



National Center for Emerging and Zoonotic Infectious Diseases

Accomplishments 2015



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





Responding to outbreaks in the United States and around the world is an important part of the mission of the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID). During a [multistate foodborne outbreak](#), for example, NCEZID often serves as lead coordinator between public health partners to detect the outbreak, define its size and extent, and identify the source.

In fiscal year (FY) 2015, NCEZID received 24 requests from states and other countries to assist in the investigations of outbreaks of infectious disease. These requests, known as Epi-Aids, involved NCEZID's support for health departments or ministries of health through epidemiological investigations, laboratory analyses, and technical assistance.



Responding to a deadly outbreak of botulism in Ohio

Home-canned potatoes were the culprit in a [botulism](#) outbreak in Fairfield County, Ohio, the largest such outbreak in the United States since 1978. Within a week, 29 people became ill after eating the potatoes that were in a potato salad served at a church potluck. A total of 24 were hospitalized, and 1 person died. Botulism is caused by a nerve toxin produced by *Clostridium botulinum*. CDC's efforts were led by a response team from NCEZID, which had teams in Atlanta and in Ohio. Their coordination across multiple groups within and outside of CDC likely saved lives and helped prevent additional cases of severe illness. Of critical importance was the work of local and state health officials in triaging patients to multiple hospitals to receive necessary medical assessment and supportive care, large-scale laboratory testing done in NCEZID's labs, and rapid delivery of 50 doses of *botulinum* antitoxin from CDC's Strategic National Stockpile to the patients in Ohio.



Children infected with *E. coli* after visiting an agricultural fair in Washington State

When more than 20 people (mostly children) became ill after attending a festival in Whatcom County, Washington, local public health authorities called in NCEZID to help investigate. They learned that the illness was connected with touring the dairy barn, where the outbreak strain of *E. coli* was found in several areas, including a hay maze. [E. coli O157:H7](#) can cause a type of kidney failure, as it did with 4 of the 10 who were hospitalized. Fortunately, no one died. Recommendations for the event organizers included evaluating their plans for cleaning and disinfection before, during, and after events, particularly surfaces with high levels of hand contact (such as seats, door and fence handles, and hand railings). Take-aways for the public? Never eat or drink in places where animals have been kept (such as barns), because they could be contaminated with bacteria and viruses. After visiting these areas, thoroughly wash your hands with soap and water. If soap and water are not available, use an alcohol-based hand sanitizer.



What's in the sushi?

Beginning in April, NCEZID, several state health departments, and the US Food and Drug Administration started investigating a [multistate outbreak](#) of a strain of *Salmonella* linked to frozen raw tuna. Most ill people reported eating sushi made with raw tuna from restaurants or grocery store sushi counters. As of August, when the outbreak was declared over, 65 cases had been reported from 11 states. State labs in Arizona and Minnesota identified several strains of *Salmonella* in samples of frozen raw tuna, including the outbreak strain that had been linked to people's illnesses. The tuna samples were imported from Indonesia. In July, the Indonesian company issued two voluntary recalls of frozen tuna from one processing plant in Indonesia. CDC advised restaurants and retailers to carefully check their inventory for the recalled products and not sell or serve them. Even if there is not an ongoing outbreak, people at higher risk for serious foodborne illness (for example, children younger than 5 and adults older than 65) should not eat any raw fish or raw shellfish.



One outbreak, two viruses

In August, NCEZID responded to an outbreak in Maricopa County, Arizona, of two different diseases spread by infected mosquitoes. This was the first time that a concurrent outbreak (same time, same place) of [St. Louis encephalitis virus](#) and [West Nile virus](#) had ever been reported. Both viruses can cause mild illness. Less than 1% of people who are infected will develop a serious disease of the nervous system like encephalitis or meningitis (inflammation of the brain or surrounding tissues). A total of 74 probable or confirmed cases were identified. In addition to providing training and assistance, evaluating mosquito surveillance and control efforts, and identifying the type of mosquitoes (the vectors) and birds (the hosts) involved in the outbreak, NCEZID experts are recommending that in future seasons, local public health authorities remain alert for the possibility that the two viruses may be circulating at the same time.



Widespread *Salmonella* infections linked to cucumbers

NCEZID's foodborne outbreak team worked with state health departments and the US Food and Drug Administration (FDA) to investigate a large [multistate outbreak](#) of *Salmonella* Poona infections linked to cucumbers imported from Mexico. A total of 888 people from 39 states have been infected. More than 190 people have been hospitalized, and 6 people have died. Traceback investigations determined that the outbreak likely stemmed from "slicer" or "American" style cucumbers imported from Baja California in Mexico and distributed to many US states. In early September, the distributor voluntarily recalled these types of cucumbers. By mid-November, the number of reported illnesses declined substantially since the peak of illnesses in August and September. However, it has not returned to the number of reported illnesses that we would expect to see (about 5 every month). The investigation into the source of these recent illnesses is ongoing.



Tracing an outbreak to contaminated medical instruments

When NCEZID received a request to assist a medical facility experiencing an outbreak of highly resistant bacteria, infection experts zeroed in on the facility's duodenoscopes—flexible, lighted tubes that are threaded through the mouth, throat, and stomach into the top of the small intestine (duodenum) to perform certain medical procedures. Although the duodenoscopes had been cleaned and disinfected (called reprocessing) following the manufacturer's recommendations, they were identified as the source of transmission of [CRE](#) (carbapenem-resistant Enterobacteriaceae). CRE is sometimes called "nightmare bacteria," because it is resistant to most antibiotics. Working with other partners, NCEZID experts identified how these complex medical instruments might remain persistently contaminated.

