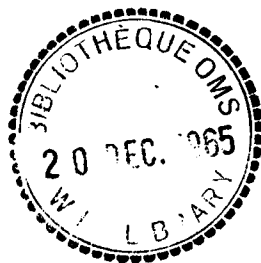


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SMALLPOX ERADICATION

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SMALLPOX ERADICATION

1. INTRODUCTION

The urgency and desirability of a global programme for smallpox eradication was unanimously affirmed by resolution at the Eleventh World Health Assembly¹ in 1958. Intensified vaccination programme followed in many of the countries with endemic smallpox. Technical assistance and support in the conduct of many programmes and for the establishment of vaccine production facilities was provided by the Organization, on request, within the resources available to the Director-General. However, as noted in the resolution taken by the Eighteenth World Health Assembly,² progress has been slow and major endemic foci remain in Asia, Africa and the Americas. It is now apparent that without a greatly intensified, well co-ordinated global effort, with substantial additional resources, global eradication is not a realizable goal in the foreseeable future.

Discussions on the establishment of a programme on smallpox can be traced back as early as the Third World Health Assembly³ in 1950, when the World Health Organization was asked to give greater weight to smallpox in its regular programme of activities. The Sixth World Health Assembly⁴ requested the Executive Board to provide a detailed study of the means of implementing the programmes. The Seventh World Health Assembly⁵ requested the Director-General to provide, within budgetary limitations, the assistance requested by national administrations to conduct wherever possible and necessary, campaigns against smallpox and to continue studies on the most effective method of smallpox control. At the Eleventh World Health Assembly,¹ the subject of a more definite programme for global smallpox eradication

¹ Resolution WHA11.54

² Resolution WHA18.38

³ Resolution WHA3.18

⁴ Resolution WHA6.18

⁵ Resolution WHA7.5

was raised. After the Twelfth World Health Assembly,¹ the urgency of achieving world-wide eradication has been reiterated in each of the subsequent Assemblies. At the Sixteenth Assembly,² Member States were invited to make voluntary contributions to enable the Organization to provide substantial assistance to the national smallpox eradication programmes.

It is abundantly clear from the results of successful programmes in Central and South America, South-East Asia, the Middle Eastern countries and North Africa, that intensified systematic vaccination programmes using potent vaccines can rapidly eradicate the disease. No insurmountable technical problems have been evident. Failure on the part of individual countries to develop programmes and on the part of those experiencing difficulties in achieving eradication have resulted principally from the lack of necessary funds for personnel, vaccine and supplies or from failures in the conduct of the vaccination campaigns or in the establishment of competent surveillance or maintenance vaccination activities.

Costs of routine vaccination programmes in the non-endemic countries are high. Czechoslovakia has estimated that it expends annually over US\$ 1 million (US\$ 0.073 per person) in maintenance vaccination; and the United States of America \$ 20 million annually (\$ 0.112 per person). If over-all costs generally for maintenance vaccination are between \$ 0.07 and \$ 0.11 per person, it can be estimated that between \$ 44 and \$ 70 million are expended annually to provide continuing protection to the 640 million persons in Europe and North America alone. Despite recognition of the fact that the non-endemic countries would realize substantial long-term savings if they were able to terminate routine maintenance vaccination programmes, requests for voluntary contributions to enable the Organization to provide needed assistance have met with a limited response only.

¹ Resolution WHA12.54, Handbook of Resolutions and Decisions, 8th ed., pp. 47-51.

² Resolution WHA16.37, Handbook of Resolutions and Decisions, 8th ed., pp. 50 and 51.

It is apparent that if the goal of global smallpox eradication is to be realized in a reasonable period, there is an immediate need to establish a soundly-based, adequately staff and financed global programme capable of providing a continuing impetus and co-ordination and technical and material assistance throughout the smallpox endemic regions of the world.

The Eighteenth World Health Assembly,¹ declaring the world-wide eradication of smallpox to be one of the major objectives of the organization, requested that countries having smallpox and without eradication programmes to initiate them and the countries with programmes to intensify them and requested the Director-General:

"To make available the increased amount of technical guidance and advisory services in order to accelerate the programme as well as to assist the countries in obtaining the necessary vaccine, transport and other equipment . . .".

