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*Getting an environmental education: Students test water quality in Aknalich, a village in Armenia's Armavir Province. Photo credit: Urban Foundation*

## **Averting a Cholera Epidemic in the Wake of Dual Natural Disasters**

September 2019

**W**hen Tropical Cyclone Idai made landfall March 15, 2019, it pummeled Mozambique's fourth-largest city Beira and three neighboring provinces, leaving only 10 percent of the port city intact. An unprecedented cyclone in scope and scale, the storm's flooding and devastation affected nearly 2 million people in three countries (including Zimbabwe and Malawi) and led to the deaths of approximately 960 people. Images of families being rescued from trees in helicopters, flattened homes along the coastline, and inland roads and bridges shorn in two — cutting off access to thousands in need — triggered an outpouring of international response.

Six weeks later, with the region still in the throes of recovery, Tropical Cyclone Kenneth hit the northern section of Mozambique and dealt a glancing blow to the

Comoros Islands. The resulting wind and rain damage affected close to 500,000 Mozambicans, killing an additional 45 people.

Back-to-back natural disasters of this scale could have taxed the donors, local governments, and NGOs on the ground, but the catastrophic nature of the disasters prompted a high-level of response and cooperation that put Mozambique and its neighbors in a better position to respond to the second cyclone and help avert a cholera epidemic.

Within days of Idai's landfall, USAID's Office of U.S. Foreign Disaster Assistance (OFDA) deployed a 17-person Disaster Assistance Response Team (DART) team comprised of USAID personnel and a Centers for Disease Control and Prevention (CDC) epidemiologist to lead the U.S. Government response. In close coordination with representatives from the Government of Mozambique (GRM) and humanitarian partners, the DART team assessed the situation on the ground and identified the restoration of water, sanitation, and hygiene (WASH) as one of the top priorities.

Home to the downstream portions of several major southern African rivers, including the Zambezi and Limpopo, central Mozambique's lowland, coastal geography and topography exacerbated the extent and duration of the flooding, the storm's death toll, and the subsequent concerns about water contamination. When the rivers began swelling from weeks of rain before and after the cyclone, people could not escape, crops and homes were destroyed, water supplies became contaminated, latrines washed away, electricity and communications were damaged, roads were cut, and bridges collapsed. "The heavy rain up-basin had a great impact downstream," explains Albert Reichert, WASH technical advisor for OFDA and a member of the DART team.

In response, USAID flew in food and WASH supplies, including jerry cans, water dispensers, emergency water treatment systems, and latrine kits. The DART team met early on and regularly with the key personnel coordinating the overall emergency response — a cholera task force and WASH cluster coordinator — to launch a multi-tiered effort to get clean, chlorinated water to people in need. "When there's flooding you want a big water supply effort and you want to chlorinate," says Reichert.

UNICEF had been working with the local water utility prior to the cyclone and could leverage that relationship early on after Idai to restart municipal water supply systems with USAID support. Meanwhile the response team set in motion emergency water treatment protocols — such as bucket chlorination and household distribution of point-of-use water products — and a massive hygiene education campaign. Though the flood waters receded and access became easier, finding safe water continued to be a problem.

On high alert for cases of acute watery diarrhea and cholera, Mozambique's Institute of Public Health (INS) requested that humanitarian agencies prioritize the distribution of hygiene kits and hygiene promotion activities to prevent the spread of disease. That community-level effort included mass distribution of Certeza, a local water disinfection product approved for household use. With the knowledge that cholera is endemic to the region, "huge efforts were put into chlorinating the water because of the flooding to prevent disease transmission," says Reichert.

Furthermore, Idai displaced more than 200,000 people and flooded or destroyed most household latrines. Accommodation centers for thousands of displaced people lacked toilets, forcing temporary residents to rely upon what remaining sanitation facilities they could find in the neighborhood or defecate in the open, until USAID and other responders established communal facilities. The lack of sanitation in the storm's aftermath exacerbated the spread of waterborne disease, with the first case of cholera appearing just two weeks after the cyclone.

