SEPTEMBER 2020

Building Global Health Capacity Through Polio Eradication

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A Report of the CSIS GLOBAL HEALTH POLICY CENTER

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

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About this Project

Over the last 30 years, experts in disease transmission and surveillance, community mobilizers, vaccinators, and a host of local and national leaders have focused relentlessly on vaccinating all children everywhere against poliovirus. A disease that primarily attacks children younger than 5, the virus can cause life-long paralysis and even death. In 1988, encouraged by progress toward polio elimination in the Americas, the World Health Assembly agreed to eradicate polio worldwide. From more than 350,000 that year, the Global Polio Eradication Initiative (GPEI) has reduced the number of polio cases to 22 in 2017. While still grappling with some difficult challenges, the GPEI continues to edge toward its ultimate goal of global eradication.

Through the Centers for Disease Control and Prevention (CDC) and the U.S. Agency for International Development (USAID), the U.S. government has been an invaluable contributor to the eradication effort. CDC, along with the World Health Organization (WHO), UNICEF, Rotary International, and the Bill & Melinda Gates Foundation, is one of the GPEI's core international partners, providing resources, leadership, and technical assistance to countries as they develop and implement their eradication strategies. USAID has provided guidance along with funding for both community- and facility-based surveillance, social mobilization, and immunization activities.

While preventing an estimated 16 million polio infections, the GPEI has at the same time developed networks of disease surveillance, laboratories, and vaccine-delivery systems providing needed public health infrastructure in the countries most at risk of disease outbreaks. In addition, it has provided training to thousands of health workers who are improving a range of disease prevention activities in their home countries.

Public health officials at the country, regional, and global levels are now taking stock of the valuable "assets" created by the polio program. They are calculating how polio-funded networks and new staff currently are contributing to public health systems and how to expand and sustain them into the future to help improve health in low-resource countries and advance global health security. This project contributes to that process by exploring public health interventions for which the U.S. government provided significant backing, either financially or through technical support. Each section examines an individual asset, explaining what it is, how it is contributing to polio eradication and to addressing other health issues, and what some of the challenges are to their continuation. Overall, the project will highlight the formidable leadership and support CDC and USAID have offered

toward eradication. It also will illustrate how polio assets already are aiding countries in preventing, detecting, and responding to disease outbreaks and what would be needed for them to be sustained into the future.

We hope through our work you will appreciate the value of U.S. contributions and leadership to polio eradication and the potential for assets developed by the program to strengthen global disease outbreak prevention and control. We live on a small planet in a time when people and diseases can travel far and fast. The evolving tools developed through polio eradication can enhance disease detection and response, protecting people everywhere.

This report was originally published as a longform web series. For additional interactive content, please visit www.csis.org/polio.

This project is made possible through the generous support of the Bill & Melinda Gates Foundation.

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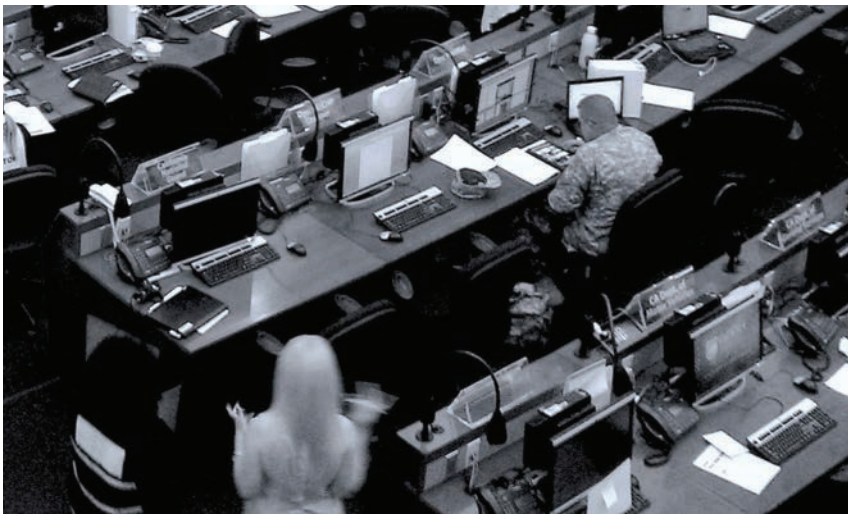
Polio Emergency Operations Centers

By Nellie Bristol & Isra Hussain | JULY 2018

This first installment in our series on U.S. support for global polio eradication discusses the role of Emergency Operations Centers in eradication efforts and their potential for establishing emergency public health response capabilities.



State Operations Center. Source: Cal OES

What They Are

Emergency Operations Centers (EOCs) provide a central location from which to coordinate data collection and response to a public health threat. They allow staff from different offices, sectors, and organizations to work directly and collaboratively, share information in real time, and formulate a joint plan of action. EOC leaders have a direct line of communication with government officials, allowing for more immediate access to needed staffing and funding. With these advantages, EOCs generate quicker, better synchronized, and more effective emergency responses.

As an example, the United States has a state-of-the-art EOC housed in Atlanta, Georgia, at the Centers for Disease Control and Prevention (CDC). Since its inception in 2001, the EOC has been activated for more than 60 incidents, ranging from the Flint, Michigan, water contamination in 2016 to the Ebola Outbreak in 2014 to Hurricane Dean in 2007.[1] When the EOC is

activated, staff relevant to the incident (for example, epidemiologists, logisticians, sanitation experts) from across CDC move into the EOC to organize activities. The center uses the National Incident Command System to coordinate multiple groups working on the same response. The system not only allows CDC to communicate better among its own staff, but also with outside organizations using the same protocols. Under the guidance of an incident manager to whom other staff become subordinate during activation, responders track data and mobilize resources, meeting regularly to keep everyone involved up to date. Ideally, as is the case with CDC's center, EOCs should have a dedicated staff that is supplemented by subject experts based on the incident at hand.

While many EOCs in developing countries do not have the same level of technology and expertise available to them, they offer the government a central command post where disparate groups can coordinate and develop consensus around appropriate actions. Developing EOCs is one of the "action packages" under the Global Health Security Agenda (GHSA), a global collaboration to improve responses to public health threats. EOCs established in Nigeria, Afghanistan, and Pakistan to reenergize polio eradication activities were among the first centers initiated in developing countries and offer many lessons for similar projects.

Then CDC Chief Dr. Thomas Frieden Updates Media.
Source: Kevin C. Cox/Getty Images

Building an Emergency Mentality for Polio Eradication

While the number of polio cases fell rapidly through the 1990s, progress slowed as the remaining endemic countries—India, Pakistan, Afghanistan, and Nigeria—struggled with weak health infrastructure, management problems, vaccine refusals, and areas of insecurity. Though India overcame the issues facing its program, seeing its last case of polio in January 2011, progress was spottier in the other three countries. To push the program toward a higher level of urgency, the polio program's Independent Monitoring Board (IMB)[2] recommended in 2011 that the World Health Assembly declare polio eradication a public health emergency:

> We now call upon each of them to lend this the global backing that it needs and deserves. To eradicate polio from the world would be a triumph. To fail now would be a disaster…. We recommend: That the World Health Assembly in May 2011 considers a resolution to declare the persistence of polio a global health emergency.[3]

The assembly, composed of the 194-member states, complied in May 2012.

> The sixty-fifth World Health Assembly…DECLARES the completion of poliovirus eradication a programmatic emergency for global public health, requiring the full implementation of current and new eradication strategies, the institution of strong national oversight and accountability mechanisms for all areas affected by poliovirus, and the application of appropriate vaccination recommendations for all travellers to and from areas affected with poliovirus.[4]

Building on the emergency theme to spur greater focus and energy toward polio eradication, then-CDC director Tom Frieden activated the U.S. EOC for the program. The move provided additional capacity for in-country technical expertise[5] and signaled to the rest of the world that the United States was strongly dedicated to polio eradication. In addition to developing emergency action plans to address polio eradication, remaining endemic countries, backed by financing and technical support from the Global Polio Eradication Initiative (GPEI)[6], began to develop their own polio EOCs.

A woman in Somalia minds a pharmacy in a stabilization center.
Source: CARL DE SOUZA/AFP/Getty Images.

Establishing EOCs

Nigeria was the first to move forward with the project, establishing its national center in Abuja in 2012 with technical support from CDC and financing from the Bill & Melinda Gates Foundation. It later developed subnational centers in eight states. Pakistan started its national center in 2014 and five regional centers later (across the four provinces of Pakistan and the Federally Administered Tribal Areas).[7] Afghanistan established four centers in 2016. All were established with GPEI aid.[8]

Partners and country officials involved with the EOCs said government leaders were immediately on board with the idea since the approach put them solidly in charge of a more coordinated effort. Some of the other organizations involved were less enthusiastic since the move required them to relinquish offices, change coworkers, and accept new leadership, but they soon became convinced of the centers' value. After some adjustment time, the centers turned a fragmented operation with multiple partners all following their own work plans into a cohesive unit acting on a unified plan under the government's leadership.

The EOCs helped immensely in tracking in real time both disease outbreaks and the resources being put toward them. Data collected from the field was transmitted to a central location

and the actions of local responders were closely watched, providing direct accountability for vaccinations and surveillance and ensuring funding flows got to where they were supposed to go.

> "Before the EOC was in place, the program didn't have this idea of partnership and collaboration. There were many quality issues within the program. There was no strong leadership to really bring everyone together to work as a team. Once the EOC was set up, the program could face these problems head on."
> *—Andrew Etsano, former incident manager, Nigeria EOC*

While direct cause and effect is difficult to establish, the polio EOCs were part of an erratic but ultimately marked reduction in cases that culminated in Nigeria being taken off the list of endemic countries. Unfortunately, additional cases were discovered in summer 2016 in areas where insecurity had made surveillance inadequate. The EOC was ratcheted up again to respond to those outbreaks, and as of July 2018, Nigeria has reported no cases since those initial four.

Liberia Turns Towards Normalcy As Fight Continues To Eradicate Ebola.
Source: John Moore/Getty Images.

EOCs and Other Health Threats

> "The rapid containment of Ebola transmission in Nigeria provided clear evidence of the wider application of the polio EOC model, a potent reminder of the legacy of the national polio program."
> *—Faisal Shuaib, Bill & Melinda Gates Foundation*[9]

Ebola Emergency Information Session.
Source: ISSOUF SANOGO/AFP/Getty Images.

The polio EOCs have been used to address other public health threats. Most famously, the Nigeria EOC organized a quick and successful response to a potentially catastrophic Ebola outbreak. Shortly after the first case of Ebola was identified in Lagos in July 2014, the Federal Ministry of Health and Lagos state government activated an Ebola EOC and Incident Management System

modeled after the polio program's emergency response infrastructure. Nigeria was declared Ebola-free within three months of the outbreak.

In addition, Nigeria has expanded EOC operations to oversee other disease outbreaks and vaccine delivery. This Polio EOC was expanded to allow the Measles Outbreak Team to work efficiently. They now have access to the EOC's electricity, internet, and printing capabilities 24/7 which have been critical for tracking measles outbreak response in the field.

EOC in Liberia. Source: USAID

Challenges

> "EOCs are more than simply a relocation and assembling of partners under one roof, but a remolding of approach towards collaboration. It took almost a year to get all the stakeholders into this frame of mind. The main thing was to convince everyone, to genuinely convince, to change not their area of work, but the modality of their work, something that they've been following for years."
> *—Zubair Mufti Wadood, MD, Technical Officer, World Health Organization*

The challenges to setting up a successful EOC are both tangible and intangible. One of the biggest obstacles cited is convincing staff to give up their offices, buildings, and even organizational loyalties and cultures to come together as a newly defined unit. Ensuring involvement of staff that is not only qualified but willing to collaborate is critical to an EOC's success.

But just finding staff with the appropriate skills is difficult in many developing countries. Key areas of expertise include data management, logistics, communications, disease control, epidemiology, field operations, and computer and management skills, all of which are in short supply in many resource-poor countries. In addition to staffing requirements, the center must be supported by the political leadership and through legislative and/or regulatory authority.

Technical Advisory Group Meeting
November 2017, Kabul, Afghanistan
Source: WHO/EMRO

> "One thing that all of us must try and strive for is not to let these EOCs vanish away with polio eradication. I think that would be a big missed opportunity..."
> *—Zubair Mufti Wadood, MD, Technical Officer, World Health Organization*

Retention and expansion of the polio EOCs to other heath activities will require transforming them from their current ad hoc, polio-specific roles into integrated sustainable elements of national, state, and provincial public health systems ultimately supported through domestic resources.

Another critical component of EOC establishment is instituting an Incident Command System that establishes a workable hierarchy and allows all partners to communicate using the same language. The system needs to be tailored to each context to ensure it is understandable to and actionable for all responders.

Tangible needs for an EOC also may be difficult to acquire and make sustainable in low-resource settings. Ideally, a center should have generators, information technology support, fuel, vehicles, and 24/7 connectivity. While having a separate building for the center is preferred by some, the center also can be set up within an existing structure.

Ensuring adequate funding for the centers is another challenge. The Nigeria, Pakistan, and Afghanistan EOCs all were supported by the GPEI, which has not only dedicated funding but top notch technical expertise. Those involved with the polio EOCs say they are valuable assets that should be sustained, and they note that the centers now are being used to support other immunization efforts, including measles. However, the centers' futures could be in jeopardy as polio is eradicated and funding declines.

National Guard Responds to Hurricane Matthew.
Source: Smith Collection/Gado/Getty Images

EOCs and the Global Health Security Agenda

EOCs are one of the key assets called for by the Global Health Security Agenda (GHSA) under the first action package related to "respond:"

> *Five-Year Target:* Every country will have a public health Emergency Operations Center (EOC) functioning according to minimum common standards; maintaining

trained, functioning, multi-sectoral rapid response teams (RRTs) and "real-time" biosurveillance laboratory networks and information systems; and trained EOC staff capable of activating a coordinated emergency response within 120 minutes of the identification of a public health emergency.

As Measured by: Documentation that a public health EOC meeting the above criteria is functioning.

Desired National Impact: Effective coordination and improved control of outbreaks as evidenced by shorter times from detection to response and smaller numbers of cases and deaths.

Progress toward capacities under the GHSA are judged via a Joint External Evaluation (JEE). Under the JEE, countries invite a group of international experts to evaluate on a scale of 1 to 5 the readiness of tools needed to respond to a public health threat. Of the 26 countries that have been examined so far, only three, Saudi Arabia, the United Arab Emirates, and the United States, received the highest score (5) for their capacity to activate emergency operations. Thirteen countries received a score of 1 or 2 on their EOC operating procedures and plans.[10] Though EOCs are one of the key assets under the GHSA, more resources must be allotted to countries ranking lower in preparedness to help the world respond to public health emergencies.

CDC Infection Control Team demonstrate how to don protective gear.
Source: TIMOTHY A. CLARY/AFP/Getty Images.

The Way Forward

The polio EOCs are valuable assets from which important lessons can be learned for establishing emergency public health response capabilities in developing country settings. The services EOCs provide not only improve the health and safety of their own countries, but they combat disease on a global scale by containing it more quickly at its source. Countries other than Nigeria, Pakistan, and Afghanistan will not have the advantage of GPEI funding and technical leadership and will have to drive the establishment of EOCs themselves. Meanwhile, the current polio EOCs are facing a precipitous drop in funding as the GPEI winds down. To sustain and expand them, the three governments will have to make concerted efforts to integrate the EOCs into their government operations and to find funding for them.