In compliance with the resolution of the Eighteenth World Health Assembly,¹ the following proposal for the eradication of smallpox within ten years is presented.²

¹ Resolution WHA18.38, Handbook of Resolutions and Decisions, 8th ed., p. 51.

² Provided the countries where smallpox is endemic will take urgent steps to plan and start the eradication programmes and provided adequate technical assistance, material and financial support for this programme are forthcoming from non-endemic countries, there is every likelihood of achieving eradication in the given period of time.

2. TECHNICAL CONSIDERATIONS

2.1 General considerations

Of all the infectious diseases, smallpox, in its epidemiological behaviour, lends itself uniquely to an eradication effort. Directly transmitted from person to person, without known insect or animal reservoirs, rarely occurring in sub-clinical form, smallpox may quickly be detected in an area. The victim of the disease is generally incapable of transmitting the virus for more than two weeks and is rendered essentially permanently immune against a subsequent attack. Since the disease has a two-week incubation period, prompt identification of a case permits the initiation of effective containment measures.

Eradication can be accomplished in a comparatively simple and straightforward manner by rendering immune, through vaccination, a sufficiently large proportion of the population so that transmission is interrupted. In a highly endemic area this requires almost 100 per cent. protection of the population.

Measurement of the proportion of a population vaccinated may be useful as a guide with respect to the conduct of a programme. However, it must be kept in mind that such measurement represents a guide only and the actual success of the programme must be appraised in terms of its success in the disappearance of the disease. Although a certain high proportion of the population may have been mechanically vaccinated, it must be recognized that substantially less are actually successfully vaccinated. Further, an over-all value of coverage rate says nothing regarding the distribution of vaccination. The Expert Committee on Smallpox¹ stated that follow-up assessments in a country have shown that although the number of vaccinations made represented 80 per cent. or more of the estimated population, there were often sections where the population vaccinated was only 30 per cent.

In densely crowded areas where infected individuals may contact a large number of persons, a very high proportion of the population should be successfully vaccinated to interrupt transmission. In sparsely settled areas with comparatively little crowding, the disease may, in fact, spontaneously disappear until imported subsequently from more distant infected areas. More definitive studies of this phenomenon are required.

¹ Wld Hlth Org. techn. Rep. Ser., 283.

Cities, towns and villages, although reasonably accessible geographically for vaccination, appear to represent the most important reservoirs of the disease and sites of transmission. In large urban areas particularly, crowding is greatest and infected individuals normally come into contact with the largest numbers of persons. A fertile soil is provided especially in the lowest socio-economic sectors, where response to vaccination is normally poor; where unprotected individuals from unvaccinated rural areas commonly migrate, where maintenance vaccination programmes are difficult to carry out and where birth rates are high.

From limited evidence it would seem probable that intensive vaccination programmes in cities, towns and villages throughout a country with the establishment of active maintenance vaccination programmes, particularly for the newborn and migrants in the lowest socio-economic strata could effectively terminate transmission.

2.2 Vaccine

The infinitely greater stability of freeze-dried (lyophilized) smallpox vaccine unqualifiedly recommends this preparation over the glycerinated form in field vaccination programmes, especially in tropical areas. Although under some circumstances the glycerinated vaccine is preferred because of lower cost and its availability in single-dose containers, it is well recognized that even in the best managed medical facilities, storage procedures are frequently inadequate.

Supplies of freeze-dried vaccine for the global eradication programme have been inadequate to date to meet immediate needs. Further, the quality, particularly the potency, of the vaccine has not infrequently failed to meet recommended standards. As pointed out in past reports to the World Health Assembly, the production of freeze-dried vaccine demands high standards of skill and responsibility in the professional and technical staff employed. Routine assessment of each lot of vaccine produced must be systematically carried out.

The costs and difficulties involved in establishing effective vaccine production facilities are considerable. Further, consultant staff available from established facilities, capable of rendering necessary assistance, is limited.

