 deaths—more deaths than any other foodborne bacteria. *Salmonella* can be found in a number of foods, including produce and processed foods, as well as foods such as eggs, poultry, and meat.

[An Atlas of Salmonella in the United States, 1968–2011](#) chronicles more than 40 years of laboratory-confirmed surveillance data on *Salmonella* subtypes, called serotypes. The Atlas gives the public, food industry partners, and researchers access to a host of information on *Salmonella* serotypes in a downloadable format.



“We all benefit from local health department investigations of foodborne illness and from effective coordination among industry and government agencies to prevent future outbreaks.”

Robert Pestronk, [National Association of County and City Health Officials](#)

Why is it important?

- *Salmonella* serotypes can now be compared more easily, which will help researchers identify how and why some serotypes cause severe illness, while others cause only mild illness.
- Prevention efforts can be targeted and tailored for a specific serotype more effectively, such as *Salmonella* Enteritidis in eggs.

Germ-free chicken in every pot

Walmart, the country’s largest grocery retailer, is partnering with food safety experts from NCEZID and the US Department of Agriculture’s Food Safety and Inspection Service to decrease pathogens such as *Salmonella* and *Campylobacter* in chicken products provided by suppliers. The new program, announced in December, requires Walmart and Sam’s Club poultry suppliers to implement holistic controls from farm to consumer, designed to significantly reduce potential contamination levels in fresh whole chickens and chicken parts. It also requires suppliers to conduct special tests to validate that the measures they have implemented are effective. All poultry suppliers must be in compliance with the new requirements by June 2016.

Why is it important?

- Collectively, Walmart and Sam’s Club’s poultry suppliers source approximately 80% of all raw chicken in the US.
- Reducing *Salmonella* and other pathogen contamination in poultry products is a crucial step toward decreasing the burden of foodborne illnesses.
- Walmart and CDC working together to protect public health and advance food safety is a great example of a public-private partnership that benefits everyone.





Chikungunya knocking down the door



For some time among US public health experts, it's not been *if* but rather *when* [chikungunya](#), a mosquito-borne disease that can cause fever and joint pain, would show up on the [mainland](#). So on July 17, when the first locally acquired case of chikungunya was reported in Florida, CDC was already working with the Florida Department of Health to prevent further spread by controlling mosquitoes and educating people about ways to avoid mosquito bites. Actually, NCEZID has been working since 2006 to strengthen surveillance of chikungunya to help public health authorities prepare to detect and respond to outbreaks. That also included collaborating with the Pan American Health Organization to develop a regional surveillance and response plan, develop and deploy new diagnostic testing tools, and create educational materials. Together, these tools and resources have helped minimize the impact of chikungunya among US citizens and travelers.

Why is it important?

- As of December 12, 2014, chikungunya had been identified in more than 40 countries or territories in the Caribbean, Central America, South America, or North America. More than 1 million suspected and 20,000 laboratory-confirmed chikungunya cases have been reported from these areas.
- Since the outbreak began in late 2013, more than 2,000 travelers returning to the United States with chikungunya fever have been reported. Before this outbreak, the average number of travelers returning to the US with chikungunya fever was only 28 a year.

“We need to make sure that state and local health departments are ready to detect and respond quickly to emerging threats, such as chikungunya.”

Jeff Engel, [Council of State and Territorial Epidemiologists](#)

The newly discovered Bourbon virus

In late spring 2014, a resident of Bourbon County, Kansas, was admitted to the hospital with symptoms of fever, fatigue, nausea, and a rash. The patient was treated but continued to worsen and eventually died. Healthcare providers initially suspected a tick-borne illness, such as ehrlichiosis or [Heartland virus disease](#), because of the patient's clinical symptoms and signs as well as his history of a tick bite. But when NCEZID researchers, who were investigating the case with the Kansas Department of Health and Environment (KDHE), analyzed a blood sample from the infected patient, they got a surprising result.