NCEZID continues to assist facilities and state health departments and work with FDA in responding to outbreaks related to duodenoscopes. To date, NCEZID has assisted with clusters of infections in 10 facilities in 7 states, involving hundreds of patients. In March, NCEZID, with input from healthcare facilities, professional partners, and stakeholders, drafted an [interim protocol](#) for facilities interested in performing duodenoscope cultures as part of their reprocessing protocol. NCEZID continues to work with partners to further refine the protocol.

NCEZID works to protect people at home and around the world from emerging and zoonotic diseases from A to Z—anthrax to Zika.



Cholera in East Africa

NCEZID staff traveled to Kenya and Tanzania to assist the respective Ministries of Health in investigations of two outbreaks of cholera. Since January 2015, more than 10,600 cases of cholera and 175 deaths have been reported in a multicounty outbreak in Kenya. Since August 2015 in mainland Tanzania, close to 13,000 cases and more than 200 deaths have been reported in 20 of its 25 regions. Although cholera is a treatable disease, it is also a highly contagious disease, as people move to and from the affected counties and transfer the infection from one locality to the next. In Kenya, the team from NCEZID conducted knowledge, attitude, and practices surveys of the residents and health workers in affected communities; performed health facility assessments; and evaluated how well in-home systems for storing and treating water were working. They also organized focus groups with national, county, and local health personnel to gain a deeper understanding of how the recent decentralization of Kenya’s healthcare system may have affected cholera preparedness and outbreak response efforts. NCEZID’s team in Tanzania assisted with all activities involved in outbreak response, for example, by providing clinical case management, epidemiology support, clinical and environmental laboratory testing, and technical support on water, sanitation, hygiene and social mobilization, as well as coordinating an emergency operations center.

“Disease threats are unpredictable and can move faster around the world than ever before. The time is now for CDC and its partners to put the Global Health Security Agenda into action.”
Karen Goraleski, American Society of Tropical Medicine and Hygiene



Monkeypox in the Republic of Congo

NCEZID poxvirus experts responded to an urgent request from the Ministry of Health in the Republic of Congo to investigate the risk of monkeypox and provide educational outreach in the Imfondo region. Earlier this year, a child infected with monkeypox, a type of poxvirus found in central and western African countries, traveled to the Republic of Congo from the Democratic Republic of Congo prompting this call to action. NCEZID’s earlier work in neighboring Democratic Republic of Congo, where monkeypox is endemic, demonstrated that community outreach combined with training healthcare workers in disease recognition, infection control, and diagnostic sample collection prevents illness and saves lives. Since 2010, NCEZID poxvirus staff have trained more than 200 healthcare workers in that country and established routine surveillance. To identify cases of illness, the poxvirus team partners with the International Conservation and Education Fund which has provided films to educate people about the disease. The well-traveled and porous borders between the two countries and a recent turnover in healthcare worker staffing in the Imfondo area made this an ideal time to implement outreach and examine risk factors associated with transmission.



Botulism in Ethiopia

The Ethiopian Public Health Institute requested assistance from NCEZID about two concurrent, unrelated clusters of an unknown nervous system illness involving two families living in geographically separated villages in southern Ethiopia. In less than 2 months, 19 family members had been affected by the disease, and 11 had died. The NCEZID team worked in collaboration with staff from CDC Ethiopia and the Field Epidemiology and Laboratory Training Program. After interviewing family members and medical staff, examining surviving patients, and receiving laboratory support, they determined that these were all cases of botulism—the first cases ever diagnosed in Ethiopia. Homemade clarified butter and homemade chili condiment were implicated in one of the two outbreaks. The source of the other outbreak couldn’t be determined during the initial investigation. The NCEZID team made some suggestions to help the people in the communities quickly recognize and treat botulism and rapidly respond to any future outbreaks.



Impressive numbers in *Listeria* project's 2nd year

Since 1996, [PulseNet](#) has been using DNA fingerprinting to detect local and multistate outbreaks of *Listeria* infection. But linking human cases of *Listeria* infection to food contaminated with *Listeria* proved challenging. In 2013, the tide turned on detecting *Listeria* infections. That's when NCEZID scientists, in collaboration with the US Food and Drug Administration, US Department of Agriculture, National Institutes of Health, and state and local health departments, began applying [advanced molecular detection](#) (AMD) methods to outbreak detection through the [Listeria Whole Genome Sequencing \(WGS\) Project](#). In the first 2 years of the *Listeria* WGS project, we have increased the number of outbreaks solved from 2 to 9 (nearly a 5-fold increase) and reduced the number of people becoming sick from 6 cases per outbreak to 3 (a 50% reduction). As a result of these successes, CDC is further engaging with 10 states to test tools needed to locally implement WGS. We have also learned that foods like apples and ice cream can also transmit *Listeria*.



Why does this matter?

- Combining AMD methods with data on what sick people ate helped NCEZID investigators rapidly determine the foods responsible for outbreaks and take public health actions.
- In the project's next phase, investigators can apply lessons learned from the *Listeria* WGS project to outbreaks caused by other foodborne germs like [E. coli O157](#), which will save even more lives.

New tools give better access to foodborne disease data

“Local health departments are critical to ensuring the health and safety of the community by detecting outbreaks and acting quickly to prevent foodborne illnesses.”

LaMar Hasbrouck, National Association of County and City Health Officials

In the past 2 decades, we have collected valuable data on foodborne disease outbreaks and antibiotic-resistant infections. Now, everyone can easily *find* and *use* this wealth of information, thanks to two new interactive tools developed by NCEZID food safety experts.

The updated [Foodborne Outbreak Online Database Tool \(FOOD Tool\)](#) lets users search nearly 20 years of outbreak data by state, food, or germ. New interactive features make it possible to search by specific foods and ingredients, view a “quick stats” display, and find case counts for multistate outbreaks.

