



CDC GLOBAL HEALTH STRATEGY

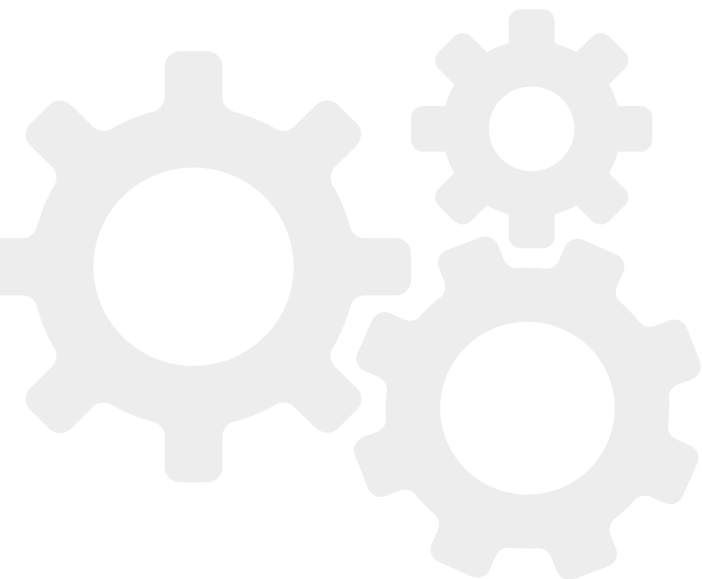
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U.S. Department of
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EXECUTIVE SUMMARY

CDC Global Health Strategy

The U.S. Centers for Disease Control and Prevention (CDC) aspires to create a world where people – in the United States and around the globe – live healthier, safer, and longer lives. As the lead U.S. Government (USG) agency dedicated to the health and safety of the American people, CDC works 24/7 worldwide to reduce morbidity and mortality and safeguard communities by addressing global health threats before they affect the United States. Achieving this vision requires that CDC draws upon its scientific and technical expertise, innovation, and research to address known and emerging public health threats globally, whether naturally occurring or man-made.

CDC understands the importance of the trust placed in the agency to keep Americans safe from public health threats both domestically and abroad. CDC also takes seriously its responsibility to be a good steward of resources and to ensure efficiencies by demonstrating its impact on leading public health priorities, fostering technical sustainability, and reducing the economic impact from diseases.

CDC Core Technical Strengths

CDC’s global health strategy is built around the agency’s core strengths: our scientific leadership and expertise, laboratory capacity and innovation, and data analytics to drive impact. CDC has unique expertise in using public health data to inform decisions, building public health laboratory capacity, developing a strong public health workforce, and establishing systems for emergency operations and response. In addition, CDC has deep technical expertise in disease-specific areas, operational research, implementation and evaluation of public health programs, and provision of technical assistance to Ministries of Health (MOHs), other public health institutions, Non-governmental organizations (NGOs) and private sector industries.

Vision

CDC aspires to create a world where people – in the United States and around the globe – live healthier, safer, and longer lives.

Mission

CDC’s global health mission is to improve the health, safety, and security of Americans while reducing morbidity and mortality worldwide.

Goals and Objectives

Goal 1 - Health Impact: Save lives, improve health outcomes, and foster healthy populations globally

Objective 1.1: Reduce the morbidity and mortality of high burden diseases and conditions

Objective 1.2: Eliminate and eradicate priority diseases and other public health threats

Goal 2 - Health Security: Protect Americans and populations across the globe by strengthening global public health prevention, detection, and response

Objective 2.1: Strengthen the capacity to prevent and detect disease outbreaks and other public health threats

Objective 2.2: Strengthen the capacity for timely and effective response to disease outbreaks and other public health threats

Goal 3 - Public Health Science Leadership: Lead and influence the advancement of global public health science and practice

Objective 3.1: Develop and apply global public health scientific, laboratory, and programmatic expertise

Objective 3.2: Translate and disseminate evidence-based research and data into global health guidance, policy, and programs

Objective 3.3: Drive innovation to accelerate new, more effective tools, products, strategies, and technologies

Pillars of CDC's Global Health Strategy



SCIENTIFIC EXPERTISE

CDC has a demonstrated record of trailblazing science, evidence-based decision-making and action, and an experienced workforce that are experts in their fields. Our workforce is available to address the most urgent global public health threats.



DIVERSE PARTNERSHIPS

CDC fosters health diplomacy through its longstanding bilateral and multilateral partnerships, engagement with the private sector, and ongoing collaborations with academic institutions and foundations. CDC maximizes the agency's unique role while leveraging these diverse partnerships to achieve measurable health impact around the world.



SUSTAINABILITY

CDC takes seriously its responsibility to be a good steward of resources by demonstrating impact on leading public health priorities, fostering technical sustainability, reducing the economic impact of disease outbreaks globally, and building lasting capacity for countries to address current and future health needs.



INNOVATION

CDC leverages the latest technologies and advanced analytics to accelerate public health impact. CDC develops new medical countermeasures, diagnostics, laboratory and data platforms, and explores new ways to innovate across its global health portfolio by identifying unique models of collaboration and partnerships.



HEALTH EQUITY

CDC helps to eliminate health disparities and achieve optimal health for all. CDC addresses health equity and reaches those in greatest need through its global programs, research, tools and resources, and leadership.

INTRODUCTION

Background and Context

Since the establishment of the U.S. Centers for Disease Control and Prevention (CDC) in 1946, the agency's global health work has grown in scale, scope, and complexity to address evolving public health challenges and emerging threats around the world. With an initial focus on malaria elimination in the United States, CDC's leadership and engagement expanded over time to address a range of diseases and conditions, improve global health preparedness and security, and enhance science-based knowledge and practice.

In today's interconnected world, a disease threat anywhere is a disease threat everywhere. From a global health perspective, domestic and international health are inseparable; no one country can safeguard the health of its citizens in isolation from the rest of the world. In order to protect our communities at home, traveling, living, and working abroad – including armed services personnel deployed overseas – CDC works with international partners to stop public health threats at their source. CDC drives change to make a lasting public health impact, mitigate health threats and help ensure stability to protect Americans and foster safe, secure, and healthy societies worldwide.

Future of Global Health

A health threat anywhere is a health threat everywhere in this increasingly globalized world; therefore, public health is at a crossroads and CDC is adapting and innovating to meet the new challenges. These new range of health challenges are tied to global production of food and medicine, an increase in global travel, more frequent and severe weather events, and a steady rise in the world's population. Outbreaks from Ebola to novel Influenza are increasingly identified in places not seen before. An aging population means people are living longer with chronic diseases, which are more costly and complicated to treat. The growing proportion of young people in sub-Saharan Africa, who will be at risk of exposure to HIV, threatens gains made in hard-won declines in new HIV infections.

Additionally, with innovations from the private sector and an increase in academic institutions and non-profit organizations implementing global health programs, CDC must not only collaborate with these organizations but also continuously bring new approaches and efficiencies to CDC's work around the world to deliver its public health mission in the most effective way.

The purpose of this strategy is to articulate CDC's unique global role in public health. As the lead public health agency for the United States and a renowned global organization, CDC continues to make measurable, sustained progress in the highest impact areas, based on burden of disease evaluations, the likelihood of producing positive effects, and an awareness of the economic implications of public health action, for a range of future and ongoing public health threats.

