



TRAINING SEMINAR ON SMALLPOX ERADICATION

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THE GLOBAL SMALLPOX ERADICATION PROGRAMME - THE FINAL PHASE

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This autumn, we inaugurate the "final phase" of this global programme to eradicate smallpox. Our target quite simply - to reduce to zero, smallpox incidence throughout the world during the next 18 months, i.e. during the course of the next two smallpox seasons.

On the surface it might seem unduly optimistic to propose anything quite so ambitious at this particular time. Note:

1. Over 53 000 cases have been recorded so far this year and the eventual total will certainly exceed 65 000 - over twice the number of cases reported in 1970 and 25 per cent more than were reported last year.
2. The 10 881 cases recorded during May of this year is the highest monthly total reported in more than four years.
3. More cases resulted from importations in 1972 than in any year since the programme began.

However, as we begin this smallpox season, we have for the first time some sort of surveillance activity in virtually all endemic areas. During the past year, activities have begun in the remaining 9 of 14 provinces in Ethiopia, in the southern provinces of Sudan, in western Nepal, in the remaining provinces in Pakistan, in Botswana and in India. While neither the quality nor the intensity of surveillance measures in many areas is yet up to the standard required to interrupt smallpox transmission, steady progress is being made and the gap between what is present and what is required is narrowing.

The increase in reported cases this year reflects this intensified surveillance activity and, as such, I regard it as a favourable sign. The present situation is reminiscent of that in Brazil only three years ago. In Brazil in 1969, after two years of a mass vaccination programme, surveillance activities were begun. The number of reported cases almost doubled as surveillance teams found 20 to 40 cases for every case reported. Authorities both in the government as well as in other countries expressed concern and pessimism. The surveillance programme was further intensified and little more than 12 months later, the incidence fell to nil. For more than 18 months now, no cases have been detected anywhere in the western hemisphere.

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With the retreat of smallpox under the pressure of vaccination programmes during the past century, it is sometimes forgotten that this disease has been the most serious and feared infectious disease known to man. Its potential is no less today. Smallpox has written across the pages of history an unparalleled account of death, blindness and disfigurement among people throughout the world. In North America, epidemics in the early 17th century are estimated to have destroyed almost 90% of the Indian population along the eastern seaboard. Without smallpox, the history of settlement in the New World would have been entirely different. The situation was little different in Europe where, before vaccination, it is estimated that two of every 10 children born eventually died of the disease. In fact, in one country, it was the custom not to name the child until after he had experienced smallpox. The problem which smallpox has posed to Asia is well known to all of you. So far as we can determine, variola major is no different nor less serious today that it was then. While vaccine is available to protect, there is no treatment.

It is for this reason plus the recognition that smallpox could be eradicated even from areas with limited resources that led the World Health Assembly in 1958 to propose that the eradication of smallpox be undertaken as a priority measure. At that time, smallpox had been eliminated from Europe and North America as well as some countries in Asia and Central America.

During the years that followed, several countries began systematic vaccination programmes, but only a few were successful. It soon became evident that the existing strategy for eradication should be reviewed, that technical and material assistance to the endemic countries needed to be stepped up and that programmes should be streamlined and coordinated, regionally and globally. The World Health Assembly in 1966 therefore adopted a resolution proposing intensification of the eradication programme. The new programme came into effect at the beginning of 1967.

In that year, smallpox was considered to be endemic in 30 countries: in Africa, most countries south of the Sahara; in Asia, Afghanistan, India, Indonesia, Nepal and Pakistan; and Brazil. Twelve additional countries reported cases believed to have been imported. However, transmission had already been successfully interrupted in many developing countries in Asia and the Americas where health services were limited and communications difficult. This was an indication that the objective of global eradication was both technically and operationally feasible.

A vital need for the success of the programme was adequate supplies of high quality freeze-dried vaccine. Surveys showed that not more than 10 to 15 per cent of the freeze-dried smallpox vaccine then in use in the endemic countries met standards recommended by WHO. The Organization assisted vaccine-producing laboratories. Reference Centres for Smallpox Vaccine were designated to test vaccines, train national laboratory workers and evaluate new techniques of production. Both the quality and the quantity of vaccines steadily improved. A number of countries began to produce sufficient vaccine of acceptable quality for their own needs. Today, two-thirds of the vaccine used in presently or recently endemic regions is produced in these regions. But in addition to indigenously produced vaccine, a further 150 million doses initially were required each year to carry out the programme; these were donated by 20 Member States, the largest contributors being the USSR and the USA. By 1969, more than 95 per cent of all vaccine in use in the endemic countries was freeze-dried vaccine conforming to the requirements laid down by WHO.

