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SMALLPOX - PRESENT AND FUTURE

Dr Donald A. Henderson
Chief, Smallpox Eradication Unit

It is a special pleasure for me to have the opportunity to attend and to speak at this, the first International Seminar on Smallpox Eradication to be held in Sudan. In some ways, it seems paradoxical to convene a smallpox Seminar in Khartoum at this time, fully ten months after the last known case of smallpox has occurred in the country. But, as we all recognize, the task is not yet completed - much remains to be done and this Seminar provides an excellent opportunity to assess the present status of the programme and to lay the necessary plans for the future.

The prolonged absence of detected cases in Sudan has been for me one of the most wholly unexpected and pleasant surprises of the entire global eradication campaign. At the same time, it has damaged my reputation as a perennial optimist. Having reviewed the status of the programme in Sudan just over a year ago, I advised that in my judgment, Sudan could perhaps become smallpox-free by June 1973, provided that an effective and aggressive surveillance-containment programme was conducted over the succeeding smallpox season. At the time, this target was considered by many to be little more than wishful thinking. The logistical difficulties, the dispersed and comparatively inaccessible populations in the remaining endemic areas and the fact that vaccination immunity was recognized to be poor in these areas were all cited as cogent reasons why at least two if not three years would be required to interrupt transmission in Sudan. Nevertheless, with a heroic and well-directed effort on the part of the programme staff, smallpox appears to have vanished - more than six months before I personally dreamed it was feasible. As we all recognize, of course, active search operations must be continued and a most alert vigilance maintained to discover possible hidden foci and to guard against importations from Ethiopia. Vaccination immunity must be improved to deter further spread should importations occur - and almost certainly they will. Nevertheless, you have made more progress in the past year than any had dreamed was possible and, for this, I must extend my heartiest congratulations to all who have participated in this remarkable programme.

The smallpox season just beginning promises to be, by far, the most exciting and, at the same time, the most crucial in the seven year history of the global programme. The global programme, as you will recall, began in January, 1967 at which time smallpox was prevalent throughout Africa, in Brazil, in Indonesia and in four countries of the Asian sub-continent. Those who participated in the original Assembly debate expressed the hope that the disease might be eradicated within a 10 year period - that is, by December 1976. A successful achievement of this objective might be interpreted in two ways (1) that the last known case of smallpox would be detected on or before 31 December 1976 or (2) that the last known case of smallpox would be detected on or before 31 December 1974 - thus permitting the necessary full two years of active surveillance throughout the world to assure that there were no persistent, hidden foci. To us, the latter interpretation has been and continues to be our target - to reach a nil incidence by December 1974.

Progress in the programme durings its early years was gratifying - in June 1970, the last case of smallpox was detected in the 21 country area of western and central Africa - in April 1971, the last case of smallpox occurred in the western hemisphere - and in January 1972, the last case of smallpox occurred in Indonesia. Nevertheless, a year ago, it appeared that the pace of activities would necessarily have to be stepped up if the December 1974 objective were to be met.

A special campaign, termed "Target Zero" commenced last September - its objective to interrupt smallpox transmission over the succeeding two smallpox seasons. Since the Target Zero campaign began, three of the seven countries which were endemic at that time have become smallpox-free - Sudan having now been joined by Nepal and Botswana. Ethiopia has made dramatic progress to the extent that transmission appears to have been interrupted in two-thirds or more of the country. Similarly, Pakistan's endemic areas are confined to less than one fourth of the country. Bangladesh, after initial setbacks, has again gained the initiative with one of its four divisions having now become virtually smallpox-free and substantial progress having been made in the others. In India, however, the situation is less satisfactory - progress in the southern and western states having been counterbalanced by serious setbacks in the states of northern, central and eastern India.