CDC Global Health Vision, Mission, and Principles

The CDC aspires to create a world where people – in the United States and around the globe – live healthier, safer, and longer lives. As the lead U.S. Government (USG) agency dedicated to the health and safety of the American people, CDC works 24/7 worldwide to reduce morbidity and mortality and safeguard communities by addressing global health threats before they affect the United States. Achieving this vision requires that CDC draws upon its scientific and technical expertise, innovation, and research to address known and emerging public health threats globally, whether naturally occurring or man-made.

CDC's global health mission is to improve the health, safety, and security of Americans while reducing morbidity and mortality worldwide. The agency does this through its expertise, unique technical skills, scientific knowledge and research, collaborative partnerships, and evidence-based, global public health action. CDC executes its global health vision and mission by focusing on three goal areas: 1) achieving measurable global health impact, 2) assuring global health security, and 3) providing world-renowned public health science leadership and expertise.

Furthermore, the following principles (referred to as “pillars” previously) guide CDC’s global public health work across the agency:

1. **Scientific Expertise** – CDC has a demonstrated record of trailblazing science, evidence-based decision-making and action, and an experienced workforce that are experts in their field. Our workforce is available to address the most urgent global public health issues.
2. **Diverse Partnerships** – CDC fosters health diplomacy through its longstanding inter-agency partnerships, bilateral and multilateral partnerships, engagement with the private sector and ongoing collaborations with academic institutions and foundations. CDC is able to maximize the agency’s unique role while leveraging these diverse partnerships to achieve measurable health impact around the world.
3. **Innovation** – CDC leverages the latest technologies and advanced analytics to accelerate public health impact. CDC develops new medical countermeasures, diagnostics, laboratory and data platforms and explores new ways to innovate across its global health portfolio by identifying unique models of collaboration and partnership.
4. **Sustainability** – CDC takes seriously its responsibility to be a good steward of resources by demonstrating impact on leading public health priorities, fostering technical sustainability, reducing the economic impact of disease outbreaks globally, and building lasting capacity for countries to address current and future health needs.
5. **Health Equity** – CDC works to eliminate health disparities and achieve optimal health for all. CDC addresses health equity and reaches those in greatest need through its global programs, research, tools and resources, and leadership.

CDC Global Health Goals, Objectives, and Strategies

CDC global health objectives align with a number of national strategies and plans including the Department of Health and Human Services (HHS) Strategic Plan, the CDC Strategic Framework, the U.S. National Security Strategy, the National Biodefense Strategy, and the U.S. Global Health Security Strategy. CDC’s work supports a number of global and presidential initiatives across several health priorities, including the Global Health Security Agenda, the Global Polio Eradication Initiative, the Measles and Rubella Initiative, the National Action Plan for Combatting Antibiotic Resistant Bacteria (CARB), the Neglected Tropical Disease Initiative, the President’s Emergency Plan for AIDS Relief (PEPFAR), and the President’s Malaria Initiative (PMI). CDC works with multilateral partners like the World Health Organization (WHO), World Organization for Animal Health (OIE), Food and Agriculture Organization (FAO), and USG agencies like the U.S. Agency for International Development (USAID), Department of State (DoS), and Department of Defense (DoD). These diverse, multi-sectoral partnerships best position the agency to affect change, maximize impact, and prevent disease among people in the United States and around the world.

Goal 1 - Health Impact: Save lives, improve health outcomes, and foster healthy populations globally

As the U.S. public health agency, CDC plays a prominent role in identifying and addressing leading causes of morbidity and mortality worldwide. Through cutting-edge science, real-time surveillance, laboratory diagnostics, and collaborative partnerships, CDC develops evidence-based programs and interventions to target effectively diseases, populations, and regions. CDC leverages the expertise of its workforce -- both at headquarters and in the field -- to improve health and well-being around the world, continuously building the evidence base, scaling up what works, and applying lessons learned to reducing and eliminating future health threats. CDC works diligently to enhance the capacity of other countries to prevent, detect, and respond to diseases and other public health threats at their source, helping to save lives, improve health, and eliminate disease in regions across the globe.

Objective 1.1: Reduce the morbidity and mortality of high burden diseases and conditions

- Collect data, analyze the information, and report on key findings to build the evidence base, target specific populations, and tailor preventive interventions
- Develop data-driven strategies and programs to prevent disease, promote optimal health, and improve health outcomes
- Implement, optimize, evaluate and scale interventions to maximize health impact and sustain improved health and well-being

1.1 Highlighted Focus Areas

A. Achieving an AIDS-Free generation

CDC supports the design and implementation of HIV-focused population surveys, sometimes referred to as “PHIAs” - Population-based HIV Impact Assessments, which provide the clearest picture to-date of the HIV epidemic in some of the world’s most affected countries. These national surveys – implemented under the leadership of Ministries of Health and by PEPFAR, CDC, and partners such as ICAP at Columbia University and the University of Maryland– directly measure progress toward global targets to control the HIV epidemic.

Recent data show that up to 13 high-HIV-burden countries are poised to achieve epidemic control by 2020. For example, Ethiopia has reached HIV/AIDS epidemic control and data from Uganda indicate that its previously expanding epidemic has stabilized. CDC also uses data from these assessments to inform planning and the decisions surrounding real-world, real-time public health solutions. CDC plays a critical role in their implementation, lending expertise in epidemiology, laboratory science, and data analysis to help partners design and implement the surveys, and rapidly harness the results for program improvement.

B. Innovating TB and Malaria prevention and treatment

The Malaria Frontline project in Nigeria, building on infrastructure established for polio eradication, is providing early lessons about how systematic collection and review of malaria case data can be used to inform local decisions about distribution of malaria commodities and timing of community-level prevention activities.

Tuberculosis (TB) is the leading infectious cause of death and the leading cause of death for people living with HIV (PLHIV). Worldwide, an estimated 40% of deaths in PLHIV are due to TB. TB preventive therapy (TPT) reduces 5-year mortality among PLHIV by 37%, independent of HIV treatment. Although the use of preventive therapy has been a World Health Organization (WHO) recommendation for PLHIV and children <5 years exposed to persons with TB since 1993, global uptake has been extremely slow. Of the 34.5 million adults living with HIV, only 4.8 million (14%) were ever reported to have been started on preventive therapy since 1993. To address this gap, CDC, through PEPFAR programs, has prioritized TPT with guidance to countries, as well as requiring reporting for TPT initiation and completion. CDC is working closely with its country offices providing technical assistance to improve and expand scale-up of TPT.

C. Optimizing impact of pneumococcal conjugate vaccines

To date, 142 countries have introduced pneumococcal conjugate vaccines (PCV) into their routine immunization programs; CDC has worked with over 35 of these countries to monitor PCV impact. For example, CDC worked with Haiti to strengthen their capacity for bacterial meningitis surveillance in anticipation of measuring PCV impact upon introduction in late 2018. Additionally, data from effectiveness studies conducted in South Africa with CDC and in-country partners resulted in a change in the PCV schedule. CDC is evaluating the impact of PCV by building epidemiological and laboratory capacity to help countries generate evidence regarding PCV introduction and sustained use. Through partnerships – with Ministries of Health, academic institutions, the World Health Organization, and other public health stakeholders, CDC has strengthened surveillance to monitor disease burden for pneumonia and meningitis and conduct studies to measure the effectiveness of PCV against disease and carriage.