These considerations dictate the necessity of limiting the number of vaccine production facilities to a few comparatively large, efficient institutions capable of supplying several countries rather than many small ones, the efficiency of which would be dubious.

Because of the urgent and continuing need for large quantities of vaccine of known high potency a substantial supply of vaccine from the non-endemic countries by donation or on a bilateral assistance basis is required on a yearly basis for the next three years at least.

2.3 Surveillance

Notably lacking in the eradication programme plans of almost all endemic countries has been the development of a systematic plan for the detection of possible cases and the concurrent investigation regarding the source and site of acquisition of the disease, their vaccination status and the prompt instigation of containment measures. Detailed epidemiological investigation of all cases as to the reasons for their occurrence and the means by which they are being spread can be one of the most effective instruments to provide continuing guidance and direction in the vaccination programme. In the simplest terms, each case which occurs suggests the possibility of flaws in the programme. An outbreak, however small, demands a full critical review with appropriate revisions of the programme.

The ultimate measure of any eradication programme is its success in reducing the number of cases to zero. So long as cases of the disease are endemically transmitted, an eradication programme has failed to achieve its goal whatever the proportion of the population ostensibly successfully vaccinated.

Even in countries with a limited local health structure, a systematic surveillance plan can and must be developed as an essential component of the eradication programme. The simplest type of approach might consist of a weekly report from each hospital and dispensary noting whether suspect cases of smallpox had or had not been seen. Simple basic information should be requested for each suspect case, consisting of name, age, sex, residence of patient and date of onset. Hospitals or dispensaries failing to submit a report should be contacted promptly to ascertain specifically whether or not cases were observed.

This portion of the surveillance activity should be initiated concomitantly with the development of any systematic vaccination programme. Even where cases are comparatively few at the inception of the programme, detailed investigative and containment efforts should be initiated promptly. The discovery of apparent indigenous transmission should be accompanied by a two- or three-day intensive mass programme of vaccination in the immediate area. In highly endemic countries, such detailed field appraisal may be impractical until a vaccination campaign in the immediate area has been completed. It should not, however, be delayed until a country-wide programme has been completed.

Accurate diagnosis of individual cases may prove vexing in some instances. Not uncommonly, smallpox cases are confused with varicella (chickenpox) or disseminated herpes simplex, for example. To facilitate accurate diagnosis, simple pictorial field manuals pertaining to clinical diagnosis must be developed. Provision must be made for the establishment of a number of virus diagnostic laboratories and the training of competent technical staff. Since facilities and competence in virological diagnosis are limited in many parts of the world, consideration must be given to centralized facilities. The stability of smallpox virus lends itself well to the utilization of such centralized facilities. Specimens from lesions of cases can be shipped without refrigeration with a high expectation of virus recovery even though many days have elapsed.

A regional surveillance programme is an important component part of the eradication scheme. Increasing facilities for travel plus continuing major population migrations across national borders permit ready dissemination of infection from country to country. Strengthening of the advisory staff at regional and country level to assist individual countries in the development of adequate surveillance programmes, able to render assistance promptly both in the field investigative phases and in direct containment operations and serving to integrate information obtained from the separate countries would ensure greater success of the over-all programme.

Failure to establish an adequate surveillance scheme in Peru and Colombia resulted in the re-establishment of endemic smallpox following the introduction of cases from neighbouring Brazil and the subsequent spread of disease before detection. Instead of limited containment operations, an extensive programme for vaccination and re-vaccination is required.

2.4 Approaches to intensive country-wide vaccination programmes

Several possible approaches to intensive vaccination programmes have been employed. Their relative merits and demerits must be carefully weighed.

1. Vaccination conducted in established local health service dispensaries, etc.
2. Vaccination on a systematic house-by-house basis.
3. Vaccination of large groups collected at a series of different locations.

2.4.1 Vaccination conducted in established local health service dispensaries etc.

Useful in maintenance programmes to provide protection to those willing or able to avail themselves of existing facilities, experience has shown that only limited coverage in a population can normally be achieved by this approach even in better developed countries with a comparative plethora of available local health services. The least well-educated in the most densely crowded areas normally respond poorly although, as previously noted, it is in this group specifically that the highest levels of immunity are required. In the present endemic areas, it is difficult to conceive of this approach, used alone, being successful.

