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SMALLPOX ERADICATION PROGRAMME

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1. Introduction

A global programme for smallpox eradication was first affirmed by the Eleventh World Health Assembly in 1958¹ and programmes in a number of countries developed soon after. Although some progress was made, a lack of resources in many endemic countries precluded the fully effective implementation of this programme.

Recognizing the need for additional resources and the importance of a co-ordinated global attack on the problem, the Nineteenth World Health Assembly² decided that the "participation of the Organization in the smallpox eradication programme should be financed from the regular budget" and "urged countries which plan to strengthen or initiate smallpox eradication programmes to take the necessary steps to begin the work as soon as possible". In view of the importance of the threat of smallpox to non-endemic countries, additional support from bilateral and other multilateral sources was requested. A total of \$ 2 674 000 has been allocated in the WHO regular budget for the 1967 programme and \$ 2 820 000 is proposed to continue and intensify the programme in 1968.

In compliance with the resolution, the requisite detailed programme planning and other preparatory work has been initiated in consultation with the governments concerned to permit the Organization to utilize the funds approved in the best possible manner.

This report, requested in resolution WHA19.16, presents the current status of programme plans for 1967 and 1968 in the context of the present smallpox problem.

2. The status of smallpox and programme development

The reported incidence of smallpox in 1966 will be approximately that observed in 1965. Through October, 1966, 50 527 cases had been reported. This compares to 59 898 cases reported during 1965 and 49 956 cases recorded during 1964. Numbers of cases by continent are shown in Table 1 and by WHO Region in Table 2.

¹ Resolution WHA11.54, Handbook of Resolutions and Decisions, 8th ed., p. 48.

² Resolution WHA19.16, Off. Rec. Wld Hlth Org., 151, 8-9.

Endemic regions persist in South-East Asia, sub-Saharan Africa and in several countries in South America. Europe, North and Central America, and the Western Pacific Region continue as non-endemic areas. In 1966, a number of countries reported cases and outbreaks resulting from imported infection. Reported episodes include the occurrence of seven cases in Sarawak, after almost four decades of freedom from the disease and 71 cases in the United Kingdom.

2.1 African Region

2.1.1 Smallpox incidence and status of activity

Smallpox continues as a problem in most countries of sub-Saharan Africa (Tables 3 and 4) although, as in other parts of the world, reporting is often incomplete making it difficult to obtain a precise assessment of the problem. From available data, the disease appears to be particularly prevalent in Burundi, Congo (Democratic Republic of), Dahomey, Mali, Niger, Nigeria, United Republic of Tanzania and Uganda.

Substantial numbers of vaccinations have been and are being carried out in many countries by mobile teams and through other health services. Extensive vaccination activities were effected by combined VDT and smallpox vaccination projects; these efforts appear to have been particularly successful in a number of countries.

2.1.2 Programme development

Two WHO inter-country advisers, one for West Africa and one for East Africa, began work in 1965. These advisers have visited most of the countries in their respective areas to review the current smallpox situation and to assist governments in the development of operational plans, including particularly those aspects dealing with surveillance and assessment mechanisms. During the coming years, they will continue to assist in the development and institution of programmes and will serve to provide co-ordination between campaigns in the various countries.

It is anticipated that in 1967, 22 African countries will be actively participating in the smallpox eradication programme with WHO and/or bilateral assistance and at least 23 countries during 1968 (Tables 3 and 4). The United States of America has offered material and technical assistance to 19 West and Central African

countries for smallpox eradication and measles control. This programme is being closely co-ordinated with WHO efforts in these and other African countries. A WHO medical officer assigned to Mali to assist in smallpox eradication activities will continue in this assignment working closely with those concerned with the bilateral programme. A plan of operations was drawn up concerning WHO technical and material support to pilot programmes for smallpox eradication and BCG vaccination in the Democratic Republic of the Congo. The programme will be initiated in three provinces in 1967 and expanded to a full-scale three-year effort beginning in 1968. Eradication programmes with WHO assistance are also being developed in 1967 in Kenya and Zambia and, in 1968, in the United Republic of Tanzania. Substantial bilateral assistance from the USSR is being provided to Zambia in the form of vaccine supplies.

2.2 South-East Asia Region

2.2.1 Smallpox incidence and status of activity

Of cases reported during 1966 from throughout the world, almost 70 per cent. of the total was reported by countries in the South-East Asia Region. Afghanistan, India, Indonesia, and Nepal continue to be principle endemic areas (Table 5). Burma which initiated an eradication programme in 1962 has effected a remarkable reduction in cases and through November 1966, had reported but a single case. Vaccine for this programme was provided partly by USSR bilateral donations and partly by vaccine donations through WHO. Neither Thailand nor Ceylon have recorded indigenous cases for over three years.

In Afghanistan, where a WHO medical officer is assisting in an eradication programme, 4.8 million vaccinations have been carried out since the start of a pilot operation in 1962. Vaccine for this programme was provided mainly by the USSR. More than a quarter of the provinces, mainly located in the south-west and eastern part of the country, are reported to have been covered by the programme. Fifty-seven cases were reported up to November 1966, contrasted to 72 cases in 1965 and 157 cases in the preceding year.

India, which started a national smallpox eradication programme in 1962, reported that over 457 million vaccinations had been carried out through mid 1966. During this period the number of smallpox cases has declined. A total of 42 231 cases

were reported in 1962, 60 901 in 1963, 31 587 in 1964, 27 658 in 1965, and 26 557 up to November 1966, according to the provisional figures. (The highest incidence of cases in India is normally observed during the first half of the year.)