The researchers used the powerful tools of Advanced Molecular Detection (AMD) to confirm that this was a brand new virus never seen before in North America. Researchers determined that the virus is related, but distinctly different from other tick- or mosquito-borne viruses. They named it [Bourbon virus](#) for the county in Kansas where it was discovered. Did the Bourbon virus contribute in any way to the patient's death and have others been infected with this new virus? Scientists can't be sure, but investigators from CDC and KDHE are reviewing the patient's case history and plan to test other residents with similar signs and symptoms who tested negative for Heartland virus in the last year. In addition, CDC will be working with state partners to conduct field investigations to understand better how people are becoming infected with this virus.

Why is it important?

- This is a new virus not seen in North America before. There is no known treatment or vaccine for Bourbon virus disease.
- CDC used next-generation sequencing to quickly confirm that this was a new virus.





NCEZID in action: Responding to Ebola

Since early spring 2014, teams from NCEZID, along with staff across CDC, have been working to stop the largest [Ebola](#) epidemic in history. Close to 300 NCEZID personnel have been deployed to West Africa to assist with response efforts, including surveillance, contact tracing, data management, laboratory testing, and health education. Hundreds of other NCEZID staff have been working in the Emergency Operations Center in Atlanta to provide technical expertise, logistics, staffing, communication, analytics, management, and other support functions for the response. Others have been partnering with Customs and Border Protection to conduct enhanced entry screening at five US airports, including developing routine processes to identify travelers who show signs of infectious disease. Another important focus for many NCEZID staff has been on preparing US healthcare facilities to safely manage a patient with suspected Ebola virus disease. Here are just three (of the hundreds of) NCEZID staff who have made significant contributions to CDC's largest-ever international response.

“The recent response to the Ebola outbreak underscores the power that CDC collaboration with other US agencies and partners can have in efforts to develop and implement lifesaving technologies worldwide.”

—Ashley Bennett, [Global Health Technologies Coalition](#)

Mary Joung Won Choi: Building infection control in Guinea from the ground up

It's a good thing that Mary Choi's French wasn't perfect. When she arrived in Guinea in May, her “intermediate French” made her a better fit to work in a clinic that had just opened in Kat-Kama in rural Guinea than to do contact tracing, which was the original plan. And a fortunate reassignment it was, because this former emergency room physician quickly set up vitally needed systems for infection control in the bare bones clinic.



Mary taught the staff how to triage patients. She negotiated with the village chief to provide the labor to convert a small roofless cooking hut into a suitable space to house suspected Ebola patients. And when she didn't know how to do something, she found someone who did. She didn't know how to make chlorine solution, so she flagged down a Doctors Without Borders truck and asked them to come inside to teach her and the staff. When words weren't enough, she improvised. To show how to take off contaminated gloves without touching skin, she poured bottled water into dirt and painted the staff's gloved hands with mud. And then she took her infection control show on the road to other clinics in rural Guinea.



Mary discovered that teaching children in the village to make paper airplanes could be a good way to reinforce health messages. Before each fold, they learned something like “wash your hands before you eat.”

She continued to teach after she returned home. Mary helped advise hospitals in Dallas and New York City when they were treating patients with Ebola, and she made slide sets that were widely circulated in Guinea, Sierra Leone, and Liberia to share infection control techniques she had developed in Guinea.

Mary reflected that what made Guineans such “great people”—their warmth, caring for each other, respecting the dead—ironically were the same qualities putting them at risk for contracting and spreading Ebola. The complicated challenge is finding workaround behaviors that keep them safe but let them stay “true to who they are.”



Abigail Tumpey: Training our nation's healthcare workers to fight Ebola

Abigail Tumpey was tapped to develop and execute a CDC plan to enhance [training and education of US healthcare providers](#) to prevent transmission of Ebola domestically. By engaging key partners across the spectrum of public health and the healthcare system in weekly—and sometimes daily—conference calls and live meetings, CDC was able to deliver critical and time-sensitive infection control guidance to US healthcare workers, while providing them with direct access to CDC resources and Ebola experts.



Abigail's team collaborated with Partnership for Quality Care to conduct live training events in New York City (seen here) and Los Angeles. These events reached more than 6,400 individuals and 65 media outlets in person, and 20,000 people from 10 countries via live stream.

