Advancing the Global Health Security Agenda:
CDC Achievements & Impact—2018

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

https://www.cdc.gov/globalhealth/security/ghsareport/index.html

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Protecting Americans from the Threat of Infectious Disease

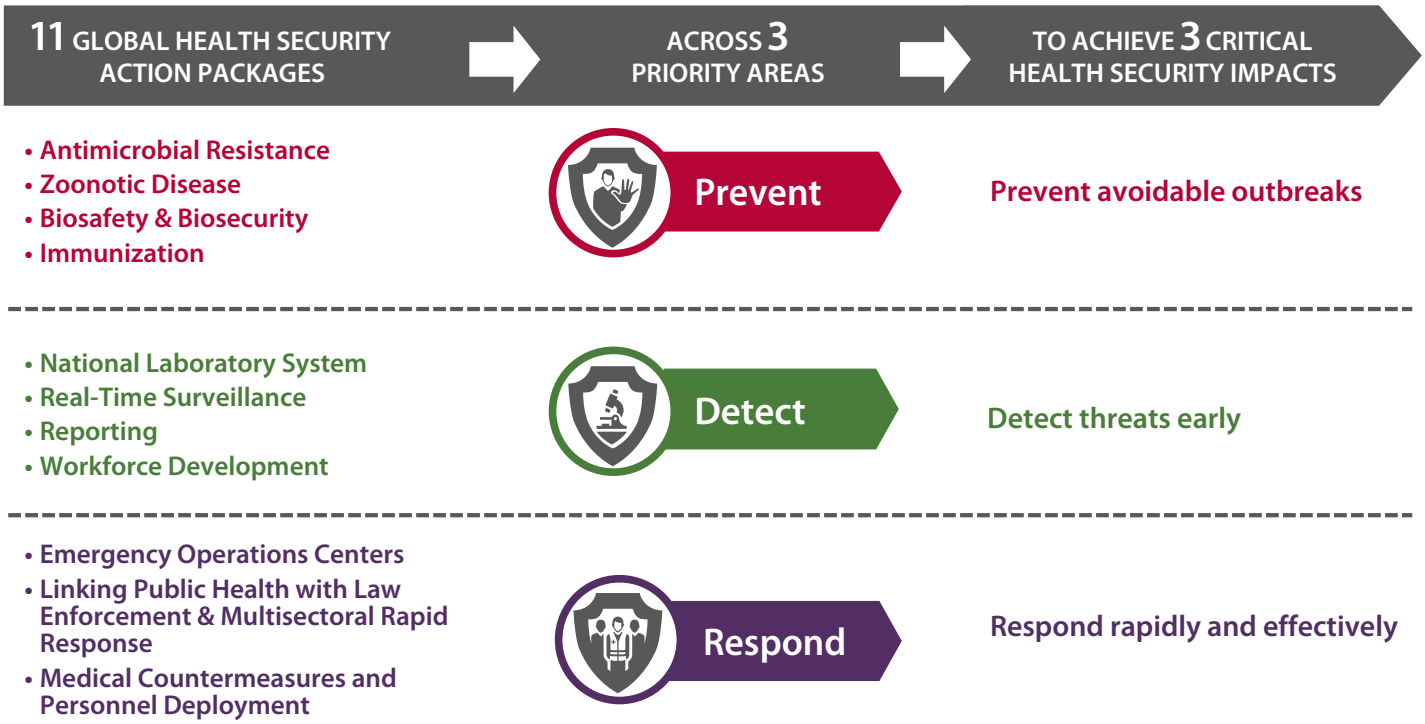
The Global Health Security Agenda (GHSA), launched in 2014, is a global effort to strengthen the world's ability to prevent, detect, and respond to infectious disease threats, whether they are naturally occurring, or accidentally or intentionally released. The Centers for Disease Control and Prevention (CDC) plays a leading role in the implementation of the GHSA for the United States by working with countries to strengthen their capabilities to identify, track, and stop disease outbreaks and public health emergencies as quickly as possible. Because of the nature of infectious diseases, everyone remains vulnerable, including people living in the United States, until every country in the world can rapidly identify and contain public health threats.

Infectious Diseases Travel Faster and Farther Than Before

New and re-emerging diseases spread quickly across the globe, resulting in outbreaks that overwhelm health systems, jeopardize lives, and devastate economies. In today's tightly connected world, a disease can be transported from a remote village to major cities on all continents in as little as 36 hours. Currently, the second largest Ebola outbreak is ongoing in the Democratic Republic of the Congo (DRC), in a resource-limited environment and armed conflict zone. This outbreak is another test of the world's preparedness for infectious disease outbreaks and the collective capacity to respond rapidly to stop further spread[1]. Global outbreaks not only cause illness and death, they can also lead to a decrease in demand for U.S. services and exports, jeopardizing the economy and American jobs. When an uncontained outbreak becomes a regional or global epidemic, costs escalate, and national and regional economies suffer. Effective and functional global health security capabilities reduce the threat and economic consequence of infectious disease outbreaks to the United States and the world.

Strategic Vision for Global Health Security

The GHSA is a multisectoral and multilateral effort that seeks to accelerate progress toward implementation of the International Health Regulations (IHR) (2005)–the legally binding instrument adopted by 196 States Parties that set requirements for preparedness and response to public health emergencies. The strategic approach of GHSA is to build capacities across 11 technical areas spanning multiple sectors and disciplines, including animal and human health, agriculture, and security. While the international community has made significant progress in mitigating infectious disease threats, challenges remain, which underscores the importance of the ongoing work to improve global health security. To address these challenges, CDC works domestically and around the world to strengthen health security and expand the capacity to prevent, detect, and respond to public health threats.