Objective 1.2: Eliminate and eradicate priority diseases and other public health threats

- Provide pathogen-specific expertise, laboratory diagnostics, and decision analysis for targeted disease elimination, eradication, and control efforts
- Apply expertise and lessons learned from elimination and eradication efforts to inform future control strategies and prevent resurgence

1.2 Highlighted Focus Areas

A. Eradicating polio and combating vaccine-preventable diseases (VPD)

CDC houses the global reference laboratories for measles, rubella, congenital rubella syndrome, and polio, providing support to global laboratory networks through training, reference testing, and research. Advanced molecular analysis allows programs to track transmission of measles, rubella, and polioviruses, to guide programmatic efforts to interrupt circulation. Environmental surveillance for poliovirus provides early warning of virus circulation before paralysis cases arise and additional evidence of interruption where paralysis cases are absent. These laboratory tools contribute to programs that are driving polio to the brink of extinction and reducing the number of annual global measles-related deaths to under 100,000 for the first time in 2016.

B. Developing advanced tools and techniques for detecting new microbes, biomarkers, and cases

CDC researchers have developed a novel, integrated serosurveillance platform for public health use across vaccine preventable diseases, malaria, neglected tropical diseases, water-borne diseases, and maternal-child health programs, that can simultaneously measure up to 100 different disease-specific antibodies from a single, dried blood spot, an easy-to-collect sample type.

C. Eliminating epidemic meningitis in Africa

MenAfriVac, a novel vaccine against serogroup A meningococcal disease, was the first vaccine developed specifically for Africa and 21 countries have introduced the vaccine since 2018.

Developed by the Meningitis Vaccine Project, a partnership between PATH and the WHO with CDC support, MenAfriVac demonstrated dramatic success, largely eliminating epidemics of serogroup A. Likewise; the CDC-led MenAfriNet Consortium created an innovative partnership to enhance collaboration for strengthening regional surveillance and generating high-quality data to inform global immunization policy.

Goal 2 – Health Security: Protect Americans and populations across the globe by strengthening global public health prevention, detection, and response

Disease knows no border; as a result, Americans' health is connected integrally to the health of the rest of the world. National and economic security is a requisite for global health security, and CDC must protect Americans by working with countries to stop health threats at their origin. The agency works collaboratively with a variety of partners, with special emphasis on counterparts in Ministries of Health (MOHs) as well as regional health organizations, to improve global health preparedness by enhancing local capacity, systems, and infrastructure to prevent, detect, and respond to epidemics, outbreaks, humanitarian crises, and other public health threats whenever and wherever they occur. This increased capacity not only protects Americans from the global spread of disease, saving lives and livelihoods, but also helps drive and sustain improvement in local health outcomes.

A 2016 report from the National Academies of Science, Engineering and Medicine estimated that the cost of pandemics in the 21st century could cost U.S. \$6 trillion, with an estimated annual loss of U.S. \$60 billion from potential pandemics. However, the same report emphasized the role investments in preparedness and response can play in minimizing the impacts of pandemic threats.

Objective 2.1: Strengthen the capacity to prevent and detect disease outbreaks and other public health threats

- Apply laboratory diagnostic tools, emerging technologies, modeling, and data visualization to better predict outbreaks, identify them early, and improve monitoring and reporting
- Define and implement effective mitigation strategies to reduce the likelihood of outbreaks and limit the impact of public health threats
- Work with partners and countries to enhance networks, systems, and infrastructure to prepare for responses
- Provide technical expertise and external funding to build in-country capacity for real-time surveillance and detection

2.1 Highlighted Focus Areas

A. Improve country capacity to detect and respond to outbreaks and prevent future ones

In 2010, CDC began a collaboration with the Uganda Virus Research Institute (UVRI) and the Ugandan Ministry of Health to establish a national surveillance and laboratory network to detect, confirm, and respond rapidly to viral hemorrhagic fever (VHF) outbreaks. Over the last 8 years, the program expanded lab diagnostic testing for VHFs and other zoonotic diseases, improved clinical recognition of cases, and used data collected from surveillance to inform disease-control decision making. The program now has over 20 sentinel surveillance sites throughout the country, which report to UVRI and the Ministry of Health when suspect VHF cases are identified. Together with the enhanced capability of VHF diagnostic testing and the ability also to screen suspect cases for wide spectrum of VHF and other pathogens, the time between clinical identification of a suspect VHF case and lab confirmation has been shortened from an average of 2 weeks to 2.5 days. This reduced the chance for additional person-to-person transmission of VHFs and has in turn reduced the size and scope of outbreaks. Perhaps most importantly, the Uganda surveillance program serves as a continent-wide resource for laboratory confirmation and outbreak response support. It also provides expert technical assistance to support Ministry of Health capacity building and training.

B. Develop and apply non-traditional surveillance tools and methods for real-time detection of emerging public health threats

The recent Zika outbreak reminded the world how vulnerable mothers and babies are to emerging diseases. It also reminded the world that strong pregnancy and birth defects surveillance systems play a vital role in detecting threats. CDC's expertise in and efforts to strengthen birth defects surveillance and infant follow-up systems domestically and globally have been critical to answering key questions about the impact of Zika virus infection during pregnancy. During the 2016 Zika Emergency Response, CDC developed an innovative pregnancy and birth defects surveillance system to monitor rapidly the impact of Zika virus on these populations. This system helped drive public health action, quickly arming healthcare providers with information to identify health problems and provide care for pregnant women and their babies.

As future threats emerge, CDC is better prepared to assist global partners by providing tools, support, and technical expertise. Surveillance activities for emerging threats may also involve expanded referral to services, improved health outcomes, and enhanced data reporting across local programs and organizations.

C. Training a multidisciplinary, global workforce

Since its inception in 1980, CDC's Field Epidemiology Training Program (FETP) has trained over 11,000 disease detectives worldwide. With program engagement in over 70 countries, CDC supports the development of a skilled public health workforce around the world who can find and stop outbreaks at their source, before they spread globally. These multidisciplinary "boots on the ground" responders (clinicians, veterinarians, scientists, etc.) have actively participated in responses to thousands of outbreaks of cholera, measles, yellow fever, and other diseases, by identifying suspected outbreaks early and raising standards for quality investigations.

More recently, CDC's Public Health Emergency Management (PHEM) Fellowship provides critical training for professionals who work in public health preparedness and response across the globe. Conducted at CDC headquarters in Atlanta, the four-month program strengthens the ability of the international community to respond to public health threats efficiently and effectively.

Through specialized classes, mentorship, and technical assistance, PHEM Fellows learn the principles behind public health emergency management and the functions of an emergency operations center. Since the 2013 inaugural class, CDC has graduated 69 Emergency Management Specialists from 28 different countries.

PHEM Fellows return to their home countries to lead emergency responses, decreasing response times to deadly threats like avian influenza, dengue, measles, and meningitis, increasing the world's health security by containing these outbreaks at the source.

Objective 2.2: Strengthen the capacity for timely and effective response to disease outbreaks and other public health threats

- Use training, mentorship, and simulations to improve global response capabilities of partner organizations and countries
- Roster, train, and deploy highly skilled public health professionals across multiple disciplines to support effective and rapid responses
- Collaborate with international stakeholders to promote adoption of international standards and strengthen surge capacity during global responses

2.2 Highlighted Focus Areas

A. Improving in-country emergency response capacity

In August 2017, CDC spearheaded a 5-day Public Health Emergency Management (PHEM) workshop in partnership with the World Health Organization, the United States Defense Threat Reduction Agency, and Public Health England. The workshop brought together 55 emergency management staff members from across Africa to learn from experts in the field about how to enhance the coordination and response capabilities of their country's PHEM programs.