Since the start of the outbreak, Abigail's team has trained more than 150,000 individuals through 150 webinars and conference calls and more than 690,000 individuals via online training resources. One of those online training resources is a series of tailored videos that instruct healthcare workers on the step-by-step procedures to put on and take off personal protective equipment safely. Abigail's goal has been for CDC's Ebola education and training to be "action-oriented, available via mobile platforms, and specific to the healthcare worker's needs and roles." She adds, "We want to take the lessons learned from Ebola and use them to improve adherence to basic infection control practices for all patient care. Training and education on these basics is critical."

Tiffany Walker: Keeping heroes safe in Sierra Leone

Tiffany Walker won't soon forget her 1-month deployment in October to Sierra Leone's Bombali District. She witnessed the lifeless body of a man who had been left overnight in an ambulance. The burial team, she learned, did not collect bodies at night. When she observed burial practices at what was just a large dirt field with sticks and small pieces of paper marking graves, she described hearing a "chorus of cries." They were coming from bereft family members who were witnessing the burial of their loved ones.

But this first-year Epidemic Intelligence Service officer kept the focus on how she could help. One glaring need was improving infection control among the ambulance workers. Ambulance workers, wearing soiled personal protective equipment (PPE), had been climbing back into the vehicles and exposing the drivers who had not been wearing PPE. That ambulance driver became ill, went to work ill, and transmitted the virus to others. Before Tiffany arrived, an entire ambulance team had succumbed to Ebola. Tiffany went on ride-alongs with the new team to observe and find ways to improve infection control. She noted that one of the most rewarding experiences during her deployment was the ambulance workers' "unwavering enthusiasm" and receptivity to recommendations. She taught them infection control practices, including how to use the buddy system while safely putting on and removing PPE.

Tiffany also advocated for local hospital needs. The healthcare facilities lacked running water and had to rely on collecting rainwater. They were concerned that, as the rainy season was drawing to a close, they would run out of water. Tiffany worked with partners at UNICEF to place bore wells in all of these facilities so they would have a sustainable source of water throughout the dry season.

Would she go back? "Absolutely," she responded, "it's not every day you get to work with your heroes."





“Antibiotic resistance is one of the most pressing public health threats today. We work with CDC to improve surveillance and promote antibiotic stewardship in healthcare, in the home, and on the farm.”

Paul Jarris, [Association of State and Territorial Health Officials](#)

Tracking and improving antibiotic use

A [new report](#) from CDC showed that doctors in some hospitals prescribed up to three times as many antibiotics as doctors in other hospitals. To address the problem of overuse and misuse of antibiotics, CDC’s [National Healthcare Safety Network](#) (NHSN) launched the nation’s first fully automated system, which will electronically capture antibiotic prescribing trends and drug susceptibility test results that show which antibiotics work on specific bacteria. This feature is now available for use by the more than 13,000 healthcare facilities enrolled in NHSN.

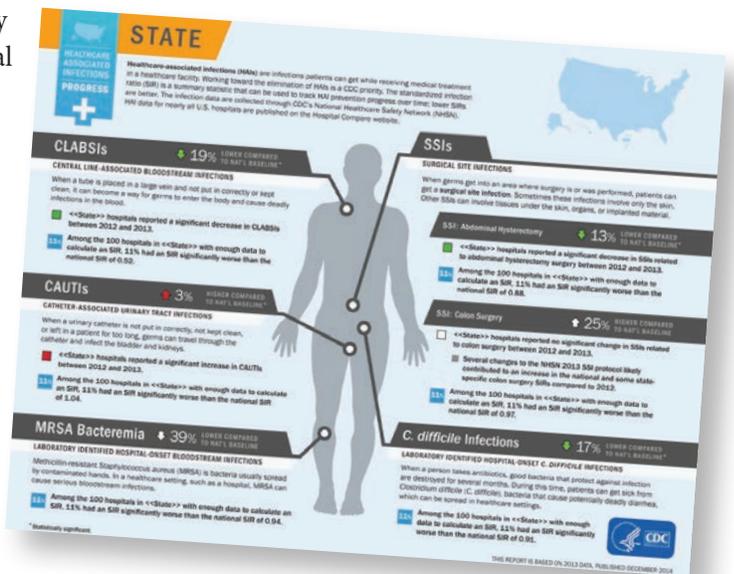
Why is it important?

