# Smallpox: Outbreak in Somalia Slows Rapid Progress Toward Eradication

An outbreak of smallpox in Somalia, in the area of northeast Africa known as the Horn of Africa, has set back the highly successful drive to eradicate smallpox from the roster of the world's diseases. Late last year public health officials felt they were tantalizingly close to eliminating the last known pockets of the disease that has ravaged millions of individuals since before recorded history.

Then reports trickled in of new cases in Mogadishu, the capital of Somalia, a busy urban center with a population of 400,000, and subsequent searches revealed cases in nine southern regions of the country. During the first 5 months of this year (ending 28 May), more than 800 cases had been detected in 239 separate outbreaks, some consisting of only one case in a village.

"There's no question it's been a setback," one epidemiologist told *Science* on the eve of his departure to join a World Health Organization (WHO) team engaged in search and containment operations in Somalia. But the reversal is expected to be temporary. Some health officials still hope to eliminate the last known case of smallpox sometime this year. Then, if no further cases are found anywhere in the world after 2 years of active surveillance, an international commission of experts will be convened to decide whether or not the surveillance has been intensive enough to justify a declaration that smallpox has, in fact, been completely eliminated. Such eradication would be a major medical milestone—the first time ever that medical science has been able to eliminate a disease from the face of the globe.

### No Cure for Smallpox

Smallpox comes in two major forms—the virulent Asian form, variola major, which kills 20 to 40 percent of its victims, and the milder African form, variola minor, which kills only 1 percent. It is caused by a virus that generally travels from person to person in droplets discharged from the nose or mouth. Victims typically develop a high fever, aches, and a rash that fills with pus and sometimes causes such swelling in the face that a patient may be unrecognizable. Scabs eventually form and then fall off, leaving disfiguring scars. Many victims are left blind. There is no cure for the disease once contracted. The only real weapon against it is prevention—the use of vaccination to protect individuals and curb the spread of the disease.

The progress in eradicating smallpox has been astonishing. Some experts contend that smallpox, by some measures, has been the most fearsome scourge in human experience, causing more harm over a longer period and in more geographic areas than such other forms of pestilence as bubonic plague, cholera, and yellow fever. The devastation it once caused was illustrated by an epidemic that killed 31 percent of the population of Iceland in 1707. As recently as 1926 an international conference was told that smallpox could be found in virtually every country. Vaccination campaigns essentially drove it out of North America and Europe by the 1940's, but even as late as 1967 there were an estimated 10 to 15 million cases in 44 countries, including 33 countries where smallpox was considered endemic and 11 others with cases attributed to importations. The chief areas of infection were the Indian subcontinent, Indonesia, sub-Saharan Africa, and Brazil.

That was the state of things in 1967 when WHO, largely as the result of persistent prodding from the Soviet Union, launched a campaign to eradicate the disease within a decade—by the end of 1976. The campaign involved substantial international cooperation. Vaccine was donated by more than 20 countries (principally the United States and the Soviet Union) and was ultimately produced in the developing countries as well. Field work was carried out by health workers from the countries where smallpox was endemic, assisted or supervised by epidemiological experts supplied by WHO and the industrialized nations.

A number of problems bedeviled the program at the start. It was soon discovered, for example, that reporting of smallpox cases was hopelessly inadequate, sometimes because the health bureaucracy in endemic regions was not proficient at gathering information, and sometimes because authorities deliberately suppressed knowledge of the extent of smallpox infection. By one expert estimate, not more than 1 percent of all cases were being reported in 1967. Thus the campaign strove to improve case detection and reporting—a goal that was largely achieved.

Significant improvements were also needed—and largely achieved—in vaccine administration. At the start of the campaign, the vaccine itself often lacked potency or lost it under field conditions. That problem was largely overcome with development of a long-lasting, freeze-dried vaccine. The technique of vaccination was also steadily improved, from the old scratch-it-in technique, to a needle method, to a jet injector gun that could vaccinate more than 1000 people per hour but was expensive and sometimes impractical, to the ultimate solution—a simple bifurcated needle that held a drop of vaccine between two prongs and could easily be used by untrained rural health workers.