Recognizing that the reporting system for cases may have improved, the decline in smallpox incidence still is not as remarkable as expected. Based on the results of field assessment, it appears that vaccination coverage is generally not satisfactory in the younger age-groups, the most vulnerable section of the population to smallpox in India.

The programme has so far been carried out by 150 mobile eradication units, each consisting of 70 field personnel, but consideration is now being given to integrating programme activities within the structure of the basic health services. At present an intensive mopping-up operation is being carried out. Over 500 million doses of freeze-dried smallpox vaccine has been provided to the programme by the USSR.

Indonesia is conducting vaccination activities as a containment measure during outbreaks but has not yet instituted a systematic programme. Through October 1966, 7686 cases were reported contrasted to 13 326 cases in 1965 and 1874 in 1964. This increase in cases in 1965 and 1966 may partly reflect an improved reporting system.

In Nepal, a pilot eradication project was started in 1962. Initially, a WHO technical officer had assisted the programme but in 1966 he was replaced by a WHO medical officer to assist in intensifying the programme. Vaccination activities were originally limited to the Katmandu Valley, but recently the programme has been expanded by incorporating panchayat workers throughout the country. Since 1962, 434 500 vaccinations have been carried out in the Katmandu Valley. In addition, 113 000 vaccinations were carried out during 1965 and 1966 in the eastern part of the country. Necessary vaccine was provided by donation through WHO.

2.2.2 Programme development

During December 1966, representatives from each of the countries met in Delhi at a regional office sponsored meeting to discuss the status and development of eradication efforts throughout the Region. Special WHO consultants visited Afghanistan, India and Nepal to appraise present smallpox eradication activities and to discuss methods for strengthening the respective programmes.

An inter-country smallpox eradication and epidemiological team is being formed to assist the countries in the planning of smallpox programmes, the development of surveillance activities as well as to participate in allied communicable disease activities.

In Afghanistan and Nepal, it is anticipated that programmes will be accelerated beginning in 1967 with additional support provided by WHO (Table 5). Emphasis will be placed on health education efforts as well as on the strengthening of surveillance and assessment activities. Additional support will also be provided to the Indian programme to provide further support to these components of the programme. Supplies and equipment will be provided to Burma to strengthen the maintenance programme there. It is anticipated that requisite vaccine supplies for the programme in India, Burma and Afghanistan will be provided mainly through USSR bilateral assistance.

2.3 Eastern Mediterranean Region

2.3.1 Smallpox incidence and status of activity

In this Region, cases are being reported from Sudan, Ethiopia and Pakistan, all of which represent significant endemic foci of disease (Table 6). Because of population movements, however, Saudi Arabia, Yemen, Somalia and Iran all appear to be at particular continuing risk of disease reimportation.

In Pakistan, intensified vaccination programmes have been carried out in recent years in both West and East Pakistan. In 1964 and 1965, over 27 million vaccinations were carried out in West Pakistan and 39 million vaccinations in East Pakistan. Although the numbers of cases have declined substantially during the past five years,

Pakistan continues to report a significant number of cases. In East Pakistan, smallpox incidence declined to its lowest figure, 43 cases, in 1964. However, the cases increased to 259 in 1965 and to 2898 in 1966 (through October). West Pakistan reported 738 cases in 1964, 1078 in 1965 and 1149 up to November 1966.

In Sudan, a WHO-assisted vaccination programme was carried out during the period 1962-1964 during which 8 840 000 vaccinations were performed. However, 70 cases were reported in 1965.

Iran, which has successfully completed a systematic vaccination programme has reported no smallpox cases since 1964. Maintenance vaccination activities are being continued. The immunity status of the population in Saudi Arabia, Somalia and Yemen is uncertain although few cases have been reported in recent years. An outbreak was reported from French Somaliland in 1966.

2.3.2 Programme development

A smallpox inter-country adviser is being recruited for the Region.

WHO consultants visited Pakistan and Sudan during 1966 to discuss the status and development of programmes in these two countries. It is anticipated that intensified systematic vaccination programmes will be developed with WHO assistance in Pakistan and Sudan and preparatory studies in Somalia during 1967 and intensified programmes in Ethiopia, Saudi Arabia, Somalia and Yemen during 1968. Vaccine will be required from outside sources except for Pakistan where national vaccine production can meet local requirements.

2.4 Region of the Americas

2.4.1 Smallpox incidence and status of activity

In the Americas, Brazil represents the principle endemic focus of smallpox although some cases are also reported from Argentina, Colombia, Peru and Paraguay (Table 7). Other neighbouring countries, who have carried out extensive vaccination programmes with a resultant cessation of endemic smallpox transmission, are at risk of reintroduction of disease. Vaccination programmes at varying levels of intensity are in progress in most countries.

2.4.2 Programme development

Early in 1966, the Regional Office for the Americas with assistance from consultants carried out a detailed appraisal of the smallpox situation in all countries of the Americas. Based on this appraisal a comprehensive five-year eradication plan was developed which includes the development or strengthening of eradication programmes during 1967 in Argentina, Brazil, Colombia, Paraguay and Peru and strengthening of activities in the neighbouring countries of Ecuador, Uruguay and Bolivia. Jet injectors will be extensively employed for vaccine administration in many of these countries. Assistance in maintenance and surveillance programmes will be provided to other countries in the Region. Vaccine for the various programmes is available from national production laboratories.

A smallpox regional adviser is being recruited for the Region. A substantial number of jet injectors and vehicles was provided to Brazil in 1966 to permit the early implementation of its eradication programme. During 1966, a course in smallpox laboratory diagnosis was held in the Region to assist in the development of necessary supporting laboratory services.