[1]Erin D. Kennedy, Juliette Morgan, and Nancy W. Knight. Health Security. Volume: 16 Issue S1: November 27, 2018 http://doi.org/10.1089/hs.2018.0120

CDC: A World Leader in Global Health Security

As the preeminent public health agency of the United States, CDC's mission is to protect the health and safety of the American people. Global health security is a critical component of America's national security and CDC has the responsibility, technical expertise, and unmatched experience to fulfill this mission that spans the globe. CDC employs experts in all aspects of public health, including infectious and non-infectious diseases, violence and injury prevention, environmental health, and emergency response. CDC plays a leading role in implementing the GHSA by utilizing its core strengths in disease surveillance and laboratory systems, workforce development, emergency management, border health security, and public health science, to assist other nations to prevent, detect and respond to health threats. CDC maintains world-class expertise in combating disease-specific health threats, domestically and in our overseas offices. For decades, CDC has used its technical expertise to combat threats across the globe, beginning with the response to smallpox and cholera outbreaks in 1958. CDC is a trusted partner to governments and global institutions that is working to limit health threats from coming to the United States from abroad.

CDC Forges Partnerships to Combat Infectious Disease Threats

Under the GHSA, the United States committed to partner with 17 Phase 1 countries (Bangladesh, Burkina Faso, Cameroon, Côte d'Ivoire, Guinea, Ethiopia, India, Indonesia, Kenya, Liberia, Mali, Pakistan, Senegal, Sierra Leone, Tanzania, Uganda, Vietnam). These countries receive technical assistance and financial support from CDC.

How CDC Advances GHSA

CDC works government-to-government with ministries of health, ministries of agriculture, and other relevant ministries, and directly with partner organizations to build capacity to contain diseases and prevent outbreaks at their source, before they spread. CDC also leverages partnerships with nongovernmental organizations, academia, multilateral organizations, the private sector, and other stakeholders to support this mission with host governments. Public health experts at CDC contribute their unique scientific expertise to these partnerships to strengthen national public health capacities, working hand-in-hand with countries to detect and contain global health threats and respond to epidemics. With partners, CDC has made great strides toward strengthening health security globally, focusing on the core technical areas of surveillance, laboratory, public health workforce development, and emergency management. CDC's focus on these core capacities has already resulted in measurable progress in the 17 Phase 1 GHSA countries where CDC has invested time and resources. CDC works to ensure collaboration, increased engagement, and accountability across the GHSA community.

Photo Credit: RTI International

Preventing, Detecting, and Responding to Epidemics: CDC's Achievements

Prevent: CDC supported Achievements in 17 Phase 1 Countries

	Antimicrobial Resistance	Zoonotic Disease	Biosafety/ Biosecurity	Immunization
Result	**11** countries demonstrated successful detection and reporting of antimicrobial resistant pathogens in the last 6 months	**9** countries shared surveillance data between human and animal health sectors for at least 80% of prioritized zoonotic diseases	**5** countries improved security controls and electronic inventories for all dangerous pathogens and toxins in national laboratories	**14** countries increased immunization coverage based on surveillance of disease burden at the community level
Why it Matters	Antimicrobial-resistant organisms have adapted to widespread use of antibiotics, decreasing our ability to treat diseases. Identifying antimicrobial-resistant organisms organisms allows us to react quickly when they spread	An estimated 6 out of 10 infectious diseases are zoonotic and spread between animals and humans. We quickly need to know about zoonotic disease outbreaks in animals to prepare for and prevent possible spread into human populations	Dangerous pathogens need to be handled carefully and stored securely to prevent them from accidentally or intentionally being released and harming the public	Effective immunization systems reduce illness and death from vaccine-preventable diseases and help limit the magnitude and number of infectious disease outbreaks

CDC's Contributions in Prevention

- Reduce factors that contribute to the development and spread of antimicrobial resistance, including improving infection prevention and control
- Keep laboratory workers safe and reduce the risk of theft, loss, or mishandling of dangerous pathogens that could harm the public
- Strengthen the prevention, detection, and response to zoonotic diseases and the development of national action plans to combat the spillover of disease from animals to humans
- Establish and strengthen vaccination programs to protect people from highly contagious yet preventable diseases, and conduct vaccination outbreak response measures

Challenges Persist

One example of a remaining challenge in preventing avoidable outbreaks is the exchange of surveillance data between the human and animal health sectors. The lack of information sharing between these sectors can leave countries vulnerable, creating barriers to collaborative action to prevent, detect, or respond to zoonotic diseases (e.g., rabies, influenza viruses, hemorrhagic fevers, and anthrax). To address this challenge, CDC is working across ministries in partner countries to prioritize zoonotic diseases and to strengthen disease surveillance systems that are able to share information rapidly between sectors for faster action.

Public health experts at CDC contribute unique scientific expertise and partnerships to strengthen national public health capacities, working hand-in-hand with countries to detect and contain global health threats and respond to epidemics. #globalhealthsecurity

Detect: CDC supported Achievements in 17 Phase 1 Countries

	National Lab Systems	Real Time Surveillance	Reporting	Workforce Development
Result	**11** countries can conduct laboratory tests to detect national priority pathogens that cause disease, outbreaks, or death	**10** countries can connect disease surveillance data with laboratory data **7** countries have established event-based surveillance in communities and health care facilities **4** countries detected more than 3000 health events through this surveillance	**13** countries established a web-based national database for surveillance	**17** countries established or expanded their program to train disease detectives
Why it Matters	Confirming diagnosis with laboratories allows health workers to respond rapidly with the most effective treatment and prevention methods, reducing spread of disease and deaths	Effective disease surveillance with rapid laboratory diagnosis enables countries to quickly detect outbreaks and continuously respond to potential risks	Having a national database that is web-based helps countries detect, respond, and report potential outbreaks and allows experts to assess public health events and respond rapidly	To maintain global health security capabilities, countries need a disease detective workforce that can quickly investigate potential outbreaks and take swift action

CDC's Contributions in Detection

- Establish monitoring systems that can predict and identify infectious disease threats at various levels of the health system, including community, district, and national levels, as well as global monitoring through CDC's Global Disease Detection Operations Center
- Strengthen countries' ability to quickly and accurately collect, analyze, and use public health information
- Train disease detectives, laboratory scientists, veterinarians, and healthcare infection prevention experts who are equipped to identify, track, and contain outbreaks in humans and animals before they spread
- Build tiered laboratory networks at the local, regional, and national levels that can transport samples safely, increase the number of samples laboratorians are able to test, and transfer information securely between patients, responders, and policymakers

Challenges Persist

One example of a persistent challenge in the early detection of health security threats is the lack of national, web-based databases that link suspected cases of illness with laboratory confirmation. This leaves countries vulnerable, as they cannot accurately and quickly identify the presence of pathogens to minimize the spread of disease. To address this challenge, CDC is sharing technical expertise with countries to strengthen disease detection through databases that are linked to laboratory results, enabling a timelier and more coordinated outbreak detection and response.