2.4.2 Vaccination on a systematic house-by-house basis

Many campaigns have been and are being carried out more or less in the fashion of malaria eradication projects, on a house-to-house basis. If done competently, the ~~over~~-all coverage which can be achieved is highest by this method. A substantial number of personnel is required, however, since experience shows that the individual vaccinator normally can vaccinate by this house-to-house method an average of only 50 to 70 persons per day in rural areas. It should be noted that one of the main difficulties so far recognized in the present projects is a serious shortage of field personnel. If household rosters are obtained, it should be simple and practical. Also, recording of the field work should include minimum items necessary for the systematic operation. The maintenance of detailed family rosters, although excellent in principle, has proved difficult in practice, especially in the areas where population movement is quite rapid.

In brief, this system of coverage can provide more effective total coverage if the staff is carefully supervised and if trained vaccinators are employed.

2.4.3 Vaccination of large groups collected at a series of different locations

Mass vaccination employing intensive publicity and the establishment of vaccination sites on a village-by-village basis, on street corners, in markets and other places of congregation in major cities permits a more efficient utilization of personnel. Simple recording procedures should be all that are necessary for this campaign. A concurrent assessment scheme too is necessary. One of the methods used is a sample survey of the population seven days following the campaign at which time those selected for survey are asked whether they have been vaccinated and, if so, their reactions are read.

In contrast with the house-by-house type campaign, a more detailed planning scheme, including intensive health education, adapted to the individual area is required if the programme is to be fully effective. This is particularly true in major population centres with less cohesive social structures. Thus, somewhat higher quality personnel are required. The operational complexities engendered by the large numbers of personnel necessary for the house-to-house type campaign would be vastly simplified in this method. If fewer vaccinators are needed, a higher quality of staff may be hired thus ensuring a higher proportion of successful vaccinations and more rigid adherence to procedures required for vaccine preservation.

This type of campaign permits utilization of mechanical jet injectors for vaccine which have the capacity of vaccinating as many as 500 to 1000 persons per hour. Adequate studies of two such devices have been reported. Successful vaccination rates with these have consistently been 20 per cent. higher than those achieved by trained vaccinators in the same area. Pilot mass vaccination programmes in Brazil conducted in a series of villages and towns ranging up to 35 000 population have demonstrated that population coverage as measured by successful vaccination has been approximately equivalent to that achieved by trained vaccinators in a house-to-house systematic programme. The costs, personnel and transport required were less than 25 per cent. of the house-to-house systematic programme.

2.4.4 Combined programme

The addition of smallpox vaccination to another programme employing systematic coverage of a population in a vaccination programme or other disease control activity has proved effective in some intensified campaigns. Since the costs of

personnel and transport are normally major expenses in a mass vaccination programme, the combination of several activities has a great deal of merit. If, however, the completeness of coverage must be compromised, the economy of the procedure could well prove to be a false saving necessitating repeat programme.

Summary

It is apparent that each of the approaches outlined, has advantages and disadvantages suggesting that, for most programmes, they should be combined in an appropriate manner. Careful advance planning is necessary but it must be recognized that for a fully effective programme, continuing adaptation is important. Provision must be made for continuing assessment of the completeness of vaccination coverage at appropriate local, country or national levels by individuals who are not themselves part of vaccination teams. The assessment aspect is an integral part of the programme and should serve to redirect operational plans. As previously pointed out, epidemiological investigations pertaining to the occurrence of smallpox cases represents a record form of assessment and similarly should serve to provide programme guidance.

2.4.5 Maintenance programmes

Until all endemic countries have completed valid eradication programmes and until at least a three-year period has elapsed without documented cases anywhere in the world, maintenance programmes of vaccination will be required in each of the countries. Methods for the conduct of maintenance programmes are expected to vary widely from country to country. Certain specific groups, however, will require particular emphasis.