- This system will identify and provide data on antibiotic prescription “hot spots” in hospitals to assess and improve appropriate antibiotic use.
- CDC will be able to track the amount of antibiotics used in healthcare facilities, assess [antibiotic resistance](#), protect antibiotic resources, and save lives.
- CDC has called on every hospital to implement an antibiotic stewardship program to improve prescribing practices.

Targeting prevention to protect patients from healthcare-associated infections (HAIs)

In collaboration with partners, CDC is taking a new approach to reducing HAIs by using data to identify hospitals and wards that can benefit from additional infection control expertise.

Two publications show the progress—and current challenges—in preventing HAIs. The [CDC Prevalence Survey of Healthcare-Associated Infections](#) estimates the full spectrum of HAIs, identifying where to focus prevention efforts. CDC’s [National and State Healthcare-Associated Infection Progress Report](#) complements this survey by showing how each state and the country as a whole are doing in eliminating six of the most common HAIs. For example, the report finds that central line-associated bloodstream infections have fallen 46% since 2008.



Why is it important?

- Progress has been made in eliminating HAIs, but there is much more work to be done.
- These data will inform national policies and recommendations that target HAI prevention, including antibiotic-resistant infections.



Protecting health at the borders

In addition to coordinating efforts to contain the Ebola outbreak, NCEZID has been working throughout the year on other infectious disease threats at our borders:

- Since the first case of [avian influenza A \(H7N9\)](#) was reported in China in 2013, CDC has been involved in taking steps to prepare because of this virus' potential to cause a pandemic. NCEZID has helped coordinate with domestic and international partners, issuing guidance to clinicians and public health authorities in the United States and providing information for people traveling to China. To date, the virus has not been identified in people or birds in the United States.
- In May, two unlinked imported cases of **MERS (Middle East Respiratory Syndrome)**, a severe acute respiratory illness, were confirmed in the United States. Both patients were healthcare workers who lived and worked in Saudi Arabia, where they are believed to have been infected. NCEZID staff focused on preventing additional US cases by producing updated information for travelers, guidance for airline crews, and two MERS videos (one for inbound flights and one for outbound flights) in English and Arabic for the Transportation Security Administration.
- In support of the humanitarian response led by the US Department of Health and Human Services and the Department of Homeland Security to the **unaccompanied children from Central America** who were crossing into the United States in spring and summer 2014, NCEZID provided consultation on medical screening, disease surveillance, and vaccinations, and helped investigate an outbreak of respiratory disease.



A model for global health security

The 2014 Ebola epidemic erupted in a region of Africa with little or no public health infrastructure. Months before the outbreak, CDC, other US agencies, and the World Health Organization were working in another part of Africa on what turned out to be a particularly successful [global health security demonstration project](#). The project's goal was to shore up the capacity of integrated disease surveillance in Uganda, which meant improving the availability and use of surveillance and laboratory data to help with more timely detection and response to outbreaks of disease. Conducted with the Ministry of Health, the project focused on three priority diseases—two types of drug-resistant TB, cholera, and Ebola. Enhancements were made in laboratory and information systems for outbreak response and coordination of information through emergency operations centers.

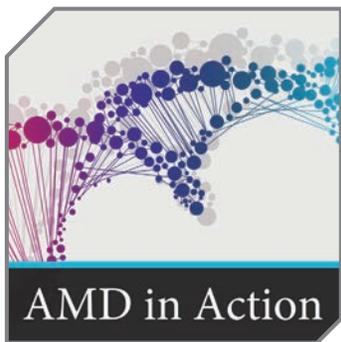
“Disease knows no borders, time zones, or zip codes. An outbreak anywhere can be a risk everywhere.”