[NARMS Now: Human Data](#) allows users to view trends in antibiotic resistance for four bacteria transmitted commonly through food—*Campylobacter*, *E. coli* O157, *Salmonella*, and *Shigella*. The tool contains 18 years of data gathered from bacteria isolated from people who have had foodborne illness. You can search by bacterial serotype or species, antibiotic, year, and geographic region.

Why does this matter?

- The updated FOOD Tool makes surveillance data on foodborne outbreaks easily accessible for consumer advocacy groups, public health workers, the medical community, the food industry, and the public.
- Public health investigators can use the FOOD Tool to search foods and the germs implicated in past outbreaks.
- Antibiotic-resistant infections from bacteria transmitted through food cause an estimated 440,000 illnesses in the United States each year.



An unexplained spike in an old disease

A teenage girl in Crook County, Oregon, was hospitalized in late October with bubonic [plague](#), marking the 16th case of the deadly illness in the United States in 2015. Health officials believe that she contracted the bacteria that causes plague, *Yersinia pestis*, from the bite of an infected flea during a hunting trip in rural Oregon. NCEZID staff have been working with state health departments to actively respond to the unexplained uptick in plague activity throughout several western US states. To date, 4 people have died. In recent decades, an average of 7 human plague cases have been reported each year.

Although it's not clear why we're seeing a higher-than-usual number of cases in 2015, it is clear what doctors should do. CDC urges healthcare providers to "think plague" if a patient has flu-like symptoms, either lives in or has traveled to places in the western United States, has been near rodent habitats, or had contact with rodents or ill pets like cats or dogs, which can bring plague-infected fleas into the home.

Why does this matter?

- The number of US cases of plague in 2015, while still small, is higher than usual.
- This is the same plague as the "Black Death" that eliminated 60% of Europe's population in the 14th century. Today, plague can be successfully treated with antibiotics. It can still be fatal if not caught early.

Rabbit fever on the rise

When a man from Wyoming died from [tularemia](#) in late August 2015, it further raised concerns about why the state and region were seeing more than the usual number of cases of the bacterial disease also known as "rabbit fever." This illness is typically found in animals, and rabbits, hares, and rodents are especially susceptible. People can become infected with tularemia in a variety of ways, like being bitten by an infected tick or deerfly.



In 2015, the number of cases of tularemia were higher than they've been since the early 1980s. As of late September 2015, 16 cases of tularemia, including 1 death, had been reported in Wyoming, which averages just a few cases per year. In one Colorado county in July, 5 men were infected with tularemia. Health officials noted they were likely exposed while mowing the lawn or gardening—activities that can create airborne dust. As of late September, Colorado had reported 43 cases, up from the typical 4 cases of the disease seen each year. By the end of September, Nebraska had reported 21 cases and South Dakota had reported 20 cases. Usually, these states have 7 cases per year.

"State and local health departments act as the linchpin in identifying and controlling the spread of new and emerging infectious diseases. They use the power of epidemiology to improve the public's health."

Jeff Engel, Council of State and Territorial Epidemiologists

There are theories, but no conclusions, to explain the increase in the number of tularemia cases this year. Thankfully, tularemia is treatable with antibiotics. Further, public health communication heightened awareness of the outbreak among healthcare providers in the affected region.

Why does this matter?

- Tularemia used to be much more common in the early 20th century than it is today. Cases have been reported from all states except Hawaii.
- The bacteria that cause tularemia occur widely in nature and could be isolated, grown in quantity in a laboratory, and used to intentionally infect people.



Seizing an opportunity to reduce HIV mortality

The fungus *Cryptococcus* can cause a serious opportunistic infection in people with advanced HIV/AIDS. An opportunistic infection is an infection that takes advantage of a host with a weakened immune system, like people with HIV/AIDS. Worldwide, approximately 1 million new cases of cryptococcal meningitis (fungal infection of the brain) occur each year, resulting in 625,000 deaths.

One approach to preventing these deaths is screening to detect early cryptococcal infections in patients with HIV/AIDS before they develop signs and symptoms of meningitis. A simple, inexpensive blood test can provide results in just 10 minutes. If the patient has a cryptococcal infection, they can be given an antifungal medication to help the body fight off the infection.

For the past 5 years, NCEZID fungal disease experts worked on cryptococcal disease screen-and-treat strategies designed for countries that have many people with HIV/AIDS. In the past year, two research studies have shown that combined with early HIV antiretroviral treatment, screen-and-treat programs can reduce deaths in HIV/AIDS patients by up to 30%.

Why does this matter?

- Throughout much of sub-Saharan Africa, cryptococcal meningitis is one of the leading causes of death among HIV/AIDS patients.
- Screen-and-treat programs are cost-effective, saving lives and money.
- HIV patients with low CD4 counts (specific cells of the immune system) are particularly at risk. If these patients can be screened sooner and given appropriate care, lives would be saved and the burden placed on health systems by hospitalization and expensive treatment for meningitis would be reduced.

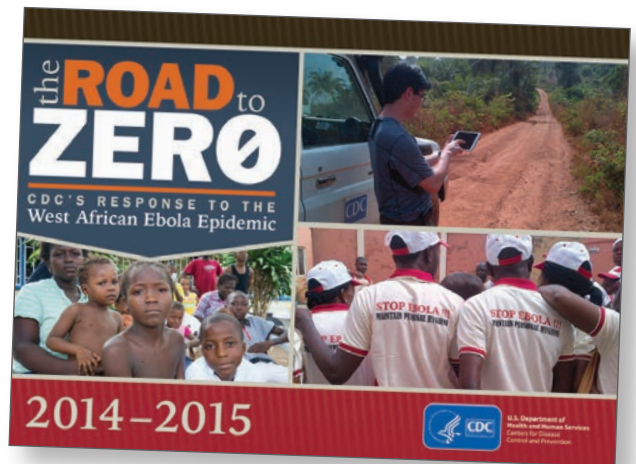




NCEZID and the Ebola response: Closing in on zero

In January 2016, there is reason to hope that the largest [Ebola](#) epidemic in history will soon be over. But even in the aftermath, there will still be work to be done—responding to flare-ups of illness, providing support for survivors, strengthening health systems in West Africa through the Global Health Security Agenda, and improving infection control in hospitals throughout the United States.