### Shift in Stragety

A serendipitous discovery also led to a major change in the strategy of the campaign. The original goal was to vaccinate at least 80 percent of the population in the endemic countries in the belief that this would reduce the incidence of smallpox to the point where the remaining foci of infection could be identified and eliminated. But a delay in deliveries of vaccine to eastern Nigeria early in the campaign led the U.S. adviser there—William H. Foege, who was recently appointed head of the Center for Disease Control by the Carter Administration—to devise an interim strategy. He searched out existing smallpox cases and vaccinated persons in the immediate area and other potential contacts. This surveillance and containment approach proved so effective that it was adopted for other countries as well, thus enabling the eradication of smallpox from vast areas where as little as 6 percent of the population was actually vaccinated.

The campaign did not succeed in eradicating smallpox by the target date, but it has nevertheless been a rousing success. In August 1973 an international commission declared that eradication had been achieved in South America (2 years of active surveillance had turned up no cases after the last known case). Subsequent international commissions certified eradication in Indonesia (1974), in Western Africa, Afghanistan, and Pakistan (1976), and in Nepal, India, and Bhutan (1977). Commissions are ex-

pected this year to certify eradication in nine countries of central Africa, as well as Bangladesh and Burma. Four countries of eastern Africa are expected to be declared free of smallpox in early 1978.

In addition to its value in alleviating human suffering, the campaign is deemed highly cost-effective. The cost of the 10-year effort is estimated at about $250 million, a fraction of the more than $1 billion per year that the nations of the world had been spending on smallpox vaccination and quarantine measures.

The disease is now making its last stand in a corner of the world where eradication is made difficult by inaccessible terrain, a raging civil war, and nomads who are difficult to track and who can spread infection far and wide. Last year Ethiopia, which adjoins Somalia, was the major center of smallpox infection, with some 915 cases reported, the last in August 1976. No sooner had those outbreaks been contained than an outbreak was detected in Mogadishu, Somalia, in September 1976, probably stemming from a case imported from southern Ethiopia. The intensified surveillance that followed the Mogadishu outbreak has led to the discovery of the 800 or so cases reported in Somalia so far this year. It is not clear at this point whether those cases were caused by the spread of infection from Mogadishu or were separate foci of infection that were previously undetected. A small outbreak of five cases early this year in Kenya, which also adjoins Somalia, was traced to an infection originating in Mogadishu.

A major effort is now under way to suppress the outbreaks in Somalia. Search and containment operations are being carried out by 32 well-trained Somali supervisors, some 400 field-workers, and more than a dozen WHO epidemiologists. One participant expresses guarded optimism that the disease can be contained, and the last case eliminated, within a matter of months.