CDC supports countries in building national laboratory systems, or laboratory networks at local, regional, and national levels, so that countries can conduct tests to detect priority pathogens that cause disease, outbreaks, or death. #globalhealthsecurity

Respond: CDC supported Achievements in 17 Phase 1 Countries

	Emergency Operation Centers (EOCs)	Public Health and Law Enforcement	Medical Countermeasures	Border Health
Result	**15** countries trained emergency management specialists and experts to support a well-functioning EOC	**7** countries coordinated public health and security personnel to respond to infectious disease threats	**11** countries improved their operating procedures and logistics systems to deploy staff, medicines, and/or supplies to combat infectious disease threats	**13** countries enhanced their cross-border communication and collaboration
Why it Matters	EOCs bring together experts and stakeholders to efficiently and effectively coordinate response to an emergency or public health threat	Health and security personnel must often work closely together to combat infectious disease threats. First responders may be police officers or security personnel, not doctors. Close ties between health and security can help the sectors work together to detect, report, and limit the threat of infectious disease	During a public health emergency, countries need medications, vaccines, or personal protective equipment. Putting systems in place before an emergency strikes is critical to preventing delays in patient care	Because of the high influx of travelers through ports of entry (POE) and in porous border regions, it is important for countries to have systems in place to reliably detect and quickly respond to infectious disease threats at borders to prevent international spread

CDC's Contributions in Response

- Establish public health emergency operations centers (EOCs) to serve as a centralized location in partner countries to efficiently and effectively respond to a crisis
- Develop technical expertise and capacity needed for countries to lead their own effective responses to public health threats
- Train Public Health Emergency Management fellows to lead and manage emergency responses
- Establish and strengthen CDC rapid response teams that can mobilize quickly to address the critical and diverse needs and priorities that arise from infectious disease outbreaks
- Develop, test, and train on protocols for the rapid identification of health threats at POEs

Challenges Persist

One example of a persistent challenge in responding rapidly and effectively to health security threats is the limited functionality of EOCs. Without well-functioning EOCs, countries' coordination during an outbreak is at risk. To address this challenge, CDC is working with countries to develop EOC infrastructure, implement sustainable models for EOC operations, and assist with training current and new EOC staff to activate and manage emergency responses.

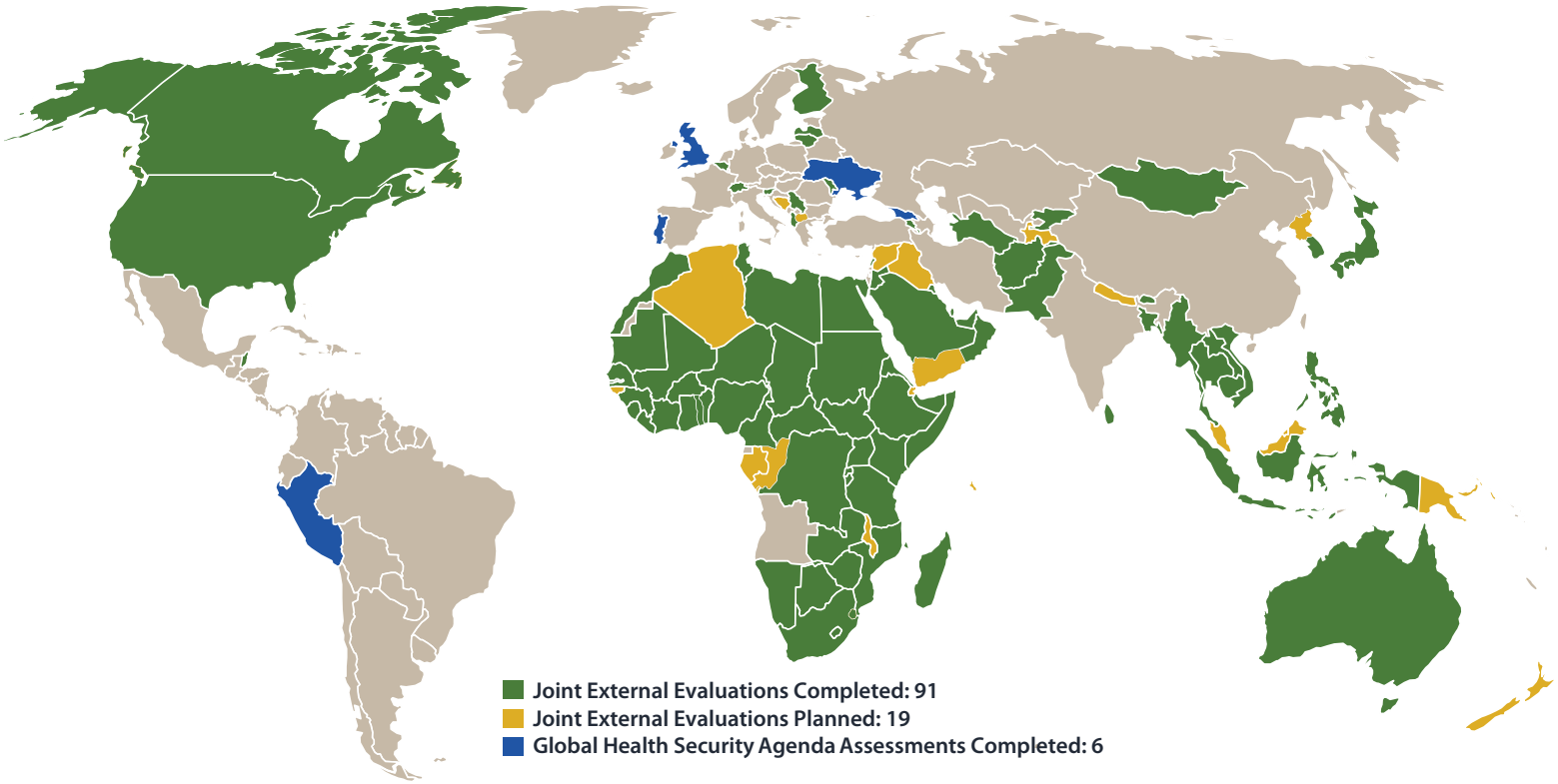
CDC works domestically and around the world to strengthen health security and expand the capacity to prevent, detect, and respond to public health threats. #globalhealthsecurity