The pace of the Target Zero campaign is once again being stepped up, however. WHO's resources are being redirected to provide additional assistance in the remaining problem areas; additional staff - both national and WHO are being added to the programme; and additional resources are being provided. This autumn, a special effort is being made to identify and eliminate existing foci at the time smallpox incidence is at its lowest ebb - from September to December. In the problem states of India during this period, all health personnel will undertake on three separate occasions a village by village search for cases; in some areas cash awards are being provided to the first person to report smallpox from a village; and, of course, in all areas additional surveillance teams are being mobilized to conduct an active search and containment programme. With a reasonably successful effort, we feel that it is quite possible that Pakistan could become free of smallpox by the end of the year and Ethiopia and Bangladesh by April. In India, the problems are more formidable and a nil incidence cannot be foreseen before the end of 1974. I hope, however, that India in particular will again prove me to be unduly pessimistic as you in Sudan have already done. And there is good reason to believe that India could do this. Fully five to ten times more smallpox personnel per capita are engaged in the smallpox programme than have been engaged in any programme in Africa; resistance to vaccination compared to that in Sudan or Ethiopia, for example, is virtually nil; transport facilities are so plentiful that the need to walk for a few hours (note hours, not days) to reach an outbreak is considered exceptional. With a firm committment to the programme on the part of the government and a realization at all levels of the key role of surveillance and containment, smallpox even in India, could be a thing of the past in a matter of months rather than years.

In the meantime, those of you in countries now believed to be free of smallpox must not relax either your vigilance or your vaccination programmes. In Botswana and Bangladesh, we have had the unhappy experience of seeing entire countries, once smallpox-free, subjected to the most extensive smallpox epidemics ever recorded following importations. It could happen again. However effective the screening system may be at borders, we know that cases may still enter during the incubation period. If the infected person is a smuggler, for example, he may specifically avoid border checkpoints and eventually develop the disease in a remote village where health facilities are non-existent. The disease may then spread for weeks or even months before the first case is diagnosed. For this reason, a single suspect case of smallpox constitutes a true emergency as, commonly, it is not the only case but, rather, only the first indication of a large outbreak already widely spread. Thus, there is a clear need for each case

to be immediately investigated clinically and epidemiologically and specimens collected for the laboratory by experienced staff. If the importation occurs in a well-vaccinated area, the spread of infection will be slower and thus there is a clear need to maintain high levels of vaccination immunity throughout the country so long as there is a risk of an importation. And, in this era of jet travel, what country is not at risk so long as smallpox persists anywhere?

Many find it difficult to envisage a day when smallpox (or any disease) will truly be eradicated from the globe. There is a feeling that somewhere in the animal population or in old crusts perhaps, smallpox will survive and once again become a scourage to mankind. Since 1967, when the global programme began, this question has been one which has been foremost in our minds. Much research has been done and a great deal of practical experience has been accumulated for the question is indeed an important one. Clearly, the best evidence that there is no reservoir other than man himself is the fact that many, many countries in diverse parts of the world have become free of smallpox and, despite active and continuing surveillance, no further cases have been detected except those which could be specifically traced to importations from known endemic areas. However, of considerable interest during the past three years has been the discovery of monkeypox, a disease which clinically resembles smallpox. Since the discovery of the first case in 1970, 15 additional cases have been documented in five smallpox-free countries of western and central Africa. The virus which has been isolated in each instance has proved to be monkeypox virus, a cousin of variola virus but distinctly different from it. In each instance when a case has been identified, surveillance teams have conducted intensive investigations extending over many square miles. In most instances, the outbreaks have consisted of single cases which have occurred in remote, often distant villages located deep in the tropical rain forest where monkeys are frequently consumed as food. Only once has infection been known to be transmitted from a patient to one of many susceptible contacts and this occurred between two sisters. At present, we don't know how or from what source the individuals became infected. We suspect, however, that monkeypox infections may have been present for decades, perhaps centuries, but only now, with the disappearance of smallpox and the development of surveillance programmes, are they being recognized. It would appear, however, that this virus has little potential for spread from man to man. However, research studies are continuing and surveillance teams throughout Africa as well as in other countries are continuing and must continue to search for possible smallpox cases to document even more clearly that this virus poses no problem to man.