3. General programme development

3.1 WHO headquarters

During 1966, the Smallpox Eradication unit was reinforced by two medical officers with supporting staff required for the preparatory work for the intensified global programme. Preparation was begun for recruitment of additional WHO personnel by the regions to take responsibility for assisting governments early in 1967. A number of technical papers were prepared by headquarters' staff to assist regions in planning for the programme. Technical assistance was provided to the Democratic Republic of the Congo to assist in the formulation of the plan of operations.

Planning sessions were initiated between relevant headquarters and regional office units, particularly those concerned with basic health services, health education, statistical methodology, surveillance and health laboratory services.

3.2 Vaccine supplies

One of the most immediate critical problems in the programme is the adequate supply of high quality, fully stable freeze-dried smallpox vaccine. As emphasized in previous documents, liquid vaccine, although effective if properly stored and transported, is commonly rendered impotent in the course of normal field operations particularly in tropical areas. Its use is specifically discouraged for the endemic countries.

The development of vaccine production facilities in the endemic countries has been actively promoted over the past several years. UNICEF with WHO technical advice has provided substantial assistance to a number of countries in different parts of the world; WHO has frequently provided consultants and fellowship training to those concerned with vaccine manufacture. Unfortunately, at this time, a number of laboratories are producing vaccines which fail to meet WHO standards. The deficit between vaccine needs and vaccine production is substantial in many areas of the world.

During 1966, Cambodia, Thailand, Philippines, Netherlands, Pakistan, Switzerland, the United Arab Republic and Monaco offered vaccine to the eradication programme. The USSR has contributed 75 million doses to be used for the programme over the next three years and continues to provide, under bilateral assistance, large amounts of vaccine to programmes in Burma, India, Afghanistan and Zambia.

Priority will be given to substantial technical and material support to the development of vaccine production facilities in the African countries, the expansion of vaccine production facilities and the provision of all possible assistance to improve the standards of vaccine produced by existing laboratories in the Region of the Americas and the South-East Asia and Eastern Mediterranean Regions.

As noted in previous documents, emphasis will be placed on the development of production facilities capable of producing large quantities of smallpox vaccine rather than on the development of many small production units which by virtue of size and limited personnel cannot maintain consistent high standards.

The problem of vaccine supply may be further compounded in countries where jet injectors are used. Although the jet injectors employ only a tenth as much vaccine, it is presently believed that the vaccines used for jet injection administration should be free or essentially free of bacterial contaminants. A few production laboratories presently appear to be able to produce vaccine of this quality. However, it is yet uncertain as to the consistency with which they can produce batches of vaccine of animal origin of requisite high quality. Consideration is being given to vaccine production on tissue culture and WHO is co-operating in appropriate studies.

It is doubtful that vaccine needs for the programme can be met from production facilities in the endemic countries for at least two to three years. Substantial donations of vaccine will thus be required for some time to come. A comprehensive study of vaccine needs and production capacities is now in progress. Long-term plans for providing continuing consultation, assistance and training to production laboratories are under study.

3.3 Consultant services

Since the provision of adequate supplies of freeze-dried vaccine of high quality is a basic key to the global programme, and since this has been a particularly problematic area, it is proposed to provide substantial consultant service to the several production facilities in the endemic countries and a regular testing service for vaccines produced.

Additional consultative services regarding the development of virus diagnostic facilities, assessment methods, surveillance procedures and operations in planning will also be required.

3.4 Training courses

It is proposed to hold training courses for national and international programme staff for methods of operation, assessment, surveillance and laboratory procedures. Such courses are planned for 1967 and 1968.

3.5 Fellowships

The principal training in operational and surveillance procedures will be provided by WHO staff and consultants at regional and country levels. Several fellowships, however, will be required for training of national personnel in vaccine production and virus diagnostic work.

3.6 Scientific groups

In order to establish the methodology of smallpox eradication on a sound technical basis, meetings of scientific groups are planned both in 1967 and 1968. These groups will be asked to study and advise on technical policy and standards for eradication and to appraise the status of research activities and advise on appropriate steps to be taken with respect to a future course of action.

3.7 Research

A number of important areas demand intensive, special study, the results of which will serve to guide the programme in the immediate years ahead. Particular attention will be focused on the question of comparative levels of susceptibility requisite to permit endemic propagation of the disease under differing circumstances. Other studies should include the choice of strains for vaccine production; the possible use of killed vaccines for immunization especially in non-endemic countries; appraisals of the safety, efficacy and stability of tissue culture propagated smallpox vaccines; comparative studies of variola strains from different regions; assessment of the relative efficacy of vaccination over varying time periods and under circumstances of natural challenge; operational studies, including studies of the jet injector, to determine the most efficient and economical means for the conduct of vaccination programmes.

Chemoprophylactic and chemotherapeutic agents, including particularly 6-azauracil-ribosid, should be carefully tested and evaluated.

In conjunction with relevant WHO reference centres, attention will be focused on the development of the most practical methods of laboratory diagnosis, the production of standard reference sera and antigens and the preparation of appropriate teaching manuals.

It is expected that total or partial financial support for many of these projects would be provided to responsible investigators from national funds.

3.8 League of Red Cross Societies

During the Nineteenth World Health Assembly, the League of Red Cross Societies expressed their desire to participate in the global programme. The modalities of their participation were substantially discussed at the XIth Session of the Health and Social Service Advisory Committee of the League of Red Cross Societies held in September. Their contribution, in collaboration with national Red Cross societies, may include health education, the training of field personnel and the actual participation of voluntary workers in programme activities at country level.

4. Eradication methodology

4.1 General consideration

Technical policy and eradication methodology have been and will continue to be under continuing review in order to develop the programme on a sound basis. The basic concepts involved in smallpox eradication have been discussed¹ in the past with full acceptance that smallpox eradication is technically feasible. These concepts continue to be valid.

