

# an end - and a beginning

The success of the smallpox eradication campaign marks the point of departure for new efforts to combat other health problems which beset mankind

BY Dr DONALD HENDERSON

Smallpox—"Point of No Return" is the slogan for World Health Day this year. And, today, literally tens of thousands of health workers around the world are engaged in what can be the final battle to eliminate the disease and for all, mankind's most feared and devastating disease—a disease which over the centuries has killed, blinded and scarred countless millions and, frequently, has changed the course of history itself.

In the mountainous highlands of Ethiopia and on the densely populated plain of the Indus and Ganges rivers of India, health workers are today diligently searching village by village the areas where cases last occurred in expectation that soon the final case will be discovered. Not that their work will then be finished. But it is from that time that the two-year surveillance period will begin to confirm that there is no remaining focus from which the disease may spread. With the goal of smallpox eradication so near, it is certain that there can now be no relaxation in effort. The world is at the "point of no return" in its global campaign.

It was just nine years ago that the World Health Assembly decided to embark on an intensified global programme for the eradication of smallpox. Some delegates expressed the hope that the task might be completed within 10 years. However, many were sceptical that smallpox or, for that matter, any other disease could be eradicated. The reservations were not unreasonable since no disease had ever been eradicated before. Smallpox at that time was endemic in 30 countries,

many of which were among the poorest in the community of nations. Often the health services were vestigial, health workers were few and poorly trained, and the problems of transport and communication in some of the most difficult geographic areas of the world were staggering.

An initial budget of \$2.3 million was provided to the Organization. Additional help was forthcoming from the USSR, which supplied the vaccine needs of India, Afghanistan and Burma and additional vaccine for WHO's Special Account for Smallpox Eradication. The USA offered material and technical support for eradication programmes in 20 West African countries, in 12 of which smallpox was then endemic.

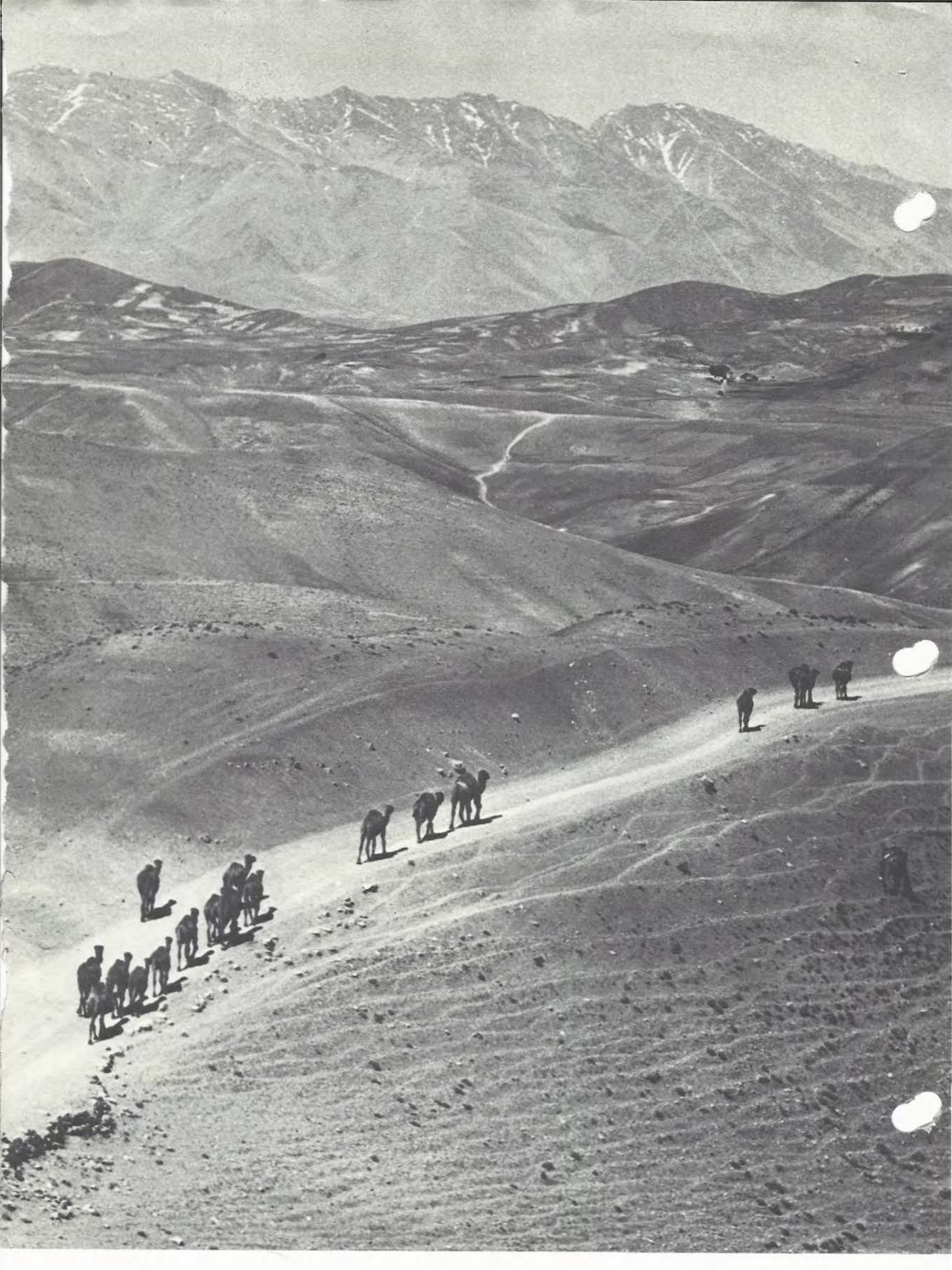
Work started in January 1967. The manuals needed for programme operation were produced, campaign plans were elaborated with smallpox-afflicted countries and with adjacent countries where there was a risk of importations, and the recruitment and training of technical staff began. An immediate problem was to provide sufficient freeze-dried vaccine—an estimated 250 million doses were required. An appeal for vaccine was launched and supplies from many countries began to flow in, but far from enough for the world's needs. To meet the requirements of this enormous undertaking, it was clear that vaccine production laboratories would have to be developed in the endemic countries themselves. Consultants met and developed a simplified manual for vaccine production and visited prospective laborato-