Karen Goraleski, [American Society of Tropical Medicine and Hygiene](#)



Why is it important?

- The need for global health security has never been more critical. In addition to the unprecedented outbreak of Ebola virus, new microbes are emerging and spreading, and drug resistance is rising.
- The project resulted in concrete outcomes. For example, now suspected cases of illness caused by the three priority diseases can be reported via text messaging to the country's information system.
- In just 6 months, the project substantially improved the capacity of Uganda's health system to more rapidly detect and respond to health threats.



Innovative sequencing quickly solves a *Salmonella* outbreak

The ultimate goal in a foodborne outbreak response is to solve the mystery of what’s making people sick before too many people fall ill. It’s easier said than done, but that’s what happened this year when CDC used whole genome sequencing in a *Salmonella* outbreak investigation. Scientists believe that without the sequencing work funded by the [Advanced Molecular Detection \(AMD\)](#) initiative, this [outbreak](#) would likely have taken longer to solve, and more people would have become ill.

Routine US Food and Drug Administration inspections in January and July 2014 had found *Salmonella* Braenderup contamination in an almond and peanut butter processing plant in Oregon. When CDC used whole genome sequencing to compare samples from people who had gotten sick with samples from the plant, they quickly discovered a match with four people, each in a different state. The patients were interviewed, and they all had consumed nut butters that originated from the same manufacturing facility. This was all the evidence needed for the manufacturer to voluntarily recall the contaminated nut butters in August.

“AMD technology must be part of the public health arsenal in the fight to improve infectious diseases identification and detection—halting disease outbreaks faster.”

[American Society for Microbiology](#)

Why is it important?

- Whole genome sequencing finds matches between contaminated food and ill people that older foodborne outbreak detection methods may not have found. Matches are more specific and more likely to result in action to protect the public.
- Outbreaks of *Salmonella* in peanut butter over the past 10 years have sickened hundreds of people at a time. Whole genome sequencing got the contaminated product off the shelf after only four people had reported illness.
- AMD gives CDC scientists the key pieces they need to better protect people from ever-changing infectious disease threats.

Strengthening state and local capacity

Local health departments are often the country’s first line of defense when disease outbreaks emerge. Annually, CDC

“MERS, chikungunya, Ebola: not one but three emerging diseases demanded rapid response from public health labs in 2014. CDC Epidemiology and Laboratory Capacity Grants laid the foundation for our successful response.”

Scott Becker, [Association of Public Health Laboratories](#)

allocates funding to help these “first responders” fight infectious disease outbreaks more quickly and develop better interventions to protect the public’s health. The 2014 funding was awarded through two platforms:

\$97.2 M

The **Epidemiology and Laboratory Capacity for Infectious Diseases Cooperative Agreement (ELC)** supports public health efforts in **50** state health departments, the **6** largest local health departments, and **8** territories or US affiliates.

\$37 M

The **Emerging Infections Program (EIP)** supports **10** state health departments and their partners in their efforts to quickly translate surveillance and research into policy and public health practice.



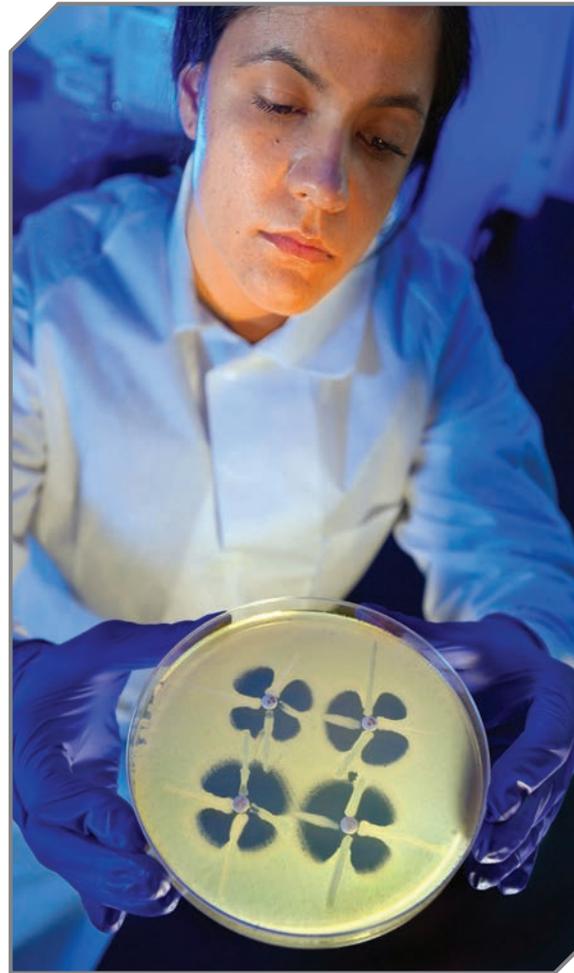
Defusing an urgent health threat: Antibiotic resistance