A second consideration in the development of the programme was the technique of vaccination. Previously, most vaccinations had been administered by the easily performed scratch technique. Under field conditions this method was found less effective than the more difficult multiple pressure technique. Alternative techniques were sought. Newly developed jet injectors were introduced into programmes in Africa and South America. The proportion of successful vaccinations was as satisfactory as that obtained with the multiple pressure method and less vaccine was required to obtain an adequate response. However,

problems were encountered in maintaining and repairing the injectors and they were unsuitable for house-to-house vaccination programmes.

The introduction of the bifurcated or forked needle about this time came as a great boon. WHO began to experiment with the bifurcated needle in 1967 - it soon proved to be as revolutionary a device as the safety pin in its day. With the needle, the rate of successful vaccination was found to be superior to that obtained by other devices, and the amount of vaccine required was reduced to one-fifth. The needles could be sterilized easily and repeatedly, and there was no question of breakage or maintenance.

While these problems of vaccine and vaccination were being resolved, WHO cooperated with health authorities to plan smallpox eradication programmes in each of the endemic countries and in many countries particularly vulnerable to the introduction of smallpox owing to their geographical situation. Some programmes began in 1967, but most started in 1968 and 1969. In all, WHO assisted programmes in more than 50 countries.

From the beginning, the strategy of the new programme emphasized surveillance as its primary component with mass vaccination a secondary component. In the past, eradication programmes consisted almost solely of mass vaccination: with the present strategy, surveillance is the keystone. There are several reasons for this.

When the characteristics of people who contract the disease are known, vaccination programmes can be aimed at high risk groups. As you know, surveillance data indicate that in Asia more than 85 per cent of cases occur among those who have never been vaccinated, and more than 80 per cent among children less than 15 years old. In many areas a disproportionate number of cases occur and persist in immigrant groups in slum areas of cities. Regularly they serve to introduce the disease into rural areas. Accordingly, vaccination programmes now stress primary vaccination of children and vaccination of poorer city dwellers. The role of the hospital as one of the most dangerous and common places for dissemination of infection was recognized. Consequently, the need for vaccination of each and every person entering an infectious diseases hospital for whatever reason has been emphasized.

In addition to being a highly useful device to define high risk groups, surveillance plays an even more important role in interrupting the transmission of smallpox. Throughout the remaining endemic areas of Asia, smallpox transmission persists at low levels despite a high rate of vaccination coverage, the disease continuing to spread from one person to another among a small proportion of susceptible individuals. Active measures to identify and contain outbreaks, however, have frequently caused transmission to be interrupted even where less than half the population has been vaccinated. The remarkable efficacy of surveillance and containment measures can be explained by the epidemiological behaviour of smallpox which, as a disease, has unique characteristics.

In contrast to most other diseases, the presence of smallpox virus in an area can be readily detected. Each person infected with the virus develops the characteristic rash. Those with subclinical infections play no role in further transmission and the virus is not present in animals or insects. If the virus is to persist, the infected person must transmit the virus to a second person and he to a third person in a continuous chain. If the infected person does not transmit the virus to anyone, the chain is broken and the outbreak stops. In remote villages and nomadic population groups, this may occur even though no specific measures are taken. Furthermore, if the source of infection of the first case in a village can be determined, previously unrecognized or unreported foci can be detected and similarly contained.

As a supporting measure, systematic vaccination is carried out to increase the proportion of immune persons. This serves to create a partial barrier to transmission and the number of chains of transmission that require the attention of surveillance teams are

reduced. It must be reiterated, however, that vaccination alone without effective surveillance will not stop transmission.

Since 1967, both the incidence of smallpox and the number of countries reporting cases have decreased significantly. In 1967, the number of cases reported was 131 000. Surveys conducted since 1967 suggest that less than 5 per cent of all cases were then being reported; the actual number of cases is thus estimated to have been at least 2.5 million. Despite increasingly complete reporting, smallpox incidence declined each year until 1970, when 33 318 cases - the fewest on record - were reported. In 1971, however, the reported incidence rose to more than 52 000 cases and this year to perhaps 65 000. The completeness of reporting, however, has improved and it is now estimated that at least one third of all cases are notified. The actual number of cases this year is thus estimated to be less than 200 000 in contrast to the 2.5 million cases estimated for 1967.