## **Mounting a Multi-Tiered Cholera Response**

Within 48 hours of the storm, six CDC-trained graduates of the Field Epidemiology and Laboratory Training Program in Mozambique deployed to the affected area to establish surveillance of emerging diseases and investigate and control possible outbreaks. These on-the-ground health experts worked with WHO to verify and confirm reported cholera, however, responders had difficulty initially pinpointing the location of the outbreak due to gaps in information sharing. Reichert, with fellow DART team members and CDC Epidemiologist Dr. Tom Handzel, provided input into the cholera surveillance strategy early on and worked with INS to strengthen existing surveillance efforts. "One of the challenges was how to identify the key locations to focus the WASH resources," says Handzel.

With support from OFDA and CDC field workers, WHO established an early warning and surveillance system known as "EWARS in a box" to facilitate the reporting of cholera cases and other outbreak-prone diseases in the hardest-hit areas. Handzel explains, "It's basically a way of helping staff at peripheral health facilities report on a daily basis, using cell phones to send information very quickly." Relief actors were also on the lookout for outbreaks in Zimbabwe and Malawi, particularly in camps for internally displaced people. Cases that began in Beira's poorest neighborhood eventually peaked two weeks later at 6,600 with eight deaths before leveling off and dropping.

The story of how Mozambique averted a significant health crisis in the midst of cyclone recovery is one of vigilance, coordination, planning, some luck, and rapid response. The INS requested cholera vaccine within a week of Idai hitting. The international stockpile of vaccine is limited and only available in response to a large outbreak. The GRM already had a plan in place to execute a campaign to blanket vaccinate 90 percent of the most affected areas, a campaign Reichert describes as "very effective." The vaccines arrived quickly, and 80 percent of the public received their vaccine within the first week, and overall coverage eventually extended to more than 90 percent. Members of the DART team describe passing by five vaccination posts within a 20-minute walk. With immunity beginning to develop within a week of vaccination, the number of new cases started to fall.

Beyond the prevention of new cases, the other critical piece of emergency response involved treatment of existing cases. To that end, NGOs that had responded to Idai with the intention of dealing with trauma victims shifted gears to establish cholera treatment centers. Community-level response of hygiene education and mass distribution of Certeza and hygiene kits continued through the peak of the outbreak. As case numbers started to go down, CDC-trained rapid response teams followed up at the household level to address clusters of remaining cases.

## **Applying Lessons Learned to the Kenneth Response**

WASH and cholera emergency response efforts in the aftermath of Idai set the stage for what was to come after Kenneth, which hit Mozambique six weeks later. Rather than overwhelming the system, the back-to-back cyclones meant that responders had worked out the kinks and hit the ground running. The port city of Pemba in Mozambique's Cabo Delgado Province became the focal point of emergency response after the second cyclone; staff involved in Idai's WASH and cholera responses traveled to Pemba to put similar systems in place.

"My impression was that things probably were implemented more quickly and more strategically because lessons learned from one location were easily applied to Pemba," says Handzel. "The issue we had with getting good quality data where [cholera] cases were coming from in Beira went much faster in Pemba." The GRM replicated the successful cholera vaccination campaign in Kenneth-affected areas, and OFDA provided support for rapid response teams. While emergency response in the aftermath of Kenneth had some unique challenges, including unrest in some of the affected areas, the number of cholera cases peaked in the low hundreds with no reported deaths.

## **On the Road to Recovery**

Months after enduring these dual disasters, Mozambique and its neighbors continue the arduous task of rebuilding, reestablishing household sanitation, and replanting crops. One effort put in place during the emergency phase with USAID and CDC technical support and funding continues — strengthening water quality monitoring of both piped water systems and household chlorination. INS is now responsible for the monitoring taking place, and UNICEF and the GRM have expressed interest in expanding monitoring to other urban areas.

"I think it helped the utility identify some gaps where they can improve the treatment of water to ensure a more adequate chlorination process throughout the piped network," says Handzel. "It doesn't have to be in response to an outbreak, it can be a preventative measure. How can we set up a monitoring system to ensure the quality of water is safe before cholera comes? That is something that we would really like to see."

Despite suffering through a series of devastating storms, Mozambique and neighboring countries have proven resilient in the face of disaster, equipped with the knowledge and experience that rapid response and smart resource deployment can help emergency responders stave off the worst impacts of future storms.

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*This article appears in Global Waters, Vol. 10, Issue 5; for past issues of the magazine, visit Global Waters' homepage on [Globalwaters.org](http://Globalwaters.org)*