On the other hand, it is well recognized from past experience that to achieve eradication, the difficulties must not be underestimated. These difficulties include financial, logistic and administrative problems, incompletely developed health administrations in many of the endemic countries, unfavourable attitudes towards vaccination on the part of the populace in some endemic areas, shortage of vaccine of good potency and the difficulties inherent in establishing suitable maintenance programmes and effective surveillance activities.

Although eradication may be achieved by a comparatively straightforward approach of extensive vaccination, the programme in each country will require a great deal of thought and imagination in respect of an adequate operational approach, epidemiological

¹ Off. Rec. Wld Hlth Org., 143, Annex 19
Wld Hlth Org. techn. Rep. Ser., No. 283
Off. Rec. Wld Hlth Org., 151, Annex 15.

surveillance, continuous assessment of the vaccination coverage and quality of vaccine used, health education, and effective maintenance programmes. Finally, the eradication programmes of many different countries must be co-ordinated over large areas due to the extensive movements of populations.

A discussion of the salient aspects of eradication methodology, as presently conceived, are presented in the following chapters.

4.2 Timing and extent of vaccination coverage

It is believed that, in general, country-wide campaigns, in the attack phase, should extend no longer than three years. If prolonged beyond three years, population migration may complicate obtaining adequate coverage, impetus and morale may wane and efficiency decline. Further, the country programmes must be closely co-ordinated on a regional basis to decrease the probability of reintroduced infection.

Although the objective of the programme is to vaccinate the entire population of an endemic country during this initial vaccination phase, it must be appreciated that, however assiduously the vaccination programme is carried out, some proportion of the people will not be reached. What proportion of the population must be rendered immune in order to interrupt transmission is not clear.

It is evident in this man-to-man transmitted disease that the proportion of susceptibles necessary to ensure continued propagation of the disease is a function of the number of contacts which the infected individual may have with susceptible persons. In densely crowded areas the frequency and number of contacts is apt to be greater and the likelihood of smallpox transmission increased; on the other hand, the more dispersed and isolated the population the less likely is smallpox transmission to persist. Evaluation must be carried out in the course of the programme to provide a more precise estimate of the requisite level of immunity needed to interrupt transmission under differing circumstances.

At this time, it would seem probable that if at least 80 per cent. of the different population subsegments are successfully vaccinated, transmission of smallpox should cease. However, in densely populated areas, a higher proportion may need to be vaccinated to interrupt transmission.

It has been common experience, throughout the world, that lower socio-economic groups residing in densely crowded areas generally respond poorly to vaccination programmes and it is in this group specifically that transmission is most readily accomplished. Intensive vaccination efforts must, therefore, be applied to these, to young children and other subsegments of the population in which transmission of disease is most likely to occur. It is conceivable that intensive systematic vaccination efforts as often as every two years may be required in at least some segments of heavily populated areas to ensure adequate maintenance of immunity.

4.3 Assessment scheme of the programme

The assessment of the smallpox eradication programme must encompass several factors, including epidemiological findings developed in the course of surveillance (4.4), continuing evaluation of the potency of vaccine used, vaccination coverage of the population, etc. Specific methods and criteria are being developed.

4.3.1 Assessment of potency of vaccine and take-rate

Assessment of the potency of vaccine should be determined first at central level before distribution to the field. Since the vaccine is administered under varying field conditions, further appraisals of vaccine potency during the operation is of utmost importance and can be best carried out by verification of take-rates after vaccination or revaccination.

Under most circumstances, continuing assessment of perhaps 10 per cent. of vaccinations should be sufficient to assure that potent vaccine is being employed and that vaccination techniques are adequate. Experience has shown that constant low take-rates are most likely to be caused by low potency vaccine either as originally delivered or resulting from improper storage. A great variation in take-rates may suggest inconsistency in vaccination technique.

4.3.2 Assessment of vaccination coverage

The total absence of reported cases in the context of an effective surveillance system represents, of course, the ultimate assessment of the programme. Measurements of vaccination coverage provide interim guide lines with respect to the progress of the programme.

Where population figures exist, the simplest form of assessment of vaccination coverage may be based on a comparison between the total number of vaccinations performed and the estimated total population in the country or given area. The proportion derived, however, represents, at least, only a rough approximation of the success of the programme. Population data are frequently in error due to original errors in enumeration or due to population migration; little information is provided with respect to coverage of subsegments of the population, e.g. young children, particular religious sects, etc. Assessment of a programme in this manner provides no information with respect to the proportion of persons successfully vaccinated.

In some programmes, where detailed vaccination records (for example, family registers) are available, it is possible to determine the coverage, mainly based on such records, by area and age. If the records are reasonably complete, the results can give reasonably reliable information on the vaccination status of the population. However, it is difficult to maintain records such as family registers and the requisite clerical work is frequently overwhelming.

Challenge vaccination represents an alternate method to assess the immunity level of a population. Recent experience, however, shows that with potent vaccine, reasonably high take-rates, sometimes over 80 per cent., can be produced even among recent vaccinees. A measurement of the frequency of primary vaccination reactions among very young children or, more simply, an assessment of the frequency of primary scars in young children can be most useful in determining the efficacy and extent of coverage of vaccination programmes in this vulnerable age-group.

A more elaborate but probably the most reliable method for assessment of vaccination coverage consists of assessing vaccination coverage by independent teams employing simple cluster sampling techniques. This might be carried out in given areas shortly after vaccination is complete. Normally, only a small percentage would need to be sampled to broadly estimate vaccination coverage of the population in a given area. The response to vaccination could be obtained by history and the

observation of vaccination reactions. An area for sampling should be defined mainly from an operational viewpoint so that if results imply an unsatisfactory coverage in areas concerned the team could return to the area for additional vaccination activities.