Joint External Evaluations for Improved Health Security

The WHO's Joint External Evaluation (JEE) helps countries assess their health security strengths and weaknesses to direct resources toward the most urgent needs, protecting the country and the rest of the world from infectious diseases. JEEs are voluntary, external assessments of a country's ability to prevent, detect, and respond to infectious diseases and other public health threats. The JEE process brings together experts from around the world to work with a country to assess its strengths and weaknesses and make recommendations to improve health security capacity. Following a JEE, countries are aware of their gaps in health security capacity and can take action to build these capabilities. One way to move toward increased capabilities is to develop National Action Plans for Health Security (NAPHS), which identify the resources and define the actions needed to address the gaps identified by the JEE. Countries can also select high priority actions identified in the JEE and begin implementation immediately. WHO's IHR Benchmarks tool can guide countries in identifying appropriate actions to take to improve capacity in each of the JEE technical areas.

CDC is a world leader in building health security capacity and CDC support to the JEE and national action planning process encourages countries to take action to address gaps in health security that could result in the spread of infectious diseases internationally, including to the United States. At the end of 2018, 91 countries had completed JEEs and more than 45 countries had completed or started a NAPHS. Sixteen of 17 of CDC's Phase 1 partners completed and published a JEE and 15 of 17 started or completed a NAPHS.

Completion of Joint External Evaluations Globally: End of 2018[2]



[2] Final JEE reports can be found at https://extranet.who.int/spp/.

Photo Credit: CDC

CDC has been critical to the success of the JEE and national action planning by:

Facilitating global implementation. CDC collaborated with WHO to develop materials necessary for implementing the JEE, including (1) training materials to prepare JEE evaluators and JEE team leads, (2) guidance for countries preparing for the JEE and for evaluators to successfully perform the assessments, and (3) tools that allow WHO to implement and oversee JEE implementation worldwide.

Leveraging CDC's world-class expertise. CDC supports JEEs through on-the-ground assistance from in-country staff for country self-assessment and participation of CDC external experts on JEE teams. CDC experts have participated as members of JEE teams in 60% of the 91 JEEs completed by the end of 2018.

Building a better external evaluation process. CDC has improved the external evaluation process by contributing to the development of the original JEE and its training tools, as well as by incorporating lessons learned into the second version of the JEE tool. JEE 2.0 was published in January 2018 and is now available in English, French, Spanish, and Russian.

Support to the JEEs and national action planning has amplified CDC's efforts to build global health security capacity by:

- Providing valuable information on countries' gaps in health security capacity
- Allowing CDC programs to target efforts to make the largest impact
- Identifying countries' gaps for support from other international organizations or donor countries
- Elevating the need for countries to support health security capacity domestically through an all-of-government approach

CDC has been critical to the success of Joint External Evaluations. At the end of 2018, 91 countries had assessed their health security strengths and weaknesses, and more than 45 countries started or completed a National Action Plan for Health Security. #globalhealthsecurity

GHSA Success Stories

BURKINA FASO
Improving Outbreak Detection

Community members are often the first to hear of possible disease outbreaks, so engaging them in disease surveillance can decrease the time it takes to detect and respond to outbreaks. At three pilot sites in Burkina Faso, CDC and partners reinforced community event-based surveillance (EBS) detection and notification of outbreaks. EBS tools and operating procedures were developed and validated with field partners and Ministry of Health leaders. Three district health teams, 210 assistant nurses and chief nurses, and 935 community health workers were trained on the EBS tools. In addition, 92 primary healthcare facilities were equipped with tools and standard operating procedures. Within three months after the EBS training, 23 disease events were reported, compared to 14 events notified over the course of the previous year. Burkina Faso's EBS system includes human health, animal health, and environmental health events, and is shared by WHO and Africa CDC technical working groups as a model from which countries can develop adaptable tools and directives.

GUINEA
Tackling Lassa Fever

Lassa fever is an animal-borne, or zoonotic, acute viral illness. It is endemic in parts of West Africa, including Sierra Leone, Liberia, Nigeria, and Guinea. When a case of Lassa fever that originated in Guinea was detected in Liberia in October 2018, the Guinean National Health Security Agency ANSS) sprang into action within 24 hours, recognizing that the patient may have infected others before traveling out of the country. ANSS immediately coordinated response activities at the community, regional, and national levels, as well as mobilized partners to support government efforts to limit transmission. With CDC support, Community Health Volunteers were trained to conduct contact tracing to identify all possible contacts. Collectively, these efforts identified 28 contacts that were followed over a 21-day period. Cross-border coordination of community-based surveillance activities and POE health monitoring minimized the potential for the disease to spread. Guinea's rapid response to a potential epidemic demonstrates that health security investments are smart investments, saving countless lives and stopping disease at its source.