Throughout 2015, staff from NCEZID, along with staff across CDC, have actively worked to extinguish the raging epidemic that has claimed more than 11,000 lives to date. Those deployed to West Africa assisted with myriad tasks including surveillance, contact tracing, data management, laboratory testing (*see story about the Bo Lab on the next page*), assisting with the vaccine trial, conducting research to see how long the virus remains in the body after recovery, and performing health communication and education activities. In Atlanta, staff worked in the Emergency Operations Center to provide technical expertise, logistics, staffing, communication, analytics, management, and other support functions. Some NCEZID staff partnered with Customs and Border Protection to conduct enhanced entry risk assessment and management of travelers at five US airports. Looking ahead, other staff have applied lessons learned in the Ebola response to improve infection control in hospitals here at home.



NCEZID and Ebola: By the numbers

What we accomplished in 2015 and what we will be doing in 2016 to ensure that we will be better prepared to face future epidemics of this scope

> 200	NCEZID staff deployed to West Africa January–September 2015
> 400	NCEZID staff working on the Ebola response January–September 2015
57	Labs in the Laboratory Response Network (LRN) in 44 states approved to test for Ebola. Prior to the outbreak, Ebola testing was only performed at CDC and US Army Medical Research Institute of Infectious Diseases (USAMRIID) laboratories.
6	Hours turnaround time for lab results at LRN labs; down from 24 hours
100	Ebola full genome sequences obtained by CDC in collaboration with the Broad Institute of MIT and Harvard and the USAMRIID
30 K	Travelers assessed at US airport entry and referred to public health authorities for monitoring
165 K	Healthcare workers trained on infection control by CDC through online and in-person instruction
\$110 M	<p>Awarded as part of the Ebola Supplement to all 62 Epidemiology and Laboratory Capacity for Infectious Diseases Cooperative Agreement (ELC) grantees</p> <ul style="list-style-type: none"> • Includes all 50 states, the District of Columbia, Chicago, Houston, Los Angeles County, New York City, Philadelphia, 6 territories/US affiliates • Provides additional resources to accelerate ELC activities in 3 areas: <ul style="list-style-type: none"> » \$85 M Healthcare infection control » \$20 M Lab biosafety » \$5 M Travel- and border-health measures



NCEZID working in the Ebola response: Bo Lab, Sierra Leone

The quick and accurate diagnostics provided by the [Bo Lab](#) teams throughout the Ebola epidemic played a significant role in saving lives and preventing transmission to families, healthcare workers, and the community. A field laboratory was first built in Kenema and then rebuilt and moved to Bo, Sierra Leone, in October 2014. The 4-person teams tested an average of 64 samples a day, efficiently testing 99% of samples the same day they were received or by the next day. By October 15, 2015, when it closed, the Bo Lab had been in continuous operation for 420 days, with no days off or disruptions in testing, and had processed more than 27,000 specimens. Throughout the year, each of the roughly 20 teams who worked in the Bo Lab confronted the many assorted challenges with ingenuity, outside-the-box thinking, and gritty perseverance.

Anticipating gaps in electrical service, they brought equipment that could tolerate unstable power and refrigerators and freezers that could run off multiple types of power sources. Knowing that lab results needed to be generated as quickly as possible, they used robots rather than relying on manual extraction of RNA, which meant that more than 100 samples could be processed in less than 30 minutes.

Word got out about the lab's success, and lab professionals from around the world wanted to see how it worked. What impressed all who saw the Bo Lab in operation was the simplicity and efficiency of its operation. Simplifying processes left less room for error and allowed the 4-member team to efficiently divide and complete tasks.

The team was sustained by feedback from the surrounding community. In evenings, they often heard drumming outside the nearby Ebola Treatment Unit. Bo Lab team member Angela Sanchez learned what the drumming meant: "One of the doctors told us that was what families did when they celebrated the release of an Ebola survivor. We were doing their testing, and whether they could be released depended on us."

"Laboratories, and the Ebola testing they perform, play a vital role in responding to Ebola and getting to zero. The Ebola supplemental funding bolsters the capabilities of US and international laboratories making them better prepared to respond quickly and accurately."

Scott Becker, Association of Public Health Laboratories



▲ Bo Lab Team 5 (from left to right) Aridith Gibbons, Angela Sanchez, Brandy Russell, and Tara Sealy