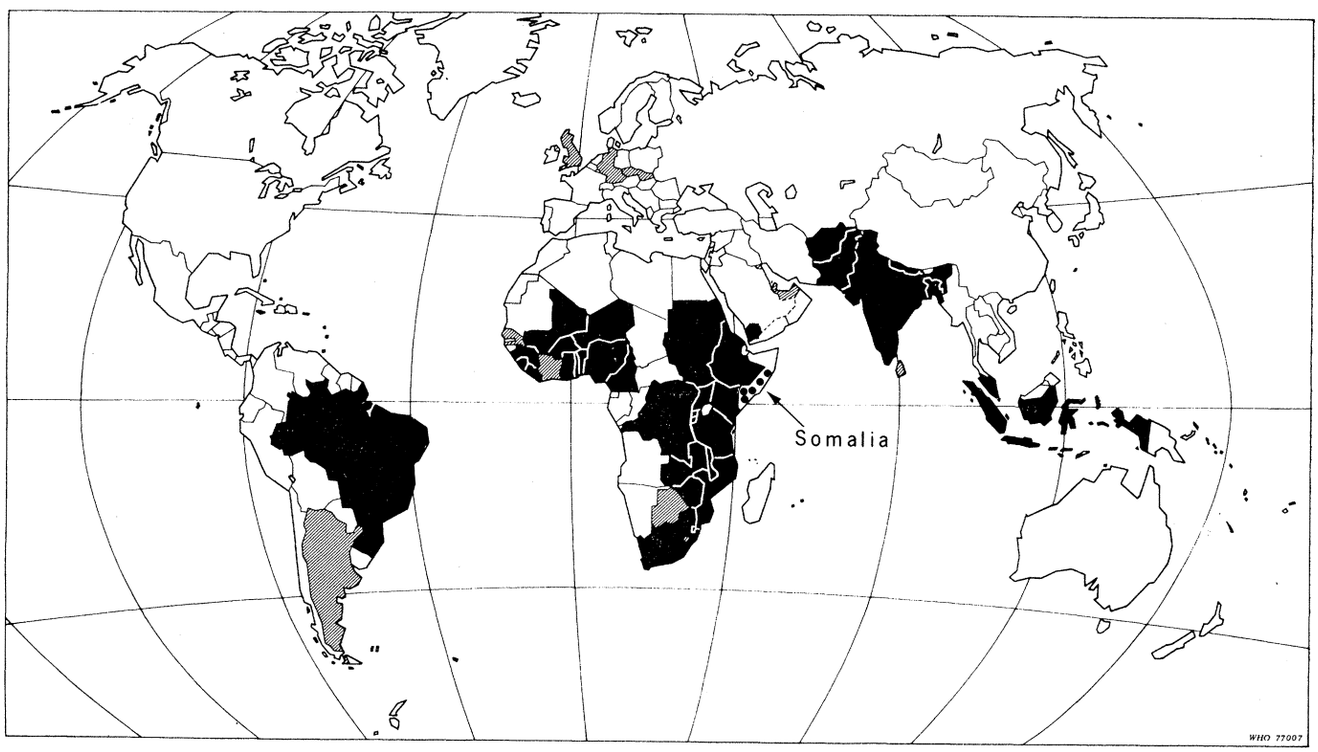
### Smallpox a Special Case

If smallpox is eventually eradicated, the achievement will not necessarily imply that similar victories can be scored over other major diseases. As one epidemiologist put it, smallpox has characteristics that render it peculiarly susceptible to eradication. Its symptoms are so obvious that even a schoolboy can diagnose it without a laboratory test. There are virtually no asymptomatic carriers of the disease. There are no known animal or insect hosts or vectors to serve as a reservoir for the disease once it is eliminated from the human population. The disease has a short period of infectivity—3 to 4 weeks—and does not spread rapidly through the population. And there are potent, stable, easily administered vaccines that provide a good level of protection.

A few specialists have suggested that the smallpox virus may find some niche to hide in and then reemerge years from now to start a new round of infection. But those directing the campaign note that not a trace of smallpox has been found in those areas where the disease has been declared eradicated, a fact which lends credence to the notion that eradication is indeed possible.

The belief that eradication is near has led to concern that laboratory stocks of smallpox virus might serve as new sources of infection to spread the disease into the community. That this is no idle threat was demonstrated in 1973, when laboratory infection was responsible for four cases in London. WHO has thus far surveyed 173 of the world's 181 countries and areas to compile an international register of laboratory stocks. According to a report published on 6 May, 18 laboratories in 10 countries retain stocks of smallpox virus while 59 laboratories report having destroyed their stocks. WHO's goal is to have as few as five laboratories retain stocks of the virus for reference purposes—under rigid safety conditions to ensure that the disease, once eradicated, stays eradicated.

—PHILIP M. BOFFEY




*Over the past decade, smallpox has been driven from most areas of the world. In 1967, when WHO launched its eradication campaign, smallpox was endemic in 33 countries (black areas) and imported cases were found in many others (shaded areas). Today, the disease seems to have been eliminated from every one of these countries and is making its last stand in Somalia (black dots).*