Countries have resources to draw on in building EOCs through the GHSA and other partners. For example, CDC has several programs that train staff in epidemiology, data collection, communications, and health systems management that can continue to build capacity in developing countries, and it runs an EOC management program in Atlanta. The program provides four months of hands-on experience at the CDC/EOC. Trained staff then is activated immediately in their home countries. In addition, the international focus on global health security provides additional funding, focus, and expertise. Using lessons from the polio EOCs combined with momentum toward the GHSA provides countries with new resources to put toward development of a constructive platform for improving response to public health threats.

SPECIAL THANKS TO:

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Zubair Mufti Wadood, MD, Technical Officer, World Health Organization

Andrew Etsano, Advisor on Immunization, Health in Complex Settings Division, Health Department, International Federation of Red Cross and Red Crescent Societies

John Vertefeuille, Polio Eradication Branch Chief & Incident Manager Polio Emergency Response, Centers for Disease Control and Prevention

Hamid Jafari, MD, Principal Deputy Director, Center for Global Health, Centers for Disease Control and Prevention

Endnotes

1) Centers for Disease Control and Prevention (CDC), "Emergency Operations Centers: CDC Emergency Operations Center (EOC)," https://www.cdc.gov/phpr/eoc.htm.

2) The Independent Monitoring Board (IMB) consists of four international health experts who oversee progress toward global polio eradication. For more see, Global Polio Eradication Initiative, "Independent Monitoring Board," http://polioeradication.org/who-we-are/governance-and-structure/independent-monitoring-board/.

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Social Mobilization for Polio Eradication

By Nellie Bristol & Isra Hussain | JULY 2018

This installment in our series on U.S. support for global polio eradication discusses the role of India's Social Mobilization Network in eradication efforts and its potential to influence communications and social outreach in other public health programs.

Indian women wait to get polio vaccine for their infants at a Chennai government hospital. Source: Arun Sankar/AFP/Getty Images

Communicating for Health

Public health practitioners sometimes have to learn the hard way: just because they offer a service, even with the best of intentions, the intended recipient may not take it up and in some instances will reject it violently. In a recent example, physicians tried to help a remote village protect itself from Ebola; village members did not understand the intrusion from strangers and attacked them with knives, stones, and machetes.[1]

Those seeking to eliminate polio in India confronted a similar conundrum. Participation in Booth Days, festival-style events where children collected at colorful tents to receive polio drops and small toys, had stagnated. Yet, many children remained unvaccinated and the disease continued to paralyze hundreds. Communications with target communities were minimal, often only involving announcements about where and when the vaccine would be available.

> "When I say communication, I'm thinking more social change kind of communication. People in the field were putting out ads or posters for a press release, but I think in terms of what I would call real communication based on proper research and engaging with people, it just wasn't accepted by the medical fraternity for a very long time."
> —*Sue Goldstein, MD, Program Director, Soul City: Institute for Social Justice; and Member, Independent Monitoring Board, Global Polio Eradication Initiative*

As polio immunization rates stalled, the government of India enlisted vaccinators to go door-to-door to deliver the polio drops to those not being reached. But some communities, including poor Muslim populations that often felt threatened by the government, felt targeted by the action and became suspicious. Why, in a community with open sewers and filthy water, with one of the highest disease burdens in the world, was the government arriving at doorsteps to offer only this one intervention? Rumors circulated that the polio drops were actually designed to cause infertility in Muslim children and thus reduce the population. After all, the government's last door-to-door campaign in the 1970s promoted forced sterilization.[2] This fear led parents to hide their children or even attack vaccinators. Others outright refused to let their children be immunized.

A resulting 20 percent vaccine refusal rate[3] and a massive polio outbreak in the state of Uttar Pradesh that paralyzed 1,600 children[4] forced the Indian government and the global polio eradication leadership into a crisis of confidence.

Indian polio patients undergoing treatment at a hospital in New Delhi. Source: Sajjad Hussain/AFP/Getty Images

While the Global Polio Eradication Initiative (GPEI)—overseen at the international level by the World Health Organization (WHO), United Nations Children Fund (UNICEF), Rotary International, the U.S. Centers for Disease Control and Prevention, and Bill & Melinda Gates Foundation—was a remarkable success that had reduced the number of polio cases by more than 99 percent, it was struggling in areas with poor immunization services, conflict, dense populations, and/or poor hygiene.

Operating in an "if you build it, they will come" mentality, its largely male, physician-led, data-driven approach did not sufficiently consider cultural and social nuances. The lack of awareness led to vaccine refusals and caused the program to stall in the then four remaining endemic countries of India, Pakistan, Nigeria, and Afghanistan. With billions of dollars and two decades of work at stake, new ideas were needed and quickly.

> "It became clear to me pretty quickly that if they didn't have a strong communication approach this whole thing was going to fall apart."
> *—Ellyn Ogden, Worldwide Polio Eradication Coordinator, USAID*

Some donors involved in the program—including the U.S. Agency for International Development (USAID), which had been funding social mobilization efforts for years—had long argued that the initiative's communications were not sufficient and had been urging a more intensive, localized, evidence-based approach. Posters, banners, and radio and television ads announcing vaccination days did not do enough to explain the risks of not vaccinating and did not always resonate with illiterate populations that were the most often missed.

Out of this conviction grew India's Social Mobilization Network, or SMNet, a network of thousands of mostly young women from the communities they worked in, who met with parents and caregivers individually to understand their concerns and explain the purpose of the polio drops. Social mobilizers enlisted local influencers—religious leaders, teachers, and doctors—to support vaccine campaigns and help them talk to parents. They hosted "mothers' groups" that addressed health issues beyond polio including hygiene and health, breastfeeding, and nutrition. Groups running the SMNet, UNICEF, and the CORE Group Polio Project developed indicators to measure the performance of social mobilization so they could prove to the data-driven epidemiologists and physicians running the polio program that the approach was working.

A woman brings her baby to be vaccinated.
Source: Noah Seelam/Getty Images

And it did work. While direct cause and effect is difficult to ascertain and can be attributed to many factors, the refusal rate fell below 1 percent by 2013[5] and the number of polio cases in high-risk districts in India dropped approximately 20 to 30 percent[6] after the SMNet was instituted. The last case was seen in the country in January 2011. Polio elimination in India, which once produced the bulk of cases in the world, was considered an extraordinary success story that included, as one of its very important chapters, the work of the SMNet.

Similar approaches are now being tried in the remaining endemic countries of Nigeria, Afghanistan, and Pakistan. Meanwhile, the Indian SMNet is helping the government improve the reach of other immunizations to under-immunized communities. However, its future is uncertain. The number of polio cases worldwide is in decline, and the funding for the program has diminished as focus moves to the remaining endemic countries. The government of India is now working to maintain at least parts of the network for the neediest communities and repurpose them to address broader health and social issues.

Health workers and villagers in Moradabad try to convince a woman to let her child be vaccinated against polio. Source: Jean-Marc Giboux/Getty Images

Why It Was Needed

> "[I]t's not isolated to the GPEI. It's a medical paradigm that's been around for a long time. When you want to solve a problem, you give a person an injection or pill and it goes away."
> *—Sue Goldstein, MD, Program Director, Soul City: Institute for Social Justice; and Member, Independent Monitoring Board, Global Polio Eradication Initiative*

While social mobilization and India's SMNet are now cited as instrumental to immunization efforts in hard-to-reach communities, those running the polio program did not always appreciate the value of interpersonal communications. Those involved talk about several turning points for transforming communications from simple awareness of campaign dates to truly mobilizing communities to vaccine acceptance.

The first was a 2003 polio outbreak in Nigeria that grew out of suspicion about the vaccine and a surge in vaccine refusals, problems that could only be addressed through better personal communications. The virus spread to 20 other countries and hundreds of children were paralyzed.[7] The episode resulted in communications being taken more seriously at the GPEI, but they still did not have the funding needed to be successful.

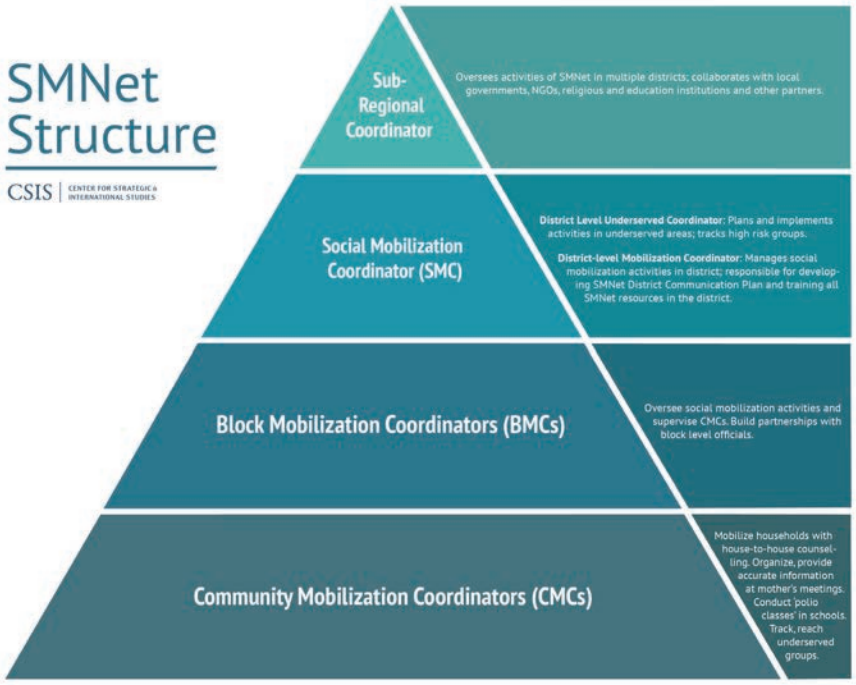
The India outbreak of 2006 mostly involved Muslim children whose parents were refusing the vaccine and was the biggest wake-up call that something needed to change in that country. But while the GPEI began to devote more resources and attention to mobilization, it was not until 2010 that the Gates Foundation made a large contribution to UNICEF to improve communications and the SMNet began to grow and professionalize.[8]

While understanding community culture and responding to it was always part of social mobilization, UNICEF began to commission surveys and analyze data to give the program more legitimacy with its epidemiologist partners.[9] Questions focused on caregiver trust not only of the health workers, but of the government and other organizations running the program, including WHO and UNICEF, and how that affected decisions to have children vaccinated.

Through the surveys they were able to quantitatively affirm, for example, that in many places, caregivers were much more comfortable having a female health worker come to their door. Some places distrusted the international organizations involved in the program, viewing them

as Western driven and anti-Muslim. Others distrusted their own governments. The surveys helped the program tailor its operations to respond to community attitudes. They added more female health workers and downplayed initiative sponsors where communities viewed them skeptically. By listening to communities and responding to their concerns, the program reached more children and reduced the violence aimed at health workers.[10]

A health worker gives polio drops to a child outside his residence in New Dehli.
Source: Sajjad Hussain/AFP/Getty Images



Pyramid illustrating the structure of SMNet
Source: CSIS

How It Works

India's SMNet began in 2003 and is a collaboration between UNICEF and the CORE Group Polio Project, a USAID- funded consortium of NGOs focused on child health, along with Rotary and the Indian government's National Polio Surveillance Project (NPSP).[11] UNICEF and CORE Group, which had been funded for polio work by USAID since 1996[12] and 1999[13] respectively, had the same type of training and similar communications materials but worked in different areas where they historically had the strongest presence. The network was set up in a pyramidal structure with community mobilization coordinators (CMCs) at the base below various levels of supervision (see chart).

CMCs serve as health promoters and as the eyes and ears of the health system. At its peak, UNICEF had more than 6,000 CMCs[14] while CORE had 1,400.[15] They perform community-based surveillance, report cases of disease not seen by physicians, and keep track of pregnant mothers and newborns to ensure they get the care they need. Through mothers' groups and

other avenues, they expanded their health promotion beyond just polio to other issues being faced by the community. They helped facilitate communications between the community and the government, in some cases getting roads paved and garbage collected. Over the years, their credibility grew both as they solidified their relationships with the community and as polio cases began to decline.

The SMNet implemented several innovations that helped achieve polio elimination in India and became iconic symbols of the eradication initiative. The first was micro planning maps. The often hand-drawn maps charted every house in a neighborhood and documented the number of children there. This helped vaccinators ensure they were reaching every house.

Another innovation helped keep track of the status of each household. Using surveillance information collected and analyzed by India's NPSP, mobilizers used chalk to mark each house, showing whether children within were seen during the campaign and if not, why. For example, a "p" chalked onto the house indicated children in the house had been given drops while an "x" meant they had not. Later, again using data from the NPSP, the "x" markings were further delineated into markings that indicated why a child was not vaccinated, be it related to parental refusal, an illness, or that the child was not home. This information helped the work of a second wave of vaccinators who returned later in the day for another attempt.

Social mobilizers are helping to stop poliovirus transmission in the remaining endemic countries as well. In Afghanistan, the Immunizations Communication Network is tracking chronically missed children, maintaining a register of households with children, promoting routine immunization, hygiene and sanitation, and identifying and tracking high risk populations.[16] In Pakistan, community-based vaccinators provide vaccination and social mobilization/communications are currently working on community engagement plans. In Nigeria in recent years, Volunteer Community Mobilizers reduced the number of children missed during vaccination campaigns by 68-90 percent in states that are high risk for polio.[17]

Indian school children hold placards reading 'India Polo Free' during their awareness campaign. Source: Noah Seelam/Getty Images

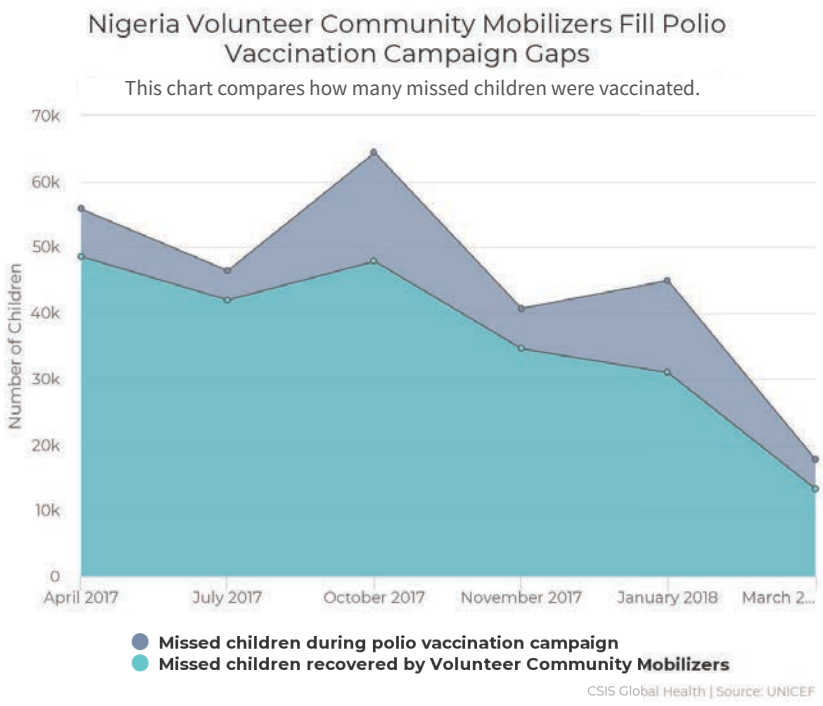
Where It Goes from Here

> "I think that disbanding the SMNet would be like pouring expensive drinks down the drain. I don't think it's a good idea at all."
> *—Deepak Kapur, Chair, Rotary's India PolioPlus Committee*

While its contribution to polio elimination in India is widely recognized, the SMNet's future will become uncertain as polio funding winds down. Providing funding for the intense interpersonal communications fostered by the SMNet is expensive: the SMNet functioning costs in India totaled more than $6 million per year.[18] Further, the government of India has developed a cadre of health workers, known as ASHAs (accredited social health advocates), that serves a similar function to CMCs.