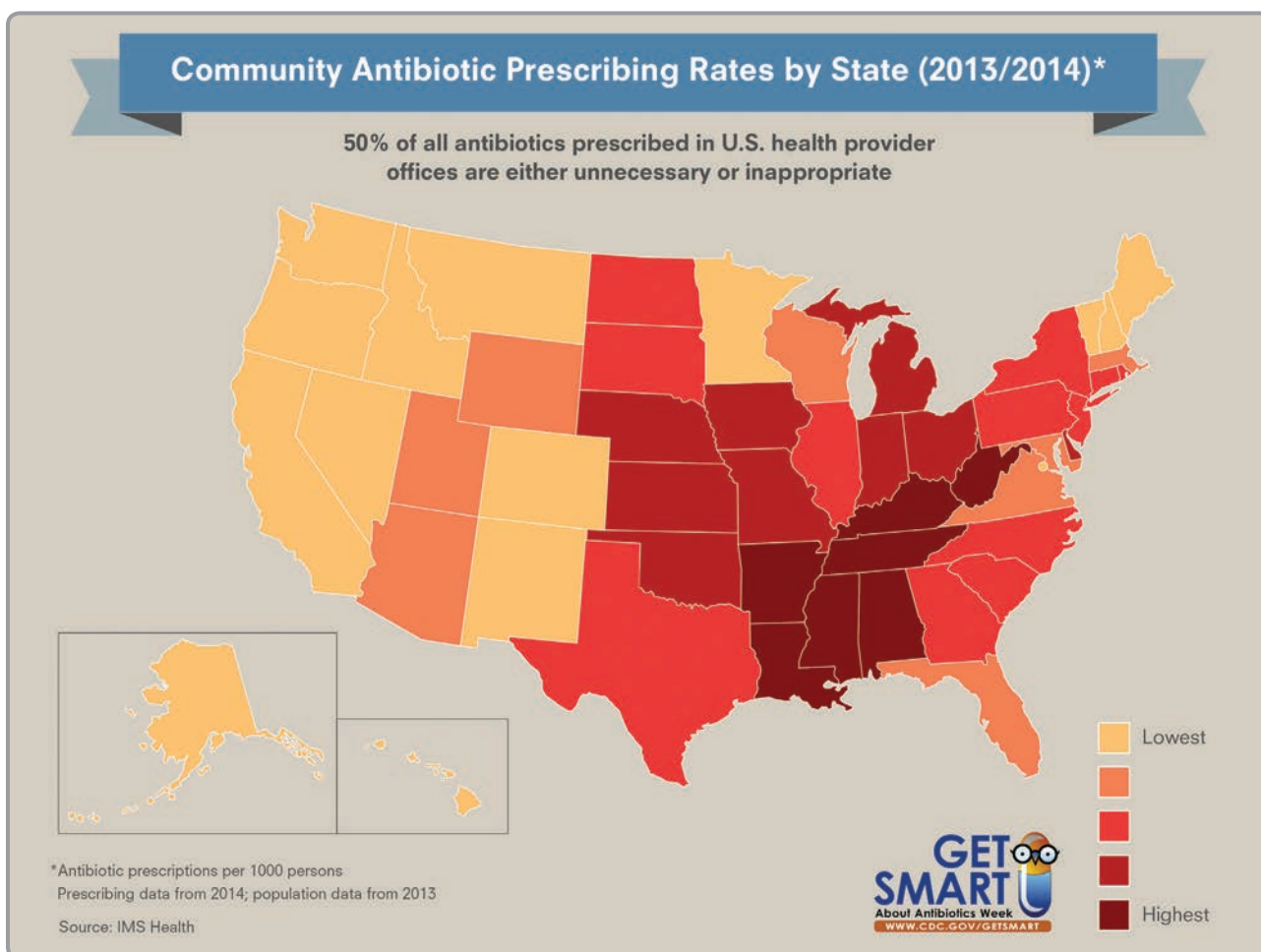
New allies join the fight against antibiotic resistance

NCEZID has worked steadily throughout the year on antibiotic resistance, what CDC Director Tom Frieden has said may be “the single-most important infectious disease threat of our time.” Following the release of the [National Action Plan for Combating Antibiotic-Resistant Bacteria \(CARB\)](#), CDC worked with other federal agencies and the White House to convene a [White House Forum on Antibiotic Stewardship](#) in June. Participants from the forum included key human and animal health experts from government agencies and private sectors, representing hospitals and healthcare systems, medical and veterinary societies, diagnostic and pharmaceutical companies, and agricultural organizations. They committed to taking part in antibiotic stewardship to change the way antibiotics are currently used.

The August 2015 [CDC Vital Signs](#), titled “Stopping the Spread of Antibiotic Resistance,” shared new CDC science and issued a call to action to make immediate, nationwide improvements in infection control and antibiotic prescribing. The report recommended that public health departments track and alert healthcare facilities to outbreaks involving drug-resistant germs in their area. It also underscored the importance of healthcare facilities working together and with public health authorities.

“Antibiotic resistance is a growing public health crisis that is sickening and killing patients and compromising the ability to practice medicine. Now is the time for the country to fully implement the National Action Plan for Combating Antibiotic Resistance, a comprehensive, multipronged policy approach to address this problem.”

Johan S. Bakken, Infectious Diseases Society of America



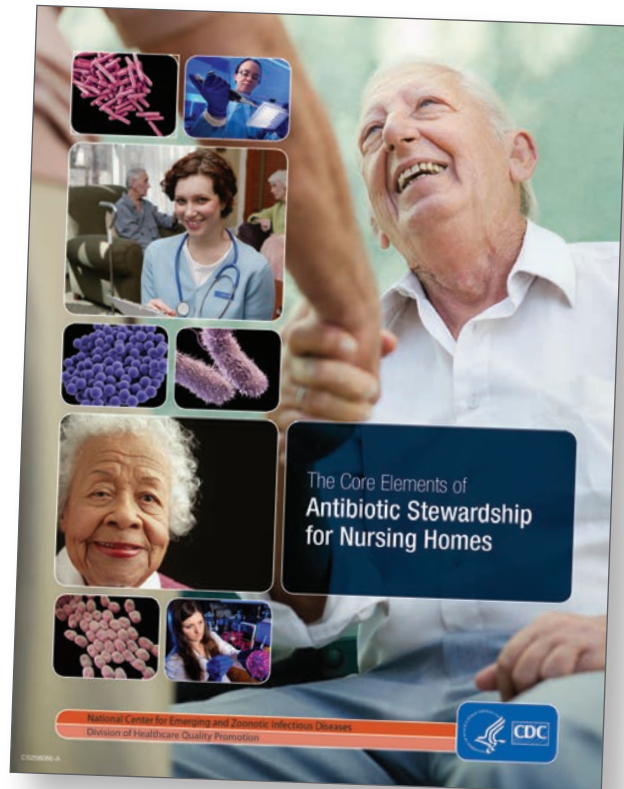


“State health agencies are critical to building important partnerships to address antibiotic resistance and are uniquely positioned to coordinate prevention efforts.”