B. Maintaining a rapid response capacity at CDC to respond to international public health emergencies

The Global Emergency Alert and Response System (GEARS) serves as CDC's one-stop shop for response needs, combining global detection, alert, and response support activities. GEARS is integral to CDC's rapid response activities and works across the agency to coordinate emergency activities. Through its standard operating procedures, GEARS helps to reduce uncertainty in emergency response support. GEARS brings together the long-standing Global Disease Detection Operations Center (GDDOPs), CDC's electronic surveillance and analysis system for global threats, and the Global Rapid Response Team (GRRT), CDC's deployment-ready and rostered experts. As a proven, critical agency asset, GEARS event detection efforts detected over 340 public health events in more than 100 countries in 2017. GEARS has rostered over 400 CDC deployers that have provided over 17,000 person-days of response support since 2015. A cross-agency effort, GEARS ensures experts are properly credentialed and trained to avoid delays in deployment – a lesson learned from the West Africa Ebola epidemic.

C. Expanding and establishing global influenza surveillance, detection and response

CDC works with international partners to prevent, control, and respond to both seasonal and novel influenza threats. Since 2004, CDC supports more than 50 countries, all World Health Organization (WHO) regional offices, and WHO Headquarters via direct bilateral support to build a network to better detect and respond to influenza globally. CDC has increased virologic and epidemiologic influenza surveillance capacity to report and characterize influenza viruses, and has contributed to a large increase in the number of countries participating in WHO's Global Influenza Surveillance and Response System (GISRS) from 57 in 2004 to 146 in 2017. CDC's international influenza work also includes assessing the economic burden of disease, quantifying vaccine effectiveness, and supporting introduction of vaccines among populations at high risk of influenza illness complications.

Goal 3 - Public Health Science Leadership: Lead and influence the advancement of global public health science and practice

CDC's greatest asset is its public health experts, including its epidemiologists, scientists, laboratory specialists, health economists, public health advisors, communicators, and behavioral scientists. The agency draws on its unparalleled scientific knowledge and technical capacity to address known, new, emerging, and unknown threats globally. Leveraging the collective strengths of its multidisciplinary staff and partners, CDC sets priorities and drives innovation for global public health science, laboratories, and programs. Serving as a model for and working collaboratively with partners and countries across the world, CDC accelerates the implementation, evaluation, and scaling of impactful, cost-effective programs, and provides the guidance needed to improve health worldwide.

Objective 3.1: Develop and apply global public health scientific, laboratory, and programmatic expertise

- Conduct and support science that increases the understanding of the epidemiology, pathogenesis, and ecology of emerging public health threats
- Develop and enhance the surveillance, laboratory, research, and programmatic capabilities of public health institutes and partner organizations to better prevent and respond to public health threats
- Invest in career development programs that further build the expertise of the CDC workforce and sustain relationships with CDC-trained experts and public health practitioners
- Apply CDC expertise globally through strategic collaboration with international stakeholders

3.1 Highlighted Focus Areas

A. Using CDC experts across the global to domestic continuum to save lives and protect Americans

Using advanced molecular detection (AMD) technologies, CDC disrupts how pathogens are detected and characterized. The agency is adapting AMD technologies, for example, to detect malaria resistance earlier and more reliably, replacing decades-old parasitic disease diagnostics with state-of-art methods, characterizing pathogens such as Mycobacterium tuberculosis, influenza virus, or hospital-acquired antimicrobial resistant organisms. AMD technologies are evolving rapidly, becoming less expensive and more automated. This rapid progress may allow Low- and Middle-Income Countries (LMICs) to “leapfrog” to advanced technologies.

B. Serving as a model for other countries to build up public health science, laboratories, and programs

After decades of support from CDC, in October 2010, the World Health Organization (WHO) designated the Chinese National Influenza Center (CNIC) as one of six WHO Collaborating Centers for Reference and Research on Influenza. CDC's support for China CDC's influenza surveillance capacity contributed to the detection of Asian H7N9 virus when it first emerged in China in 2013.

In 2013, virus sharing of H7N9 with the United States and other WHO collaborating centers led to the development of the first candidate vaccine virus for manufacturing pandemic vaccine to help protect the world in the event the spread of H7N9 virus led to a pandemic. The bilateral support also created capacity for China to mount a rapid and robust response to novel influenza viruses that continues to this day. China's comprehensive influenza surveillance network is now self-sustaining.

C. Strategically using technology for workforce development

High-quality standards, safe laboratory testing, and a well-equipped competent laboratory workforce are essential for producing reliable laboratory data. Innovative technologies provide the laboratory workforce with additional resources to improve their efficiency.

Examples of these technologies include :

- Broadcasting platforms used to deliver webinars on preparedness topics
- Robust programming software used to develop computer-based eLearning courses that are available 24/7 targeted to clinical and public health laboratory staff
- Creation of 3-dimensional laboratory environments to support learner interaction during eLearning
- Acquisition of virtual reality equipment and software to support the development of virtual laboratory environments to assess practical laboratory skill competency.

Objective 3.2: Translate and disseminate evidence-based research and data into global health guidance, policy, and programs

- Inform global public health priority setting by engaging with key international players across sectors and within high, middle, and low income countries
- Improve accessibility, usability, and translation of CDC and partner data to improve real-time surveillance, analysis, and evaluation
- Conduct and support implementation research that informs culturally appropriate intervention design, implementation, and evaluation
- Disseminate findings in peer reviewed literature, international guidance documents, and through other visible communication channels

3.2 Highlighted Focus Areas

A. Data analysis to best inform programming in limited resource settings

CDC's One Health experts have worked with 20 countries to implement a One Health Zoonotic Disease Prioritization process that builds collaboration across disciplines and sectors to focus limited resources on preventing, detecting, and responding to those zoonotic diseases of greatest national concern. Countries with limited resources can focus on the top priority zoonotic diseases (for example, rabies and Ebola) of greatest national concern. Participants include a wide-ranging group of people who protect health--of people, animals, or the environment--and they identify the country's top 5 diseases to target. Prioritizing diseases means countries can more efficiently build lab capacity, conduct disease surveillance, plan outbreak response and preparedness activities, and create disease prevention strategies to reduce illness and death in people and animals. During the prioritization, participants discuss action plans, roles, and responsibilities for how each sector will collaboratively engage in developing control and prevention strategies using a One Health approach for the newly prioritized zoonotic diseases. After the prioritization, scientists continue to collaborate with countries on their priorities and strategies to help mitigate their greatest zoonotic disease threats, implement and strengthen One Health approaches, and further the goal of a world safe and secure from infectious disease threats.

B. Rapid translation of data to improve public health outcomes

In December 2015, a yellow fever epidemic began in Angola and subsequently spread to the Democratic Republic of Congo (DRC). Soon after cases began to increase dramatically in Brazil. More than 30 million doses of vaccine were distributed quickly, depleting the global vaccine stockpile. CDC experts led an emergency consortium of the World Health Organization, pharmaceutical companies, and ministries of health to devise a bold proposal, based on limited but solid evidence, to vaccinate using 20% fractional doses.

