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Cholera is a disease of poverty, and spreads rapidly in communities lacking clean water supplies and sanitation.

PUBLIC HEALTH

Cholera tightens grip on Haiti

Those tackling the epidemic are struggling to keep pace with an escalating crisis.

BY DECLAN BUTLER

As cholera rages through Haiti, some epidemiologists are warning that the country could face more than half a million cases over the coming year. Yet tracking and treating the disease is proving increasingly difficult as civil unrest grips the country.

Roughly 20,000 clinical cases, and 1,100 deaths, have officially been reported since the outbreak was first detected on 21 October in the Artibonite region of Haiti — figures likely to be underestimates, say epidemiologists,

given the many additional cases in the wider community. “It’s spreading like wildfire,” says Andrew Camilli, a cholera researcher at Tufts University School of Medicine in Boston, Massachusetts (see ‘Epidemic proportions’).

As the current Haitian population has never been exposed to cholera, they lack any immunity to the disease, which makes the toll even greater. Vaccination might have helped, but it has never been tested during a large cholera

outbreak and was not an option in Haiti because of the vaccine’s scarcity and the logistical difficulties in getting it to people in time (see ‘Would cholera vaccines have helped in Haiti?’).

Cholera is caused by the bacterium *Vibrio cholerae*, transmitted through contaminated water supplies or by direct contact with infective faecal material. Haiti already lacked clean water and basic sanitation, and conditions have deteriorated further following January’s huge earthquake (see *Nature* **467**, 1018–1019; 2010) and Hurricane Tomas in early November.

Some 80% of symptomatic cholera cases ▶

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Cholera receives relatively little R&D funding see:
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STOPPING AN EPIDEMIC

Would cholera vaccines have helped in Haiti?

When the cholera outbreak started in Haiti, health agencies briefly contemplated using vaccines to try to curb it. But they abandoned the idea once it became clear that the available global production was completely insufficient for an effective vaccination campaign — only a few hundred thousand doses would have been available, and even these would have taken weeks to manufacture, whereas millions of doses were needed.

Only one cholera vaccine — Dukoral — is approved by the World Health Organization (WHO). Made by the small Dutch company Crucell, based in Leiden, it is aimed at people travelling to cholera-endemic areas, and as such is too expensive to be widely deployed in the developing world. A second vaccine called Shanchol, already licensed in India, is currently going through the WHO's approval process. Developed by the International Vaccine Institute in Seoul, with support from the Bill & Melinda Gates Foundation, the vaccine is produced by Shantha in Hyderabad, India, and should cost less than US\$1 a dose.

Even if sufficient Dukoral or Shanchol had been available at the start of the Haitian outbreak, it might have had little impact. Two doses of the vaccines have to be given a fortnight apart, with protective immunity taking another week to form. Mounting a large vaccination campaign also causes inevitable delays. So it is by no means clear that vaccination would have made any major dent in the spread of the disease.

The logistics would have been daunting, says Claire-Lise Chaignat, coordinator of the WHO's Global Task Force on Cholera Control. Just vaccinating the 2 million people in the Haitian capital Port-au-Prince would have required rapid deployment of some 4 million vaccine doses. That's a huge logistical challenge in any situation, but in the dire conditions Haiti now finds itself in it would be "almost impossible", she says.

Had sufficient vaccine been available, Jon Andrus, deputy director of the Pan American Health Organization, says that he would have considered trying vaccination in case it had a positive impact. Pre-emptive vaccination

of people in the neighbouring Dominican Republic could also have made sense, he says.

In the longer term, vaccination for cholera deserves further study, says Robert Quick, an epidemiologist at the Enteric Diseases Epidemiology Branch of the Centers for Disease Control and Prevention in Atlanta, Georgia. If a longer-lasting and highly efficient single-dose vaccine could be developed it might make a significant impact on outbreaks such as Haiti's. A single-dose vaccine called Orochol has been developed, but its manufacturer, the Swiss company Berna Biotech (acquired by Crucell, based in Berne, in 2006), stopped making it in 2004 after switching its limited production facilities to make another vaccine.