James Blumenstock, Association of State and Territorial Health Officials

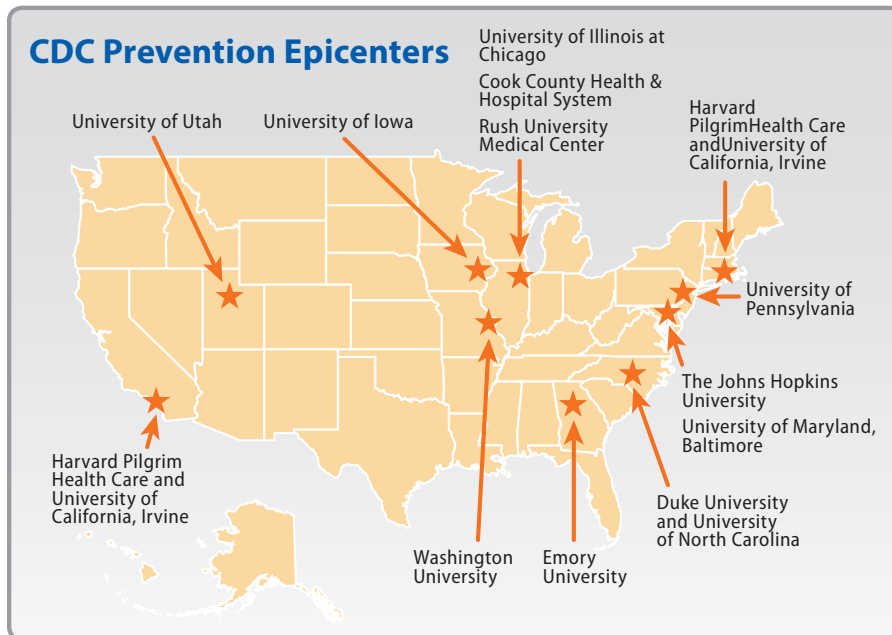
In the fall, NCEZID developed a new resource, [Core Elements of Antibiotic Stewardship for Nursing Homes](#), which featured recommendations for nursing homes designed to improve antibiotic prescribing practices. The document also has guidance about reducing inappropriate use of antibiotics to protect nursing home residents from the consequences of antibiotic-resistant infections, such as *Clostridium difficile* (*C. difficile*).

To bring national attention to the problem of antibiotic resistance, in November the White House issued a [Presidential Proclamation](#) to announce [Get Smart About Antibiotics Week, 2015](#). It calls upon the scientific community, medical professionals, educators, businesses, industry leaders, and all Americans to promote the responsible use of antibiotics and raise awareness of the dangers inherent to their misuse and overuse. The Hospital Corporation of America (HCA) joined CDC to track antibiotic prescriptions in HCA facilities by automatically collecting and reporting monthly antibiotic-use data. Walmart showed educational videos at checkout lines across the country to give their customers clear information on antibiotic resistance. Major airlines ran inflight public service announcements to inform passengers about the problem.



Why does this matter?

- Antibiotic-resistant germs cause more than 2 million illnesses and at least 23,000 deaths each year in the United States. *C. difficile* caused close to half a million illnesses in 2011.
- *Vital Signs* showed that if action is taken now, an estimated 619,000 antibiotic-resistant and *C. difficile* infections can be prevented, and 37,000 lives can be saved over 5 years.
- 40–75% of antibiotics prescribed in nursing homes may be unnecessary or inappropriate.



▲ In 2015, CDC funded six additional academic institutions to serve as CDC Prevention Epicenters, which address scientific questions about preventing antibiotic resistance and other healthcare-associated infections. The additional epicenters will help identify novel approaches to prevent the spread of germs, including Ebola and other infectious disease threats, in healthcare facilities.



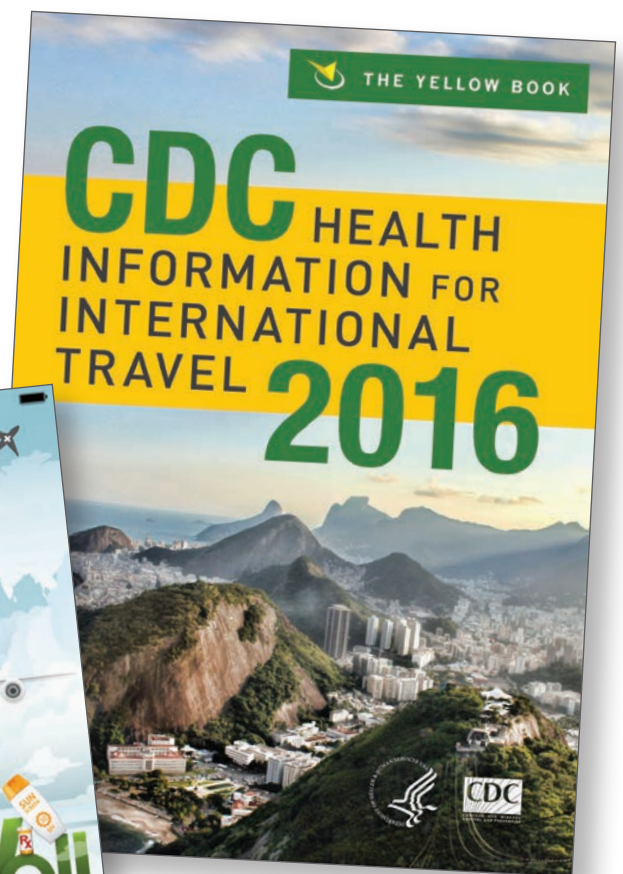
Safe—and healthy—travels

NCEZID produced two resources that need to be included in the packing list for any traveler journeying abroad. The 2016 edition of [CDC Health Information for International Travel](#), commonly known as the *Yellow Book*, is the ultimate guide for travelers and clinicians who advise them. The most recent version, which is available in print and at CDC’s Travelers’ Health website, www.cdc.gov/travel, features expanded guidelines for 16 popular travel destinations, including Brazil, Cambodia, Dominican Republic, and Haiti. Also provided are yellow fever vaccination recommendation maps for 10 countries, 15 country-specific malaria risk maps, discussion of complementary and alternative health approaches to travel medicine, and much more.