During a 10-day period, the DRC, under WHO guidance, vaccinated a record 7.6 million people at risk while CDC experts monitored for efficacy and side effects. The campaign was a success, the epidemic stopped, and lives were saved. The CDC study showing safety and efficacy of the fractional doses established a critical option for future yellow fever epidemic responses.

C. Supporting partners in using and translating Joint External Evaluations as standard of practice

Since 2016, CDC has been involved in the standardized Joint External Evaluation (JEE) assessments to evaluate a country's capacity to prevent, detect, and rapidly respond to public health risks. As of May 2018, over 75 countries have completed JEEs, and CDC experts have participated in more than 60% of the evaluations. Importantly, JEEs help countries develop costed action plans, which can open the door for partnership by matching needs with resources. As one of many examples, the Private Sector Roundtable (PSRT) and Uganda collaborated to identify areas of cooperation based on the JEE. Workforce development was one of the areas identified, and because of this cooperation, Johnson and Johnson agreed to provide \$250,000 to Uganda to strengthen their workforce. By measuring progress on specific targets, JEE results help us understand where and how countries are making improvements towards meeting the International Health Regulations.

Objective 3.3: Drive innovation to accelerate new, more effective tools, products, strategies, and technologies

- Systematically identify and invest in innovative tools, research, and programs internally, domestically, and globally
- Fund, evaluate, and support the innovative work of partners
- Rapidly disseminate emerging and innovative findings to be tested and scaled elsewhere
- Integrate and share data to accelerate discovery, generate insights, and improve programs

3.3 Highlighted Focus Areas

A. Developing technologies to detect disease faster

CDC developed two new tests to detect Zika virus in human tissue. CDC scientists used these tests to confirm the tissues were positive for Zika virus. This evidence led CDC to conclude that Zika virus causes microcephaly and embarked on a critical research to protect pregnant women in the U.S. and around the world.

B. Applying laboratory leadership through networks

CDC's Polio and Picornavirus Laboratory serves as a WHO Global Specialized Laboratory and provides technical and programmatic assistance to the Global Polio Laboratory Network. The Network consists of 146 WHO-accredited poliovirus laboratories in all World Health Organization (WHO) regions. The accuracy and quality of testing at Global Polio Laboratory Network member laboratories is monitored through an annual accreditation program that includes onsite reviews and proficiency testing.

CDC's laboratories provide critical diagnostic services and genomic sequencing of polioviruses to help guide disease control efforts in many countries. This includes implementation of improved laboratory procedures that have increased sensitivity to detect and confirm new polio infection. Other new laboratory procedures are helping countries overcome specific operational challenges, enable more rapid detection of wild poliovirus (WPV), and allow for faster response to importations or spread of virus. Additional efforts include technical assistance to laboratories implementing environmental surveillance for polio detection.

C. Bringing innovative findings to scale

CDC has worked with university researchers to develop and test microneedle patches to deliver vaccines like measles, rubella, polio, influenza, and rabies. The microneedle patch should improve the ability of CDC and partners to get the measles-rubella vaccine to remote areas because the patch is more stable at varying temperatures than the currently available vaccines and takes up less space than the standard vaccine. Because microneedles dissolve in the skin, there is no disposal of needles, reducing the risk of accidental needle sticks. The measles patch is expected to be manufactured at a cost comparable to the currently available needle and syringe vaccine. The patches also do not require highly skilled health workers to administer.

In 2017, CDC experts collaborated with partners to evaluate the feasibility and acceptability of using a novel Digital Microfluidics (DMF-ELISA) to detect antibodies to measles and rubella. This new rapid diagnostic system could be a useful tool to identify people at risk of contracting measles and rubella living in remote settings without access to laboratories. Findings could help better target areas for vaccination campaigns and limit the spread of vaccine preventable diseases. CDC works closely with partners to strengthen immunization systems in order to advance global health security, protecting vulnerable populations from life-threatening vaccine preventable diseases.

CDC is working to implement point-of-care testing for measles infections in collaboration with the WHO Global Measles and Rubella Laboratory Network.

ACHIEVING MORE THROUGH PARTNERSHIP

CDC has a long-standing commitment to working closely with domestic and international partners to set common objectives, implement comprehensive public health prevention and response programs, and ensure that the resources entrusted to CDC achieve the maximum impact by leveraging the unique roles and mission of other organizations. In order to achieve its global health priorities, CDC deploys innovative and proven models for multi-sectoral engagement. This includes working closely with international organizations like the World Health Organization, the United Nations and the World Bank; engaging counterparts in the Ministries of Health around the world to achieve a range of health objectives; and collaborating with foundations, the private sector and academic institutions to define, implement and evaluate a variety of health programs. CDC is strengthened by the diversity of its partners and will continue to bring new partners together to innovate and accelerate the work that the agency does around the world to protect the health of all people.

CDC'S GLOBAL HEALTH PARTNERS

Through its work with partners, CDC maintains a strong, effective global health presence to protect Americans from major health threats wherever they arise. Global partners expand the reach of the work CDC experts do to strengthen critical public health services around the world—which helps protect the health of Americans both at home and abroad. Our partners in global health include a variety of valuable stakeholders and partners, such as:

<p>Foreign governments including ministries of health</p>	<p>Other U.S. government agencies</p>	<p>The World Health Organization and other international organizations</p>	<p>Academic institutions</p>
<p>Foundations</p>	<p>Nongovernmental organizations</p>	<p>Faith-based and community-based organizations</p>	<p>Businesses and other private organizations</p>



CONCLUSION

Our agency's mission to protect the health of persons in the United States is based on a strong domestic public health system that is prepared to respond to all threats, and a global footprint that supports our global health commitments. To succeed, we must work globally both to ensure the health and safety of our own citizens and to help countries develop the health systems and public health capacities they need to protect their populations. CDC's Global Health Strategy outlines the agency's approach to achieving its global health vision of a world where people – in the United States and around the globe – live healthier, safer, and longer lives. To achieve the goals and objectives outlined above most effectively, we must continue to implement the strategies, prioritize activities and partnerships, and leverage resources, investments and the work of other U.S. government agencies and global entities.

We must adapt the way we work so that we as an agency are nimble and agile enough to respond to disease threats no matter where they occur. To help ensure our global reach, CDC is establishing platforms with regional offices to advance global health security and maintain a sustainable global presence, allowing CDC to strengthen its ability to accomplish its mission of protecting Americans by responding more rapidly, efficiently, and effectively to health threats wherever they occur. We must strengthen and nurture our relationships with existing partners like USAID, Department of State, and World Health Organization, as we look to expand our partnerships with the U.S. Department of Defense, Commerce, and the private sector so we truly work in a multi-sectoral fashion.

The global health challenges we face – which threaten both our nation's health and well-being and the global community – are significant. The sheer numbers of people who struggle against deadly diseases like HIV and TB; the always-present threat of a pandemic influenza and emerging vector-borne viruses; the growing resistance to front-line antibiotics; these are not easy problems to solve. However, the time to address these challenges is now. As CDC Director Dr. Robert Redfield has said, "Embracing the possible, we will do it together." We look forward to working with our partners to meet these challenges and make a lasting impact in global health.



