

Genesis, Strategy and Progress of the Global Smallpox Eradication Programme

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ABSTRACT

When the global smallpox eradication programme began in 1967, 30 countries were considered to be endemic in four major endemic areas of the world. Smallpox eradication has been achieved in two areas, Americas and Indonesia, the transmission is believed to be interrupted in Africa excepting in deep forest areas of Ethiopia and in the fourth area—Mainland Asia—smallpox endemic areas are rapidly disappearing. In India, with the intensified campaign launched, it is reasonable to expect virtual elimination of smallpox by the end of the year, 1974. The new strategy of the campaign has been discussed.

INTRODUCTION

September, 1974 marks the commencement of the final battle to defeat, once and for all, the ancient and devastating scourge of smallpox. Never before in history has this disease been confined to such a limited geographic area and never before have the nations of the world marshalled such an array of resources in an effort to achieve its final defeat. During the coming months, epidemiologists from countries throughout the world and health workers of all categories will be attacking vigorously the last strongholds of smallpox in each of the remaining endemic countries. If all proceeds as hoped, the last case of smallpox may be recorded less than a year from today and surveillance teams may then begin the required two-year intensive search to make certain that no remote or hidden focus remains anywhere in the world.

It was just eight years ago, in 1966, that the nations of the world, during the course of the 1966 World Health Assembly, decided unanimously to undertake an intensified programme to eradicate smallpox and expressed the hope that this might be achieved within a period of 10 years. Earlier World Health Assemblies, virtually since the founding of WHO, had discussed annually the desirability of smallpox eradication and many resolutions had been passed urging that each endemic country attaches priority to the elimination of smallpox from its territory. Countries undertook mass vaccination campaigns in an effort to do so but few succeeded. The 1966 Assembly, however, provided a special budget for smallpox eradication and asked that WHO assume a principal role in the organization and coordination of the efforts.

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Position at the commencement of the programme

In 1967, when the global smallpox eradication programme began, 42 countries reported one or more cases of smallpox and 30 were considered to be endemic—over 130,000 cases were reported. Later studies, however, showed that the reporting of cases at that time was so incomplete that at best not more than one case in 20 was being recorded and, in most areas, not more than one case in 100. At that time, four major endemic areas were defined; (1) Brazil in South America, (2) African countries lying south of the Sahara Desert, (3) Indonesia and (4) four countries of Mainland Asia—India, Afghanistan, Nepal and Pakistan (including, at that time what is now Bangladesh).

Requirements of vaccine

When the programme began in 1967, the most urgent requirement was for a sufficient supply of freeze-dried smallpox vaccine of satisfactory quality. An estimated 250 million doses were required in endemic areas, yet almost none of the vaccine then in use met WHO standards of potency and stability. Urgent steps were taken to provide needed equipment, consultants and fellowship training to laboratories in the affected countries; a panel of experts pooled their expertise to develop a detailed manual dealing with vaccine production; international reference centres for vaccine testing were established in Canada and the Netherlands; and donations of vaccine were solicited from countries able to produce vaccine of satisfactory quality. The USSR provided more than 125 million doses annually during the first years of programme but important contributions were also made by the U.S.A., Canada, Switzerland, Kenya and some 20 other countries. By 1969, all vaccines in use in the endemic countries met accepted standards and, by 1973, more than 80 per cent of the vaccine was being produced in the developing countries themselves.

Techniques for vaccine administration

A second immediate need was to simplify and improve techniques for vaccine administration. The multiple pressure technique was known to produce the highest proportion of satisfactory takes but this technique was more difficult to teach to vaccinators than the simpler but less effective scratch method (the rotary lancet is basically a device for scratch vaccination). Vaccinators at that time were further encumbered by bottles of alcohol, acetone or soap as well as cotton swabs used for "cleaning" of the skin. New techniques in vaccination were sought. Jet injectors were introduced in 1967 for routine use in programmes in South America and West and Central Africa. Vaccination efficacy was found to be comparable to that obtained with the multiple pressure technique and in large-scale vaccination programmes, where large groups could be assembled, vaccinators could vaccinate far more persons than with manual techniques.

With a single jet injector, as many as 1000 persons per hour could be vaccinated. The injectors, however, required continuing skilled maintenance and repair and offered no advantage when vaccination was performed on a house by house basis. A new device, the now well-known bifurcated needle, was first successfully tested in multiple puncture vaccination in 1968 and, immediately afterwards, was made available world-wide. Efficacy of vaccination with this device was as high as that obtained with any other device; the technique of multiple puncture vaccination could be quickly learned; and therefore, rapid-vaccinators using this technique are now vaccinating 500 or more persons per day. Most important, less vaccine is required with this new technique. An ampoule of vaccine which previously permitted vaccination of 20 to 25 persons now can be used to vaccinate 100 to 125 persons. The needle can be sterilized and re-used literally hundreds of times. Other studies revealed that bacterial infections of the vaccination site were uncommon whether or not the skin was cleansed with alcohol, soap or acetone and that the infrequent occurrence of such infections was the same whether or not the skin was cleaned with these substances. Since alcohol, acetone and soap offered no advantage, their use was abandoned. Thus, the vaccinator, was able to work with the minimum of equipment, a tube of vaccine, one container for sterilized bifurcated needles and one container for used needles.