The number of countries reporting smallpox decreased from 42 in 1967 to 16 in 1971. Of the 42 countries reporting smallpox in the former year, 30 were considered to be endemic, whereas the remaining 12 notified imported cases. At present, continuing transmission is believed limited to 7 countries: in Africa - Botswana, Ethiopia and Sudan, and, in Asia - Bangladesh, India, Nepal and Pakistan.

In 1967, the smallpox endemic countries were considered to fall within four regions: South America, Indonesia, Africa and the mainland of Asia. It was considered unlikely that smallpox would be transmitted between any two of these regions. And, indeed, during the last five years, no such transmission has been detected. Thus, when smallpox transmission is interrupted in one of the regions, it will probably remain free from smallpox. Two of the four regions, South America and Indonesia, now appear to be smallpox-free.

In South America, more or less extensive smallpox eradication programmes have been conducted in various countries during the past 20 years. By 1967, endemic smallpox was reported only in Brazil, which began an eradication programme in that year. During the next four years, 83 million of a population of 94 million persons were vaccinated in a well organized and carefully assessed programme. As I mentioned earlier, surveillance activities were begun in July 1969 and the smallpox incidence subsequently rose precipitously as the detection and notification of cases improved. During 1970, a steady decline in incidence occurred until mid-November, when zero incidence was first recorded. Subsequently, a single localized outbreak of 20 cases was detected in suburban Rio de Janeiro and lasted until April 1971, when the last known case of smallpox in South America was reported. Mobile surveillance units continue to operate in each of the states of Brazil to investigate every suspect case and to undertake an active search for cases. More than 4 000 reporting posts throughout the country report weekly whether or not cases are detected.

An intensive search for possible residual endemic foci in Brazil and in neighbouring countries has been in progress over the past two years. No foci have been found. Thus, 450 years after smallpox was first introduced into the Americas, transmission appears to have been interrupted.

In Indonesia, the second of the target areas, an eradication programme began in July 1968 in Java and Bali and was subsequently extended to include the outer islands. Surveillance and containment measures were primarily emphasized. During the first years of the programme, between 10 000 and 18 000 cases were notified annually but, in 1971, the number decreased sharply to 2 000. In 1972, only 34 cases were reported, all of which occurred in one localized area during January. Notification posts throughout Indonesia which report weekly whether or not cases have been observed have reported no cases. A special active search for cases has been conducted on a national scale and special surveillance teams are continuing this activity. No cases have been detected.

In Africa in 1967, smallpox was widely endemic throughout most countries south of the Sahara and during the past six years, most have conducted eradication programmes. Except in Botswana, Sudan and Ethiopia, reported smallpox incidence has now decreased to zero.

In the 20 countries of western and west central Africa, with a total population of 120 million, reported smallpox incidence declined to zero in October 1969. One additional outbreak was detected in Nigeria in March 1970, the last known case occurring in May, over two years ago.

In the countries of eastern and southern Africa, outside of Ethiopia and Sudan, smallpox incidence declined steadily, apparently reaching zero incidence following the occurrence of two cases in Zaire in September 1971. Subsequently, it was discovered that Botswana, previously smallpox-free, became infected almost at the time the last cases were occurring in South Africa. Over 1 000 cases have occurred. Intensive containment measures have been undertaken and transmission is expected to be interrupted within a matter of weeks. In addition, introductions occurred into the French Territory of the Afars and Issas, as well as into Uganda, but were successfully contained.

Thus, in Africa, Ethiopia and Sudan are the two remaining countries of primary concern. Sudan's programme was originally limited to the central and northern provinces because of civil disturbances in the three provinces of the south and here endemic smallpox persisted. With the cessation of hostilities this spring, the government undertook a smallpox eradication programme in the south as a priority measure. This is being accomplished primarily by special surveillance teams complemented by systematic vaccination in the larger cities and towns. Smallpox incidence has declined rapidly and with the cessation of the rainy season this month, teams will move into the more remote areas for active search operations. Transmission is expected to be interrupted by March.