ANNEX – EVIDENCE OF CDC’S IMPACT IN GLOBAL HEALTH

CDC’s success as a world premiere scientific and data driven agency is dependent on our core capabilities. This includes the development and deployment of a world-class surveillance and data analytics system to tell us what has happened, what is happening, and what may happen. It requires CDC to maintain our state-of-the-art laboratories, which serve as the reference laboratories for the world. CDC must recruit and retain our elite public health workforce who stand ready to collaborate strategically with others to solve the public health challenges of today and tomorrow. Finally, the agency needs to maintain the ability to respond quickly to outbreaks when they occur. CDC’s global health programs leverage these capabilities for meaningful results.

EARLY DETECTION AND EFFECTIVE RESPONSES TO OUTBREAKS

Liberia Builds Health Security Capacity

During and following the 2014 Ebola response, CDC worked closely with Liberia to develop public health capacity. This investment paid off in May 2017, when Liberia reported 14 cases and 8 deaths from an unknown illness. Within 24 hours of learning of the outbreak, Liberia’s Ministry of Health mobilized CDC-trained disease detectives to investigate the report; this team was able to quickly investigate the cases, and work with the CDC-supported national laboratory to rule out Ebola. Through the close collaboration with CDC, the government of Liberia sent samples to CDC where its premiere laboratories identified the cause as meningococcal disease. The outbreak was controlled within a matter of weeks. Through the CDC-supported disease detectives and laboratory capacity, Liberia limited the outbreak to 31 cases and 13 deaths due to the improved ability to prevent, detect, and respond to disease threats.

Providing Customized Solutions for Outbreak and Other Urgent Investigations

CDC’s Epi Info is a public domain suite of interoperable software tools designed for the global community of public health practitioners and researchers. It provides for easy data entry form and database construction, a customized data entry experience, and data analyses with epidemiologic statistics, maps, and graphs for public health professionals who may lack an information technology background. Epi Info is used for outbreak investigations; for developing small to mid-sized disease surveillance systems; as analysis, visualization, and reporting (AVR) components of larger systems; and in the continuing education in the science of epidemiology and public health analytic methods at schools of public health around the world. In support of recent regional outbreaks:

CDC developed a customized version of the Epi Info desktop application with a focus on viral hemorrhagic fevers. Although not fully operational prior to the 2014-2016 Ebola outbreak in West Africa, the customized application was still used in all three affected countries to track cases and contacts. CDC is currently using the application in laboratories for the 2018 Ebola outbreak in the Democratic Republic of the Congo.

In response to the potential safety signal of the antiretroviral drug dolutegravir and a possible link to neural tube defects, CDC collaborated with the Kenya Ministry of Health rapidly leveraging existing birth defects surveillance capacity. This work includes the development of a tablet version of Epi-Info that tracks structural birth defects in real time. Electronic reporting has the potential to identify cases more quickly and reduce delays in accurate diagnosis and reporting over the standard paper-based system. These improvements will help inform the urgent discussion of the safety of certain antiretroviral drugs for women living with HIV and their children.

Vietnam Adopts Event-Based Surveillance as National Surveillance Standard

In Vietnam, CDC supported an event-based surveillance (EBS) pilot project in six provinces from 2016-2017. The EBS pilot program is the first of its kind in the country, actively engaging local community members, leaders, and health care staff in the detection and reporting of outbreaks or unusual health events. As of December 2017, the CDC project had trained approximately 9,000 health workers in outbreak detection and reporting, resulting in more than 5,900 early warning signals of potential outbreaks reported. Each report was screened and verified, resulting in confirmation of more than 420 infectious disease outbreaks, including foodborne outbreaks; hand, foot, and mouth disease; mumps; diphtheria; and chickenpox. More than 400 of the confirmed outbreaks were responded to in less than 48 hours. Due to the pilot's success, the Ministry of Health has adopted the EBS framework as their standard detection strategy.

Indonesia Builds Laboratory Capacity to Detect Priority Pathogens

Indonesia, a GHS priority country, considered by many, to be a hotspot for emerging pathogens did not have the capacity to diagnose or characterize vector-borne viruses. Beginning in 2012, CDC in partnership with the Ministries of Science and Technology and of Health, established a state of art molecular diagnostic laboratory for the identification and sequencing of emerging viruses. The lab, which is largely funded by GHSA, has confirmed the first transmission of West Nile and Zika viruses in Indonesia and demonstrated a high natural prevalence of Zika in children throughout the country. Equally important, the lab has trained more than 400 local staff in virus diagnostics and biosafety, and has conducted continuing medical education courses for more than 1,000 Indonesian health professionals. Based on this success, in 2018 the Government of Indonesia spent more than US \$1 million to expand the lab's capacity.

CDC Rapid Response Teams Surge to Address Yellow Fever Outbreaks

Global Health Security Agenda (GHSA) investments allowed **CDC's Global Rapid Response Team (GRRT)** to surge in response to a significant yellow fever outbreak in Angola and the Democratic Republic of Congo (DRC) in 2016. The GRRT is a trained and ready multidisciplinary workforce with 50+ CDC staff on call each month. In DRC, 2,000 samples were tested for yellow fever to help target a vaccination campaign to contain the 2016 outbreak.

HIV Laboratory Capacity Serves as Platform for Other Disease Detection

Laboratories play a crucial role at every step in responding to the HIV and TB epidemic: from accurate diagnosis and testing, to effective treatment, care and monitoring of the disease, to preventing new HIV infections. Strong laboratory systems are critical to both controlling today's epidemics and getting ahead of the curve for an effective response tomorrow. With partners' support, CDC experts are implementing efforts on a number of fronts to help bring laboratories around the world to international standards and enhance lab capacity. These include:

- Establishing public-private partnerships to improve lab quality and strengthen the skills of lab personnel in communities severely affected by HIV and TB.
- Helping partner governments launch accreditation programs for labs including the creation of the first lab accreditation program in 2009.
- Helping labs along the path to accreditation, by implementing the CDC-developed Strengthening Laboratory Management Toward Accreditation (SLMTA) program, which has supported more than 1100 labs in 52 countries worldwide.
- Working with countries to develop national strategic plans for laboratories to better support their response to HIV, TB and other diseases.

These efforts to improve lab capacity and enhance lab quality to fight HIV and TB are laying the groundwork for countries to respond to other diseases and emerging global health threats.

STRATEGIC PARTNERSHIPS

Global Polio Eradication Initiative (GPEI)

Since the Global Polio Eradication Initiative (GPEI) was started in 1988, (with CDC as one of the five spearheading partners along with WHO, UNICEF, Rotary International, and the Bill & Melinda Gates Foundation), the number of countries with endemic poliovirus transmission has decreased from 125 to 3, and reported polio cases have decreased from 350,000 in 1988 to 22 in 2017. Through the transition planning process, CDC and its partners are working systematically to merge best practices learned from years of fighting polio, measles, rubella, and other vaccine-preventable diseases with lessons learned from strengthening immunization systems and programs.

Saving Mothers, Giving Life (SMGL)

Reductions in maternal and perinatal mortality are global development priorities yet still present major challenges in sub-Saharan Africa. CDC provided scientific leadership for the Saving Mothers, Giving Life (SMGL) public-private initiative implemented from 2012–2016 in selected districts of Uganda and Zambia with the goal of improving maternal and perinatal health in high mortality settings. Through community and facility evidence-based interventions and district-wide health systems strengthening, SMGL reduced delays to timely and appropriate obstetric care.