4.4. Surveillance

Since the ultimate objective of the total programme is the occurrence of "0" cases of smallpox, quite clearly a surveillance mechanism for the detection, reporting, and investigation of suspect cases must be established in every area and every country. This is particularly important not only for endemic countries but also for those bordering endemic countries. Since the establishment of an effective surveillance programme is a lengthy process, attention must be focused on this activity from the inception of every programme.

Each case of smallpox occurring after a systematic vaccination programme represents a possible flaw in the programme. If the case has occurred in a person ostensibly recently vaccinated, it suggests that the vaccine used may have been impotent or vaccination techniques inadequate. If numbers of cases occur among unvaccinated persons in one age-group or segment of the population, such as nomads, male field workers, etc., it suggests that the operational aspects of the programme may need revision to ensure that such groups are vaccinated. An effective surveillance system consists of several interrelated aspects:

- (1) routine, systematic reporting of cases from "detection posts" throughout the country. Special field investigations, surveys, etc. will serve to clarify the data obtained by routine reporting
- (2) prompt analysis and interpretation of routinely reported data and other studies
- (3) the initiation of appropriate action including on-the-spot epidemiological investigations, control measures and, as indicated, modification of operational procedures, etc.
- (4) distribution of the interpreted information to reporting units and to others concerned with communicable disease activities.

4.4.1 Routine case reporting

Virtually all countries have some form of disease notification system from basic health service and other medical and preventive care units and facilities. Prompt, regular reporting of suspect clinical cases observed at all such units generally should provide a reasonably complete detection network in most countries. In some instances, this network may require extension through carefully selected and trained "village reporters", "school-teachers", itinerant health-workers, mobile teams concerned with specific disease control, etc. Since the persistence of smallpox is dependent on its continuing transmission from man-to-man, even limited outbreaks should soon come to recognition even with a simple detection and reporting network. With field investigation of reported cases, the source can generally be identified, the problem appraised and definitive containment measures initiated.

Past experience indicates that the local reporting "units" will perform best if they fully understand the need for reporting, if specific actions such as field investigations follow the reports of cases and if the units are required to report regularly whether or not cases have been seen during a fixed one- or two-week reporting period.

4.4.2 Analysis and interpretation of data

The pattern of smallpox occurrence must be constantly under study to permit prompt action to be taken where indicated. Reports of smallpox cases should be dispatched promptly to those responsible for the eradication programme.

4.4.3 Initiation of appropriate action

Rapid investigation of cases and outbreaks and their effective containment becomes increasingly important as disease incidence declines. The sooner they can be investigated, the sooner the problem can be defined and the more quickly corrective measures can be taken. Since follow-up of reported cases and outbreaks is one of the best measures for motivating reporting units, consideration might be given from the beginning of programmes to the development of special mobile emergency units at area or country level whose principle responsibility would be the investigation and control of local outbreaks and eventually of individual cases.

4.4.4 Continuing distribution of information pertaining to smallpox and the progress of the campaign

The regular publication of data pertaining to the occurrence of smallpox, the progress of the campaign, problems of concern, etc. can have a material educational value for all direct participants in the programme, basic health service personnel and others. Such a publication can serve to motivate and inform and will constitute a continuing link with all participants.

4.4.5 Definition of a case of smallpox

In developing the detection network for cases, the constant aim should be to develop the most sensitive possible system. As a maxim, it is better to err on the side of overreporting than underreporting. Reporting units should be encouraged to report all suspect clinical cases. As the eradication programme progresses, epidemiological and laboratory confirmation of cases may be increasingly employed and many "suspect" cases may later be discarded as other illnesses.

Although in some countries cases of supposed "alastrim" (variola minor) are reported as such and are not considered to be "true" smallpox, this practice is to be deplored. Both forms of smallpox are caused by the variola virus and in most instances, they cannot be clinically differentiated.

4.5 Maintenance programmes

The development of effective tactical approaches for conducting the maintenance phase of the programme requires considerable skill and imagination. The strategy needs and costs for the maintenance phase need to be considered preferably prior to the initiation of the attack phase of the programme.

The maintenance phase of the programme includes two important components:

- (1) surveillance and
- (2) continuing vaccination.

A sensitive case detection system for introduced cases, coupled with an active field investigation and containment activity is of vital importance if the re-establishment of endemic foci is to be prevented. Particular attention should be paid to "high-risk" areas, i.e. densely populated areas and areas where migrants are particularly prevalent.

The importance of vaccination during the maintenance phase is emphasized by the fact that, each year, newborns will account for a two to four per cent. increase in the population and all will be susceptible to smallpox; large numbers of persons may be expected to migrate to urban centres from rural areas, many of whom may have resided in comparatively inaccessible locations with inadequate vaccination coverage; normal waning of immunity will occur in those previously vaccinated. In a comparatively short time a large susceptible population group will accumulate.

Of principal concern are the newborn and migrant populations. To reach recently born children early in life for routine vaccination is a continuing and difficult problem which has only been partially solved in areas with complete birth registration and adequate numbers of health centres. For children born in hospitals or under supervision of staff from maternity centres the children are accessible for vaccination at birth. Only in a few areas of the world, however, are very substantial proportions of children born under the supervision of maternity centre staff.

Full reliance on routine vaccination at health centres, while excellent in concept, poses difficulties in execution. Health centres in most endemic countries are few and sparsely distributed; adequate refrigeration in these centres is often problematical and the response of the local population frequently limited.

The establishment of mandatory vaccination or revaccination at school entry serves to ensure immunity within the school, a likely place for disease transmission. In many areas, of course, comparatively few attend schools.