Also complicating the situation, the pay scale for the international organizations supporting the SMNet is higher than that of the Indian government. For several years, UNICEF has been in negotiation with the Indian states of Bihar and Uttar Pradesh, where the SMNet has the bulk of its resources, to secure its future. The states have agreed to gradually take on more of the funding and have altered the SMNet's job responsibilities to respond to a broader set of challenges faced in their communities. However, it will be essential for the government ultimately to take on the bulk of the SMNet's costs if it wants the program to continue since USAID and UNICEF likely will phase out their support.

Those involved in the program expect many of the CMC positions to be eliminated but supervisory roles of the SMNet may be retained. This is an important step for the Indian health system, which often has lacked effective oversight of government health services. Mobilizers who leave the SMNet also are seeking other training opportunities and finding jobs with NGOs, the government, and international organizations.



In high risk states in Nigeria, Volunteer Community Mobilizers, supported by UNICEF, are playing an important role in vaccinating children who were missed during polio vaccination campaigns.

Even if most of the SMNet is dismantled, it has proven the importance of understanding cultural norms and experiences and adjusting programs to respond to them. In fact, a set of former polio professionals from UNICEF and WHO became so convinced of the approach that they started a business around it. Called Common Thread, the global enterprise designs applied social and behavior change strategies for public health. It aims to show that putting people at the center of public health is not only important, but essential for programs aiming to achieve impact.[19] Clients include large multilateral organizations like the Red

Cross, UNICEF, and WHO, which retain Common Thread to create and improve health communication programs. The founders of the firm saw a need to incorporate evidence-based social data with epidemiological data to create a more accurate portrait of public health.

While they were a long time coming and hard-learned, lessons from the SMNet are contributing to changes that span well beyond polio and India, embedding the belief that human behavior is often not only what spreads diseases, but is critical to stopping them.

> "Communications has often been like a stepchild of public health programs. And I don't think it's just polio. I think it's a broader phenomenon in public health."
> *—Sherine Guirguis, Founder and Lead Strategist, Common Thread; formerly Senior Manager of Communications, Polio Eradication Unit, UNICEF.*

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Dr. Lalit Kant, formerly Senior Scientific Advisor, Bill & Melinda Gates Foundation

Deepak Kapur, Chair, Rotary's India PolioPlus Committee

Ellyn Ogden, Worldwide Polio Eradication Coordinator, USAID

Joshila Pallapati, Capacity Development Officer, Polio, UNICEF

Dr. Roma Solomon, India Director, CORE Group Polio Project

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‘STOPing’ Poliovirus with Dedicated Volunteers

By Nellie Bristol & Isra Hussain | JULY 2018

This third installment in our series on U.S. support for global polio eradication discusses the role of the Stop Transmission of Polio (STOP) program in training field epidemiologists to strengthen disease surveillance and response in low-resource settings.

Sewunet Ayan Hassan and Sahro Ahmed travel long distances to deliver polio vaccination in hard to reach areas. Source: UNICEF Ethiopia

Developing Disease Detectives

The Global Polio Eradication Initiative (GPEI), led by national governments and global partners, reduced the number of polio cases by more than 98 percent in 10 years, from an estimated 350,000 cases in 1988, when the eradication push began, to 6,227 in 1998.[1] Yet progress began to stall as countries with remaining polio transmission faced challenges including weak immunization systems, lack of resources and political will, conflict, and/or poor program management.

To brainstorm ways to give the program a boost, leadership at the U.S. Centers for Disease Control and Prevention (CDC), one of the pillars of the international effort, called together a group of current and former CDC staffers. Comprised of the agency’s “smallpox warriors,” CDC staff who were pivotal to the success of the world’s first—and to date only—successful eradication of

a human disease, the group recommended providing expert field support to countries that were lagging.

Twenty-five current and former CDC staff volunteered for the job, traveling to remaining polio endemic countries to identify program deficiencies on the ground and at the national and regional levels and suggesting improvements. They found that providing outside expertise brought new ideas and increased motivation, thus improving program performance in low-resource settings.

Seeing the program's value, CDC, with additional support over the years from Rotary International, UNICEF, and the Bill & Melinda Gates Foundation, collaborated with the World Health Organization (WHO) to continue it, drawing in foreign nationals to supplement the program's CDC staff. Named Stop Transmission of Polio (STOP), the program is entering its 20th year and has trained more than 2,000 mostly African health professionals in the valuable skills of polio detection, surveillance, and response along with immunization program implementation and management, data analysis, and effective public health communications. STOPpers have been deployed to more than 75 countries worldwide.

This map shows the total STOP deployments per country since 1999.

The focus of the program has broadened over the years and in addition to training for polio eradication, STOPpers receive skill development in measles and rubella control and in activities to address other vaccine-preventable diseases. STOP alumni have returned to support their country health systems, or with their additional training, gained positions with national and international health organizations providing extra capacity for global disease response.

With renewed post-Ebola focus on global disease control, the need for well-trained epidemiologists, who have undergone high-quality, standardized training and can work urgently and collaboratively in stressful disease outbreak situations, is greater than ever. The Global Health Security Agenda, a U.S.-initiated international effort to bolster national and international disease control capabilities, calls for 1 trained field epidemiologist per 200,000 people,[2] a goal the Africa region misses by 4,000 for its population of 1.2 billion.[3] The value of the program was reaffirmed when current and former STOP

trainees joined other epidemiologists to thwart a potentially catastrophic Ebola outbreak in Nigeria in 2014.[4] And although the number of wild poliovirus-infected countries is now down to three (Afghanistan, Nigeria, and Pakistan), country requests for STOP staff have increased.

> *"I have my own ambitions, but I feel the experience that I will gain from the STOP program will be a valuable tool, not just in my academic prospects, but also overall in my professional career. So, it will be a valuable asset for me to not only strengthen what we have in the country, but also to be a resource for the world."*
> *—STOP 52 Trainee*

But as with other valuable global health assets developed through polio eradication, future funding for STOP is uncertain as eradication is achieved and the GPEI ramps down its financial support. STOP program directors are revamping the curriculum for next year so that while polio tools will remain the top priority until eradication is achieved, STOPpers can gain a broader set of skills they can apply to a wider array of infectious disease. The program meshes with other CDC-supported epidemiology training programs, including National STOP, which trains and deploys people in their own countries, and the Field Epidemiology Training Program,[5] which provides a more intensive training program in-country to help create an even greater cadre of experienced and effective epidemiology field staff.

Health workers depart to designated centers to immunize children in Lagos.
Source: Getty / PIUS UTOMI EKPEI

How It Works

The first STOP team was comprised of experienced CDC staffers who deployed to remote areas with limited communications for three-month assignments. Recruitment opened globally in 1999 drawing in health professionals from a variety of countries.[6] Training early on expanded to measles/rubella and broader immunization management to help countries address deficiencies in those areas. Management training was added to the curriculum in 2013 and 2014 to address identified systemic weaknesses in countries that were still struggling to stop polio transmission.[7] Training is conducted by CDC, UNICEF, and WHO staff. For the bulk of the program's history, training was held in Atlanta, but officials moved the venue to Kampala, Uganda, in January 2017, largely to take advantage of the fact that more STOP participants hail from Africa and are deployed to other countries on the continent.

> "I would like the community, the population, to embrace that immunization is a right and that it becomes for them a need."
> *—STOP 52 Trainee*

CDC is responsible for STOP recruitment, country placement, training, technical assistance, and mission support for STOPpers in the field. CDC-supported WHO headquarters staff in Geneva review applicant resumes, help decide country placements, draw up contracts, oversee deployment of STOP teams, and manage their finances. UNICEF provides communications and country support. WHO and UNICEF country and regional offices handle country requests for STOP deployments, coordinate with country ministries of health, and provide orientation and in-country training. While the number of wild poliovirus-infected countries is now down to three (Afghanistan, Nigeria, and Pakistan), country requests for STOP staff have increased. Requests are submitted to WHO from countries at high risk for polio reimportation, those working on measles and rubella elimination, and those with outbreaks of other vaccine-preventable diseases.

STOP team members board a canoe to travel through the flooded areas of Chad to vaccinate children.
Source: CDC GLOBAL / Freddy Banza

While original STOPpers were deployed for three-month assignments, the program now holds two training sessions a year, one in January and one in June. Trainees deploy for a year and can reenlist for another year. STOPpers do not receive a salary, but are paid a per diem that supports their living expenses. Other needed resources, transportation to field assignments, laptops, and health insurance are provided by WHO with CDC funding.

> "Once I finish with STOP… I intend to continue my work at a local level or go back to where I was, or I continue working with organizations, but there will be one condition: the family. I'm married, mother of four; three boys and a girl. The girl is only 3 ½ years old."
> *—STOP 52 Trainee*

Application to STOP is highly competitive. For the latest training, 1,500 people applied for fewer than 75 positions. Many successful applicants are physicians and all must have at least five years of experience. Some apply multiple times before they are accepted. While the program can provide a gigantic boost to a STOPpers' career, participants must be willing to leave their families for months at a time and often are assigned to difficult, remote, and sometimes

dangerous locales. The practice of assigning STOPpers to countries other than their own is part of the culture of WHO. International consultants provide a different perspective and can bring innovations and new energy to programs that have stalled. While a few STOPpers had difficulty integrating into established field staffs, the vast majority have been successful, program organizers say. STOP training puts a strong emphasis on listening to staff and understanding the context they will be working in before they begin making suggestions.

> "STOP participants are new to these countries. It is important that they arrive with an open mind, that they listen and observe first before they share the expertise and experiences they bring from their own countries."
> *—A.J. Williams, Public Health Advisor and Team Lead, STOP Program, CDC*

CDC helps build in country public health capacity to meet international standards for global health security. Source: FLICKR CDC GLOBAL / CDC

Becoming a STOPper

CSIS Global Health Policy staffers attended STOP 52 training held at the Speke Resort outside Kampala June 4–8, 2018, to get a better look at the program. The full training lasts three weeks. The first week covers skills needed to conduct polio surveillance and immunization campaigns, the second focuses on measles and rubella, and the third week highlights communications and data management. The training involves roughly two dozen CDC staff from various fields along with several staffers from WHO headquarters in Geneva. Presentations, offered in English and French, covered administrative details STOPpers needed to facilitate their deployments along with discussions on the status of polio eradication and program expectations post eradication. In-depth tutorials were offered on polio surveillance, microplanning, developing effective cold chains, outbreak preparedness and response, and planning a polio immunization campaign. Facilitators walked trainees through polio outbreak response and vaccination campaign case studies.

Trainees in STOP 52 came from 21 different almost all African countries (the exceptions were two participants from Bangladesh and one from Georgia) and will be deployed to 29 countries

STOP 52 Training. Source: CDC

other than their own. For example, one participant from Cameroon was assigned to Afghanistan. Another, from The Gambia, was assigned to Kenya. As with all STOP classes, trainees were largely male: STOP 52 had only five women out of a class of 75. STOP organizers said the disparity was particularly glaring in that STOP class but said females often are a significant minority in all the training sessions. They attribute the lack of balance to the program's requirement of long periods away from families and deployment to dangerous areas that would be even less safe for women.

Map depicting top STOP volunteer contributing countries for STOP 52 in 2018. Source: CSIS

Five STOP 52 trainees interviewed said they heard about the program from others they worked with in the field. One said he was impressed with the engagement and commitment of STOP teams. Most were motivated to apply for the program to gain additional skills and knowledge and to help advance polio eradication. One interviewee spoke movingly of a friend who was paralyzed by polio and about how difficult his life was as a result. All expressed dedication to the goal of polio eradication and to being involved in an important global health campaign.

> "And if my experience can help polio eradication, I will be really, really proud and then I can say that I was useful for something in this world."
> *—STOP 52 Trainee*

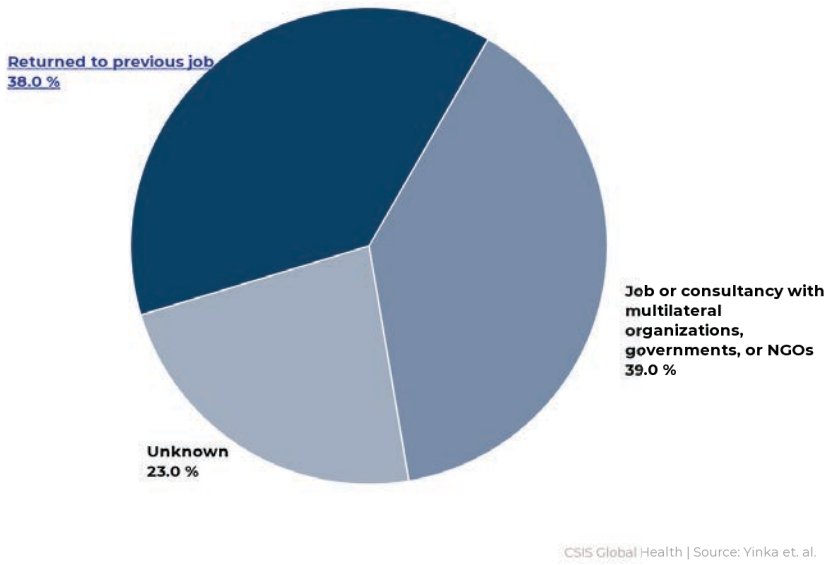
Vaccinations are provided in Tulugulid, Ethiopia during the Polio NIDs Campaign.
Source: UNICEF Ethiopia

The Future of STOP

While officials at CDC and WHO are complimentary of the STOP program and eager to see its continuation, the program, with a budget of $15 million per year, will face additional scrutiny as polio funding dwindles. While the program's focus remains polio eradication, as the number of cases continues to fall, the emphasis will shift to training epidemiologists who can respond to any disease outbreak and support other programs including routine immunization.

To make a solid case for itself, the STOP program may need to quantify more thoroughly what STOPpers have contributed to country polio programs they were assigned to and where alumni ended up after their deployments to show the global health leadership STOP has fostered. With WHO's current focus on gender equity in global health, the program may need to devise ways to give more women the career advancement opportunity STOP offers.