Over the course of the 5-year SMGL initiative, population-based estimates documented a 44% reduction in the SMGL district-wide maternal mortality ratio (MMR) in Uganda (from 452 to 255 per 100,000 live births) and a 41% reduction in Zambia (from 480 to 284 per 100,000 live births). The MMR in SMGL-supported health facilities declined by 44% in Uganda and by 38% in Zambia. The institutional delivery rate increased by 47% and 44% in Uganda and Zambia SMGL-supported districts. The number of facilities providing emergency obstetric and newborn care (EmONC) rose from 10 to 26 in Uganda, and from 7 to 13 in Zambia. SMGL's comprehensive district systems-strengthening approach successfully improved coverage and quality of care for mothers and newborns.

The lessons learned from SMGL can inform policymakers and program managers in other low- and middle-income settings where similar approaches could be utilized to rapidly reduce preventable maternal and newborn deaths.

CDC and WHO Collaborating Centers

CDC and WHO work collaboratively within the **WHO Network of 55 Collaborating Centers for Occupational Health** to develop practical guidance and tools and to provide technical assistance to upgrade international capacity to prevent work-related diseases, injuries, and fatalities. CDC and WHO collaborate to: 1) strengthen the performance of health systems in occupational health; 2) assess the effectiveness of a global database platform for monitoring worker health globally; and 3) evaluate and improve the ability to identify workplace hazards and apply controls globally and domestically. CDC contributes from its research base to reduce occupational diseases, injuries and deaths in the United States and globally, and benefits from achievements in other nations.

Viral hepatitis is a global health problem and CDC is a long-standing supporter of the viral hepatitis prevention activities of the World Health Organization. As a **WHO Collaborating Center for Reference and Research on Viral Hepatitis**, CDC serves as a national reference laboratory for viral hepatitis, an evaluator of new vaccination and test technologies, and a convener of conferences on topics ranging from viral hepatitis prevention priorities for persons who inject drugs to strategies for improving the quality of hepatitis laboratory testing. This support has helped WHO develop a Global Hepatitis Program; guidance for viral hepatitis immunization, surveillance, testing, and treatment; and the first Global Health Sector Strategy on Viral Hepatitis 2016-2021. Endorsed by the 2016 World Health Assembly, the strategy targets the elimination of hepatitis B and hepatitis C as public health threats by 2030.

CDC serves as a **WHO Collaborating Centre for Sexually Transmitted Infections Prevention (STI)** providing epidemiologic, economic, and laboratory expertise. As part of this work, CDC provides STI global burden estimates and economic costs, training, and proficiency testing related to antimicrobial resistant gonorrhea work and syphilis point of care test technology. CDC is collaborating with WHO on **global congenital syphilis elimination** providing technical assistance in validation and certification of this goal and working with countries on progress towards this milestone. On December 1, 2017, PAHO celebrated the validation of elimination of mother-to-child transmission of HIV and syphilis in six Caribbean countries and territories. Since 2015, 11 countries have validated elimination of congenital syphilis of which nine are in the Americas Region. In addition, CDC is working with WHO and the World Bank on triple elimination of mother-to-child transmission of HIV, syphilis, and hepatitis B in Africa.

CDC One Health Program and Zoonotic Diseases

CDC's One Health experts have worked with 20 countries to implement a **One Health Zoonotic Disease Prioritization** process that builds collaboration across disciplines and sectors to focus limited resources on preventing, detecting, and responding to those zoonotic diseases of greatest national concern. Countries with limited resources can focus on the top priority zoonotic diseases of greatest national concern (for example, rabies and Ebola). Participants include a wide-ranging group of people who protect health--of people, animals, or the environment--and they identify the country's top five diseases to target. Prioritizing diseases means countries can more efficiently build lab capacity, conduct disease surveillance, plan outbreak response and preparedness activities, and create disease prevention strategies to reduce illness and death in people and animals. After the prioritization, scientists continue to collaborate with countries on their priorities and strategies to help mitigate their greatest zoonotic disease threats, implement and strengthen One Health approaches, and further the goal of a world safe and secure from infectious disease threats.

In 2015, Ethiopian human and animal health professionals identified anthrax, brucellosis, and rabies as three of the top five zoonotic diseases of concern during a **One Health Zoonotic Disease Prioritization** Workshop. Canine rabies is also a concern, with 2,700 human deaths each year due to the disease. Along with selected regional labs, Ethiopian Public Health Institute (PHI) and the National Animal Health Diagnostic and Investigation Center (NAHDIC) underwent a 4-month assessment of laboratory bacteriological and serological sections and brucellosis diagnostic capacity. CDC provided both public health veterinary labs with necessary equipment, supplies, and training to enhance their ability to conduct serologic and molecular testing. CDC staff are working with the Ethiopian government to establish practical country-based brucellosis guidelines for laboratories and clinicians. CDC is working with regional partners to conduct laboratory assessments that focus on bio-safety and bio-security measures for anthrax at EPHI, NAHDIC, and regional labs. CDC procured the necessary equipment and supplies and is training laboratorians, establishing rabies testing capacity in three regions (Addis Ababa, Amhara, and Tigray). Experts have coordinated with the Ministry of Health and Ministry of Livestock and Fisheries to implement an integrated bite-case management program for rabies surveillance and response. CDC is also helping the National Vaccine Institute to conduct potency testing of canine rabies vaccine and increase animal vaccine potency to meet international standards.

Developing a Public Health Workforce at Points of Entry to Control the Spread of Disease

Ensuring that a country's air, sea, and land points of entry (POE) are protected from health threats is a vital health security consideration, both for the country itself, as well as for the protection of the international community. In many countries, Ministry of Health staff stationed at POE (i.e., Port Health) who help detect and respond to ill travelers are in short supply. To enhance a POE's ability to detect ill travelers, CDC trains non-traditional public health partners, such as immigration, customs, security, airline, and other staff who have direct contact with the traveling public to know what signs and symptoms of illness of public health concern to look for and to know how to notify medical authorities for further evaluation. This extension of the public health workforce at a POE can help to prevent ill travelers from boarding a conveyance or entering a country, thereby mitigating the risk of a disease being imported or exported beyond a country's borders.

Influenza Vaccine Program Development

CDC works with more than 120 partners both public and private to develop and advance influenza vaccine program development. Using the broad surveillance capacity built since 2004, foreign governments are able to provide evidence of influenza circulation, seasonality, and population burden to establish the need for strategic and evidence-based seasonal influenza vaccine programs and policies.

Global Water, Sanitation and Hygiene (WASH)

In Sierra Leone, a country where 60 percent of the population does not have access to potable water and where flooding and waterborne disease outbreaks, such as cholera, can occur during the rainy season, CDC provided vital training for waterborne disease outbreak detection and response. CDC trained multisector partners, including those from the Sierra Leone Ministry of Health and Sanitation (MoHS) and the Ministry of Water Resources (MoWR) as well as community health centers using the Global Enteric Disease Outbreak Response Capacity Building Toolkit developed by DFWED. The toolkit builds needed capacity in epidemiology, environmental health, and clinical and environmental microbiology. CDC will continue to deploy the toolkit, to strengthen workforce capacity in GHSA countries. The toolkit offers a sustainable platform for training by utilizing modules and an eLearning platform to prevent, detect, and respond to waterborne outbreaks such as cholera.