- (1) Urban populations, especially those in densely crowded lower socio-economic areas.
- (2) Migrants who might be expected to transmit the disease widely and those recently entering urban areas from less well vaccinated rural districts.
- (3) Schoolchildren among whom disease may pass quickly and thence to the community at large.
- (4) New-born babies, if not adequately vaccinated: a large proportion of fully susceptible individuals can accumulate in a community within a comparatively short time.

(5) Dispensary and hospital staffs including laundry personnel. The high risk of disease spreading to these groups has repeatedly been demonstrated.

Some countries may elect to carry out intensified programmes augmented by continuing vaccination programmes in health centres and elsewhere; others may incorporate vaccination into other types of immunization and disease control programmes. Whatever the approach, it is most important to reach specifically the groups noted above and achieve as near total coverage of the population as possible.

3. THE SMALLPOX ERADICATION PROGRAMME AT PRESENT

During 1959, when the global eradication programme was initiated, 81 444 cases of smallpox were reported (Table I). The number of cases reported since this time has fluctuated reaching a maximum of 98 720 cases in 1963, but declining to somewhat less than half this number in 1964, according to provisional figures. Eradication and control measures have been partly responsible for this decline. However, incomplete reporting in certain areas and delayed reports of cases are known to have influenced these figures. Further, a natural, long-term cyclical variation in the incidence of smallpox is well recognized.

Eradiation of the disease appears to have been achieved in North and Central America, Europe, North Africa, the Middle East and Pacific and Western Pacific countries as well as in some countries in South America.

Endemic areas now include six countries in Asia (India, Burma, Indonesia, Pakistan, Afghanistan and Nepal), essentially all African countries in the Sub-Sahara region and three countries in South America (Brazil, Peru and Colombia). Although the great majority of cases are reported from the far more populous Asian countries, the incidence of disease is probably at least as high or higher in many areas of Africa and South America.

Transmission of disease from the endemic countries to smallpox-free areas remains a problem. Peru and Colombia, for example, both previously free from endemic smallpox, have experienced the reintroduction and establishment of endemic foci. Multiple imported cases continue to be reported annually to WHO from various countries throughout the world.

At the present time, eradication and control programmes are at various stages of development in Asia, Africa and South America with problems of differing character in each of the areas.

Africa

In Table II is shown smallpox incidence in individual countries. Smallpox control programmes, of a more or less intensive nature are now being conducted in all of the endemic African countries.¹

¹ Relatively intensive smallpox control programmes have been carried out in recent years in the French-speaking countries, including Cameroon, Central African Republic, Chad, Dahomey, Gabon, Guinea, Mauritania and Niger.

TABLE I. SMALLPOX CASES REPORTED BY CONTINENT
 1959-1965

	1959	1960	1961	1962	1963	1964	1965 1st 26 weeks (up to 3/4 July)
Africa	15 781	16 127	24 182	24 837	16 723	12 362	10 039
America	4 899	5 531	8 168	7 860	6 430	716	591
Asia	60 749	39 251	53 217	49 579	75 438	34 414	25 069
Europe	15	47	27	137	129	-	-
World total	81 444	60 956	85 594	82 413	98 720	47 492	35 699

WHO-assisted eradication projects have been, or are being, carried out in eight other African countries. Two of these countries report having completed systematic mass vaccination campaigns.

In the Ivory Coast and Upper Volta, systematic coverage of the total population has been achieved by mobile teams. Reported cases in both countries have shown a marked decrease. In the Ivory Coast, 4656 cases were recorded in 1961 and 11 cases in 1964; in Upper Volta, 2360 cases were reported in 1961, 8 in 1964. To maintain immunity levels, repeat mass vaccination campaigns every three to four years are being considered. Population movement from adjacent endemic countries is a significant problem. The surveillance systems in both countries need strengthening.

Projects in the remaining six countries have encountered a variety of problems which have prevented their effective development. In Liberia, the WHO-assisted project was started in 1962 but so far only less than 20 per cent. of the population has been covered. Shortages of field personnel and transport are the main obstacles hampering the project.

In Mali the WHO-assisted eradication project was agreed upon in 1962. Serious shortages of transport and field equipment, adverse weather and inadequate numbers of supervisory staff and field personnel have permitted coverage of only one-third of the population so far.

