How can we be sure?

It is difficult to prove that a disease no longer exists on earth. But a mass of carefully compiled evidence has convinced the Global Commission that Smallpox Target Zero has in truth been attained

by Frank Fenner

The claim that smallpox has been totally eradicated from the earth is a broad one. “How do you know?” and “How can we be sure?” are questions that many people may well ask, particularly those health administrators who are responsible for vaccination programmes.

From the outset of the Intensified Smallpox Eradication Programme, who has been aware of the importance of these questions, firstly for the countries where smallpox was endemic as they moved towards eradication, and then for the world as a whole as country after country signalled the all-clear. The mechanisms devised to give the answers are novel ones, simply because mankind has never before faced such questions.

Given the essential tools, namely a good vaccine and an adequate surveillance network, two concepts were of outstanding importance for the achievement of global smallpox eradication. Firstly, international cooperation and, secondly, assessment or quality control. Many individual countries could and did wipe out endemic smallpox without international help, but global eradication could not even have been contemplated without the involvement of WHO as the instrument of international cooperation in health matters.

The role of assessment is less obvious, but it was just as essential. It had to be applied to all phases of the programme, from the quality control of vaccines, so that the vaccinator could have potent material for his work, to the overseeing of work in the field, so that full coverage of the population by vaccination could be assured in the early stages of the campaigns, and the adequacy of surveillance could be guaranteed in the later stages.

As country after country achieved the goal of Smallpox Zero, the question arose as to how the world community itself could be assured of the reality of these achievements. Later, with approaching global eradication, the question took on a new urgency and involved other considerations; for instance, how to maintain variola virus stocks in laboratories, and what measures to take after global eradication. To answer these new questions the same two concepts were evoked, international cooperation and assessment. A system for certifying smallpox eradication in countries or in groups of countries was introduced in 1973 and became ever more elaborate as the programmes proceeded, reaching a peak of intensity with the two most difficult strongholds of the disease—the Indian subcontinent and the Horn of Africa.

This system depended on a series of International Commissions for the Certification of Smallpox Eradication. 21 of which examined the situation successively in 61 countries, beginning in South America in 1973 and ending with Somalia in October 1979. Although the International Commissions were convened by WHO, it was realized from the outset that they must be, and must be seen to be, independent of WHO yet of high standing in international health matters. WHO therefore sought for service on the International Commissions a group of people from several different countries, each a respected authority in public health, epidemiology or virology, and each with at least some experience in smallpox control.

The response of scientists and administrators was enthusiastic; rarely was a request from WHO for service on an International Commission refused. The next important matter to be determined was when the commissions should assess the situation in relation to the last reported case in a country or region, and what preparations should be made. As the situation developed, two different kinds of response seemed necessary. In countries where smallpox had been
recently endemic, it was decided that a minimum of two years should elapse between the last known case of smallpox and the visit of the Commission. During this time intensive active surveillance for smallpox should be carried out, and special reports on the situation and on post-eradication surveillance should be prepared for the Commission.

In other countries, such as those adjoining highly endemic regions, smallpox had been eliminated by national programmes with little assistance from WHO; in many of these certification was delayed for several years after the last known case, but WHO-assisted surveys were carried out before the Commission's visit.

Intensive preparations

Especially in countries where smallpox had long been a scourge, the visit of the International Commission was an important event and preparations were as intensive as the activities of the last few years of the eradication programme itself. Detailed "Country Reports" were drawn up, based on the history of the eradication campaign but supplemented by the results of special searches and surveys carried out during the post-eradication period. Active surveillance for fever-and-rash cases continued and intense publicity campaigns made sure that everybody knew about the reward offered for the notification of smallpox cases.

Country-wide "special searches" were sometimes carried out, and as the programme evolved two special kinds of survey developed. One was the facial pockmark survey, especially suitable in countries that had experienced severe smallpox; the other was the chickenpox survey, which proved invaluable in countries where variola minor—the less serious form of smallpox—had occurred.