ries to assist in starting production; equipment was provided by WHO and UNICEF; International Reference Centres in Canada (Connaught Laboratories) and the Netherlands (Rijks Instituut) agreed to monitor vaccine samples from laboratories around the world, to assist in the training of laboratory workers and to consult on technical problems as they arose. By 1969, progress was such that virtually all vaccine employed in the programme was internationally certified as being potent, freeze-dried vaccine which could withstand exposure for a month at room temperature in tropical climates. And, by 1973, fully two-thirds of all vaccine used in the campaign was being produced in the developing countries themselves, some of which were donating vaccine for use by neighbouring countries. Samples of all vaccine were regularly tested by the International Reference Centres to assure that they conformed to international standards of potency and stability.

At the beginning of the programme, changes were made in vaccination techniques to assure a higher proportion of successful

*Behind the back of beyond. During the nine years of the WHO smallpox eradication campaign, teams of health workers have fanned out into remote areas such as this, tracking down that one case of infection which unsuspecting travellers could turn into a raging epidemic far away. (Photo WHO/P. Almasy)*













vaccinations. In 1967, jet injectors were first introduced for field use in western and central Africa, and subsequently in Brazil and Zaire. These permitted large numbers of people to be vaccinated quickly while using less vaccine than was the case with conventional methods of vaccination. Over 1000 persons could be vaccinated. A major problem in the use of the injectors was that of assembling large enough numbers to permit effective utilization of the instrument. A solution emerged when the now well-known bifurcated needle became available and was shown in WHO field trials to be highly effective in multiple puncture vaccination. Not only did the new needle permit efficient vaccination of small groups or individuals in house-to-house vaccination, but vaccination by this method required only one-fourth as much vaccine as had previously been used. By 1969, use of the bifurcated needle had been extended world-wide.

Most programmes in the endemic countries began between 1967 and 1969—the last started in 1971. Initially, programme strategy called for mass vaccination to control smallpox. Simultaneously, a reporting network and outbreak containment programme would be gradually developed and then intensified when mass vaccination had succeeded in reducing smallpox incidence to a manageable level. It was soon discovered in West Africa, however, that the surveillance-containment component of activities could succeed dramatically in stopping transmission, even when smallpox incidence was high and immunization levels were low. These findings were subsequently confirmed in Indonesia and Brazil. Accordingly, programme strategy was altered to place primary emphasis on the detection of cases and outbreaks and their rapid containment. This change in strategy was the principal factor accounting for the rapid interruption of smallpox transmission in so many countries.