Migrants pose an even more difficult problem since there is no ready method for identifying migrant persons. Although in some areas vaccination cards or certificates have been issued and it has been "required" that they be carried, the complexities of enforcing such a ruling compounded by problems of lost certificates, falsification of certificates, etc., has frequently led to abandonment of this system.

For many if not most endemic countries, effective maintenance vaccination programmes will probably have to rely principally on systematic community-wide vaccination programmes at regular intervals. An over-all scheme might be proposed as follows:

- (1) routine vaccination of newborns, cared for by health services or other medical or auxiliary health personnel
- (2) routine vaccination of children at health clinics and at school entry
- (3) periodic systematic community-wide vaccination programmes at regular intervals. For urban centres and in other vulnerable areas and population concentrations, community-wide programmes probably should be conducted at least every two to three years to ensure adequate immunity. In sparsely settled rural areas, less frequent intervals of vaccination, perhaps every four to five years, should serve to maintain adequate immunity levels.

4.6 Health education

The development of well-planned health education activities is a basic requirement since the success of the programme depends on the population's acceptance of vaccination as well as their active participation in surveillance and assessment work. The educational component should be of such a nature and scope that it can serve to motivate people's immediate readiness for vaccination and also generate people's interest on a continuing basis in the prevention of smallpox as well as other priority health problems in accordance with local needs and available resources and health services. Many otherwise well-planned programmes have not achieved satisfactory population coverage due to the population's unawareness, apathy, or unfavourable attitudes towards vaccination.

The health educational aspect should, in the first instance, be included as one of the important aspects in training of field personnel, in the preparatory phase as well as during operations. Close co-operative planning and organizational work by officials and specialist staff responsible for the smallpox programme and those responsible for health education services is of vital importance to develop essential educational activities in country programmes at central and peripheral levels.

The motivation of voluntary co-operation of the people in the vaccination programme and in related health measures should be an integral and specific role of every health worker who comes in contact with the public. For example, with the proper approach and explanations most suitable in various local circumstances, all

vaccinators, should be capable of persuading the people to accept vaccinations. Collaboration should be sought with recognized authorities and with various influential local persons, school officials and teachers, interested workers of voluntary associations, religious leaders, and other respected persons, and groups as may exist in the various areas concerned. Early contact and participation of the appropriate and influential elements of any given population group in helping to work out plans for the promotion of public participation can be an important step towards enlistment of more effective and widespread co-operation of the people in the programme.

Low vaccination coverage rates usually are due either to lack of co-operation on the part of the population or lack of adequate supervision of the vaccination teams. Whenever a team finds a very low coverage rate in a particular area, it would be useful to determine the reason by a study on the spot. A proper scheme for implementation of such a study should be prepared and appropriate action taken to improve the situation based on the results.

A proportion of the funds made available for the smallpox eradication programme should be allocated to health education activities to assist relevant health ministries to develop the essential activities most urgently needed for health education programmes including: (a) training programmes for health personnel (e.g. vaccinators, supervisory personnel, etc.); (b) co-operative teaching projects with schools and teacher-training institutions; (c) joint educational projects with existing professional and voluntary organizations such as the Red Cross, agricultural groups, religious institutions, and others; (d) preparation and production of visual aids and other communications media suitable to varying local requirements and available resources and services.

5. Role of basic health services in the smallpox eradication programme

The importance of the full participation of the basic health services in the smallpox eradication programme is well recognized. The Eighteenth World Health Assembly comprehensively reviewed the position of global smallpox eradication, as well as the requirements for its effective development and in its resolution WHA18.38 requested "governments to take early steps to establish basic health services for the maintenance phase . . .".

It is anticipated that in some countries the existing general public health services will be able to undertake a significant portion of the smallpox eradication activities and may, in large part be capable of integrating the smallpox eradication activities. This will serve two main purposes, namely, the desirable promotion of the basic health services structure, and the achievement of the important task of smallpox eradication.

The relative degree and type of participation of basic health services in smallpox eradication will vary from country to country dependent upon the resources available and on the pattern and coverage by community health services of any particular country or part of a country. Detailed planning can be done effectively only on the spot and must involve all concerned sections in the national health administration to see how best existing health services can be mobilized to assist the smallpox eradication programme and how the smallpox programme, in turn, can strengthen the existing health structure. It is essential for those responsible for basic health services at all levels, central, intermediate and local, to be involved as from the planning stage of the smallpox eradication programme to ensure their full collaboration in all phases of its implementation.

To assist in developing this collaboration, a close relationship has been established at WHO between those concerned with smallpox eradication activities and those concerned with various aspects of the development of basic health services.

Many countries already have had a considerable experience with mass campaigns for control or eradication of some specific diseases, e.g. yaws, malaria and tuberculosis. It is important that the lessons learned should be taken into consideration in planning for smallpox eradication. Specialized mobile teams, either provided by the basic health services, or newly recruited, will generally be needed for total population coverage in the attack phase. If, in any local areas, existing health services are strong enough to provide coverage of the community with a house-to-house family service within the context of existing health services, specialized vaccination teams may not be necessary. Even so, in such situations, a special effort will be needed to stimulate and train health personnel towards organization of effective immunization coverage. As soon as a particular community has been covered in the first "round" of vaccination, plans should be developed where

possible for local community health services to assume the maximum possible responsibility for the continued vaccination of newborns, of immigrants, of persons "missed" during the mass vaccination period, and of the population at large at regular intervals.