Post-STOP Deployment Career Trajectories



In addition to funding uncertainties, STOP also will be subject to an administrative shuffle in the future. WHO will need to decide which department will oversee STOP once the polio program, which handles STOP administrative duties, is incorporated back into the larger organization post eradication. The collaboration between CDC and WHO for STOP is an unusual one for WHO since it is providing administrative support for a program essentially funded by an individual country, so program officials will have to work through those issues as well. STOP has become important

to WHO since it now supplies two-thirds of the organization's outside consultants to countries while the number of paid consultants has fallen to one-third of the total.[8] STOP officials see it as a possible model for immunization system strengthening central to WHO's goal of universal health coverage and said that STOP, like the GPEI overall, shows the strength of multilateral partnerships.

> "The WHO has traditionally recruited international consultants who provide needed diversity and different perspectives. Some people have gone back to their countries after their STOP assignments, while others have gone on to work for WHO."
> *—Steve Wassilak, Medical Epidemiologist, Centers for Disease Control and Prevention*

While its future is uncertain, there is no doubt the skills STOPpers gain through the program will remain critical to polio eradication. As the number of polio cases drops, there will be an even greater need for top-notch polio surveillance to ensure the disease is definitively eradicated. Current STOPpers and STOP alumni are fully qualified for the task. In addition, as polio wanes, global health outbreak response capacity still will need to be increased. STOP provides a cost-effective method not only to aid in outbreak response but also to build additional overall global health capacity.

SPECIAL THANKS TO:

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Gena L. Hill, Associate Director for Policy, Global Immunization Division, Center for Global Health, Centers for Disease Control and Prevention

Dr. Chima John Ohuabunwo, Executive Director, African Field Epidemiology Network (AFENET)

Brendan Pocock, Acting Team Lead, Human Resources, World Health Organization Polio Eradication Initiative, WHO

Patricia Tanifum, Epidemiologist/Regional Advisor for Immunizations, Centers for Disease Control and Prevention

Steve Wassilak, Medical Epidemiologist, Centers for Disease Control and Prevention

A.J. Williams, Public Health Advisor and Team Lead, STOP Transmission of Polio Program, Centers for Disease Control and Prevention

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The Future of Polio Surveillance

By Nellie Bristol & Michaela Simoneau | MAY 2019

This fourth installment in our series on U.S. support for global polio eradication highlights the role polio surveillance systems play in detecting global health threats.

Disease surveillance is essential to identifying where health threats are occurring—the first step to stopping transmission and preventing epidemics. Over its 30-year history, the Global Polio Eradication Initiative (GPEI) has developed a top notch surveillance system that can find new polio cases nearly anywhere in the world. More recently the GPEI system has been expanded to track other diseases, ranging from measles and rubella to meningitis. Many countries now depend on polio surveillance resources—funding, technical assistance, and supervisory personnel—to alert them to a variety of outbreaks within their borders. In fact, the disease surveillance system is one of the most significant potential long-term global health assets to emerge from polio eradication efforts.

Source: World Health Organization

To speed responses to potential epidemics and enhance global health security, countries and international organizations are working not only to preserve the polio system but to transform it into a broad-based global network that will allow every country to track a range of diseases. Before this can be accomplished, however, several critical questions must be answered, including who will oversee the system, what the most effective model will be, and, most importantly, who will pay for it after polio is eradicated and the GPEI winds down.

Polio Surveillance

While many countries have established disease monitoring mechanisms over the years, they often are fragmented and have varying standards, degrees of effectiveness, and resources. With its mandate to find not only every polio case in the world but every poliovirus, GPEI has had to develop a system that can consistently and reliably reach nearly everyone everywhere. Even in countries with weak public health systems and remote or disenfranchised populations with intractable disease monitoring challenges, the polio program has succeeded in ways no others have. In India, for example, the National Polio Surveillance Project, backed by GPEI, devised strategies for tracking the health of the remote population of the Kosi River Basin, a flood-prone area with limited access to health services. GPEI has also fostered a network of community health workers in several countries that facilitates disease surveillance and vaccination for mobile populations and other previously underserved groups.

Martha Dodray, a health worker in the Kosi River Basin, on a raft as she travels to Tilkeshwar village to deliver vaccinations. Source: Christine McNab/UN Foundation

GPEI's system operates in all 194 World Health Organization (WHO) member states.[1] Based on surveillance methods developed in the Americas, it searches for and reports cases of acute flaccid paralysis (AFP), the clinical symptom for polio infection that can also be present in other diseases. To prove the system is working, the GPEI set a target of at least two AFP cases per 100,000 population of children under age 15. A system that finds AFP cases at this rate is considered effective enough to discover any paralysis caused by poliovirus.

The polio system engages health workers at several levels. Health facilities are asked to report any cases of paralysis among children to a central focal point in each district. Supported by GPEI, local surveillance officers travel to a designated set of health facilities weekly to review their records to catch any cases that were not reported. Health personnel follow up on suspected polio cases by collecting stool samples at specified time intervals and sending them to accredidated laboratories to test for poliovirus.

GPEI also relies on several other types of disease monitoring, including community-based surveillance and environmental sampling. To shorten the time between onset of disease and reporting, community-based surveillance relies on locally nominated volunteers or traditional healers who are trained to identify AFP, measles, and neonatal tetanus and bring the child to the attention of a designated facility-based focal point. Community-based surveillance is most often used in remote areas without easy access to health facilities.

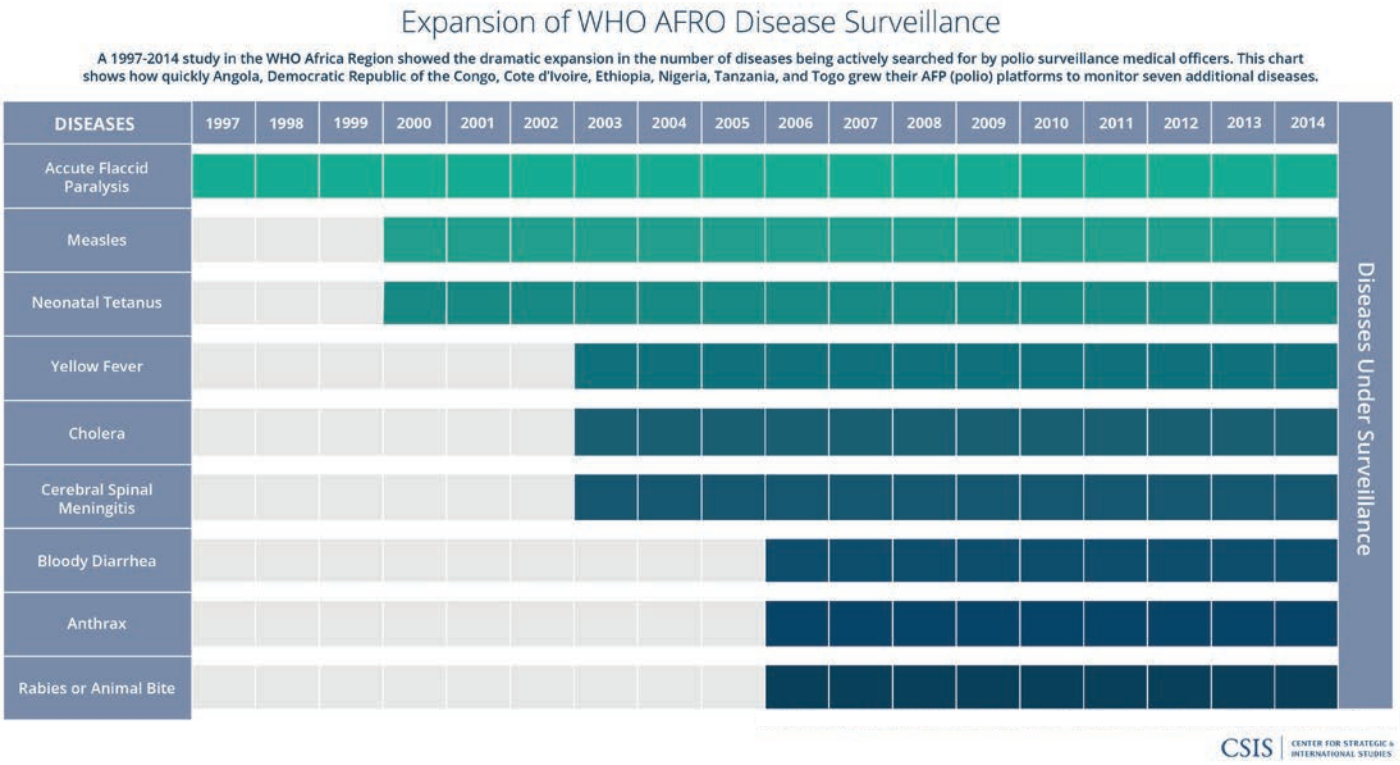
Source: World Health Organization

Environmental surveillance is seen most frequently in high-risk areas as the number of polio cases declines. For this type of monitoring, health workers collect and test sewage in search of poliovirus. This type of surveillance will become increasingly important as the number of polio cases continues to decline.[2] Polio symptoms, including varying degrees of paralysis sometimes leading to death, occur in only one of every 100-200 people who become infected with the virus. Nonetheless, all of those infected can transmit the virus through their stool. Finding poliovirus in sewage indicates the virus is circulating among the local population even though no actual cases have yet been reported.

Expanding the Disease Surveillance Network

On-going, systematic collection and analysis of disease-related data is critical to an effective public health system. It alerts officials to health threats allowing them to respond in a timely manner. It also guides resource allocation by indicating the scale and scope of disease outbreaks. The success and resources of the polio surveillance system have made it an attractive platform for country governments to monitor other diseases.

In theory, adding other diseases to the polio surveillance systems is a simple procedure: surveillance officers look for and report other designated diseases in addition to polio when they review facility records, and community-based health workers are trained to identify symptoms other than paralysis. But in practice, this adds considerably to the workload. In addition to reviewing records, surveillance officers must follow up with each patient who has left the health facility to confirm that the disease has actually been contracted, a cumbersome and time-consuming process that involves tracking down affected individuals, collecting histories, and ensuring samples are packaged adequately to remain viable for laboratory analysis. Many areas have only one surveillance officer, so countries have to be careful not to overburden them with tracking too many diseases. The polio program also needs to ensure that paralysis reporting remains the priority and that surveillance officers do not get pulled in too many different directions before eradication is achieved.



Source: William Mwengee et al., "Polio Redatication Initiative: Contribution to improved communicable diseases surveillance in WHO Africa region," Vaccine 34, issue 43 (October 2016): 5170-5174

On a more macro level, there are two main challenges to sustaining and building a comprehensive global surveillance network. First, there is no centralized authority to take over operations when GPEI disbands, a milestone expected to occur three years after the last reported case of wild poliovirus. WHO is the logical choice, however, and officials and other stakeholders are actively discussing how an expanded surveillance system would best fit into the organization's structure. Secondly, although a fraction of the cost in terms of lives and money of responding to a major outbreak, the system will be expensive and there is no clear source of funding once polio is eradicated and the GPEI phases out. WHO currently is trying to raise $14 billion to cover its expenses for 2019–2023.[3] The GPEI budget includes funding to continue needed polio assets as GPEI winds down, but new funding mechanisms will need to be developed to support polio's infrastructure and personnel into the future.

Other organizations are concerned about how GPEI's dissolution will affect their programs. Gavi, the Vaccine Alliance, relies on GPEI support staff to conduct continued disease surveillance in Chad, Somalia, South Sudan, and other fragile states. The Measles and Rubella Initiative, a global consortium aimed at reducing the incidence of both diseases, depends on polio surveillance resources for its operations. Estimates show that about 70 percent of measles surveillance is supported through polio funds totaling $77 million a year.[4]

Source: NEOC/PAK2017/A. Ahsan

Sustaining Surveillance Funding

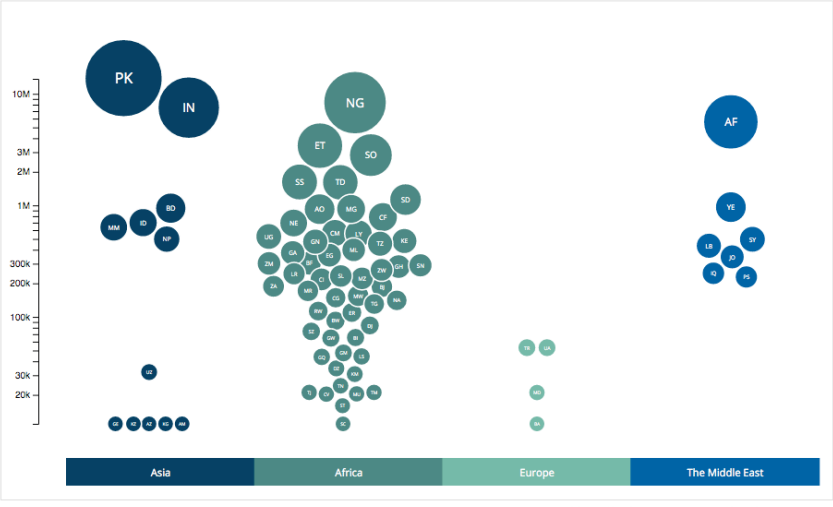
The polio program's surveillance success has been possible because of the significant financial and technical resources devoted to polio eradication.[5] Contributions and pledges to GPEI total $15 billion from 1985-2019. Further, technical, advocacy, and fundraising expertise is provided by an international partnership that includes WHO, UNICEF, the U.S. Centers for Disease Control and Prevention (CDC), Rotary International, and the Bill & Melinda Gates Foundation.[6] However, GPEI will dissolve as a governance structure when eradication is declared, a milestone expected to occur three years after the last case of wild poliovirus is reported.[7]

As the GPEI dissolves, the potential for future surveillance gaps increases, particularly in Africa. In 2016, polio surveillance was funded at $34.5 million in the region compared to $2.6 million for measles and $2.1 million for new vaccine introduction.[8] As of July 2017, GPEI paid for 355 full-time epidemiologists and surveillance officers in Africa and another 2,500 temporary staff to bolster surge capacity. In contrast, staff funded specifically for measles-related activities totaled only seven for the entire region.[9] While surveillance resources are still being prioritized, GPEI funding in Africa dropped from $384 million in 2017[10] to $290.6 in 2018.[11] The decrease in funding resulted in the layoffs of support personnel, which will ultimately affect the system's effectiveness.