INDIA
Detecting Nipah Virus

Nipah virus has no cure, kills approximately 75% of the people it infects, and can be spread quickly by both animals and humans. This highlights the need for fast and accurate diagnosis of this fatal emerging zoonotic virus and potential threat to global health security. When Nipah Virus was suspected in India in 2018, accurate diagnosis was swift, as state and central government agencies responded to the outbreak quickly, containing its spread and limiting its severity. The Government of India used the technical expertise gained from training by CDC experts, including the use of next-generation sequencing (NGS) analysis, to swiftly and accurately diagnose the initial Nipah cases, allowing India to do the testing in-country instead of referring samples out for testing to CDC headquarters.

INDONESIA
Detecting AMR

Antimicrobial resistance (AMR) is a growing threat to health security around the world. With support from CDC, Indonesia's Eijkman Institute for Molecular Biology, in collaboration with the National AMR Committee, established AMR surveillance in four hospitals across the nation and incorporated two additional pathogens, S. pneumoniae and H.Influenzae, into the existing National AMR surveillance platform. Extensive training of hospital laboratory staff helped establish culturing and antimicrobial susceptibility testing capacity for the two WHO priority pathogens. Initial results after only four months of surveillance identified strains of S. pneumoniae with high levels of resistance to several classes of antibiotics. These highly resistant strains were all characterized as a single serotype, which is vaccine preventable. Indonesia has not yet introduced pneumococcal conjugate vaccine and the evidence generated through this new surveillance will be used to inform vaccine policies and National AMR guidelines. CDC and country partners will continue to strengthen this effort by expanding the surveillance system to other hospitals, conducting additional laboratory trainings, and helping the country make evidence-based decisions to combat antibiotic resistance.

MALI
Managing Measles

Measles is a highly contagious disease that is still a real threat everywhere around the world. A 2018 measles outbreak in Mali threatened the lives of thousands of people throughout the nation, including healthcare providers who were overburdened and working under difficult conditions. Twenty-seven graduates of the CDC-supported Field Epidemiology Training Program (FETP), in coordination with Mali's Ministry of Health, led the outbreak investigation and conducted contact tracing to stop the spread of the infection. This response, which was initiated within 24 hours of notification of the first case, limited the outbreak to 492 suspected cases and 154 laboratory-confirmed cases. Confirmed measles cases received immediate care, leading to quick recovery times and minimization of exposure to others. From working with the FETP graduates, health officials learned about risk factors for the disease, which informed response interventions, including immunization and sensitization campaigns to increase community awareness. In 2018, 23 new FETP graduates entered the workforce in Mali. More than 115 disease detectives have graduated from the program since the start of the Mali FETP in 2016.

SIERRA LEONE
Responding Rapidly to Limit Threats

On June 4, 2018, a measles outbreak was reported in two remote communities of Sierra Leone's Koinadugu district near the Guinean border, striking fear that the outbreak could become a cross-border epidemic. Within 24 hours of beginning the outbreak investigation, four CDC-supported Sierra Leone FETP trainees conducted an active case search and identified new cases, instituted prevention and control measures, reviewed and harmonized the outbreak data, and prepared the outbreak report with the national response team. The district mounted a response within hours, which dramatically reduced the response time from an average of seven days. The outbreak was limited to 31 confirmed cases, the majority of whom were children under five years old. The rapid response and containment of this measles outbreak by Sierra Leone FETP confirms the need for a trained and skilled workforce that can immediately be deployed to stop outbreaks in their tracks and save lives. Since the start of the program in 2016, more than 100 disease detectives have graduated from the Sierra Leone FETP. In 2018 alone, Sierra Leone added 42 FETP graduates to its ranks.

UGANDA
Saving Lives

In 2016, CDC launched the first regional acute fever surveillance network in Uganda. Six hospitals, already part of the President's Malaria Initiative, were selected as sentinel sites across the country. Each hospital now has the capacity to perform, for the first time, blood culture and AMR testing for bloodborne enteric bacteria. From June 2016 to December 2018, more than 40,000 pediatric admissions were assessed, nearly 10,000 blood cultures were completed, and at least 18 pathogenic bacteria species were identified. The introduction of routine antimicrobial drug testing in Uganda has uncovered many resistant strains, which led to appropriately targeted treatment and enabled the Ministry of Health to supply hospitals with alternative antibiotics. Additionally, cases of leptospirosis, arboviruses, and a high prevalence of spotted fever rickettsioses were identified.

CDC Programs Driving Progress

The National Public Health Institute (NPHI) Program Helps Countries Prepare for and Manage Infectious Diseases

Integral to CDC's mission is the establishment of National Public Health Institutes (NPHIs), which serve as the nexus of a country's public health functions, a focal point for public health information, and the natural government-to-government partner in times of crisis. CDC is working with ministries of health and other partners to help more than 25 countries develop and strengthen their NPHIs. Functions critical to the success of GHSA, including lab systems, surveillance, workforce development, and emergency management often sit within or are closely linked to NPHIs, and NPHIs may lead and serve as homes for planning, coordination, implementation, and monitoring of capacity building activities, as well as multisectoral coordination of activities outside of their direct responsibility.

With support from CDC's NPHI program, Africa CDC established the Extension for Community Healthcare Outcomes (ECHO) platform in its Regional Collaborating Centers (RCCs) to improve data and information-sharing in real time. ECHO is a virtual community of practice that develops knowledge networks for learning and teaching with a strong emphasis on peer-to-peer sharing and learning. During the 2018 cholera outbreaks in Zambia, Zimbabwe, and Malawi, the Zambia NPHI, which currently hosts the Southern Africa RCC, facilitated regional surge capacity alongside CDC cholera experts and local health workers in each community. They have also mobilized experts in the region to support the Ebola response in DRC and used the platform to share information about the 2017-2018 listeriosis outbreak in South Africa.

NPHI strengthening efforts in Cambodia, specifically those related to a public health workforce strategy, are contributing to strengthening and cultivating greater recognition for the public health workforce in a clinically-oriented system. CDC has supported Cambodia's National Institute for Public Health in operationalizing and leading a working group for promoting the recognition and use of public health professions in the country, composed of MOH staff, human resource experts, and other governmental and non-governmental health partners.