Between 1967 and 1973, the number of endemic countries declined from 30 to five. By June 1973, more than two years had elapsed in the Americas since the last case of smallpox had been detected. In August of that year an international commission, after full evaluation of the programme, proclaimed the eradication of smallpox in the Americas. Smallpox had by then been eliminated in many African and Asian countries, even with

the most limited health services and the most primitive transportation and communication. It was apparent to all that global eradication was more than a dream. It was recognized that it could become a practical reality not in decades but in years. The World Health Assembly requested that the remaining endemic countries accord the programme the highest possible priority and that the Organization redouble its efforts to achieve the historic goal in the shortest possible time. And this was done. The campaign called "Target Zero" was underway.

In the autumn of 1973, a new approach to case finding was introduced in India and subsequently extended to Pakistan and Bangladesh—the only remaining endemic countries in Asia. Health workers of all categories participated for one week each month in a carefully organized village-by-village search for cases. In municipalities, the initial searches were disappointing and eventually these were performed on a house-by-house basis. The number of reported cases surged to record levels as workers ferreted out innumerable cases and outbreaks which otherwise would not have been detected. Although more cases were found and reported, more outbreaks were contained.

Despite comprehensive training programmes, the search operation took time to perfect and not until spring of 1974 was it reasonably effective in most areas. Unfortunately, this was late in the smallpox season and smallpox, especially in India but also in parts of Bangladesh and Pakistan, had spread so extensively that health workers simply could not cope effectively with the large numbers of outbreaks. Major epidemics occurred in the Indian States of Bihar and Uttar Pradesh. Because of greatly improved reporting, the epidemics as recorded seemed even more severe than they were.

However, recognizing the progress made and the need to intensify support at this critical juncture, an additional \$700,000 was made available to the programme in January 1974 by WHO's Executive Board. In July, Sweden provided an additional \$3,000,000 to assist activities in India and Bangladesh. These funds permitted assignment of a much larger number of national and international epidemiologists to provide closer supervision of surveillance and containment activities. Additional transport and more petrol could be given for supervision of the active search and containment programme, as well as expenses for local staff and volunteers to undertake search operations and to remain in the infected villages for containment and vaccination. Activities were steadily strengthened throughout the first half of the year and reached maximum levels in mid-August.

Increasingly better supervision permitted

each outbreak to be dealt with quickly—to ensure that all contacts were vaccinated, that the source of the outbreak had been identified and that visitors and newcomers to the village were immunized. It became possible by mid-1974 to receive a weekly report from each district throughout Asia listing the number of villages where new outbreaks had been detected that week and the number of villages in the District which had experienced one or more cases during the preceding four weeks. Each village in which even one case had occurred in the preceding four weeks was designated as an "active outbreak". It was required that each be visited regularly until four weeks after the last case to make sure that transmission had been stopped. Progress soon was charted in terms of the number of "active outbreaks" remaining each week.

The number of "active outbreaks" in Asia reached a peak of almost 10,000 at the end of May. Summer heat and the monsoon rains normally result in a decrease in smallpox transmission and the number of cases. During previous years, health workers relaxed their vigilance during the summer, but the summer of 1974 was different. Activities actually increased during the summer season as workers continued their pursuit of smallpox outbreaks despite intense heat and floods in an effort to find and contain all possible foci. Volunteers from schools, industries and civic clubs assisted in the search for cases. The number of active outbreaks began to fall precipitously—to 5,000 at the end of July—to 3,000 at the end of August—to 2,000 at the end of September—and to 800 by the end of October.

As an aid to the discovery of outbreaks, a substantial reward was offered to anyone reporting a previously unknown outbreak. This was widely publicized by radio, news paper, poster and word of mouth. As the number of outbreaks decreased, the reward was increased, finally reaching 100 rupees—almost three weeks' pay for the average labourer. With ever fewer outbreaks, the staff was increasingly able to deal with each outbreak as a public health emergency and smallpox receded even more rapidly.

Today in Asia, the search continues day in and day out—by vehicle, by boat, by motor cycle and on foot. The outbreaks are now difficult to find. Those persisting longest have been in population groups which have resisted vaccination for religious reasons, or among beggars moving from place to place, or in remote forest and mountain areas. But the search continues. Each suspect case triggers an immediate response but more and more of the reported suspect cases have proved to be cases of chickenpox, measles or scabies.