LEVERAGING SURVEILLANCE AND DATA

Birth Defects Surveillance Improves Health Outcomes Globally

The Birth Defects Countries and Organizations United for Neural Tube Defects Prevention (Birth Defects COUNT) is CDC's global initiative to reduce mortality and morbidity caused by folic acid-preventable neural tube defects. Neural tube defects are serious birth defects of the brain or spine and are a major cause of death and lifelong disability worldwide. Birth Defects COUNT focuses on increasing the availability of birth defects surveillance and blood folate data to drive and monitor the effectiveness of prevention policies. Through Birth Defects COUNT, CDC provides technical expertise and assistance, convenes partners, and disseminates best practices to enable countries to realize positive public health outcomes.

Acute-Febrile Illness

Typically, healthcare workers in Uganda would presumptively treat a child suffering from acute fever for malaria. Beginning in 2016 at six regional hospitals that are part of a GHSA-funded CDC partnership with the Ministry of Health and the President's Malaria Initiative, doctors can order blood and antibiotic susceptibility tests never before available to them on site. During the first 18 months of this pilot initiative, more than 30,000 pediatric admissions were tested. Only half had malaria but as many as 8% yielded pathogenic bacteria, some of which were found to be drug resistant, allowing the children to be successfully treated. Other children were found to be infected with mosquito-borne viruses and animal transmitted bacteria. This GHSA project leverages prior surveillance investments to better track causes of illness, generate antimicrobial susceptibility results, and improve clinical care and policy planning. The results build a foundation to enhance capacity to detect, report, and rapidly respond to public health concerns in Uganda.

Community-Level Data to Predict Risk

In an increasingly globalized world, diseases whose geographic spread used to be limited to well-defined areas can now spread to every part of the world within 24 hours—often before disease surveillance systems can detect them. There is thus increasing need to integrate population movement into traditional epidemiologic methods, especially when the travel crosses an international boundary. Human population movement is influenced by a number of factors, including travel purpose, duration, season, and familial and community connections. CDC subject matter experts have designed novel methods, such as community level mapping to illustrate population movement patterns into, through,

and out of their borders. Ministries of health can use this information to identify geographic areas with greater public health risk to target their surveillance and response interventions and thus limit a disease's potential to spread.

South-East Asia New Born Birth Defects system

In South-East Asia, strong collaborations with the World Health Organization South-East Asia Regional Office, has led to the development of a sophisticated surveillance database for tracking newborn health, birth defects, and stillbirths. In collaboration with ministries of health, CDC and WHO have trained and built capacity among health care providers in 145+ hospitals from seven countries that now contribute data to the South-East Asia New Born Birth Defects system. This system has the flexibility and the adaptability integrate into country health information systems and has been expanded to respond to emerging threats such as Zika Virus.

Developing Surveillance Capacity to Improve Outcomes in Pregnancy

The capacity to conduct rigorous biomarkers surveillance is a critical component of global public health infrastructure. One biomarker, red blood cell (RBC) folate, can be used to identify groups of women at increased risk for having a neural tube defect-affected pregnancy and to identify women with folate deficiency associated anemia, both of which are significant causes of morbidity and mortality worldwide. To improve monitoring of RBC folate in populations and to estimate NTD risk, CDC has worked to establish harmonized regional laboratories that use the microbiologic assay, the most reliable method for assessing RBC folate. By training and equipping scientists from low- and middle-income countries, CDC has developed regional expertise and capacity in three continents.

Violence against Children Surveys (VACS)

Violence underpins many public health problems and increases vulnerability to other health problems. Violence against children leads to higher risks of health and social problems, such as chronic disease, HIV, mental health issues, substance abuse, and violence perpetration later in life. The economic impact of violence against children is estimated at hundreds of billions of dollars per year.

Many inter-related factors contribute to violence against children. A variety of institutions and sectors can play a role in preventing and responding to it. Country-specific data and evidence-based approaches can inform how best address violence against children at individual, family, community, and society levels.

A first step in preventing violence is better understanding its magnitude, nature, and consequences. Violence against Children Surveys (VACS) measure physical, emotional, and sexual violence against girls and boys. CDC conducts these surveys to guide programs and policies to prevent violence before it starts. Findings from VACS provide reliable evidence to enable countries to make better decisions using limited resources to develop, launch and evaluate violence prevention programs and child protection systems.

VACS are nationally representative household surveys of children and young adults aged 13-24 years. The data collected can inform steps already taken to address violence against children and give insight into where these can be strengthened or expanded. In addition, findings can help raise awareness of the scope of the problem, support outreach and advocacy, and bring in new and diverse stakeholders.

RESEARCH, INNOVATION AND TECHNOLOGY

CDC Laboratories Play a Critical Role in Successful Global HIV Response

A core area of strength for CDC is the agency's laboratory expertise, particularly around the development of diagnostics and testing quality assurance. For example, CDC is the only agency to independently evaluate and certify the quality of rapid HIV test kits for use in PEPFAR-supported countries. To date, only 50% of rapid tests presented for evaluation have passed CDC's rigorous testing. CDC also worked closely with commercial partners to transfer the technology and development of a

HIV rapid recency testing kit for global use and implementation in PEPFAR-supported programs for enhanced surveillance and prevention efforts. As a point-of-care device, the rapid recency assay can diagnose HIV infection and distinguish recent from long-term infection, all in one test. This allows for urgent intervention including counseling, contact tracing, and partner testing to prevent further transmission. The rapid recency assay is commercialized by two companies and is now widely used and implemented in more than 50 countries. This assay also plays an integral role in the implementation of population-based HIV surveys that are utilized to measure the status of the national HIV response. Use of this assay has shown significant decline of HIV-1 incidence in several countries. Swaziland in particular has demonstrated a nearly 50% decline in incidence in 5 years (from 2011 to 2016).

Developing Novel Laboratory Assays

CDC developed two new tests that could detect Zika virus in tissues. CDC scientists used these two new tests to confirm the tissues were positive for Zika virus. This evidence led CDC to conclude that Zika virus causes microcephaly and embarked on a critical research to protect pregnant women in the U.S. and around the world.

Research to Improve Domestic and Global HIV Prevention and Treatment

CDC platforms in Kenya and Thailand collaborate through public-private and U.S. government partnerships to conduct clinical trials of innovative biomedical and integrated interventions to prevent new HIV infections, improve sustained HIV viral suppression, and reduce HIV morbidity. Innovations along the continuum from prevention to treatment are critical components of strategies to achieve an AIDS free generation and eliminate HIV in the United States, the host countries, and around the world. Research at the sites focuses on evaluating alternative, novel HIV pre-exposure prophylaxis (PrEP) agents and delivery systems to optimize PrEP efficacy. Previous research evaluated HIV vaccine candidates and novel diagnostics. Additional clinical trials are focused on biomedical innovations to achieve long-term HIV viral suppression among people living with HIV (PLHIV), towards a functional HIV cure, and to reduce chronic morbidity and co-morbid infections among PLHIV. Research currently focuses on men who have sex with men (MSM) and young MSM (Thailand) and women, adolescent girls and PLHIV (Kenya); representing key at-risk population in the United States, the host countries, and globally. The research evaluates new interventions that can translate to improved domestic and global HIV prevention and treatment. The sites also represent platforms of skilled local staff capacity and response units that can quickly implement new clinical trials in areas other than HIV, such as urgent and planned clinical trials of vaccine candidates, novel antimicrobials for resistant agents, and new diagnostics.

<https://www.ncbi.nlm.nih.gov/books/NBK368391/>