Severe smallpox can leave two serious legacies in those who survive: blindness and pockmarks. About 70 per cent of people who have recovered from severe smallpox have more than five facial pockmarks that they carry for the rest of their lives. By examining large numbers of persons in various age groups in a population, particularly school and preschool children, and recording histories of the date of the smallpox attack in each pockmarked person, it proved possible to get a retrospective estimate both of the amount of smallpox that had occurred and, most importantly, when it had last occurred. The facial pockmark survey
Above: Somalia—Rewards were offered to anyone notifying a smallpox case.
Left: Bangladesh—Quality control of local production of vaccines.
Right: USSR—Millions of vaccine doses contributed to the success of the worldwide eradication campaign.
(Photos WHO/E. Shafa, WHO/J. P. Claquin and WHO/Novosti).

was particularly valuable in the Indian subcontinent, some parts of Africa and China.

Variola minor, which has a mortality rate of one per cent or less compared to up to 40 per cent for variola major, leaves much less facial scarring—only about seven per cent of known cases in Somalia had facial pockmarks a year later. However, this form of smallpox can be mistaken for chickenpox, so that surveys of this disease provided a useful indicator of the presence or absence of mild smallpox. In such chickenpox surveys, specimens for laboratory examination were sought from a selection of cases of chickenpox; one from each separate chickenpox outbreak, from severe or fatal cases, and from chickenpox in unvaccinated individuals, as well as from all suspected cases of smallpox. The specimens were sent to Geneva and examined at the WHO Collaborating Centres in Moscow or in Atlanta, USA. More than 5,200 specimens were examined in the periods leading up to certification in Ethiopia and Somalia, without variola virus being detected.

When it was clear that these preparations had been adequate, an International Commission was convened to visit the selected country or region. On arrival, the members conferred with the national health authorities and discussed all the evidence that had been assembled to show that there had been no case of smallpox for at least two years, and then
made field visits. These were designed to assess the efficiency of the surveillance system for smallpox. The question that the International Commission sought to answer was: If there had been a case in the last two years, would it have been detected? The field visits concentrated on difficult or "problem" areas, the location of the last reported case, border districts, and inaccessible areas with poorly developed health services. Then the members met again to go over the country reports once more, with the added information gleaned from the field visits, and the Commission produced its report. In every case the preparations had been so thorough, or such a long period had elapsed since the last known case, that the International Commission was able to certify the country or region free of smallpox.

**Global certification**

By 1977, when worldwide eradication appeared to be imminent, it was clear that some independent authoritative group was needed to map out the strategies for certifying global eradication of smallpox, to assess the results of International Commissions and other enquiries, to consider such implications of global eradication as the cessation of smallpox vaccinations among the general public and the significance of variola virus stocks in laboratories, and to map out a post-eradication "insurance policy".

The Director-General of WHO called a Consultation on worldwide certification of smallpox eradication in October 1977, consisting of 17 experts from 16 countries, most of them being epidemiologists and virologists experienced in the eradication programme operations and certification procedures. The Consultation made detailed recommendations for a programme for the following year, and recommended the setting up of an "International Commission for the Global Certification of Smallpox Eradication" to provide consultative assistance and to verify this unique event. The Global Commission, as it was subsequently called, was formed early in 1978 and met in December of that year and again in December 1979.

That first meeting of the Global Commission, in December 1978, considered the situation relating to smallpox in every inhabited country and area in the world, and drew up a programme of work which was designed to result in certification of freedom from smallpox from every country by December 1979. It also addressed itself to several problems of special importance in a world free of smallpox: vaccination policy, stocks of variola virus in laboratories, and the possibility that there might be an animal reservoir of variola virus.

