INFECTIOUS DISEASES

# Haiti's Outbreak Is Latest in Cholera's New Global Assault

Was it imported or indigenous?

That was one of the first questions cholera scientists were asking after a deadly surprise outbreak of cholera began in Haiti 2 weeks ago. Angry Haitian protesters had already decided: They held peacekeepers from Nepal—a country where the disease is endemic—responsible for bringing *Vibrio cholerae* to their already ravaged country and demanded their departure. But some scientists pointed out that although Haiti had never reported the disease before, *V. cholerae* is ubiquitous in aquatic environments; given the right circumstances, its numbers can swell dramatically and trigger an outbreak.

On Monday, the U.S. Centers for Disease Control and Prevention (CDC) rendered its verdict: DNA fingerprinting of the microbes from 13 patients had shown that it was most similar to strains from South Asia, according to a press release, suggesting that that's where the disease was imported from. (The carefully worded statement did not mention Nepal.)

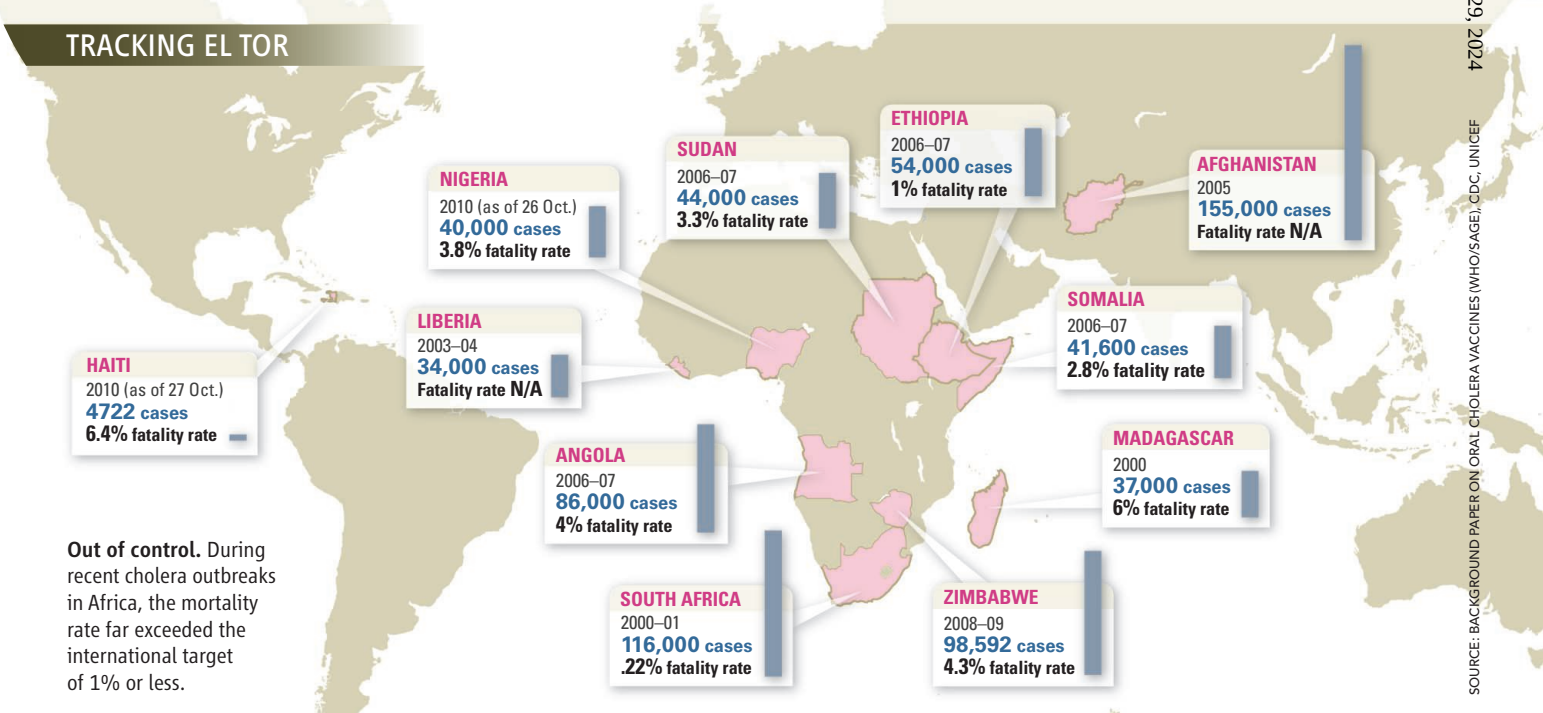
For cholera experts, it was a familiar debate that often takes place when cholera pops up in a new locale. "People always assume cholera had to come from somewhere else. It's usually local," contends Rita Colwell, a veteran cholera scientist and former head of the U.S. National Science Foundation, who had put her money confidently on the environmental route.

Cholera experts agree on one thing, however: The outbreak is another coup for El Tor, the cholera biotype that emerged over half a century ago and has since slowly spread across the globe in what researchers say is cholera's seventh recorded pandemic. Recently, El Tor—"a pretty nasty beast," according to molecular biologist John Mekalanos of Harvard Medical School in Boston—has also been wildly successful in Africa, where the disease has gone from sporadic to increasingly entrenched in just the past decade. An epidemic raging in Nigeria this year, which so far has not grabbed international headlines, has already killed more than 1500 people, and at least 550 lives have so far been lost in neighboring Cameroon. In 2008–09, Zimbabwe had a massive epidemic that killed over 4000 people.