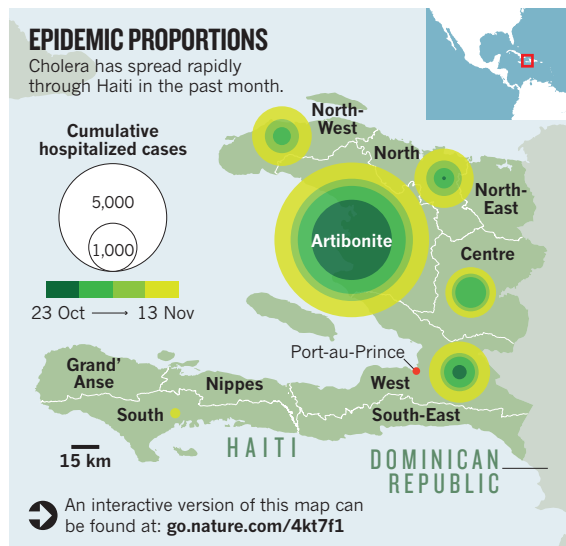
But Quick emphasizes that a single-dose vaccine would not be a panacea, and stark choices would remain. Mounting a vaccine campaign during an outbreak takes away scarce resources and staff, he argues. "Do you want staff treating people, or vaccinating?" he asks. "The first priority is saving lives." **D.B.**

► are mild or moderate, but 20% cause severe dehydration from watery diarrhoea that can kill within hours if untreated. Until the 1970s, when oral rehydration therapy was widely introduced, death rates during outbreaks often exceeded 50%. But cholera is eminently treatable if patients are promptly rehydrated, and public-health responses to cholera epidemics typically reduce mortality rates to below 1%.

Experts think that conditions in Haiti are resulting in far higher death rates than this. At the beginning of the outbreak, mortality was estimated at around 9%, falling to an estimated 4–6% over the past few weeks as patients began to be treated.

That gain, however, has been wiped out by riots that were fanned by rumours that Nepalese UN peacekeepers were the source of the outbreak. The row over the source has been self-defeating, says Jon Andrus, deputy director of the Pan American Health Organization (PAHO), the regional office of the World Health Organization. With many of the sick unable to get past roadblocks to reach treatment centres, and deliveries of supplies held up, death rates have again soared past 9%, he says. The precise death toll is uncertain, like everything else about the outbreak. PAHO relies partly on a vast network of humanitarian groups and non-governmental organizations, such as Doctors

Without Borders and the UN Children's Fund, to collect and report data from the field. Many of these groups aren't coordinated well with each other, and Andrus says that it's a huge challenge to ensure data quality, adherence



to a standardized cholera case definition, and timely reporting. "Coordinating these groups on a normal day in Haiti would be difficult enough, but in post-earthquake Haiti in the middle of a cholera outbreak, it becomes a huge challenge," he says.

For every clinical case of cholera there will

be several undetected asymptomatic carriers shedding bacteria and spreading disease, complicating predictions of how the epidemic will spread. But the data are often good enough for their key functions: pinpointing trends such as a rapid increase of cases in an area, or the appearance of geographical clusters. These hotspots can then be targeted for rapid intervention.

Last week, PAHO announced that the epidemiology suggested that 200,000 more cases could be expected in Haiti over the next year, but Andrus says that more recent estimates are likely to raise that figure to more than 500,000. Having these numbers is crucial to making sure that enough lifesaving supplies and staff are on hand when and where they are needed. "We are doing everything possible to keep ahead of the game, to be weeks in advance, so that we don't get into a situation where we run out of supplies," he says.

Health officials are also alert to the risk that the Haiti outbreak could spread further into the neighbouring Dominican Republic, where cases have been reported, and far beyond. Experts are mindful of how a 1991 outbreak in Peru — the first in the Americas in a century — led to a suite of entrenched large cholera outbreaks across the Americas in the ensuing decade (except the Caribbean). "We've put the whole hemisphere on alert," says Andrus. ■