In Nigeria, Sierra Leone and Togo combined projects of yaws control and smallpox vaccination are now underway. However, with the possible exception of the Togo project, the programmes are not expected to effect eradication because of the extended time necessary to reach the entire population. In Nigeria and Sierra Leone intensive mass smallpox vaccination campaigns would be preferable but shortages of personnel, transport, vaccine and field equipment have precluded this possibility.

In Sudan, the WHO-assisted project was started late in 1962; half of the population has been vaccinated so far. However, very few provinces included in the campaign have shown satisfactory results and the immunity level is decreasing rapidly. The lack of sufficient planning and supervisory staff and field personnel is hampering the development of the project.

TABLE II. SMALLPOX INCIDENCE IN THE CONTINENT OF AFRICA

AFRICA	1959	1960	1961	1962	1963	1964	1965 1st 26 weeks (up to 3/4 July)
South Africa	-	65	8	112	163	329	62
Algeria	11	7	8	1	-	-	-
Angola	7	-	-	23	38	1	-
Basutoland	1	-	83	52	-	-	-
Bechuanaland	5	22	16	4	-	174	-
Burundi	-	-	-	26	3	-	-
Cameroon	17	-	1 345	792	133	81	-
Congo (Brazzaville)	-	-	22	1 313	1 515	196	68
Congo, Rep. dem.	3 036	605	2 251	3 785	5 496	2 302	2 106
Ivory Coast	784	1 634	4 656	2 066	219	11	3
Dahomey	1 708	768	119	124	228	703	6
Ethiopia	362	293	761	360	232	103	28
Gabon	-	-	-	1	111	49	1
Gambia	3	7	12	4	52	6	4
Ghana	105	139	75	135	23	9	6
Guinea	441	176	96	2 948	224	300	39
Sp. Equat. Region	-	1	-	-	-	-	-
Port. Guinea	24	1	7	2	-	-	-
Upper Volta	368	126	2 360	1 335	339	8	13
Kenya	572	347	289	96	254	266	282
Liberia	591	-	1 119	323	57	128	38
Malawi	559	795	1 465	634	455	704	152
Mali	772	1 212	1 706	1 668	1 096	321	555
Mauritania	32	123	12	40	1	-	-
Mozambique	37	81	51	67	85	250	44

TABLE II (continued)

AFRICA	1959	1960	1961	1962	1963	1964	1965 1st 26 weeks (up to 3/4 July)
Niger	1 149	2 408	1 740	1 038	445	29	330
Nigeria	1 599	4 140	3 538	3 863	1 774	1 416	3 427
Uganda	334	709	398	628	419	523	668
United Arab Rep.	30	7	1	4	2	-	-
Central African Rep.	-	1	-	57	3	-	-
Southern Rhodesia	133	12	3	15	44	200	10
Ruanda-Urundi	77	17	18	-	-	-	-
Rwanda	-	-	-	30	-	-	-
Senegal	487	6	201	231	87	2	-
Sierra Leone	96	12	6	78	14	89	46
Somalia	94	2	-	-	-	-	-
Somalia Fr.	110	-	-	-	-	-	-
Sudan	517	135	104	70	26	-	60
Swaziland	-	-	-	-	182	517	58
Tanzania	1 442	1 575	925	973	837	1 405	1 671
Chad	34	4	273	1 157	10	5	62
Togo	66	347	281	572	274	21	9
Zambia	178	350	233	210	1 882	2 214	296
Total	15 781	16 127	24 182	24 837	16 723	12 362	10 039

Regional vaccine production facilities in Nigeria are partially operative but will require substantial direct and advisory technical assistance. Similar arrangements to develop a production centre in Kenya are in hand.

In brief, lack of adequate technical assistance, personnel, equipment, vaccine and supply have hampered most of the African programmes initiated to date. Co-ordination of the programme on a regional basis has not yet been attempted; surveillance aspects of the eradication programme have received minimal attention. It is felt, however, that the principal difficulties can be remedied if the countries concerned place a greater emphasis on the programme and if additional assistance in the form of assigned WHO technical staff at the country and regional level in addition to adequate vehicles and supplies are provided. If mass campaign techniques employing mechanical equipment (jet injectors) can be employed, a major difficulty, the lack of sufficient local personnel, could largely be surmounted in some of the programmes.