Nigeria's recent experience illustrates the importance of total coverage and the difficulty of discovering outbreaks in challenging environments. In 2015, after an entire year with no identified polio cases, Nigeria celebrated its removal from the WHO list

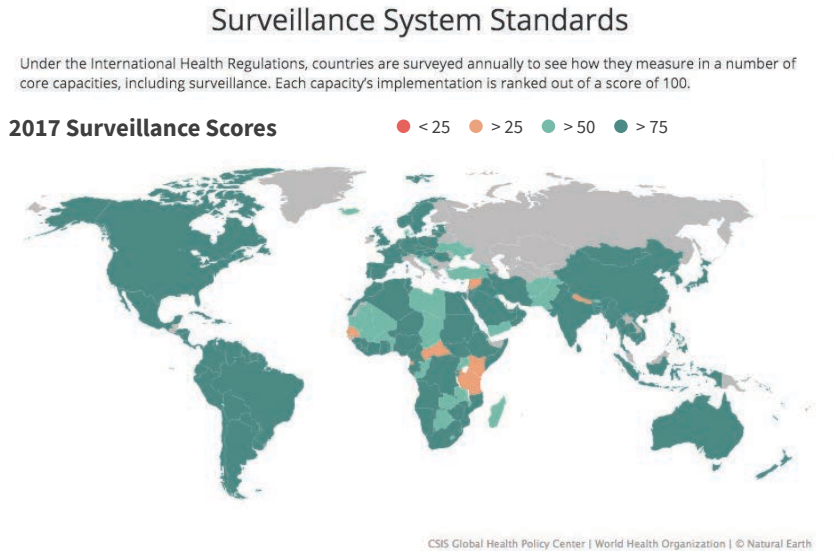
GPEI 2018 Surveillance and Running Costs by Country

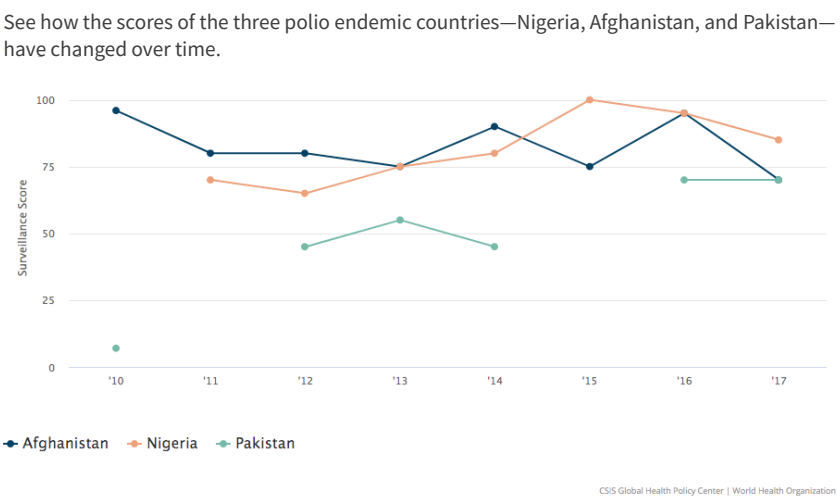
Funding is concentrated among endemic regions, or where countries rely on polio funding to surveil for additional VPDs of concern.



CSIS Global Health Policy Center | Source: World Health Organization

of polio endemic countries. But elation turned to alarm a year later when an area in the north-east of the country—controlled by extremist groups and inaccessible to government and GPEI personnel—reported several cases of polio. Even worse, tests proved that the virus had been circulating silently in the region for more than five years.[12] The event highlighted the need to sustain a comprehensive network of surveillance officers and ensure access to all areas before declaring a disease eliminated.





Maintaining a polio-free world will require vigilance for some time post eradication. Significant attention and resources for polio-related tasks such as vaccination and virus containment in research and manufacturing facilities must continue for at least an additional 10 years after eradication is declared. In particular, high-quality polio surveillance will be critical to ensuring the virus has been irrevocably erased from the world's population and environment. GPEI partners have initiated a series of meetings to develop a successor organization capable of overseeing and monitoring polio assets after the original initiative disbands.

While polio funding dedicated to surveillance is expected to continue at the same level and even increase for the foreseeable future, GPEI already is preparing countries for the initiative's eventual dissolution, when country governments largely will be expected to assume the cost and operation of polio assets themselves. In a process called polio transition, the 16 countries that now receive the bulk of GPEI funding are delineating which polio assets they want to continue, or perhaps expand, and determine how they will pay for them, either through domestic funding or in partnership with donors.[13] Assuming financing will fall short in many resource-poor countries, WHO leadership has been hosting meetings with surveillance stakeholders to develop an investment case for potential donors.[14]

Source: Fabrice Coffrini/AFP/Getty Images

The U.S. and Global Leadership in Disease Surveillance

Polio surveillance is a top priority of the two U.S. agencies involved in polio eradication, CDC and the U.S. Agency for International Development (USAID). Regarded as the world's top health technical agency, CDC works with WHO to set the system's standards and improve its quality and reach, and also provides training and salary support for health workers in the field. CDC funding for the polio surveillance system totaled $40 million in fiscal years 2016 and 2017,[15] out of polio budgets of $169 million and $174 million respectively.[16]

USAID initially funded the development of the AFP surveillance system in the Americas starting in 1988. The agency has funded global polio surveillance since 1996. It considers the surveillance system to be one of the eradication assets most likely to serve other long-term health and development goals and other disease purposes in the future. Around three-quarters of USAID's $59 million yearly polio funding goes to NGOs that perform community-based surveillance and other tasks, and to support for WHO's surveillance work.[17,18]

CDC's Maureen Bartee represents the U.S. Delegation during the 5th GHSA Ministerial Meeting.
Source: Sara Clements/CDC

The U.S. government supports disease surveillance more broadly through the Global Health Security Agenda (GHSA), a multi-national program to bolster country capacity to prevent, detect, and respond to epidemic-prone diseases globally. GHSA includes real-time surveillance as one of its "action packages" to improve global disease response capacity. The package calls on all countries to develop "a functioning public health surveillance system capable of identifying potential events of concern for public health and health security." Further, it calls for "country and regional capacity to analyze and link data from and between strengthened real-time surveillance systems, including interop

erable, interconnected electronic reporting systems." The international impetus behind global health security is a promising vehicle for fostering the political and financial support for a broad-based global disease surveillance system built on the polio platform.

Other organizations are also working together on a global plan to preserve and expand the polio surveillance system, including WHO, CDC, the United Nations Foundation, the Measles and Rubella Initiative, and Gavi. The move is supported by the Transition Independent Monitoring Board, a panel of 11 international health experts convened to oversee polio transition. In its second report, the panel warned that failure to convert the polio system into "the global public good of a modern, dependable, and comprehensive integrated global communicable disease surveillance system" would be a "massive lost opportunity" that would "cost the world dearly."[19]

Source: Christine McNab/UN Foundation

The Future of Disease Surveillance

Reliable, real-time disease surveillance is essential to global health. It allows the earliest possible response to outbreaks, shows immunization teams where the greatest need is, and provides information to decisionmakers tasked with allocating scarce public health dollars. The polio surveillance system has the reach and technical capacity to serve as the foundation for the most effective global surveillance system ever developed. But supporters must address challenges to the system's future. Most critically, this includes designating an appropriate disease surveillance system administrator and ensuring proper funding. As GPEI phases out, it will be up to country governments and global organizations to generate sufficient political will and resources to sustain and expand the polio system. Doing so would provide the best path forward to ensuring outbreaks are detected and contained before they can become widespread epidemics.

SPECIAL THANKS TO:

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Lee Hampton, Senior Specialist, Monitoring and Evaluation, Gavi the Vaccine Alliance

Ellyn Ogden, Worldwide Polio Eradication Coordinator, USAID

Lori Sloate, Senior Director, Global Health, United Nations Foundation

Steve Wassilak, Medical Epidemiologist, U.S. Centers for Disease Control and Prevention

Endnotes

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Polio Labs

By Nellie Bristol & Michaela Simoneau | JUNE 2019

This fifth installment in our series on U.S. support for global polio eradication discusses the role of the Global Polio Laboratory Network in providing the underlying evidence base for disease detection and identification, and as a model for other networks.

Reliable, standardized data are essential for tracking diseases to their source and understanding their movement among populations. For the Global Polio Eradication Initiative (GPEI), this information is key to judging how the eradication effort is faring and where additional resources and attention are needed. The Global Polio Laboratory Network (GPLN) is critical to making those determinations.

Established in the late 1980s, the now 146-lab network is closely integrated with local surveillance systems, ensuring that every country has access to top quality, near real-time disease identification tools. Public health officials use the data to control outbreaks and plan immunization campaigns. The GPEI, with its focus on finding and eliminating every polio case in the world, has developed the GPLN into a uniquely coordinated and effective system. It is now being used as a model for laboratory networks to help prevent and contain rotavirus, measles, and yellow fever.

Tracking Disease to Its Source

Confirming the presence of disease and identifying its type is the first step to containing it. Through its combined analysis of more than 200,000 stool samples per year, the GPLN determines whether individuals are infected with poliovirus and if so, by which of three serotypes.

It can also determine whether the virus is wild or vaccine-derived. Wild polioviruses are those that occur in nature—only 33 cases of wild virus disease were reported last year in just two countries, Afghanistan and Pakistan. In 2018, there were also 105 reported cases of what is known as circulating vaccine-derived poliovirus. These outbreaks occur when the weakened virus included in the oral polio vaccine passes among a population with low immunity and mutates into a disease-causing state.[1] Knowing which type of poliovirus is causing disease is essential to determining the best response.

A polio sample kit.
Source: WHO Pakistan / S. Mughal

In addition to identifying which type of polio a sample contains, the network conducts genome sequencing analysis to pinpoint where a poliovirus originated. By sequencing the genetic code of a virus, microbiologists can search a database of existing samples to determine what specific strains it is related to. This places the virus's lineage into a family tree of sorts to help determine its original source.

Comparing this viral genetic information with population movements can show how the virus is traveling from place to place and also suggest containment strategies. For example, through genetic testing, the GPLN was able to trace polio outbreaks in 20 countries in Africa, the Middle East, and Southeast Asia to a 2003 vaccination ban in Northern Nigeria. Armed with this knowledge, leaders and health workers were able to apply diplomatic and epidemiologic resources to halt the ban and contain the virus globally.[2]

Source: UNF/McNab

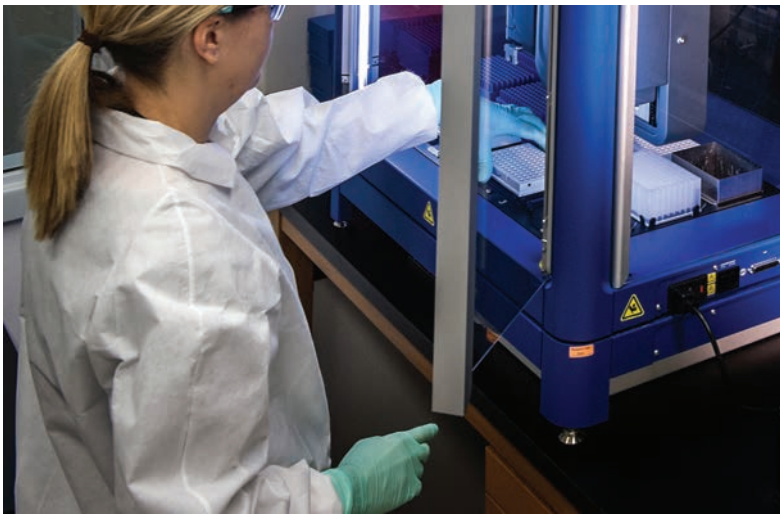
An Effective Collaboration

Efficient operating procedures and a well-trained workforce are critical to the GPLN's success. In a 2014 survey, GPLN personnel praised the network's organizational structure, efficient collaboration and coordination among the various levels, integration with immunization programs, competency and reliability of personnel, and excellent quality assurance and data management.[3] The value staff place on local ownership and a common culture of high-quality work enables the network to provide data that can quickly be translated into programmatic results in even the harshest conditions.

> "There's a certain institutional culture about these polio labs that's unique in that when you get in there and you start talking to people, you feel they are all well connected to the program, that they're all connected to a common goal and that they're really focused on providing the information in a way the program can use."
> *—Dr. Paul Rota, Viral Vaccine Preventable Diseases Branch, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention*

Like many global polio eradication structures and procedures, the GPLN is based on a model developed for the Americas, the first region to eliminate poliovirus in 1991. Laboratories nominated by national authorities are subjected to on-site evaluations, then judged on their availability of suitable personnel and ability to implement needed procedures. The laboratories are layered into a tiered network that comprises 123 subnational or national members, 16 regional facilities, and seven global specialized laboratories.

Sub-national and national laboratories are the first stop for samples, which have been gathered by polio surveillance officers from potentially infected individuals or found in the environment. Here, the virus is separated from the larger sample and confirmed as poliovirus. Larger regional reference laboratories isolate the virus for countries that do not have their own laboratories, perform viral genetic sequencing, and provide training, quality assurance, and other support for national facilities. The seven global laboratories prepare and distribute reagents needed for testing.



Source: CDC / Holly Patrick, MS, MPH

The CDC: Backup Laboratory for the World

While the GPLN is overseen by the World Health Organization (WHO) through regional coordinators, the U.S. Centers for Disease Control and Prevention (CDC) also has played a critical role in its creation and enduring capacity. The CDC serves as one of the seven specialized global laboratories and is the largest with 45 people. The second largest, in India, has 25-30 people on staff.[4]

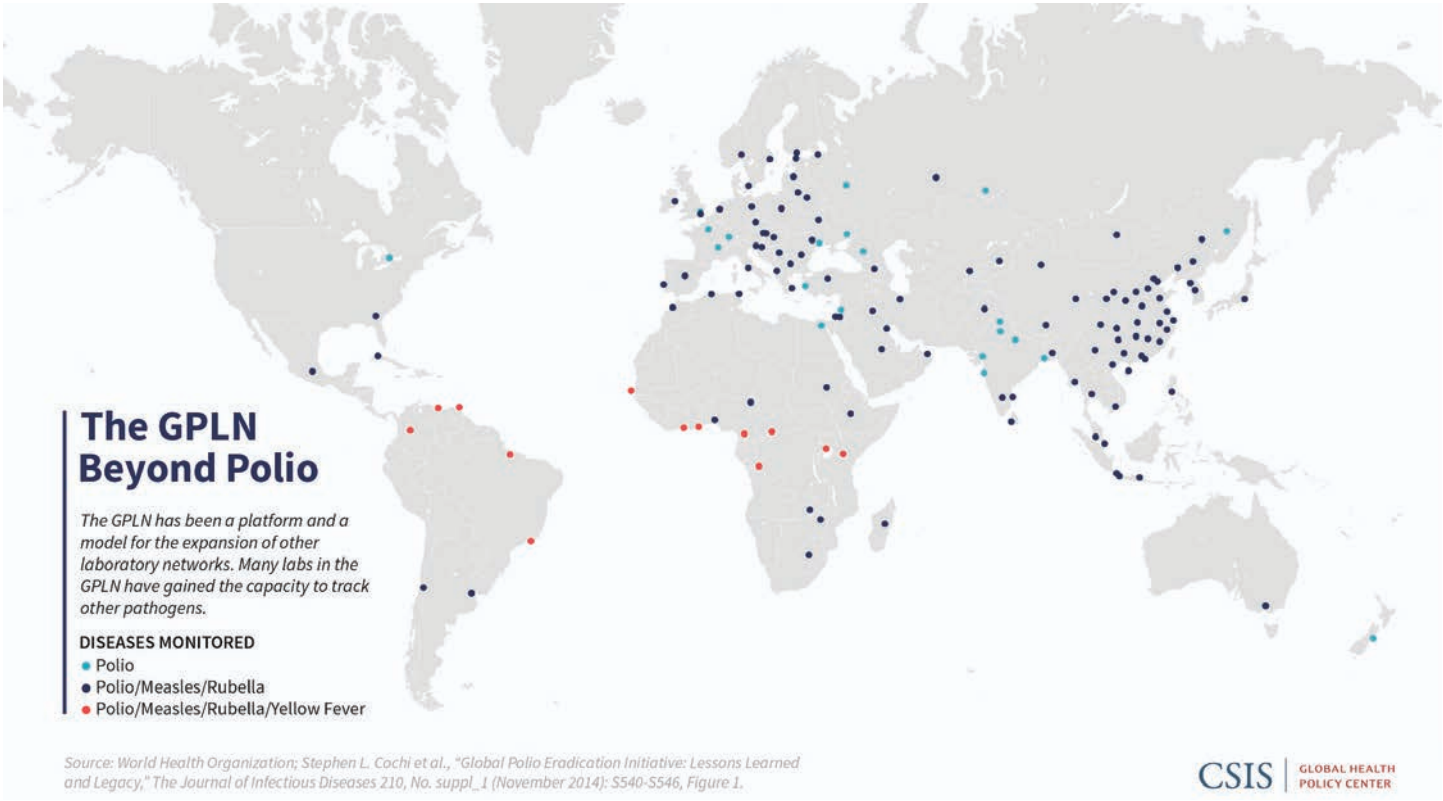
One of the CDC laboratory's main tasks is overseeing quality assurance. It manufactures diagnostic and reagent kits for global distribution. These allow all laboratories to conduct the same level of rigorous testing and ensure that results can be understood by public health officials worldwide. CDC also provides human resource support by conducting training workshops and supplying consulting and troubleshooting advice.