El Tor appears to cause longer-lasting outbreaks than its predecessor, simply named "classical," and to survive longer in the environment. That could be bad news for Haiti. A preliminary study by CDC suggests the outbreak could last years and cause as many as 100,000 cases.

Few saw it coming. After the 12 January earthquake, which killed an estimated 230,000 Haitians and left more than a million homeless and living in squalid camps, health officials were worried about a panoply of diseases, including dysentery, malaria, and dengue. An international effort was launched to help the country beef up surveillance and equip the National Public Health Laboratory in Port-au-Prince for diagnostic testing.

Although cholera wasn't on the radar screen, the effort has proven useful during the outbreak, says Eric Mintz, a CDC epidemiologist specializing in waterborne diseases: The Port-au-Prince lab fingered *V. cholerae* just 4 days after the first suspected case surfaced. CDC's labs in Atlanta confirmed the diagnosis and typed the bug. (It belongs to the strain O1, like most cholera around the world, and a serotype called Ogawa.)




**Out of control.** During recent cholera outbreaks in Africa, the mortality rate far exceeded the international target of 1% or less.





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*V. cholerae* is normally present in coastal waters worldwide, even in countries where the disease is absent. It loves brackish water and can occur in rivers and lakes as well. Clinging to zooplankton—in particular, to tiny crustaceans called copepods—the bacteria can hang around indefinitely in relatively low numbers. There's no question that outbreaks can kick off when a series of environmental factors—including rising water temperatures, alkalinity, and high nutrient levels—conspire to cause zooplankton blooms, offering the cholera microbe a chance to proliferate as well. People become sick when they ingest the water and spread the disease when traces of their feces end up in other people's drinking water.

But there's debate about how often this scenario plays out. When Peru was hit by cholera in 1991, the start of a massive outbreak in Latin America that killed almost 9000, there were suspicions that the microbe had been introduced by one or more ships, presumably from Asia. But Colwell's studies suggested that the bug came from Peru's coastal waters as a result of conditions caused by El Niño. "Based on 40 years of research," Colwell says she believes something similar happened in Haiti. She is "not convinced" by the CDC statement because the agency used a technique called pulsed-field gel electrophoresis that doesn't yield a very detailed fingerprint. Colwell says she'd like to study water samples from Haiti herself but has been unable to obtain them.

But Mekalanos says the case for an environmental outbreak in Peru was never quite clinched and that Colwell and others may have dismissed the Nepalese connection in Haiti too soon. The fact that the troops were based along a tributary to the Artibonite River, where some of the first cases were found, and left home during a cholera outbreak "was a bit of a smoking gun," says Mekalanos, who is eager to do some molecular sleuthing of his own. Any infected soldiers would presumably have been asymptomatic, he says; 75% of those infected with El Tor are. (Of course, there are other potential routes through which a South Asian strain could have arrived in Haiti, he adds.)

Over the past 5 decades, El Tor has almost entirely replaced the classical biotype that scientists assume had reigned for centuries. Why it has done so is the topic of much speculation but few hard facts. One theory, says Mekalanos, is that the classical biotype was more adapted to reproducing in humans—and it had ample opportunity to do so until well into the 20th century. But as sanitation and drinking water started improving around the world, a strain that is hardier and better at staying alive in the environment may have gained an edge.

**New threat.** A woman takes care of a cholera patient at a hospital in the Artibonite Province in Haiti.

CREDIT: ANDRÉS MARTÍNEZ CASARES/EPA/LANDOV

What's next for Haiti? Mintz and his colleagues have tried to predict the Haitian outbreak's course by extrapolating from the Latin American one, which spared the islands of the Caribbean. Like Haiti now, the population had little or no immunity at the time, not having seen the disease for decades. Not surprisingly, the scope of the outbreak in each country strongly correlated with basic indicators of socioeconomic development such as infant mortality, literacy, and GDP, says Mintz. In terms of development, Haiti is roughly where Bolivia was in the early 1990s, and models suggest that Haiti could face some 100,000 cases over the next couple of years, he says. "It's both extensive spread and possible persistence that we are concerned about," he says.

Online
**sciencemag.org**
Podcast interview with author Martin Enserink.

The key weapon is to prevent transmission where possible, with clean water, sanitation, and education, and to rush treatment to those affected. Until a few decades ago, cholera had horrific death rates of 20% or more. The advent of so-called oral rehydration therapy—a simple solution that replenishes the body's electrolytes—in the 1970s has dramatically lowered those numbers, but it needs to be provided rapidly, as cholera can kill within a day. That can be a huge challenge in the places where cholera often strikes: poor countries with little infrastructure and a dearth of medical facilities.

Today, an unofficial international standard says that mortality during outbreaks should be 1% or lower, says Claire-Lise Chaignat, head of the Global Task Force on Cholera Control at the World Health Organization in Geneva. Some countries in Asia that experience cholera often do even better, but mortality during outbreaks rates during recent outbreaks in Africa have been several times higher (see map). Early this week, the official case fatality rate in Haiti still stood at 6.4% but was dropping.

One particular worry in Haiti is that a million or so people still live in camps, mostly in Port-au-Prince, where diseases spread easily. A 1994 outbreak among Rwandan refugees in Goma in the Democratic Republic of the Congo, in which more than 20,000 people perished, is a vivid reminder of how dangerous camps can be. So far, the disease has not reached the Haitian tent cities. Mintz, for one, says the camps are better organized than those in Goma, and people living there may actually be at an advantage compared with other Haitians because most drink chlorinated water and have a better chance at timely treatment.

**–MARTIN ENSERINK**





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