*Nomadic tribesmen, always on the move, suspicious of strangers and their ways, presented a social problem for the vaccination teams. An Afghan girl submitting to the mild pricking of the needle was one of nearly four million people vaccinated in Afghanistan in 1970. (Photo WHO/P. Almasy)*





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# LA VACUNA CONTRA LA VIRUELA



## PROTEGE A TODA LA FAMILIA





By July 1974, smallpox outside of Asia lingered in only one country—Ethiopia, and in only one small portion of that country. But the problem area was a forbidding mountainous highland plateau, deeply cut by river valleys hundreds of metres deep. The inhabitants are an illiterate but proud and independent people, living in dwellings scattered randomly across the terrain, and more resistant to being vaccinated than almost any group on earth. Few roads penetrate the area. A messenger travelling on foot constitutes the only form of communication and health facilities are almost non-existent. In such areas in other countries, the chain of smallpox transmission had frequently stopped even though no special measures were taken. The infected individuals, having few contacts, simply failed to transmit infection to others and smallpox disappeared. But in the Ethiopian highlands, the inhabitants think little of walking 50 to 100 miles to visit relatives and, moreover, they practise the ancient technique of variolation to protect themselves against smallpox. The head of a family, knowing of smallpox many miles away, may walk to the patient's house, obtain pustular material and bring it to his family to inoculate his children. While those receiving inoculation usually have only a mild illness, they transmit infection to others in the normal manner and so the chain of transmission continues.

It seemed an almost impossible task to eliminate smallpox in such an area but the task is virtually finished. It was slow, difficult, often frustrating work. Government authorities at the local levels—called meketel governors, chickashums and balabats—were contacted one by one, and to each the programme was patiently explained and his help requested. Church leaders, teachers and landowners were approached in the same manner. Until November 1974, teams of Ethiopian workers and volunteer health staff from the USA, Japan and Austria, had criss-crossed the area on mule-back and on foot—talking, talking, talking. At first, vaccination was refused or only hesitantly accepted by a few. But, as time passed, the confidence of the people was gradually won and more and more accepted vaccination. When drought struck some of the areas, vaccinators were posted at food distribution points and each

family received first vaccination and then food.

Finally, by November 1974, the time was ripe to complete the task and so began "Operation Crocodile". Two helicopters were provided by the USA and more than 100 two-man teams were mobilized. The teams were conveyed to a point, left in the area for a few days to search for cases and then picked up again to be ferried to another point. What would have taken months by foot and mule alone could be achieved in weeks. All areas could be searched and vaccinated as necessary in a comparatively short period of time. To ensure that smallpox transmission had really been stopped, the operation was extended to three months as teams searched and searched again to find the last cases.

Today, throughout Asia and Africa, the search continues. In Bihar, India, a telex message addressed to "Zeropox, Patna", operations headquarters, reports another suspect outbreak checked by a surveillance team and found to be chickenpox. In Ethiopia, a helicopter descends slowly between canyon walls to a remote cluster of villages and soon by two-way radio the report is relayed to operations headquarters in Addis Ababa that another area of that vast country has been checked and found to be free—another white pin goes on the map. At Mymensingh in Bangladesh, a health inspector arrives by motorcycle to record another week without cases in the thana (village) for which he is responsible. And everywhere, in the recently endemic countries, posters and radio messages proclaim a cash reward to anyone reporting an outbreak of smallpox.

Two years of this intensive activity must continue after the last known case. Next an international commission will need to be convened in each area to assure themselves and the rest of the world that transmission has really been interrupted. Only then can it be safely said that smallpox transmission has been stopped and that the world has at last vanquished its most feared and devastating disease. Tribute then will be due to the thousands of dedicated workers around the world who, without regard to climate or terrain, have worked tirelessly to seek and contain, one by one, each of the thousands of outbreaks of smallpox.

The eradication of smallpox is unique in the annals of history. But the campaign must represent a beginning and not be an end in itself. The recognition of how much can be achieved for so little and in such a short space of time with a coordinated international effort should be the point of departure for mobilization of efforts to combat the many other health problems which beset mankind. ■

*"Vaccine against Smallpox: Protect all your Family" said the poster displayed by a health worker in Colombia. He and his colleagues got the message across. By August 1973 an international commission was able to proclaim the eradication of smallpox in the Americas. (Photo WHO/P. Almasy)*