> "Sometimes if you look at a public health problem and you're trying to interpret data from a number of different sources, they might be using different techniques and different strategies. It makes it difficult to interpret it. If we have laboratory networks that are functioning under more or less standard operating systems it helps people to interpret what the results mean."
> *—Dr. Paul Rota, Viral Vaccine Preventable Diseases Branch, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention*

While the network's decentralized structure is focused around regional hubs, CDC plays a role globally as a backup laboratory for much of the world. It performs sample testing for several countries in the Americas and for Yemen, which doesn't have its own laboratory.[5] The CDC laboratory also handles genetic sequencing for Nigeria and previously did work for DR Congo.[6]

Monitoring Other Diseases

In addition to analyzing polio samples, GPLN laboratory staff report spending an average of 30 percent of their time providing surveillance data for other diseases, thus aiding national public health systems in identifying and controlling other health threats. There is room for even more



expansion. With adequate long-term support the GPLN could play a role in helping to reduce the incidence of diseases ranging from severe acute respiratory syndrome to dengue, to Ebola, to Zika.[7]

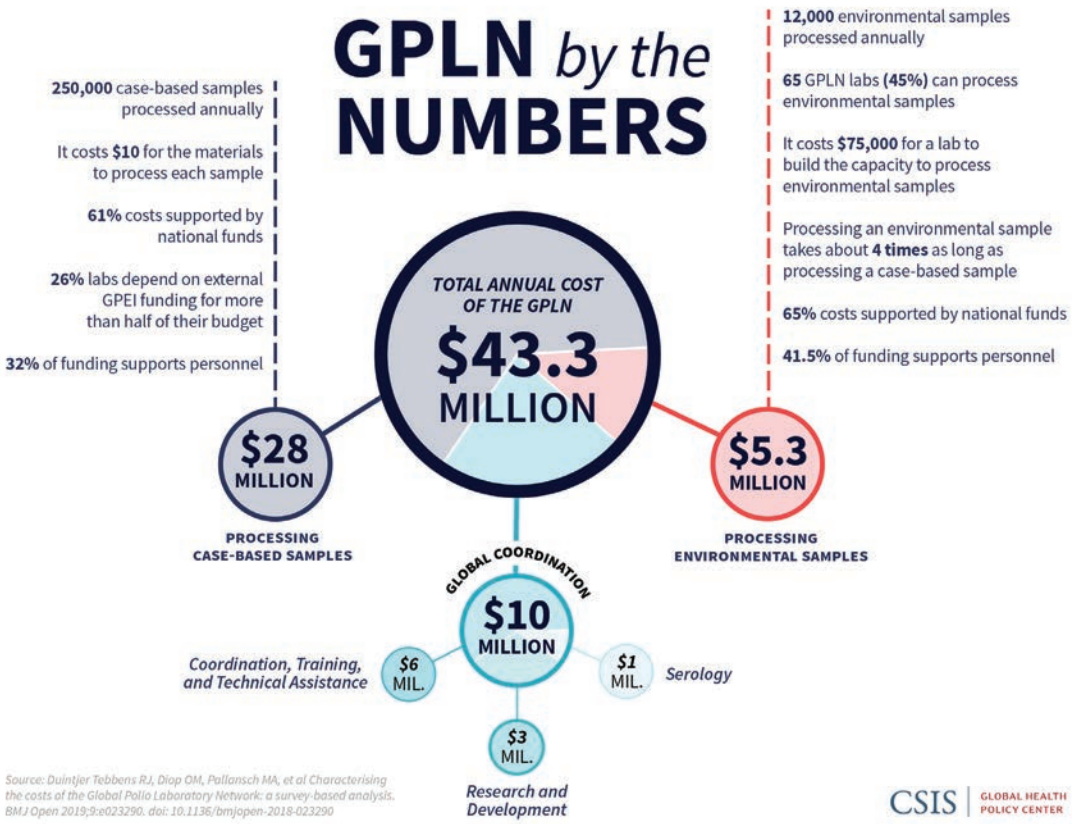
The network is already being used as a model, including for the 700-plus member Global Measles and Rubella Laboratory Network, which uses procedures, training materials, communications strategies, and quality control mechanisms developed by the GPLN for polio eradication.[8] They also share much of the same infrastructure. As with the polio laboratories, measles and rubella laboratories are designed to create information for action, providing quick analyses to public health officials so they can make timely decisions about their vaccination approaches. Both the GPLN and the measles and rubella network serve as models for a variety of other laboratories including those to monitor yellow fever, Japanese encephalitis, rotavirus, and invasive bacterial diseases.[9]

Source: NEOC/PAK2017/A. Ahsan

Sustaining and Integrating the GPLN

> "We know how to build these out. It's just getting the resources to keep them running. It's challenging. If you look at the measles-rubella lab network, they're turning out 400,000 test results a year for a couple million dollars. We're getting a lot of bang for the buck."
> *—Dr. Paul Rota, Viral Vaccine Preventable Diseases Branch, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention*

As with all polio assets, assuring GPLN continuation both for long-term polio needs and to address other health challenges will require political and financial commitment at the national and global levels. A recent study put the network's cost at $43 million a year. While more than half (62 percent) of the funding for processing samples came from national governments, the remainder was provided by global donors, along with an additional $10 million in external funding to support global and regional coordination.[10] While the goal of the GPEI is for country governments to assume most recurring costs of the polio assets they see as valuable, including the GPLN, many countries will need external financial and technical aid in both the short and the long term.



In fact, the GPEI has identified a set of "polio essential functions"—including long-term polio immunization, surveillance, virus containment, and outbreak preparedness—that outlines what countries will need to maintain for at least 10 years after eradication is achieved. The GPLN will play an essential role in these activities and will require funding from global donors to provide equipment, training, technical aid, and salary support for regional coordinators. In addition, once polio is eradicated, the GPLN will be needed to test environmental samples to ensure a polio-free world continues into the future. It also will be tasked with monitoring a handful of facilities that will retain polioviruses for their work—mainly laboratories and vaccine manufacturers—to ensure the virus remains properly contained.

> "Maintenance of global surveillance of vaccine-preventable and other diseases is of the utmost importance for security as well as for health reasons."
> *—Polio Transition Independent Monitoring Board: A Debt of Honour- Third Report, December 2018*

Beyond those requirements, with proper planning and support, the GPLN could also serve as the foundation for a surveillance laboratory system for a range of other diseases. The network's ability to forge interregional relationships is cited as a potential boon to the Global Health Security Agenda, a multi-national consortium aimed at improving global capacities to prevent, detect, and respond to infectious disease.

> "There are polio assets that are already being used for other things…you're just sort of cobbling together from the leftovers, so figuring out how those are going to be supported going forward is going to be critical."
> *—Dr. Steve Oberste, Chief, Polio and Picornavirus Laboratory Branch, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention*

Stakeholders in the laboratory system imagine several options for the GPLN's continuation: as an organization devoted to specific diseases, integrated into existing laboratory networks, or as the core for broader support of public health activities.[11] WHO is leading a process now that will lay out transition strategies for the network and other polio assets.

Source: CDC / Holly Patrick, MS, MPH

Preserving and Extending Polio's Disease Tracking Capabilities

> "The relationship between polio laboratories worldwide is quite unique because if you look at every kind of politically complicated region, political issues don't actually get reflected in laboratory working. Beyond the fact that there are political sensitivities between countries, when we talk about polio eradication, we have the same goal."
> *—Dr. Ousmane M. Diop, Coordinator of the Global Polio Laboratory Network, World Health Organization*

Through its many donors, including the U.S. government, the GPEI has already made the initial investments in developing a top-notch disease monitoring system with the capacity to not only detect polio but also to contain the spread of other diseases. To maximize that investment, U.S. decisionmakers should proactively support the GPLN to ensure a polio-free world and enhance global health security.

SPECIAL THANKS TO:

Dr. Ousmane M. Diop, Coordinator, Global Polio Laboratory Network, World Health Organization

Dr. Steve Oberste, Chief, Polio and Picornavirus Laboratory Branch, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention

Dr. Paul Rota, Chief, Viral Vaccine Preventable Diseases Branch, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention

Karen Mason, Associate Director for Policy, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention

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Orchestrating Global Polio Eradication

By Nellie Bristol & Michaela Simoneau | SEPTEMBER 2019

This sixth installment in our series on U.S. support for global polio eradication explores the evolution of the Global Polio Eradication Initiative, discussing how its multi-layered governance model, while unwieldy at times, has proven the value of partnerships through its success.

Source: World Health Organization

A Unique Alliance

The Global Polio Eradication Initiative (GPEI) is one of the largest public health programs ever.

Over the last 30 years, the program has engaged millions of health workers and volunteers, delivered polio vaccines to the most remote corners of the planet, and managed billions of dollars. The organizational and logistical challenges have been enormous as the five core partners worked with national governments and other collaborators to extinguish the polio virus in every part of the world.

> "GPEI as it is now… really is a unique governance structure which no other health program has been able to follow… I'm sure that to the extent that eradication has been successful, it's due not least to this governance structure."
> *– Bjorn Melgaard, Independent Global Health Policy Consultant*

A child in Vanuatu is vaccinated against polio.
Source: UNICEF via Getty Images

The World Health Organization (WHO), UNICEF, Rotary International, the U.S. Centers for Disease Control and Prevention (CDC), and the Bill & Melinda Gates Foundation lead the initiative through a unique governance structure that evolved organically based on the needs of the program and the desires of partners and major donors. The resulting multi-layered, somewhat bureaucratic alliance has been highly effective despite its flaws, reducing the number of wild polio cases worldwide by more than 99 percent.

World Health Organization meeting in 1988 that resulted in the founding of the GPEI. Source: World Health Organization

Humble Beginnings

In 1988, a World Health Assembly resolution committed all countries to global polio eradication. The initiative was launched as a small program within the WHO's immunization division, the Expanded Programme on Immunization (EPI). It was led officially by WHO but supported through an informal alliance with the original partners, UNICEF, CDC, and Rotary. The number of polio cases fell rapidly at first, as countries with solid immunization systems added the vaccine to their schedules or used their existing networks to conduct national polio immunization campaigns.

> "One of the things that makes [the GPEI] unique is that it wasn't organized initially around a governance structure and it continues to be unconventional. At the start, it was a freeform alliance of different organizations each raising money."
> *– Ellyn Ogden, Worldwide Polio Eradication Coordinator, U.S. Agency for International Development*

The initiative encountered its first obstacles when it began to focus on regions with weaker health infrastructure that had fewer health workers and financial resources. Since these countries lacked strong existing immunization networks, the task of reaching every child required

In Bangladesh, a doctor and her assistant prepare to take polio vaccines via rickshaw to families in local slums.
Source: Gavi

the program to organize and fund vaccination campaigns itself, including resource-intensive house-to-house vaccine delivery.

As the eradication program's responsibilities grew, so did its need for financing. When the program began, planners predicted the task of polio eradication would cost $155 million and be completed by 2000.[1] Instead, its budget has hovered around $1 billion a year since 2011, and total costs are now $17 billion over its lifetime.[2]

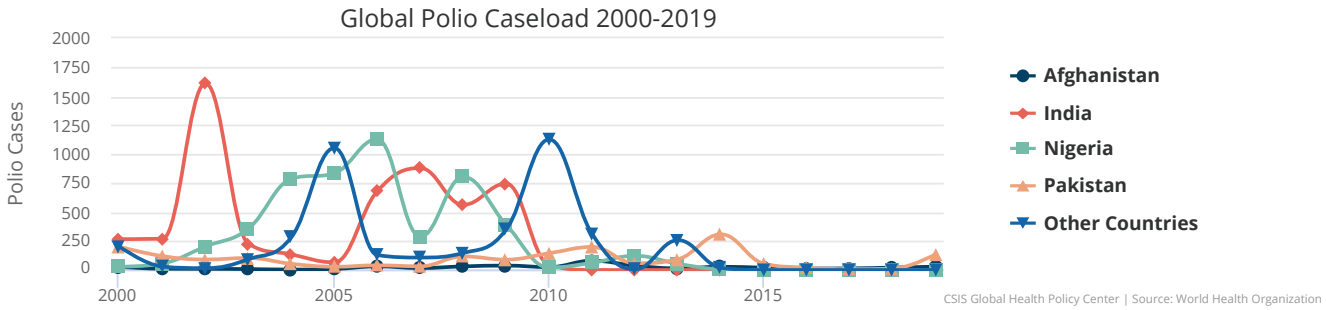
By 1998, the program was still struggling to meet its goals. WHO increased its advocacy and fundraising efforts and hired a director devoted specifically to polio eradication. With new management and focus, the program picked up steam. In order to gain visibility and develop its own fundraising brand, the GPEI began to operate separately from the EPI under the name of the Global Polio Eradication Initiative.

Source: Jean-Marc Giboux/Getty Images

Finding a New Path

In the mid- to late-2000s, the initiative stalled again. The GPEI had been missing targets and struggling to extinguish the virus in the last few endemic countries: India, Afghanistan, Pakistan, and Nigeria.[3] GPEI management was criticized for its lack of transparency and being unduly positive about the program's progress. Some criticized the initiative for its overly centralized, inflexible operational style that allowed it to "stick doggedly to a particular course of action, regardless of whether it was working or not."[4]

These issues, combined with a failure to achieve eradication, led to dissatisfaction among some partners, which now included the Gates Foundation. The partners commissioned several management reviews starting in 2010 and developed new oversight bodies. These included the Polio Oversight Board (POB), a panel of the top executives from each of the core partners, and



the Polio Partners' Group, which pulled together a range of donors and other stakeholders. An accountability mechanism also was added—the Independent Monitoring Board of the Global Polio Eradication Initiative (IMB).

The IMB began issuing assessments that often were critical of GPEI management. For example, in a 2011 report it asked, "How can it be that individuals known to be tired and ineffective are allowed to remain in key leadership positions?"[5] WHO ultimately reconfigured its polio team, the other four core partners took on stronger decision-making roles, and governance became more horizontal and consensus-based.