The continuing success of the smallpox eradication programme has led public health administrators in many countries to examine carefully the various elements of the programme to determine what lessons might be learned in regard to the control of other diseases. It would seem there are many but, particularly, these apply to diseases subject to control by immunization - diphtheria, pertusis, tetanus, poliomyelitis, tuberculosis, measles and yellow fever being the principal ones for which good antigens are readily available which provide a high level of protection and long-lasting immunity. Three years ago a committee of public health experts reviewed this question and presented their observations to an International Conference on Immunization which was held in Washington in December 1970. Additional observations have become available since then which provide further support to these recommendations. A copy of this paper has been made available to you. I should like to comment briefly on certain of the observations. Most significant, I believe, is the opening statement:

> "In areas where health manpower and material resources are limited, the communicable diseases normally constitute a significant problem and immunization programmes are of special importance. Effective, alternate approaches for the prevention of most diseases are not at the moment available or economically possible. Although programmes of immunization represent, by and large, one of the most productive public health investments any country can make to improve the health of its people, such programmes in

the developing countries have, to date remained comparatively limited in scope and have generally been restricted to a few antigens".

What have we learned in regard to implementation of immunization programmes?

1. Vaccines of assured potency and stability must be used and provision made for their transport at proper temperatures to assure that they are potent at the time of delivery. This would seem obvious and yet this basic principle is regularly neglected. At the beginning of the smallpox programme, for example, we found that less than 10% of the vaccine in use met WHO standards. In some batches of vaccine produced by supposed reputable laboratories, no virus whatsoever could be detected. Even if one has a good vaccine which is relatively stable when subjected to heat - such as smallpox, BCG and DPT vaccines - one must bear in mind that vaccines such as measles and yellow fever vaccines are so highly unstable as to require that they be transported to the vaccination site in refrigerators. Many countries have been obliged to forego measles vaccine programmes at present for this reason. These facts, however, must be kept in mind in planning any vaccination campaign.

2. To obtain reasonable vaccination coverage, the vaccine must be brought to the people. Many countries have deceived themselves into thinking they had an immunization programme by simply supplying vaccine to health centres and hospitals and assuming the job was done. Almost without exception, the actual results have been disastrous. In most areas, we have found that many in health centres refuse to administer vaccines, pleading that they are too busy, or if persuaded to do so, very soon cease giving vaccine. Vast amounts of vaccine are wasted in health centres as vaccines are commonly stored in non-operative refrigerators or simply stored at room temperature. Often only one or two vaccinations are given from a large multi-dose vial. Finally it has been calculated that in the African country with the most extensive network of health centres, less than 15% of children ever attend a health centre or clinic. In brief, a health centre based scheme reaches a negligible population which is only rarely vaccinated when they do attend and, then, often with vaccine already destroyed by heat. At this time, mobile teams are the only satisfactory answer; without them, an effective immunization programme is simply not possible.

3. Careful planning is required with specific targets for each team each day and each week. The results of the efforts of such teams must be carefully and regularly assessed by a totally independent team to insure that they are performing as expected. If they are not, corrective measures need to be taken immediately.

4. The disease for which vaccination is being given should be under continuing surveillance to determine if, in fact, the programme is reducing the incidence of the disease. This, of course, is the ultimate test of the programme. If the immunization programme is having little or no effect on disease incidence, something is obviously wrong and a special investigation is immediately required.

5. Necessary measures must be taken to insure continuing replacement of vehicles as required and provision must be made for adequate petrol as well as travelling allowances for staff. This again would seem obvious and yet we have seen, again and again, hundreds of thousands of dollars being expended in salaries and for equipment but a totally non-operative programme because there were no vehicles or no gas or insufficient travelling allowances.

The contrast between an effective, well-planned and well-supervised programme and one which is not can be very dramatic indeed. In one African country, for example, vaccinators regularly administer an average of 500 to 750 vaccinations per day with a

coverage exceeding 90% in pre-school children. The cost is about US$.08 per vaccination. In an Asian country which will remain nameless but with a very poorly supervised programme, vaccinators rarely average more than 5 to 10 vaccinations per day. Although wages are low, the cost per vaccination in some districts has been calculated to range from $.25 to $1.25 each! The costs, let alone the effectiveness, of most health centre based programmes are, I am sure, even higher than this when measured in terms of effective immunization.

An immunization programme requires work, organization and constant attention but the dividends in terms of the health of the people can be substantial. In Sudan, you have seen the visible results of a successful smallpox programme - similar results could be obtained in regard to other infectious diseases susceptible to immunization. But in undertaking such a programme, keep in mind the fact that smallpox threatens - don't lose the substantial gains already made.