This approach presupposes that the planning of smallpox vaccination programmes will provide for the training of basic health services' staff as well as for the training of specialized vaccinators. It may often be desirable as the programme advances to detach trained vaccinators and to leave them as permanent additions to the strength of the local health unit. Whatever, training of existing personnel in various health units in smallpox eradication requirements is a sine-qua-non to a successful campaign.

In areas where mobile teams represent the only feasible approach in the vaccination programme, consideration should be given to enlisting the services of a local "leader" to maintain records and to prepare the community for each visit of a mobile team. This approach might develop the participation of the local authorities in the programme.

In many countries there may be communicable disease programmes in progress, for example, BCG vaccination, yaws eradication, malaria eradication or pre-eradication, trachoma control, etc. The combined work of smallpox eradication activities with these programmes can be envisaged, especially in maintenance and surveillance activities.

In most countries an effort could be made to train midwives in vaccination of the newborn; maternal and child health and school health services wherever they exist obviously should participate. In many Muslim countries an organization could be expanded to cover communities from which the pilgrims come.

In addition to these activities, the health units of the country should at all stages of the programme participate actively in the reporting of smallpox cases. Where possible, they should be trained in simple field investigation procedures of cases and outbreaks and appropriate containment measures to be taken. In other words, they should play a key continuing role in the surveillance structure.

All such considerations lead to the conclusion that a successful smallpox eradication programme must intimately involve all levels of the general health services. A pre-planning activity in any country should include:

- (1) a study of how and where existing general and specialized health activities can effectively plan a part and a definition of the responsibilities of medical officers and auxiliary health workers at district and community levels
- (2) delineation of areas where no general health services exist and where mobile health teams must play a more comprehensive role
- (3) what health facilities are required to provide inter alia adequate maintenance of vaccination status in the population
- (4) the role and participation of the facilities in the essential surveillance activities of the programme.

TABLE 1. SMALLPOX CASES REPORTED BY CONTINENT
1959-1966 (UP TO 3 NOVEMBER)

	1959	1960	1961	1962	1963	1964	1965	1966 (up to 3 November)
Africa	15 781	16 127	24 182	24 837	16 723	12 362	15 882	11 526
America	4 899	5 531	8 168	7 860	7 126	3 051	1 529	262
Asia	60 749	39 251	53 217	49 579	75 621	34 543	42 486	38 668
Europe	15	47	27	137	129	-	1	71
World Total	81 444	60 956	85 594	82 413	99 599	49 956	59 898	50 527

TABLE 2. SMALLPOX CASES REPORTED BY WHO REGIONS
1964-1966 (UP TO 3 NOVEMBER)

	1964	1965	1966 (up to 3 November)
AFRICA	12 259	15 754	11 346
West	5 677	9 880	7 974
East	6 582	5 874	3 372
THE AMERICAS	3 051	1 529	262
EASTERN MEDITERRANEAN	901	1 465	4 228
SOUTH-EAST ASIA	33 745	41 149	34 613
EUROPE	-	1	71
WESTERN PACIFIC	-	-	7
World Total	49 956	59 898	50 527

TABLE 3. AFRICAN REGION (WEST AND CENTRAL)
STATUS OF SMALLPOX ERADICATION ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES

Country or other political unit	Estimated* population (in millions)	Smallpox cases reported			Vaccinations (A) performed (in 1000)		Eradication activities (B) anticipated	
		1964	1965	1966 (up to 3 November)	1964	1965	1967	1968
Angola	5.3	1	-	3	+	+	xx	xx
Cameroon	5.2	81	-	3	1 035	664	x	x
Congo (Republic of)	0.8	196	89	2	+	+	x	x
Congo (Democratic Republic of)	15.8	2 302	3 643	1 485	+	+	x 1)	x 1)
Ivory Coast	4.0	11	8	-	3 629 1)	+	x	x
Dahomey	2.4	703	167	461	475	+	x	x
Equatorial Guinea	0.3	-	-	-	+	+	xx	xx
Gabon	0.5	49	1	-	13	+	x	x
Gambia	0.3	6	6	3	60	52	x	x
Ghana	7.8	9	7	12	+	+	x	x
Guinea	3.6	300	69	38	1 050	712 2)	x	x
Portuguese Guinea	0.5	-	-	-	+	+	xx	xx
Upper Volta	4.9	8	14	68	1 516	1 121 3)	x	x
Liberia	1.0	128	40	-	728 1)	+	x	x
Mali	4.8	321	615	269	723	608	x 2)	x
Mauritania	0.9	-	-	-	147	120	x	x
Niger	3.4	29	509	905	586	298	x	x
Nigeria	58.4	1 416	4 566	4 494	3 127 4)	+	x	x
Central African Republic	1.4	-	-	-	182	372	x	x
Senegal	3.5	2	-	-	+	+	x	x
Sierra Leone	2.2	89	60	130	245	+	x	x
Chad	2.9	5	73	-	559	1 022	x	x
Togo	1.6	21	13	101	→ 1 112 5)		x	x
TOTAL	131.5	5 677	9 880	7 974				

* 1966 (est.)

- (A)
- + Data not yet available
 - 1) During 1962-1964
 - 2) Up to October
 - 3) Up to October
 - 4) Northern region only
 - 5) During 1962-mid-1966

- (B)
- x Programmes expected to start or to be intensified mainly with the United States of America bilateral assistance with the exception of the Democratic Republic of the Congo
 - xx Maintenance activities without WHO assistance
 - 1) With WHO assistance
 - 2) WHO medical officer will also assist programme.