[Antibiotic-resistant bacteria](#) threaten to return us to the time when simple infections were often fatal. Today, these “superbugs,” as they are often called, annually cause at least 2 million illnesses and 23,000 deaths in the United States and present a serious threat to public health and national security. The estimated annual impact of antibiotic-resistant infections on the national economy is \$20 billion in excess direct health care costs, and as much as \$35 billion in lost productivity from hospitalizations and sick days.

The President’s Executive Order and the [“National Strategy for Combating Antibiotic-Resistant Bacteria”](#) announced this fall signify a national commitment to address the major drivers of resistant infections.

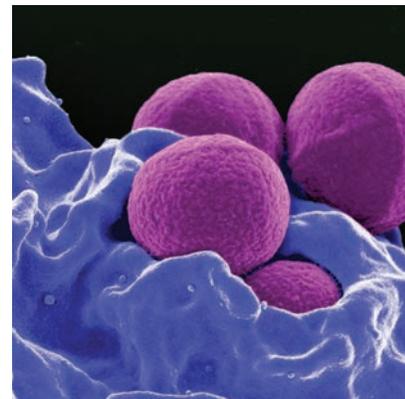
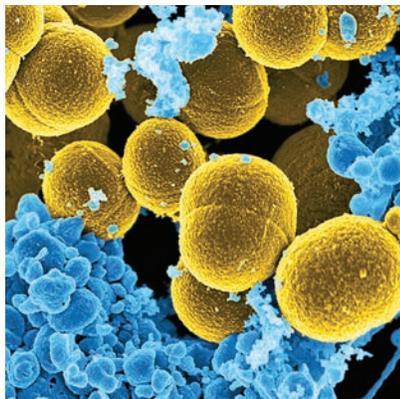
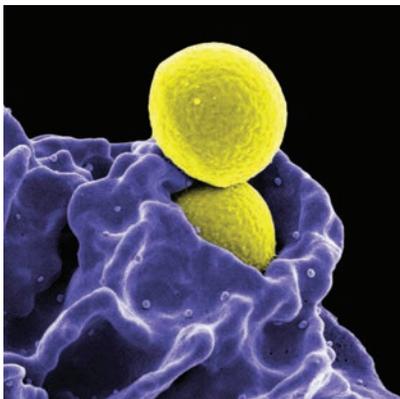
Detecting, preventing, and controlling antibiotic resistance requires a coordinated effort. To support the “National Strategy for Combating Antibiotic-Resistant Bacteria,” CDC is working to address the threat in these four areas:

1. Slow the development of resistant bacteria and prevent the spread of resistant infections.
2. Strengthen national [One Health](#) (animal-food-human interface) surveillance efforts to combat resistance.
3. Advance development and use of rapid and innovative diagnostic tests for identification and characterization of resistant bacteria.
4. Improve international collaboration and capacities for antibiotic-resistance prevention, surveillance, control, and antibiotic research and development.



“Antibiotic resistance is a serious threat to public health. The longer we wait to address antibiotic resistance, the larger and more costly the problem will become.”

Stephen B. Calderwood, [Infectious Diseases Society of America](#)



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