Ethiopia's programme is not yet two years old but has probably made more progress with fewer resources than any eradication programme to date. Only 80 people are engaged or one for each 300 000 persons in the population. The 80 programme staff are distributed across the country as one and two man surveillance teams who spend 20 to 25 days each month in the field. They investigate every suspect case or rumour of smallpox - in all, they have investigated and contained over 40 000 cases of smallpox in less than two years. Vaccination is done as part of this activity supplemented by vaccination programmes in major towns and cities. When not engaged in containment activities, they conduct active search operations in the provinces for which they are responsible. Various studies which they have done now suggest that when immunity levels reach 30 to 40 per cent in an overall area, containment activities are able to stop transmission very rapidly. Already, transmission appears to have been interrupted in 5 of the 14 provinces and is expected to be interrupted in 10 of the 14 provinces by the end of the year. A nil incidence is expected by the end of 1973.

In brief, a nil incidence on the entire continent of Africa by December 1973 seems a very reasonable objective.

Since 1967, the only known endemic countries on the mainland of Asia have been Afghanistan, Bangladesh, India, Nepal and Pakistan. China is reported to have become smallpox-free after intensive vaccination campaigns in the 1950s. Burma, Iraq, Iran, Syria and countries of the Arabian peninsula have recorded only infrequent importations of smallpox from the endemic countries in Asia.

In the fourth year of a well-executed programme, Afghanistan, as we shall hear, has experienced a considerable decrease in incidence this year and since February all cases have been among immigrants from Pakistan and their contacts. Nepal this year extended its programme of activities to the western Terai and the Himalayan hill Districts thus extending coverage throughout the country. At the same time the surveillance programme was markedly intensified everywhere. With the extension of the programme, outbreaks were

discovered in the western Terai and were rapidly contained. Since June, only 8 cases have been detected, all following importations from India.

Bangladesh, as you know, experienced a serious setback in its programme when early this year, large numbers of infected refugees returned from India. Prior to this, the last known cases had occurred in August, 1970. No cases were reported for over 16 months and five central surveillance teams failed to detect cases during active search operations. The enormous number of importations, coupled with problems of transport and communication, overwhelmed the capability of the surveillance teams. Over 8 000 cases have been reported to date. I'm happy to report, however, that the government has given this programme the highest priority, additional staff have been assigned and the surveillance and notification system has been fully re-established. Cases are now confined to five of the 16 districts, all in the southwest. An intensified surveillance programme has been implemented in this area. At the same time, active search operations throughout the rest of the country have thus far managed to detect and contain outbreaks originating from the now endemic focus. Programme staff express confidence that transmission will once again be interrupted before the beginning of the next rainy season.

The programme in India has made considerable progress during the past year with the result that transmission is expected to be interrupted by the end of this year in all but four states - West Bengal, Bihar, Madhya Pradesh and Uttar Pradesh. Additional assistance is now being provided to strengthen programmes in these states. Meanwhile special surveillance activities are planned for the remaining states to insure that they remain smallpox-free.

Overall, it is clear that the areas with significant problems at this time are limited in extent and those with the most serious problems, those in Asia, have far more and better trained staff, far better communications and far less population resistance to vaccination than most others which have already interrupted transmission.

Our problem for both now and the future is to determine how best to assure that smallpox-free areas indeed remain free of smallpox while, at the same time, deciding how best we can proceed with maximum possible speed to eliminate the remaining foci. Every day, every week, every month of delay, especially now when smallpox transmission is exhibiting a seasonal increase, means that much more work and that much more delay in breaking the final chains of transmission. Such delays may also have implications to the global programme as a whole. As we recapitulate the events leading to Botswana's epidemic we realize that the disease was probably introduced perhaps weeks before transmission was interrupted in South Africa. The massive outbreaks in Bangladesh could probably have been averted had the outbreak in one refugee camp been recognized perhaps 2 to 3 weeks sooner. We hope that the next two years do not add more episodes of "what might have been".

In this final phase, a high degree of national coordination as well as close cooperation between provinces and countries will be more important than ever before. The past six years have been replete with examples of smallpox behaving as a ping-pong ball, infecting first a village on one side of the border and then the other and then back again. Until there is a high degree of national coordination and full and complete cooperation between provincial and national authorities on both sides of borders, transmission will persist as neither area quite catches up with the problem and each heatedly blames the other for its troubles.

With the full support of the respective governments, with mutual understanding between all concerned with the programme and with a sustained, determined effort on the part of all to seek out foci and indeed treat every suspect smallpox case as a public health emergency, this final phase of the programme will I know, be no less successful in accomplishing what was universally termed an impossible task but a few years ago in Brazil, in West Africa, in Indonesia, in Zaire and in Afghanistan.