> "If you look back at the structures we had to accommodate, all the different partners and agencies that wanted to have a stronger voice, it made [the GPEI] evolve into a fairly unwieldy bureaucracy because of the expectation that each agency would be represented on every level of technical as well as decision-making bodies."
> *– Brent Burkholder, Independent Global Public Health Consultant*

The structure now operates without a central authority, and all the partners spend an enormous amount of time discussing issues and deciding on a course of action as a group. Despite the loss in efficiency, the GPEI has continued to improve eradication infrastructure while ensuring continued partner commitment.

Source: Asif Hassan/AFP/Getty Images

Geopolitical Hurdles

In the late-2010s, the program began facing fatigue on the part of some country-level administrators and resistance from some parents of children repeatedly approached by polio vaccinators.[6] However, a more pressing concern has been the national and geopolitical obstacles in the remaining endemic countries that limit its access to unvaccinated children.

In April, the Afghanistan Taliban banned WHO from operating in its territory.[7] The Pakistan program has suffered deadly violence against polio vaccinators fed by unfounded rumors about the vaccine and by the program's (false) association with the U.S. hunt for Osama bin Laden.[8] Insecurity and insurgent activity by Boko Haram in northern Nigeria has blocked both vaccination campaigns and disease surveillance efforts.

Pakistani children look at a health centre torched by a mob following rumours of reactions to polio vaccination in April 2019. Source: Abdul Majeed/AFP/Getty Images

> "At this point, a fundamental issue preventing eradication is lack of access to unvaccinated children. It's not that we merely need a better manager or improved supply chain to achieve eradication—the fundamental issue is lack of access in areas controlled by anti-government elements."
> *– Amb. John Lange, Senior Fellow, Global Health Diplomacy, United Nations Foundation*

As the GPEI attempts to respond to new challenges, management entities—largely task teams and working groups—have proliferated. In a somewhat ironic result, the GPEI governance structure has grown dramatically, even as its global caseload has shrunk. This reflects the complexity of the polio endgame. The GPEI still labors to reach its ultimate goal, and it is unclear whether the strategic management expansion has truly helped.

> "The reasons that polio has not been eradicated really aren't related to the organization structure in Geneva. So no amount of restructuring in Geneva will get us to eradication. And they know that."
> *– Mara Pillinger, PhD Candidate, The George Washington University*

In October 2018 an independent team commissioned by the IMB to review progress in the remaining endemic countries questioned whether "this elaborate structure remains fit for purpose, or whether it may now be a drag on country level efforts."[9] Others note that much of what is hindering eradication at this point is beyond the control of program management. "The fight to eradicate polio will be won (or lost) on the ground," one researcher noted. "Even if GPEI HQ were to implement the most successful change initiative of all time, the program's key security, political, and socio-cultural challenges can only be solved at the country level."[10]

Source: Rizwan Tabassum/AFP/Getty Images

Private-sector Partners

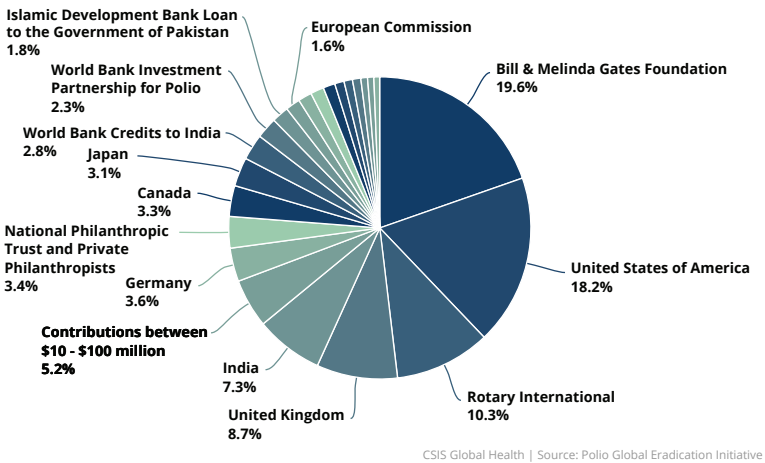
By working at both the country and global levels, private-sector organizations have driven and sustained what is essentially a public heath campaign. Rotary, an international service organization with 1.2 million business and professional members, committed to polio eradication as an organizational goal in the mid-1980s.

So far, Rotary has donated $1.9 billion to the effort. In addition, Rotary members have volunteered for local vaccination campaigns and advocated for the initiative at all levels of government. Despite being a private-sector organization, Rotary has been a key partner in GPEI management from the very beginning.

The Gates Foundation first joined the GPEI in the early 2000s as a donor but has since become one of its most active partners. Polio eradication is now one of the Gates Foundation's top priorities, and Bill Gates personally urges government officials and donors to maintain their commitments.

In addition to providing technical, policy, and programmatic support, the foundation is now the GPEI's top donor, with contributions totaling $3.6 billion as of the end of 2018. By comparison, the U.S. government has contributed $3.3 billion over the past 30 years.[11]

GPEI Contributions by Donor 1985-2018



CSIS Global Health | Source: Polio Global Eradication Initiative

The Gates Foundation notes that it plays a unique role in the GPEI because it has the "ability to contribute by taking big risks and making nontraditional investments. Examples include our investments in vaccine research and our establishment of emergency operations centers in Nigeria, Pakistan, and Afghanistan."[12] With its enormous resources and flexibility as a private-sector entity, the Gates Foundation has been able to identify and respond immediately to program gaps that the frequently cash-strapped WHO, CDC, and UNICEF would have been hard-pressed to address.

Source: UNF/McNab

A Broader Focus

While Rotary and the Gates Foundation play a pivotal role in the GPEI, some speculate that the program's high visibility and association with U.S. organizations may now be hurting the effort. The program has been struggling to extinguish the virus in areas of Pakistan and Afghanistan that have a high concentration of anti-Western sentiment. While U.S. support will remain critical to successful eradication, the current environment seems to call for yet another governance and communications shift in order to lower the GPEI's profile in these challenging geographies.

This realignment will also require integrating polio vaccination more into country immunization programs rather than operating through separate vaccination campaigns. In exploring that option, the POB has added the executive director of Gavi, the Vaccine Alliance, to its membership. Gavi focuses on the provision of a range of vaccines to low-income countries.

> "The governance structure of a mostly vertical program such as polio eradication has all of these difficulties as it comes very close to reaching its goal, but the only way it can really succeed and sustain the gains is through a horizontal routine immunization program that will maintain essential polio functions."
> *– Amb. John Lange, Senior Fellow, Global Health Diplomacy, United Nations Foundation*

This new partnership has required some adjustment but to many is long overdue. The IMB recommended as early as October 2014 that the GPEI make Gavi part of the partnership as a way to boost its commitment to broader immunization systems. "Although it appears prominently in the strategic plan, routine immunisation is treated by the main body of the polio programme as if it is some side issue – a 'nice-to-do' not a 'need-to-do'," the IMB noted. "This is short-sighted. It may, in Pakistan, be key to reaching those children whose parents are fed-up of repeated polio-only campaigns but would willingly accept a package of vaccinations for their children."[13]

The Power of Partnership

Despite eradication's many challenges and the GPEI's potentially cumbersome structure, the GPEI continues to operate effectively. Its unique use of a consensus-based "club governance model" allows partner principals to operate as a unit separate from their parent organizations.

Source: United States Mission Geneva

"The GPEI is an impressive management entity, with a cohesive amalgam of partners that has embraced a common goal and ceded policy-making powers to this body in pursuit of that goal," noted the Transition Independent Monitoring Board, a panel convened to oversee the integration of polio infrastructure into country health systems. Through this alliance, the initiative "has created a leadership and accountability function that is unprecedented in global health," the board added.[14]

The longstanding engagement of all partners and their leaderships' direct buy-in through the POB has given the polio program unmatched commitment both to the goal of eradication and to the partnership itself. "The core partners consider themselves as being in a long term, close-knit relationship. They are in this together until the end; they will succeed or fail as a unit; and they are committed to collaborating to get the job done."[15]

Indian schoolgirls hold signs celebrating their country being polio-free in 2012.
Source: Noah Seelam/AFP/Getty Images

> "There is a commitment in the organization that goes beyond anything else that I've seen in any other public global health program."
> *– Bjorn Melgaard, Independent Global Health Policy Consultant*

Over time, the GPEI has proven the value of strong partnerships where each organization has an equal say and illustrates the vital role the private sector can play in public health. It also reflects how governance changes, painful as they may be, are part of a necessary evolution to respond to realities on the ground.

The last chapter for polio eradication remains to be written, and other reforms may be necessary before the program can succeed. However, the GPEI's commitment to inclusive management will continue to offer important lessons for the successful implementation of other global health programs.

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Mara Pillinger, PhD Candidate, The George Washington University

Michael H. Merson, Wolfgang Joklik Professor of Global Health and Director, SingHealth Duke-National University of Singapore Global Health Institute

Michael McGovern, Chair, International PolioPlus Committee, Rotary International

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Innovation for Eradication

By Nellie Bristol & Michaela Simoneau | JULY 2020

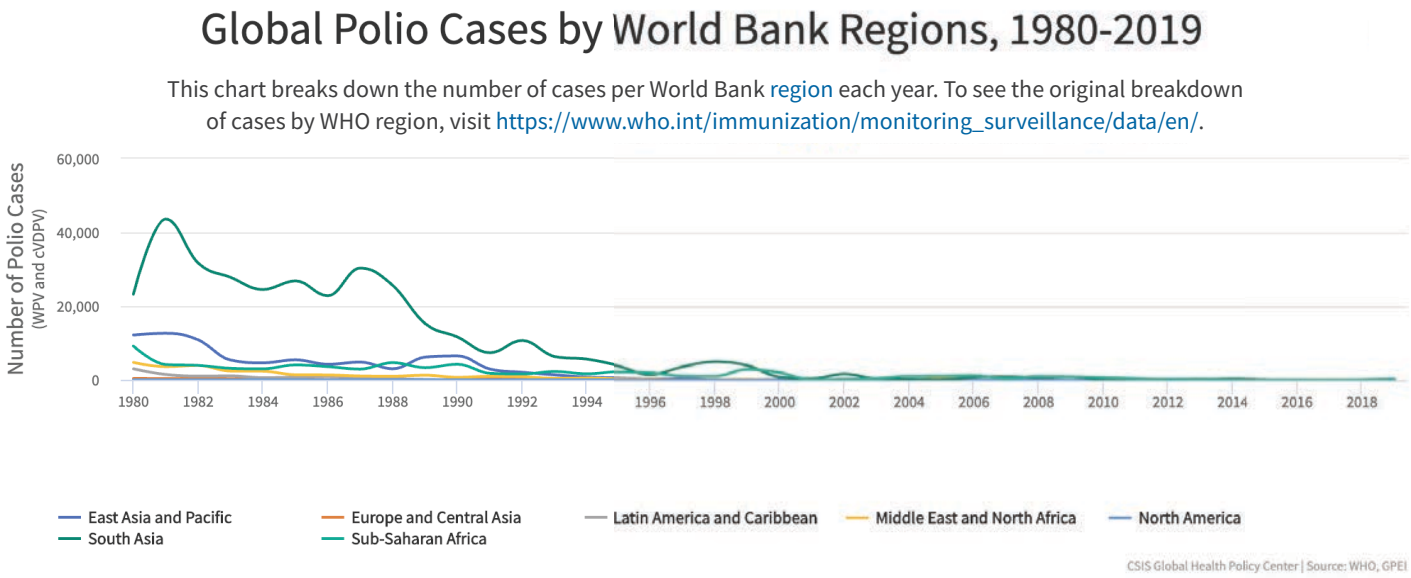
This seventh installment in our series on U.S. support for global polio eradication explores how ongoing research has allowed the eradication program to learn and adapt in real time, overcoming new obstacles and building a body of knowledge that can be applied to other global health campaigns.

Introduction

When the World Health Assembly committed all nations to the global eradication of polio in 1988, it did so thinking there was a solid game plan that would surely lead to success, if not by the original 2000 target, then soon after.[1] After all, developed countries already had made substantial progress against the disease. Furthermore, the Americas region, which included countries at all economic levels, was on the verge of scoring a major public health victory by eliminating the disease in under a decade.[2]

Source: Nigeria/WHO

> "Certainly, the program has had different phases where research was not needed. We had tools, we had two good vaccines. One-hundred countries eliminated the circulation of polio quite readily with the application of the basic approaches."
>
> — *Mark Pallansch, Director, Division of Viral Diseases, U.S. Centers for Disease Control and Prevention*



But after substantial early successes, which drove down the number of cases by more than 99 percent, the program met unexpected obstacles as it strove to vaccinate all children everywhere. In addition to encountering problems with the polio vaccine itself, the Global Polio Eradication Initiative (GPEI) struggled to reach communities that were constantly on the move, disenfranchised from their own governments, or plagued by insecurity.

These developments made it clear that some of the original assumptions about polio operations were overly simplified or incorrect and could threaten the eradication goal itself. In response, the GPEI, including the U.S. Centers for Disease Control and Prevention (CDC), and other eradication supporters, such as the U.S. Agency for International Development (USAID), began funding a variety of research projects to better understand how to move the initiative forward.

Source: UNICEF/Serge Wingi

But as progress continued to stall, it became apparent that a more coordinated approach was needed. In response, the GPEI established the Polio Research Committee in 2008, leading to the rapid implementation of program innovations.[3] Research conducted for polio eradication led to changes not only in vaccination approaches but also in operations and communications. Many of these innovations developed for polio eradication also have been applied to other public health programs. Ongoing research will continue to be critical to the initiative as it faces its toughest challenges in the final push for eradication.

A Proven Strategy Hits New Obstacles

Global polio eradication was predicated on a four-pronged approach:

1. Strengthening immunization systems, which include polio vaccination as part of essential childhood immunizations;
2. Conducting mass polio vaccination campaigns using the inexpensive and easily administered oral polio vaccine (OPV);
3. "Mop up" activities to ensure vaccination of any children missed through the first two approaches; and
4. Strong surveillance systems able to detect any new cases and trigger a rapid response.[4]

While groundbreaking scientific research had made the initiative possible, continuing studies were not originally prioritized by the GPEI since it already had a proven approach and program resources were needed to support an ongoing wave of vaccination campaigns.