With CDC assistance, Mozambique's National Institute of Health (INS) opened a new biosafety level 3 laboratory facility in June 2018. To help the country safely and quickly identify dangerous emerging diseases, CDC supported staff trainings and connections between INS and mentors from other public health laboratories. INS also trained public health workers around the country in outbreak investigation, sample collection, and interpretation of results. These improvements build upon health security gains in laboratory systems and enable Mozambique to rapidly stop disease at its source.

NPHIs are a way to sustain investments in GHS, helping countries build and strengthen public health competencies and achieve compliance with the International Health Regulations. Having an NPHI, like the United States has with CDC, enables a country to more effectively prevent, detect, and respond to public health threats that can cost lives, cause political and economic instability, and spread to neighboring countries.

GEARS Protects Americans and the World from the Spread of Infectious Disease Outbreaks

A disease outbreak anywhere in the world can travel around the globe to major cities in 36 hours or less[3]. Within CDC's Global Emergency Alert and Response Service (GEARS), the Global Disease Detection Operations Center detects and monitors events around the world that could be a serious risk to public health. Each day approximately 30-40 public health threats are monitored. GEARS also maintains the Global Rapid Response Team, a deployment-trained workforce drawn from across CDC that is ready to deploy anywhere in the world in response to global public health emergencies. The Global Rapid Response Team has supported response efforts in more than 80 countries and territories since 2015, including 39 countries in 2018 alone.

[3]Jonas, Olga B. 2013. Pandemic Risk. World Bank, Washington, DC. © World Bank. License: CC BY 3.0 IGO. https://openknowledge.worldbank.org/handle/10986/16343

Using a One Health Approach to Protect Health for All

One Health is a concept that recognizes that the health of people is connected to the health of animals and the environment. CDC experts collaborated with partners to conduct One Health Zoonotic Disease Prioritization Workshops in Ghana, Mozambique, Pakistan and Uzbekistan, and hosted a regional workshop for the Economic Community of West African States. In Uzbekistan, a new toolkit was used to help the country develop a One Health strategy to address the diseases identified as high priorities. Pakistan has established a "One Health Hub" that links the National Institute of Health with the Animal Sciences Division of Pakistan Agricultural Research Council. Commonly prioritized diseases worldwide include rabies, brucellosis, anthrax, and viral hemorrhagic fevers like Ebola and Marburg. By prioritizing the zoonotic diseases of greatest concern, countries can more efficiently build their laboratory capacity, conduct disease surveillance, plan outbreak response and preparedness activities, and create disease prevention strategies to reduce illness and death in people and animals.

Influenza Laboratory Mentorship Program Prepares the World for Pandemic Influenza Response

CDC and the Association of Public Health Laboratories partnered in the design and implementation of a two-year laboratory mentorship program for ten countries in West Africa. The program aims to strengthen laboratory quality improvement processes through engagement with U.S.-based laboratory mentors, regular reporting, and procurement of diagnostic equipment and reagents. Three new countries in the region successfully shipped influenza-positive specimens to the WHO Collaborating Center for Influenza at CDC in 2018. CDC is one of 6 WHO Collaborating Centers for Influenza in the world, which is designated by the Director-General to carry out activities in support of WHO's influenza program. Increased virus detection capability in the region contributes to the global capacity to detect and respond to novel viruses in addition to ensuring that the biannual influenza vaccine strain selection is globally representative.

National, Binational, and Regional Cross-Border and Border Health Systems Building

Lessons learned from the 2014-2016 Ebola epidemic emphasized that cross-border information sharing and collaborations are necessary to reduce the chances of public health threats spreading between countries. In 2018, CDC worked with the West Africa Health Organization (WAHO), to design and co-facilitate a national-level, three-day meeting with the Mano River Union (MRU) countries of Cote d'Ivoire, Guinea, Liberia, and Sierra Leone to strengthen bi-national outbreak response and advance CDC support of WAHO's goal to develop formal, operational agreements on cross-border collaborations among all 15 WAHO countries. Meeting participants drafted a memorandum of understanding (MOU) for cross-border public health information sharing, paving the way for stronger public health relationships and coordination.

Early Warning Systems for Health Threats in Ghana, Vietnam, India and Cameroon

Emerging public health threats can be stopped in their tracks when communities are equipped with the knowledge to detect and report them. In India, Vietnam, Ghana, and Cameroon, CDC has supported the respective governments to train about 6000 communities to detect health threats rapidly. This program has resulted in the development of guidance documents, training materials, and data collection tools and trained over 3000 public health staff and 17,000 community health volunteers. As of December 2018, communities have captured over 8000 signals, leading to the detection of more than 3000 public health events that would not have otherwise been discovered. Reported events included suspected measles cases, avian influenza, Dengue fever, clusters of acute hemorrhagic conjunctivitis, suspected meningitis cases, and suspected rabies. The implementation of early warning surveillance has demonstrated that the more prepared communities are, the more protected everyone is from public health threats.

Emerging public health threats can be stopped in their tracks when communities are equipped with knowledge to detect and report them. In India, Vietnam, Ghana, & Cameroon, CDC has supported respective governments to train 6000 communities to detect health threats rapidly.

CDC's Innovations

Improving Specimen Transport through Repurposing Advanced Cold Chain Technology

Poor specimen transport networks can take days to move biological samples from the collection site to the testing laboratory and lead to sample deterioration, which may affect the sample testing results. Through an innovative collaboration, CDC partnered with the Association of Public Health Laboratories and the technology company, Global Good, to modify existing vaccine storage technology to support laboratory sample transport in resource poor environments. These modifications are designed to provide cold chain stability for up to 30 days and triple packaging of the samples within a lockable chamber, therefore maintaining the integrity of laboratory samples during transit and improving the laboratory's ability to protect the world from dangerous pathogen outbreaks.