NCEZID developed “[TravWell](#),” a mobile application for planning safe and healthy travel. Users can build a trip by selecting a destination and dates of travel. For each trip, the app provides destination-specific vaccine and medicine recommendations, a fully customizable “to do” list that includes the ability to set reminders (such as to get vaccine boosters or take medicine), a customizable, destination-specific healthy travel packing list, and emergency services numbers for the destination. The app also archives past trips and keeps a record of vaccinations received.

Why does this matter?

- The 2016 *Yellow Book* includes updated sections on emerging diseases, including Ebola, MERS, and chikungunya.
- In a mobile world, having on-the-go access to CDC travel recommendations is critical. Once a trip is created, the “TravWell” app’s functions can be accessed offline, so users do not need an international data plan to use it when traveling.



“We live in a highly connected world where people routinely cross the globe. Public health communication tools empower individuals to protect themselves and ensure safe travel.”

Georges C. Benjamin, American Public Health Association



Keeping rabies on our radar

Although [rabies](#) doesn't pose the public health threat in the United States that it used to, we continue to vigorously work toward its eradication in other countries. In 2015, the NCEZID Rabies Team responded to a variety of requests for rabies control:

- In Haiti, which has the highest rate of canine rabies in the Western Hemisphere, the team led a rabies education certificate course for veterinary professionals and worked with local officials on a campaign to vaccinate about 80,000 Haitian dogs in just a few weeks.
- The team confirmed rabies in a Saudi Arabian man who had received a liver transplant. Further investigation revealed that the organ donor had been bitten by a dog while in India several months before traveling to Kuwait, where he became ill and died. The Rabies Team, assisted by other experts at CDC, provided technical assistance in the epidemiologic investigation tracing people who had received other organs from the donor.
- The Rabies and Importation and Animal Contact Teams were consulted in June, when public health officials in Virginia confirmed rabies in an adult female dog that had recently been shipped from Egypt by a US animal rescue organization. Officials learned that the rabies vaccination certificate used to allow entry of the rabid dog had intentionally been falsified. This case highlighted the ongoing risk posed by importing domestic animals that have not been adequately immunized.



▲ These dogs were part of a campaign conducted in Haiti that vaccinated 80,000 dogs in just a few weeks.

Why does this matter?

- Each year, an estimated 59,000 people die from rabies worldwide.
- Globally, dogs are the principal source for human rabies infections. There is an ongoing risk of importing domestic animals that have not been adequately immunized.

An improved test for poxviruses

NCEZID's Poxvirus and Rabies Branch has made strides in the field and in the lab reducing a group of viruses (including monkeypox) that belong to the genus *Orthopoxvirus*. The [poxvirus](#) experts have developed new tests (assays) that are particularly valuable for analyzing viruses that cannot be genetically modified, like variola virus, and may replace traditional assays. The new tests have several advantages: they require very small amounts of test material, are less labor intensive, and require shorter incubation times than traditional methods. Collected images are stored on a secure server and could be re-analyzed using additional testing parameters. In addition, both of the new tests could be combined with other assays and used in place of, or before, expensive animal model studies.

Why does this matter?

The new tests will work on different species of *Orthopoxvirus* and are more versatile and easier to administer than traditional tests.



Unraveling, discovering, linking

Innovation and discovery characterize much of our work in NCEZID, and the range of discoveries made in 2015 are far-reaching, including old mysteries solved, never-before-seen pathogens identified, and a new disease involving cancer cells that originates in a common tapeworm. Examples of notable work include:

- Poxvirus experts at NCEZID have unraveled a mystery, dating back to 2000, which involved a renal transplant patient from New York who developed a rash, the cause of which could not be identified. The patient made a full recovery, but infectious disease specialists in New York and poxvirus experts at CDC initially were stumped about the cause of illness. Years later, scientists in New York and in CDC’s Poxvirus Lab combined pathological and chemical analysis and applied next-generation sequencing methods to discover this was a new poxvirus genus, similar to *Orthopoxvirus*.
- Across the continent, another new *Orthopoxvirus* was discovered in Alaska. Alaska Public Health contacted CDC poxvirus experts about a woman who had tested positive for an orthopoxvirus that had not been seen before. CDC used whole genome sequencing to help them better characterize the new poxvirus.
- After a woman was bitten by a rabid fox in Lincoln County, New Mexico, NCEZID’s Rabies Lab was asked to help in the identification. Genetic sequencing done by the Rabies Lab showed that this was a rabies virus strain that had never before been identified. The new strain was related to other rabies strains found in bats.
- NCEZID pathologists were amazed when they found a new disease—tapeworms growing inside a person essentially getting cancer that spreads to the person, causing tumors. The cancer cells that originate in a common tapeworm can take root in people with weakened immune systems. It is the first-known case of a person becoming ill from cancer cells that arose in a parasite—in this case, *Hymenolepis nana*, the dwarf tapeworm, which is also the most common tapeworm in humans. The lead author of the study, published in the [New England Journal of Medicine](#), acknowledged that this type of event is rare. However, the tapeworm is found worldwide and millions of people around the world suffer from conditions like HIV that weaken their immune system and make them more vulnerable to this tapeworm. So there may be more cases that are unrecognized.