America

In Table III is shown smallpox incidence in individual countries. In the Americas, a regional eradication effort was started in 1950 and eradication was achieved in many countries. Recently, however, the disease has become re-established in Colombia and Peru. Notably, endemic smallpox in Peru recurred eight years following an effective eradication programme.

In Argentina, 300 000 persons were vaccinated in 1964. Twelve cases occurred in 1964 and there was an outbreak in the province near the border with Paraguay in the latter half of 1965. A national vaccination campaign will be carried out and the surveillance system will be strengthened.

Although reporting is incomplete in Brazil, it would appear that smallpox is presently endemic throughout the country. An eradication programme was initiated in 1962 and about 16 million persons have been vaccinated in two years. However, the programme has suffered from lack of central direction and control and adequate vehicles and equipment. Little has been done in terms of surveillance. Three laboratories in Brazil, equipped by the Pan American Health Organization, are producing good quality freeze-dried vaccine in quantities adequate for the programme. National health authorities are presently engaged in revising the plans for the programme and in developing a more effective administrative structure.

TABLE III. SMALLPOX INCIDENCE IN THE AMERICAS

AMERICA	1959	1960	1961	1962	1963	1964	1965 1st 26 weeks (up to 3/4 July)
Argentina*	36	65	4	2	-	12	-
Bolivia	7	1	-	-	-	-	-
Brazil	2804	3017	7656	7589	5516	306	437
Canada	-	-	-	1	-	-	-
Colombia	867	209	16	41	4	21	147
Ecuador*	1184	2185	491	205	45	-	-
Paraguay	-	35	-	-	-	-	-
Peru	-	-	-	-	865	374	7
Uruguay	-	19	1	11	-	3	-
Venezuela	-	-	-	11	-	-	-
Total	4898	5531	8168	7860	6430	716	591

*Since July, Argentina has reported 15 cases and Paraguay 30 cases.

Colombia completed a well-organized eradication programme in 1961 but experienced a reintroduction of the disease, apparently from Brazil, in 1965. The disease has once again become moderately widespread. The Government is now considering a repeat programme of mass vaccination to be completed over a three-year period. External assistance will be required.

Peru, free of endemic smallpox since 1955, reported 863 cases in 1963, a result of disease-reintroduction in north-eastern areas bordering Brazil. A mass vaccination programme has again been initiated.

Bolivia and Paraguay, neither of which is at present believed to be harbouring endemic smallpox, are at great risk of disease-reintroduction because of their proximity to Brazil and relatively inadequate vaccination status and surveillance programme. A vaccination programme in Bolivia is in progress with assistance from an assigned WHO health inspector but a variety of administrative, economic and political factors have hampered the programme.

The need for a regional eradication scheme is only too apparent in the South American programme. The continuing endemic area of smallpox in Brazil has necessitated the reinitiation of national campaigns in adjacent countries. Failure to establish adequate surveillance schemes prevented Peru and Colombia from detecting imported cases sufficiently early to permit containment; maintenance immunization programmes were ineffective and widespread transmission soon resulted.

Of the principal endemic areas of the world, South America is most easily subject to smallpox eradication. The key to the problem is Brazil. Some assistance in the form of technical aid and equipment will be required in several countries; by certain of the facilities; and a vastly more effective programme of surveillance, nationally and regionally, will be required throughout the Americas.

Asia

In Table IV is shown smallpox incidence in individual countries. The status of smallpox eradication in Asia is intermediate between the relatively advanced situation in the Americas and the developing stages in Africa. Most of the endemic countries in this continent started mass vaccination campaigns in 1960-1962. However, progress has been irregular. Between 1959 and 1964 several countries, Ceylon, Malaysia, Singapore, Thailand and Viet-Nam became smallpox free. Six countries remain endemic, Afghanistan, Burma, India, Indonesia, Nepal and Pakistan.