Building Sustainable Whole Genome Sequencing Capacity for Surveillance, Advanced Diagnostics and Pathogen Discovery

Whole Genome Sequencing (WGS) may be the most important advance in infectious disease laboratory technology of our time. This tool is set to integrate pathogen diagnostics (viral, bacterial, parasitology and mycology), pathogen characterization (AMR, virulence, and subtyping) and pathogen identification (outbreak etiology and molecular epidemiology) in the public health laboratory. CDC is working with partners in multiple countries to develop this expertise among host-country laboratorians. Through hands-on work, laboratorians are empowered to become self-sufficient without external expertise, to make this vision a reality.

For example, in only five years, CDC and the Government of Indonesia built WGS capacity at the Eijkman Institute for Molecular Biology in Jakarta. The state-of-the-art Emerging Virus Research Unit (EVRU) laboratory is one of the leading facilities in Southeast Asia and, for the first time, provides the fourth most populous country in the world with the capacity to detect emerging vector-borne pathogens using WGS. EVRU scientists have been able to sequence the first Zika virus isolated in the country, characterize the whole genome of a neuroinvasive dengue virus, and identify Rickettsia felis in fatal neurological disease cases. The success of the team led to the institute being named as the National Genomic Research Center in 2018 by the Government of Indonesia. In addition to the WGS advances and success, the EVRU, with CDC support, has trained more than 1,500 clinicians in the diagnosis of vector-borne diseases and more than 400 laboratorians in advanced biosafety techniques.

Rolling Out an Improved Surveillance App

In May 2018, the Western Area rural district of Sierra Leone, with CDC technical assistance, launched a program that enables workers to report critical health information to the country's surveillance network via a smartphone app. Health workers use the app to submit weekly reports to the country's electronic Integrated Disease Surveillance and Response system, which is designed to capture data on any device, including desktops, laptops, tablets, and smartphones. Most systems also have the capability to be used offline, which is especially helpful in rural areas with poor connectivity. Fast and accurate information from local health facilities can help us get ahead of diseases and stop outbreaks.

Crowdsourcing to Report and Respond to Zoonotic Diseases

CDC's Farmer & Rabies smartphone app allows people who work with poultry and swine to report human and animal sicknesses or deaths with the click of a few buttons. Recognizing that those who are regularly in close contact with animals are often the first affected when a zoonotic disease strikes, the Thai Ministry of Public Health's (MOPH) Bureau of Epidemiology partnered with CDC in 2017 to develop a new app and website for use by farmers, local health volunteers, and health officers. The reporting tool quickly informs the MOPH of increases in animal illness and deaths, illness in people possibly linked to animals, or other abnormal events. A provincial One Health team monitors the reports and initiates rapid response to control outbreaks. In its pilot year, the app led to successful investigations of potential Strepotococcus suis infection and Japanese encephalitis. In 2018, the app was expanded to include reporting of dog and cat bites to help detect rabies outbreaks. By putting surveillance in the hands of the community, the app helps contain zoonotic diseases before they spiral into epidemics.

Photo Credit: right, Alaine Knipe, left, David Snyder, CDC Foundation

Testing Technology in the Field

In all regions of the world, measles cases are on the rise. Many countries have declared outbreaks. Especially risky for young children, measles can have serious health consequences. Yet the disease is preventable through vaccination. Since measles spreads rapidly, having technology that can provide immediate results in the field is a radical innovation for health security. To help stop measles in its tracks, CDC is testing an innovative new technology, the Measles-Rubella Box (MR Box). The field study which takes place in the Democratic Republic of the Congo (DRC) was planned and executed by CDC laboratorians. The technology, developed by scientists from the University of Toronto, has the potential to confirm active measles and rubella infections in the field to help quickly stop outbreaks before they spread beyond borders.

In the DRC, measles and rubella tests have to be sent to the national laboratory for confirmation. DRC is a large country, and transporting blood samples can be difficult. It takes a minimum of a week to get results from a sample. The MR Box has the potential to solve this issue.

The MR Box is portable, easy to use, and—at less than a 25 cents per test—affordable. It is also compact, weighing less than 11 pounds. The technology inside each box, called digital microfluidics- enzyme-linked immunosorbent assay (DMF-ELISA), or "ELISA on a chip," has some distinct advantages over other technologies used to detect measles and rubella. It can test samples from up to four people at the same time and yields results in less than an hour—much more efficient than transporting blood samples to the national lab and waiting for laboratory results. Because measles is highly infectious, delaying public health response by several days can lead to significant expansion of outbreaks.

Disease detectives from DRC's CDC-supported FETP were integral to the testing process, which involved long days going from house-to-house in Kinshasa. FETP residents and graduates tirelessly knocked on doors, getting up early and working late, to collect blood samples and fill out electronic data forms. Though additional work is required, FETP's work in DRC is a first step. Without urgent efforts to address measles, outbreaks like the ones occurring around the world will continue, and innovations like the MR Box are an important step toward containing these threats.

Participatory Epidemiology to Understand Human Migration Patterns

The Population Connectivity Across Borders (PopCAB) method, is a CDC-developed tool kit designed to engage multi-sectoral stakeholders at national, intermediate, and community levels in focus group discussions with participatory mapping. A PopCAB implementation team has trained Ministries of Health (MOH) and partners on how to analyze and create a visual representation of the gathered information to tailor public health surveillance, preparedness, and response efforts as well as cross-border collaboration strategies that respond to population mobility dynamics. In 2018, CDC PopCAB experts trained the Ugandan MOH and their country partners to conduct population movement and connectivity mapping to identify potential high-risk areas where Ebola could spread from the Ebola outbreak in DRC. Uganda has since used the results from their mapping to strengthen cross-border public health collaboration and to inform social mobilization, infection, prevention, and control, and vaccination activities in high-priority districts along the Uganda-DRC border.

Partnering to Implement the Global Health Security Agenda

The increasing flow of global information, goods, and people means that the world is increasingly interconnected. While interconnectivity is an enabler of global economic growth, nations can also be hit hard by the cost of controlling diseases. Governments and the private-sector often have to deal with the burden of decreased travel and tourism, lost business continuity, surges in healthcare costs, and disrupted trade with international markets. Economists estimate that the 2002-2003 SARS outbreak cost the global economy $40 billion[4] and the 2014-2016 Ebola Virus Disease outbreak in West Africa cost an estimated $53 billion[5]. The shared risk of global pandemics means shared responsibility, not only across borders, but also across sectors. In this era, no single country, sector, or organization can achieve global health security alone.