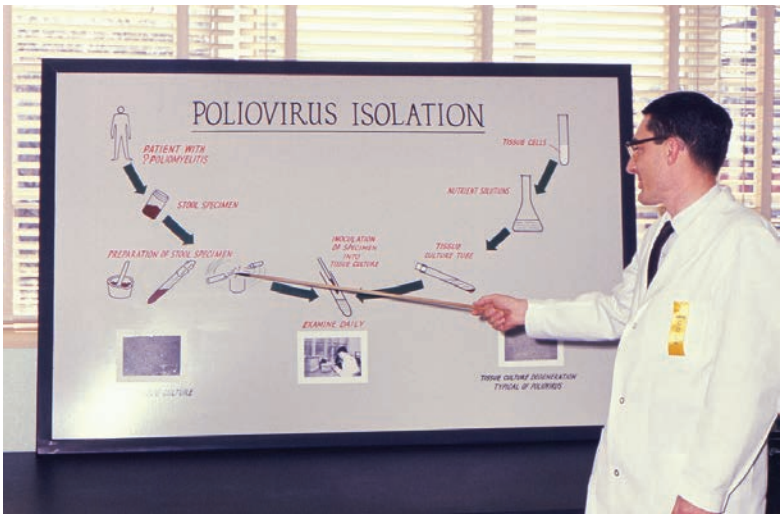
Yet despite the strategy's success throughout much of the world, daunting challenges developed, particularly in areas with weak immunization systems and low polio immunity:

- A growing number of polio cases emerged stemming from the live virus OPV;[5]
- The three vaccine doses deemed sufficient to immunize children in most of the world were ineffective in poor areas of India with inadequate sanitation;[6]
- The program struggled to reach nomads and refugees who typically were underserved by traditional primary health services;[7] and
- As the initiative dragged on, more communities began to refuse the vaccine.

Members of the Afghanistan polio eradication initiative go door to door on their mission to vaccinate every child.
Source: WHO Afghanistan/Tuuli Hongisto

As the downward trend in polio cases flattened out in the first decade of the 2000s, it became evident that fresh ideas were needed. The GPEI began to devote substantial funding, focus, and attention to polio research, which has produced findings related to vaccine dosing schedules, disease tracking and surveillance, and negotiating social norms.[8]

The GPEI's experiences show that devoting resources to social research is as critical to public health efforts as focusing on more technical issues. Overall, the biggest lesson is the need to dedicate funding and attention to research throughout a disease eradication effort to effectively adapt program operations to the range of biomedical and cultural situations found throughout the globe.



Source: CDC/Wallace Richter

A Well-researched Disease

> "The GPEI invests in research and innovation as vital assets to inform and optimize polio eradication efforts."
> — *Abhijeet Anand, MBBS, Epidemiologist, Polio Eradication Branch, CDC's Center for Global Health*

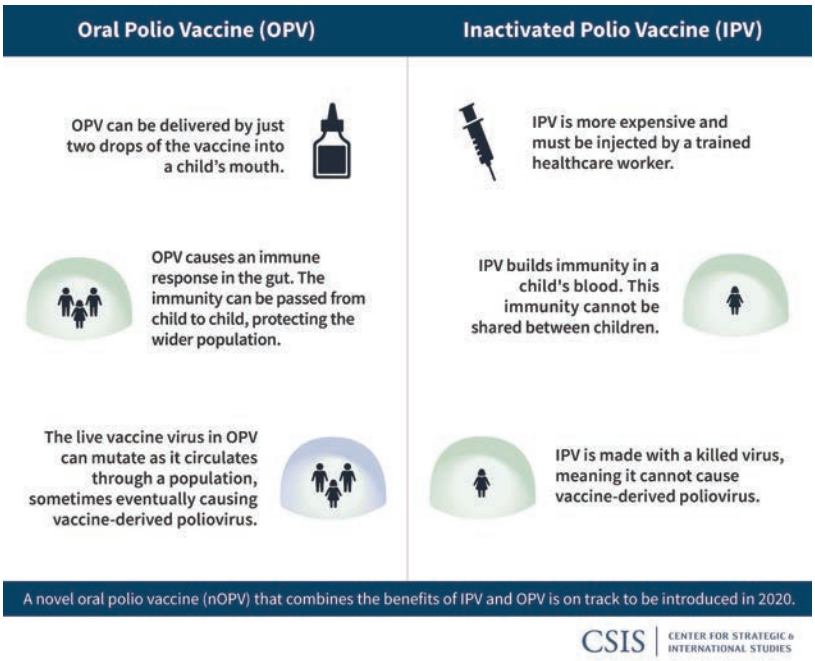
The polio virus is one of the most thoroughly researched pathogens of the modern age, principally because of its structure. It is a simple virus that is easy to work with in the laboratory, and because the disease is vaccine preventable, scientists can work with it safely. It proved to be an ideal model for researchers at the CDC, the World Health Organization (WHO), and elsewhere to understand how viruses worked and how they affect the host.

Starting in the mid-1970's, even before the global eradication effort began, researchers were able to distinguish between wild and vaccine-derived poliovirus and understand how the virus mutates over time. With the development of genome sequencing technology in the early 1980's, researchers at the CDC were able to determine the geographical origin of a particular virus by studying how it mutated and through those discoveries follow its path to other regions. This allowed the GPEI to pinpoint the origin of outbreaks in areas that previously had been polio-free and helped set vaccination strategies.

Genome sequencing is now a routine part of viral research and disease surveillance, tracking global circulation of not only polio but other viruses such as measles and yellow fever.[9]

Optimizing Polio Vaccines

But even with advanced knowledge and proven approaches, further innovations were needed. Research conducted for the initiative in the early 2000's helped devise strategies to ensure children in high-risk areas of India were able to achieve immunization levels required to stop viral transmission. Researchers discovered that children in these areas were subject to other intestinal diseases that hindered the polio vaccine's effectiveness.[10] As a result, they required 8, 10, and sometimes more vaccinations to be fully protected.[11] By better understanding these interactions, the GPEI tinkered with the vaccine's formulation to make it more effective in that environment.[12]



Research led to other innovations as well. As part of an eventual phased global withdrawal of OPV to stop the circulation of the vaccine-derived disease, the program recommended that all countries provide at least one dose of inactivated poliovirus vaccine (IPV).[13] IPV protects individuals from polio but is a more expensive, injectable vaccine requiring a more complex administration regime and does not provide the type of immunity found to be most effective in developing countries.[14]

Unfortunately, IPV manufacturers were not able to provide the supply needed in a timely manner.[15] Research funded through the GPEI discovered the minimal amounts of IPV required per dose to achieve immunity and pioneered dose sparing administration methods, allowing the initiative to ensure the scarce vaccine reached the maximum number of children possible.[16] Some of these new techniques are now being used for hepatitis B and yellow fever vaccines.[17]

Stemming Vaccine-derived Polio

> "The long-term use of traditional OPV is not compatible with polio eradication."
> — *Ondrej Mach, Polio Research Team, World Health Organization*

Source: UNFoundation/Christine McNab

The initiative now is conducting research to address the Achilles heel of the entire eradication effort: vaccine-derived poliovirus. OPV, the primary vaccine used by the initiative, is a weakened live virus vaccine. In populations with low vaccine coverage, the vaccine virus can be passed among unimmunized populations, mutating as it circulates until it reaches a state where it can cause outbreaks with the same paralyzing effects as those of wild poliovirus.

In an effort to reduce the number of vaccine-derived cases, the GPEI in 2016 re

moved from OPV the component that causes the majority of outbreaks, which immunized against the type 2 strain of polio. The program began using a bivalent OPV instead that only inoculated against polio types 1 and 3.[18] While the initiative expected to see some additional cases of type 2 vaccine-derived polio after the vaccine switch, it instead is facing an unexpectedly large number outbreaks, mostly in Africa.[19]

Researchers are now fast-tracking development of what is called novel OPV (nOPV), a more stable form of the oral vaccine aimed at type 2 polio that is less likely to mutate into a disease-causing state.[20] "GPEI officials are counting on the vaccine, hoped to be available in 2020, to halt the advent of the vaccine-derived disease and move the initiative into its final stages.[21]

> "The research going into [nOPV] goes back more than 15 years… this is an example of multiple laboratories, including the CDC polio labs, doing basic research into the nature of polio replication that came together with a practical end point of a potential new vaccine."
> — *Mark Pallansch, Director, Division of Viral Diseases, U.S. Centers for Disease Control and Prevention*

Introduction of nOPV will be paired with expanded and simplified environmental surveillance techniques which can detect and categorize poliovirus in sewage samples. Improved environmental surveillance will tell the GPEI where poliovirus is present and whether the sample is wild or vaccine-derived. It also will be able to show whether the correct vaccine is being used in a particular area and if programmatic changes are required to boost immunity.[22]

Source: CDC/Holly Patrick, MS, MPH

Prioritizing Innovation: The Polio Research Committee

> "In the early years there was no research committee . . . we were trying to get a handle on some of the gaps early on. We funded [projects] that we thought would improve the quality of the program."
> — *Ellyn Ogden, Worldwide Polio Eradication Coordinator, U.S. Agency for International Development*

Individual members of the GPEI partnership—including the CDC, Rotary International, UNICEF, the World Health Organization, the Bill & Melinda Gates Foundation, and recently Gavi, the Vaccine Alliance, as well as donors such as USAID—had been supporting and conducting sporadic research projects even before the initiative began. But the challenges facing the initiative led the GPEI to establish a more formal process to streamline and prioritize as a way to drive program progress.

A lab technician in Kenya works with samples to test for poliovirus. Source: WHO Kenya/L. Dore

The Polio Research Committee (PRC), established in 2008 and led by the WHO, CDC, and Bill & Melinda Gates Foundation, is considered by many in the GPEI to be a game-changer for the initiative.[23] It ensures money is set aside to encourage ongoing innovation and streamlines the path from discovery to application in the field. Findings are discussed at PRC meetings and can be incorporated into operations even before they go through the lengthy process of peer-reviewed publication. Furthermore, since funding is specifically earmarked for research, the resources are guaranteed and cannot be diverted to program operations or other needs.

> "The polio program has benefited from dependable donor funds that have allowed it to consistently improve program strategy based on research that has been responsive to the changing realities on the ground."
> *— Abhijeet Anand, MBBS, Epidemiologist, Polio Eradication Branch, CDC's Center for Global Health*

Comprised of experts in virology, epidemiology, sociology, and public health, the committee meets twice a year to publicize priorities, review proposals, and recommend projects for funding. Most funding for research is provided by the International PolioPlus Committee of Rotary International and by the Bill & Melinda Gates Foundation, with some specific funding from the CDC.[24] The bulk of approved projects focus on clinical measures, vaccine optimization, and operations improvements.[25] The PRC gives preference to relatively short-term research (12-24 months) that will have substantial immediate impact on eradication progress.

In addition to the PRC structure, several organizations—both core partners such as CDC and UNICEF and other collaborators and donors such as USAID—continue to conduct their own research on a more project-by-project basis.

THE U.S. GOVERNMENT & POLIO RESEARCH

Different arms of the U.S. government have contributed substantial new knowledge in support of global polio eradication. The CDC, a core member of the GPEI, has conducted its own research focused on epidemiology, vaccine efficacy, and improving operations during vaccine campaigns.[26] With their premier cadre of scientific expertise and strong bilateral partnerships with labs around the world, CDC staff have led landmark studies to track the spread of the virus, optimize vaccine schedules to improve population immunity, and implement the vaccine "switch" to bivalent OPV.[27] Most recently, CDC scientists have helped lead efforts to develop and test candidates for type 2 nOPV, and they continue to work on novel type 1 and 3 vaccine candidates as well.[28]

USAID, by contrast, has focused more on operational research, "recognizing and raising the importance of mobile populations, cross-border coordination, communications, and the need for women vaccinators."[29] Its efforts extend beyond polio to address other immunizations, water and sanitation, breastfeeding, and handwashing and fit into broader goals around disease surveillance and outbreak response.[30] The agency has worked with the CORE Group Polio Project and a variety of other NGOs to emphasize this communication-based approach to polio eradication.[31]

Source: WHO Afghanistan/Tuuli Hongisto

Expanding the Research Portfolio

> "It went beyond just knowing about the disease. It went to looking at attitude and intentions. Then to follow through and look at actual coverage. Actual acceptance of the vaccine."
> — *Rustam Haydarov, Senior Communication Manager, Polio, Health Section, Program Division, UNICEF*

While the PRC has been pivotal in encouraging needed research, it and the GPEI overall have been criticized for focusing too much on biomedical approaches at the expense of social research. The bulk of research by the GPEI and other eradication supporters focused on understanding the poliovirus, improving surveillance, and optimizing the vaccine,[32] but the program needed better guidance to improve communications and operations. The need for a broader

research portfolio became apparent as the initiative faced increasing vaccine fatigue and refusals and struggled to reach mobile populations and disenfranchised and remote communities.[33]

Vaccinators traverse rural Pakistan by camel to reach villages with otherwise inaccessible children. Source: UNICEF/PAK2016/Waseem Niaz

The GPEI partners realized that negotiating social norms and weaving vaccination into the existing fabric of these communities would be critical to lasting success. They also discovered that being able to identify and quantify social obstacles in a scientific manner lent credence to the findings, making them more palatable to the largely medically-oriented GPEI operations officials.

UNICEF and USAID have supported and partnered with institutions such as Harvard University in using surveys to reveal and quantify community norms that were hindering acceptance of the polio vaccine.[34] The studies identified illiteracy as a major barrier to knowing about specific vaccine campaigns and gaps in understanding the lack of a cure for polio, spurring development of alternative forms of communication. UNICEF worked with BBC Media Action to produce vaccine information in a variety of new formats, including radio and television, to assess their effects on vaccine uptake.[35] These studies also revealed the importance of working with local leaders to gain community trust of the vaccine and the organizations behind the GPEI.[36]

Religious leaders are trained on the basics of social mobilization, communication, health, and hygiene. They also learn about the religious justifications for polio vaccination. Source: WHO Pakistan/Dawood Batozai

Anthropological research became critically important as the GPEI struggled to vaccinate nomadic and mobile populations. Such research was able to illuminate social norms among different populations that allowed the program to provide better access to vaccination. For example, a study of Somali pastoralists led the program to offer vaccination at cattle water points and markets, doing so in concert with veterinarian services.[37] The research has now been applied by programs focused on tuberculosis in the Horn of Africa.[38]

In Pakistan, one of the three countries where wild poliovirus remains endemic, research helped formulate hyper-local programming to address vaccine acceptance on a neighborhood-by-neighborhood basis, another set of findings now being adapted for broader immunization programs.[39] These tailored programs will be essential as GPEI becomes increasingly focused on the remaining wild polio hotspots during the eradication endgame.[40]

Source: Adek Berry/AFP/Getty Images

Eradication Needs Innovation

> "If there is one lesson from polio that is broadly applicable, it's to never assume you know enough . . . there is no reason, even going into an eradication effort, to stop research."
> — *Mark Pallansch, Director, Division of Viral Diseases, U.S. Centers for Disease Control and Prevention*

Ongoing research has been and continues to be critical to global polio eradication. Although the poliovirus and its vaccines were well known and the Americas presented an effective proof of concept for global eradication, the need to vaccinate every child in the world living in every possible geography and culture presented challenges that in many cases could not be foreseen. Continued exploration of effective vaccination doses and strategies along with operational adjustments were imperative.

In addition to fast-tracking novel approaches to address polio and other diseases, social and cultural research pioneered by program supporters will continue to provide insights into ensuring health services reach and are accepted by all communities. Research will continue to be a high priority for the GPEI as it moves into the difficult eradication endgame and likely will add to the collection of new approaches useful to the broader health community.

SPECIAL THANKS TO:

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Ondrej Mach, Polio Research Team, World Health Organization

Ellyn Ogden, Worldwide Polio Eradication Coordinator, USAID

Mark Pallansch, Director, Division of Viral Diseases, U.S. Centers for Disease Control and Prevention

Linda Venczel, Director, Global Health Security, PATH

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