TABLE 4. AFRICAN REGION (EAST AND SOUTH)
STATUS OF SMALLPOX ERADICATION ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES

Country or other political unit	Estimated* population (in millions)	Smallpox cases reported			Vaccinations (A) performed (in 1000)		Eradication activities (B) anticipated	
		1964	1965	1966 (up to 3 November)	1964	1965	1967	1968
South Africa	18.1	329	62	-	+	+	xx	xx
Lesotho	0.8	-	-	-	+	+	xx	xx
Botswana	0.6	174	-	-	+	+	xx	xx
Burundi	2.9	-	1 209	245	7	+	-	-
Kenya	9.5	266	271	142	500-1000	500-1000	x	x
Malawi	3.9	704	228	49	+	+	-	-
Mozambique	7.0	250	111	19	+	+	xx	xx
Uganda	7.6	523	1 315	442	+	7 500 1)	-	-
Southern Rhodesia	4.3	200	40	33	654 2)	+	xx	xx
Rwanda	3.1	-	5	-	+	+	-	-
Swaziland	0.3	517	89	27	+	+	xx	xx
United Republic of Tanzania	10.6	1 405	2 016	2 355	→	3 000 3)	-	x
Zambia	3.8	2 214	528	60	1 657	1 500	x 1)	x
TOTAL	72.5	6 582	5 874	3 372				

* 1966 (est.)

(A)

- + Data not yet available
- 1) During 1965-mid-1966
- 2) Period of vaccination not available
- 3) During 1964-1965

(B)

- Preparatory phase
- x Programmes expected to start or to be intensified with WHO assistance
- xx Maintenance or intensification of activities anticipated without WHO assistance
- 1) It is anticipated that vaccine will be supplied by USSR bilateral assistance.

TABLE 5. SOUTH-EAST ASIA REGION
STATUS OF SMALLPOX ERADICATION ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES

Country or other political unit	Estimated* population (in millions)	Smallpox cases reported			Vaccinations ^(A) performed (in 1000)		Eradication activities ^(B) anticipated	
		1964	1965	1966 (up to 3 November)	1964	1965	1967	1968
Afghanistan	15.9	157	72	57	→	4 800 1)	x 1)	x
Burma	25.1	28	8	1	5 500	+	x 1)	x
Ceylon	11.4	-	1	-	+	+	xx	xx
India	488.0	31 587	27 658	26 557	→	457 781 1)	x 1)	x
Indonesia	106.4	1 874	13 326	7 686	+	+	-	-
Nepal	10.1	99	84	312	→	547 1)	x	x
Thailand	31.1	-	-	-	+	+	xx	xx
TOTAL	688.0	33 745	41 149	34 613				

* 1966 (est.)

(A) + Data not yet available
1) During 1962-mid-1966

(B) - Preparatory phase
x Programmes expected to be intensified with WHO assistance
xx Maintenance programme or intensification of activities anticipated without WHO assistance
1) USSR bilateral assistance for vaccine supply is anticipated.

TABLE 6. EASTERN MEDITERRANEAN REGION
STATUS OF SMALLPOX ERADICATION ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES

Country or other political unit	Estimated * population (in millions)	Smallpox cases reported			Vaccinations (A) performed (in 1000)		Eradication activities (B) anticipated	
		1964	1965	1966 (up to 3 November)	1964	1965	1967	1968
Ethiopia	22.8	103	58	128	+	209 1)	-	x
French Somaliland	0.08	-	-	52	+	+	xx	xx
Iran	23.7	12	-	-	4 000	4 000 2)	xx	xx
Pakistan	103.9	781	1 337	4 047	32 519	34 107	x	x
East Pakistan	55.3	43	259	2 898	19 840	19 229		
West Pakistan	48.6	738	1 078	1 149	12 679	14 878		
Saudi Arabia	6.6	-	-	-	+	112 1)	-	x
Somalia	2.5	-	-	-	+	+	-	x
Sudan	13.7	-	70	-	8 840 3)	+	x	x
Yemen	5.0	5	-	-	+	+	-	x
TOTAL	282.18	901	1 465	4 227 **				

* 1966 (est.)

** One imported case - Iraq.
Not included in Regional total.

(A) + Data not yet available
1) Approximately during the first six months
2) Estimated from quarterly reports to WHO
3) During 1962-1964

(B) - Preparatory phase
x Programmes expected to start or to be intensified with WHO assistance
xx Maintenance programme or intensification of activities anticipated without WHO assistance.

TABLE 7. REGION OF THE AMERICAS
STATUS OF SMALLPOX ERADICATION ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES

Country or other political unit	Estimated* population (in millions)	Smallpox cases reported			Vaccinations ^(A) performed (in 1000)		Eradication activities ^(B) anticipated	
		1964	1965	1966 (up to 3 November)	1964	1965	1967	1968
Argentina	22.6	12	15	5	284	3 686	x	x
Bolivia	4.4	4	-	-	1 040 1)	417	x	x
Brazil	82.5	2 505	1 318	243	8 016	22 120	x	x
Chile	8.8	-	-	-	1 481	829	xx	xx
Colombia	17.9	24	146	5	1 702	5 408	x	x
Ecuador	5.1	42	-	-	652	919	x	x
French Guiana	0.04	-	-	-	1	+	xx	xx
Guyana	0.7	-	-	-	7	+	xx	xx
Paraguay	2.1	7	32	5	135	929	x	x
Peru	11.7	454	18	4	3 165 2)	+	x	x
Surinam	0.3	-	-	-	6	+	xx	xx
Uruguay	2.8	3	-	-	188	196	x	x
Venezuela	8.9	-	-	-	953	1 295	xx	xx
TOTAL	167.84	3 051	1 529	262				

* 1966 (est.)

(A) + Data not yet available
1) January 1964 - May 1965
2) January-September 1964

(B) x Programmes expected to start or to be intensified with WHO assistance
xx Maintenance programme or intensification of activities anticipated without WHO assistance.