The year 1979 was one of intense and carefully orchestrated activity, which succeeded in laying before the December 1979 meeting of the Global Commission reports on the smallpox situation in every country in the world, an expert opinion on the justification and extent of the retention of stocks of variola virus in laboratories, and ideas for a post-smallpox-eradication "insurance policy". In addition to considering all this informa-
tion, the 1979 meeting completed a final report on its activities. And it concluded its intensive four days of work by witnessing the signature, by all members, of a document bearing the words, in six languages: “We, the members of the Global Commission on Certification of Smallpox Eradication, certify that smallpox has been eradicated in every country in the world.”

The report, which is about 120 pages long, summarizes the campaigns that led to the eradication of smallpox and the certification of eradication, by country, by groups of countries, and throughout the world as a whole. It also outlines in some detail an insurance policy for the post-eradication era. The report and its recommendations were considered by the Executive Board of WHO in January 1980, and figure on the agenda of the World Health Assembly this month.

It is difficult—perhaps impossible—to “prove a negative”, that is, to prove that smallpox no longer exists on earth. But evidence provided by the careful work of national health authorities in every country, of who expert consultants and advisers, and of the staff of the Smallpox Eradication unit at WHO headquarters in Geneva, has convinced all members of the Global Commission that transmission of this disease from person to person has been interrupted everywhere in the world. The last case of endemic smallpox occurred in Somalia in October 1977. Smallpox Target Zero has now indeed been reached, and the Global Commission has formally certified that the world is at last free of this appalling disease.

In the next issue
The June issue of World Health, published on the eve of the World Conference of the UN Decade for Women, in Copenhagen, will look at the role of women in the closely interrelated fields of development and health. Contributors from many parts of the world emphasise some of the most striking aspects of women’s situation in different cultures and settings.

Authors of the month
Dr D.A. HENDERSON, formerly WHO’s Chief of Smallpox Eradication, is now Dean of the School of Hygiene and Public Health at the Johns Hopkins University, Baltimore, Maryland, USA.
Mr. J. MAGEE is the Information Officer of the Smallpox Eradication unit at WHO headquarters, Geneva.
Dr Marcella DAVIES is the WHO Programme-Coordinator for Sierra Leone.
Dr V.T.H. GUNARATNE is the Regional Director for WHO’s South-East Asia Region.
Mr. J. TULL is the Public Information Officer for WHO’s South-East Asia Region, based in New Delhi.
Mr A.M. CHACKO is a freelance journalist based in New Delhi.
Dr H. MAHLER is the Director-General of the World Health Organization.
Dr D.R. HOPKINS is the Assistant Director for International Health at the Center for Disease Control, Atlanta, Georgia, USA.
Mr J. ARITA is the Chief of the Smallpox Eradication Programme at WHO headquarters in Geneva.
Professor S. MARENKOVA is Chief of the Smallpox Prophylaxis Laboratory, Moscow Research Institute for Viral Preparations.
Professor F. FENNER, until recently Director of the Centre for Resource and Environmental Studies of the Australian National University, is the Chairman of the Global Commission for the Certification of Smallpox Eradication.

WORLD HEALTH
1980 Subscription Rates

<table>
<thead>
<tr>
<th></th>
<th>US$</th>
<th>Sw. fr</th>
</tr>
</thead>
<tbody>
<tr>
<td>One year</td>
<td>12.50</td>
<td>25.00</td>
</tr>
<tr>
<td>Two years</td>
<td>22.50</td>
<td>45.00</td>
</tr>
<tr>
<td>Three years</td>
<td>30.00</td>
<td>60.00</td>
</tr>
</tbody>
</table>

ORDER FORM
Please enter my subscription to ‘World Health’ as follows:

One year ☐
Two years ☐
Three years ☐

I enclose cheque / international postal order in the amount of:

Name:

Street:

City:

Country:

World Health, WHO, Avenue Appia, 1211 Geneva 27, Switzerland.

World Health is also distributed through the network of international bookstores and subscription agencies. For payment in national currencies, please contact your usual bookseller.
Of the smallpox god Sopona, worshipped by the Yorubas of Nigeria, it was said that "being a very stubborn deity, he would not heed any appeasement."

(Photo WHO)