“CDC research is unlocking discoveries that catalyze the development of much-needed diagnostics and other technologies critical to improving and protecting health worldwide.”

Erin Will Morton, Global Health Technologies Coalition



▲ The dwarf tapeworm (*Hymenolepis nana*) pictured here is the most common tapeworm found in people.

Why does this matter?

- Increasing numbers of people have developed *Orthopoxvirus* infections since routine vaccination against smallpox ended in the 1980s.
- The report about cancer cells originating in a common tapeworm raises the concern that similar cases may be misdiagnosed as human cancer, especially in less developed countries where this tapeworm and illnesses like HIV are widespread.



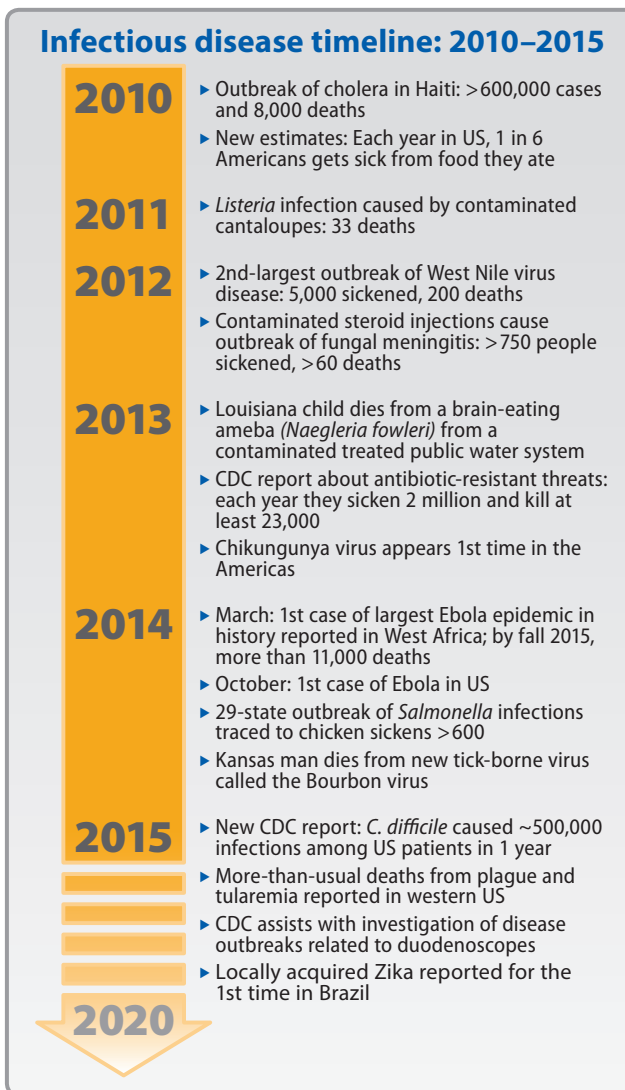
The next 5 years

What's the next Ebola? It's a question often asked. While it's impossible to accurately predict the future, we can look back at our work to curb infectious diseases during the past 5 years—some involving old, brand new, or newly resistant infections, and others appearing on our shores for the first time. The timeline, while sobering, contains lessons learned that will help us better prepare for future outbreaks. For example, we know that

- The capacities of state and local public health departments need strengthening to meet the next infectious disease challenge.
- We are precariously close to a time when simple infections may no longer respond to antibiotics that once cured them. All of us need to be better [stewards of antibiotics](#).
- Diseases spread by mosquitos and ticks will continue to evolve and move into new areas, like the recent arrival of [Zika virus](#) in the Western Hemisphere. Better diagnostics and tracking systems are needed to help us implement the best prevention strategies.
- Disease threats spread faster and more unpredictably than ever before, so we need to accelerate implementation of the [Global Health Security Agenda](#).

We also need new tools and to apply new methods if we are to stay one step ahead. Looking forward to 2020, we will need to

- Augment state and local capacity to address [antibiotic resistance](#) (AR) with AR Prevention Programs and AR Regional Labs, which can better track and respond to outbreaks, determine which antibiotics to use, improve prescribing practices, and prevent infections.
- Continue to support [advanced molecular detection](#) (AMD), which since 2013 has increased critical next-generation sequencing and bioinformatics capacities.
- Generate innovations that target emerging infectious diseases through the development of new diagnostics, vaccines, and novel prevention strategies.
- Evaluate the potential of new [culture-independent diagnostic testing](#) (CIDT) to quickly differentiate bacterial from viral infections. That, in turn, will help improve antibiotic use and prevent the spread of resistant infections. Adapt existing foodborne outbreak and antimicrobial resistance surveillance systems to work with CIDT.
- Increase public awareness of [sepsis](#), which can lead to organ failure and death, and improve sepsis treatment given by healthcare providers and facilities.
- Bolster US health security by strengthening the public health workforce's ability to quickly detect emerging infectious diseases. Rapid disease detection at local, state, and national levels is a key line of defense against new health threats.

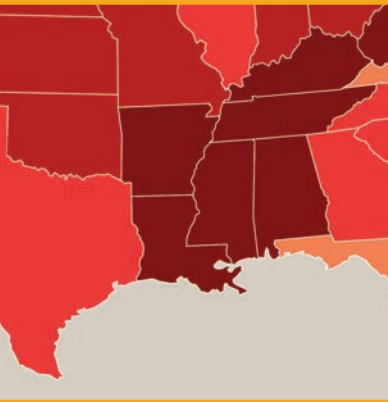




National Center for Emerging and Zoonotic Infectious Diseases

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2015

- ▶ More-than-100 tularemia re
- ▶ CDC assists 10 outbreaks re
- ▶ Locally acq 1st time in

2020