Private companies and nongovernmental entities possess resources and expertise that can contribute to the strengthening of global health security. The health of their employees, customers and the communities in which they operate is imperative to their success. CDC works to bring public and private sector partners together to collaborate and strengthen disease surveillance systems, laboratory networks, public health workforce, and emergency response structures. CDC has sought continual engagement from important stakeholders that include nongovernmental organizations, faith-based groups, academic institutions, and international organizations such as the World Health Organization, the United Nations, and the World Organization for Animal Health. Two examples of multisector forums that have developed from these engagements, and that are taking action to address global health security, include the Private Sector Roundtable and the Global Health Security Agenda Consortium.

The Private Sector Roundtable (PSRT) is a partnership of diverse companies who have committed to expanding the role and contributions of the private sector toward the shared goal of global health security. The mission of the PSRT is to mobilize industry to help countries prevent, detect and respond to health-related crises, and strengthen systems for health security. At the end of 2018, the PSRT was selected as a member of the GHSA Steering Group, becoming a trusted partner in collaborations with governments and other GHSA stakeholders. Notably, the PSRT began a formal partnership with the Ministry of Health of Uganda, offering support for capacity building across areas including data literacy, diagnostics for AMR, biosafety and biosecurity, communications, and monitoring & evaluation. The partnership will serve as a model for future public-private collaborations for GHSA.

The Global Health Security Agenda Consortium (GHSAC) is a voluntary and open collective of nongovernmental entities who are dedicated to the implementation of GHSA and promoting the adherence to international health laws and agreements. GHSAC seeks to liaise between its nongovernmental members and the member-nations of GHSA, while working in coordination with the GHSA Steering Group and the Joint External Evaluation Advisory Group. Through advocacy of the Joint External Evaluation process, GHSAC helps to advance global health security.

[4]Institute of Medicine (US) Forum on Microbial Threats; Knobler S, Mahmoud A, Lemon S, et al., editors. Learning from SARS: Preparing for the Next Disease Outbreak: Workshop Summary. Washington (DC): National Academies Press (US); 2004. The Impact of the SARS Epidemic. Available from: https://www.ncbi.nlm.nih.gov/books/NBK92462/

[5]Caroline Huber, Lyn Finelli, Warren Stevens, The Economic and Social Burden of the 2014 Ebola Outbreak in West Africa, The Journal of Infectious Diseases, Volume 218, Issue suppl_5, 15 December 2018, Pages S698–S704, https://doi.org/10.1093/infdis/jiy213

Global Health Security

Stopping Outbreaks Globally to Protect Americans Locally

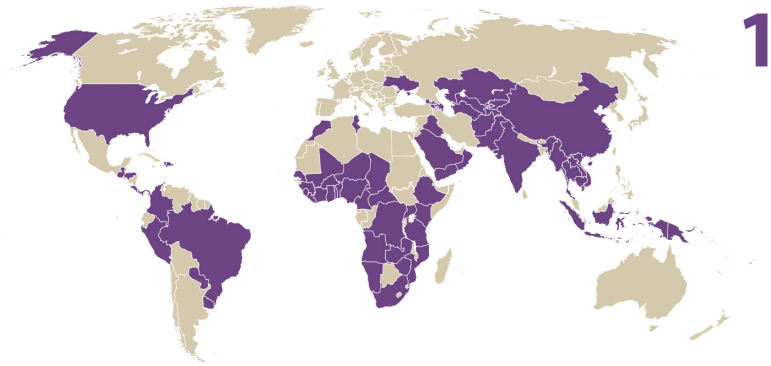
Tracking and Responding to Disease Threats 24/7

2,000+
Outbreaks
and other public health emergencies responded to since 2006

11
New Pathogens
and strains of dangerous dieseases discovered since 2006

30-40
Threats
to public health monitored daily

Training Disease Detectives to Identify and Stop Outbreaks



12,000+ People trained in field disease detection and response since 1980

4,000+ Outbreaks investigated by trainees since 2005

70+ Countries with trained, boots-on-the-ground outbreak responders

Deploying Prepared CDC Responders to Tackle Emergencies

500+ Rostered CDC experts ready to respond to crises since 2015

500+ Mobilizations for global health emergencies since 2015

17,000+ Person-days of deployments for rapid response since 2015

For more information:
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The Road Ahead for GHSA

Though significant progress has been made, the world must continue to come together as a global community to strengthen the capabilities to prevent and detect global health threats posed by infectious diseases–whether natural, deliberate, or accidental–and to respond quickly to minimize harm when they do occur. CDC remains committed to efforts to advance global health security, including through the next phase of GHSA, known as "GHSA 2024," and through the *U.S. Global Health Security Strategy*[6].

GHSA 2024 aims to facilitate multisectoral work toward sustainable and measurable advances in health security. GHSA 2024's target is for countries to take greater ownership of global health security efforts, and for more than 100 countries to improve health-security-related technical areas within five years. CDC is a major contributor to and leader of the U.S. Government's commitment to this next phase of GHSA.

The *U.S. Global Health Security Strategy* reaffirms the U.S. Government's commitment to accelerate countries' abilities to prevent, detect, and respond to disease outbreaks. It underscores the importance of global health security for national security and biodefense. CDC remains a critical U.S. Government agency in the efforts to ensure global health security and domestic preparedness. CDC works closely with other U.S. Government agencies to ensure a unified U.S. Government approach.

Everyone remains vulnerable until the world can rapidly identify and contain public health threats. CDC stands ready to support global health security and continues to work toward a world safe and secure from emerging and re-emerging health threats. Diseases won't stop, and neither can we.

[6]White House. (2019). United States Government Global Health Security Strategy. Retrieved from: https://www.whitehouse.gov/wp-content/uploads/2019/05/GHSS.pdf

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