New strategy

The most important development in smallpox eradication, however, was the change in the strategy of programme from one which advocated mass vaccination as the only approach to one which emphasized discovery and containment of outbreaks. Early studies conducted in Nigeria, and subsequently in other countries in Western and Central Africa where the eradication programmes were assisted by the USA, revealed that programmes which emphasized reporting and detection of cases, followed by effective containment of outbreaks by vaccination, could stop smallpox transmission even when as few as 30 to 50 per cent of the population bore scars of vaccination. Studies in Indonesia, on the other hand, revealed that when no special efforts were made to contain outbreaks, smallpox epidemics occurred in population in which 95 per cent of the population had been vaccinated. Thus, while routine vaccination programmes were continued in all countries, increasing emphasis was given to the detection and reporting of smallpox outbreaks and their rapid containment by specially trained teams. Even more effective techniques for case detection have evolved year by year and increasingly greater emphasis has been placed on continuing active search for cases by health staff. Questioning of those attending schools and markets about possible cases has been found to be especially valuable. The latest approach, developed in India, in which health staff systematically visits all villages and towns to search for smallpox cases during a one-week period every month has been found to be the most effective. Cash incentives to discover outbreaks in areas where few outbreaks are occurring have further improved the system.

While systems for the detection of cases have markedly improved, especially during the past 12 months, procedures to ensure prompt and effective containment of outbreaks still require improvement. In the areas where containment has proved most rapid and effective, one or two vaccinators under supervision remain in the village until three weeks after the onset of the last case, to vaccinate the village residents and subsequently all visitors and to inform immediately should any of those infected or their contacts leave the village to go elsewhere. Because of the large number of outbreaks in some areas, this type of activity was not possible during the spring and early summer months, but such an approach is now possible everywhere.

Progress

Overall progress in the programme during the past seven years has been most encouraging, and there is every indication to believe that the objective of stopping smallpox transmission within the 10 years period, originally proposed by the World Health Assembly, will be achieved. In South America, the last case of smallpox was detected in April, 1971. Two years of intensive surveillance followed, but no case could be discovered. An international commission met in Rio de Janeiro in August, 1973, and after a full review of activities and spot-checks in the field, agreed that smallpox eradication had been achieved in the Americas—the first of the target zones. In Indonesia, the last case was detected in January 1972 and following more than two years of intensive but fruitless search for hidden foci an international commission convened in April 1974, decreed that smallpox had been eradicated in Indonesia—the second of the principal target areas.

In Africa, the third of the target areas, smallpox transmission is now believed to have been interrupted throughout the continent except in the geographically rugged central mountainous area of Ethiopia. The disease is now confined entirely to remote rural areas which require one to several days walk to reach. To facilitate activities, costs for two helicopters for the period September through December have recently been donated. With an increased number of personnel and helicopter transport, Ethiopia programme staffs are confident that the last scattered vestiges of smallpox on the continent of Africa will be eliminated by the end of the year.

In the last of the four target areas—Mainland Asia—smallpox endemic areas are now rapidly disappearing. Afghanistan has detected no case for more than a year and, in fact, indigenous transmission appears to have been stopped more than three years ago. All cases since that time have occurred as a result of importations from Pakistan. Smallpox incidence in Pakistan has this year declined rapidly to the extent that at the end of June, less than 100 villages were known to be affected and the final interruption of smallpox transmission appeared to be a matter of weeks. Nepal, for almost two years, has traced all its outbreaks directly or indirectly to importations

mostly from India. Bangladesh had been actively engaged in an aggressive eradication programme and through June 1974, had recorded a decrease in smallpox incidence of more than 50 per cent from the previous year, despite far more extensive activities and more complete reporting. A special monsoon programme, employing large number of boats, is expected to further reduce the extent of the infected areas and to result in interruption of transmission by October or November.

Intensive campaign in India

In India, the Government during the past year has substantially increased the scope of effectiveness of its programme. This augmented programme has been further assisted by support from WHO and from the Government of Sweden which made funds available to WHO for use on behalf of the Indian Smallpox Eradication Programme. At present the states of Bihar and Uttar Pradesh account for the bulk of smallpox in the country. More than 100 epidemiologists drawn from non-endemic areas of India and from other countries are now working in the still affected areas; additional transport has been provided as well as special funds for petrol and per diem of field workers. With the marked reduction in the number of villages and towns afflicted with smallpox, it would now seem reasonable to expect that a full-scale intensive campaign between September and December could succeed in the virtual elimination of smallpox by the end of this year, before the period of more rapid transmission begins. This will require an absolute priority effort by health staff in all endemic areas as well as most important and necessary support from District Magistrates, Block Development Officers, school teachers and others. At the same time, those in now non-endemic area will have to treat every suspect case as a true public health emergency requiring immediate action to contain the outbreak and to identify its source. While it is recognized that some other health programmes, especially in the endemic areas, will make less progress during the period, it would seem a small price to pay for the achievement of smallpox eradication in India and in the World.

The ultimate goal

Following the official report of the last case of smallpox, two years of active search for hidden foci of smallpox will be necessary. Surveillance teams and local health staff will be busy during this period as experience has shown that many false reports are received after smallpox disappears from a country. Also during this two-year period, and so long as smallpox persists anywhere in the world, vaccination programmes will have to be continued.

But when this two-year period has concluded and the necessary international assessment for certification has been completed, eradication for all time of this most devastating disease will be a reality, one of the most significant milestones in the history of medicine and hopefully, the beginning of more effective programmes for the control of other diseases susceptible to immunization.