In Afghanistan, although WHO-assisted projects were started in 1962, a systematic programme has not yet been developed. Only 20 per cent. of the total population has been vaccinated. Principal difficulties include the lack of national funds to provide sufficient supervisory and field personnel, transport for the project, difficult terrain, and problems in vaccinating the comparatively secluded female population in many areas. WHO and the USSR have supplied sufficient freeze-dried vaccine for the project so far.

Burma has conducted a successful campaign and is expected to complete the mass campaign phase by 1966. The project is based mainly on existing basic health services with planned coverage of the total population once every three years. In 1964, only 28 cases were reported compared to 1533 cases in 1959. Vaccine production was started in 1965, but most of the vaccine is still being supplied by the USSR.

India started a campaign in 1962 and hopes to complete it by the middle of 1966. So far 360 million have been vaccinated with a coverage of 75 per cent. of the total population of 473 million. However, India is still reporting a substantial number of cases (31 587 cases in 1964, approximately the same number as recorded in 1960). A careful reassessment of the project, together with strengthening of the surveillance system, is urgently needed. The project is receiving a large amount of freeze-dried vaccine (over 400 million doses so far) from the USSR on a bilateral basis, plus some additional vaccine donated through WHO from other countries. Four vaccine production plants, started in 1962 and 1963 with the assistance of WHO and UNICEF, are in the development stage.

In Indonesia an eradication plan has been drawn up but the nation-wide programme has not yet been implemented. Adequate freeze-dried vaccine is produced locally.

In Nepal, a WHO-assisted programme was started in 1961 but the project is still limited to the Katmandu Valley. Recent assessment has revealed that even in the Katmandu Valley coverage is only 30 per cent. The project is suffering from a serious shortage of field personnel, lack of transport under extremely difficult geographical conditions and some resistance on the part of the people against vaccination. An intensive effort, supported by substantial external assistance, employing mobile teams with adequate transport, including a small plane or helicopter, probably could achieve proper coverage within a three-year period. Vaccine must be supplied from outside sources.

TABLE IV. SMALLPOX INCIDENCE IN ASIA

ASIA	1959	1960	1961	1962	1963	1964	1st 26 weeks 1965 (up to 3/4 July)
Aden: Col.	8	8	1	-	-	-	-
Prot.	62	5	-	-	-	-	-
Afghanistan	441	111	174	303	571	157	41
Saudi Arabia	115	32	17	1	-	-	-
Burma	1 533	392	88	21	10	28	8
Cambodia	4	-	1	-	-	-	-
Ceylon	-	-	34	12	1	-	1
Korea, Rep.	-	13	1	-	-	-	-
Malaysia	38	15	-	-	-	-	-
India*	45 942	31 071	45 319	42 231	60 901	31 587	19 977
Indonesia	1 129	5 196	4 677	3 340	7 966	1 745	4 094
Iraq	23	-	-	-	-	-	-
Iran	311	378	123	29	6	12	-
Qatar	1	-	1	-	-	-	-
Kuwait	10	-	-	1	-	-	-
Muscat & Oman	8	-	-	8	-	-	-
Nepal	-	-	5	-	779	99	-
Trucial Oman	-	-	-	17	-	-	-
Pakistan	9 553	1 998	2 742	3 614	5 199	781	948
of which:							
East Pakistan	6 292	1 086	421	523	3 724	43	115
West Pakistan	3 261	912	2 321	3 091	1 475	738	833
Singapore	10	-	-	-	-	-	-
Thailand	1 548	32	33	2	-	-	-
USSR (Asiatic part)	1	-	1	-	-	-	-
Viet-Nam	12	-	-	-	-	-	-
Yemen	-	-	-	-	5	5	-
Total	60 749	39 251	53 217	49 579	75 438	34 414	25 069

* Taking into consideration the seasonal variation of smallpox in India as a whole (from 11th 4 weeks' period to 10th 4 weeks' period) the figures can be shown as follows: 1959-60, 28 960; 1960-61, 45 610; 1961-62, 36 715; 1962-63, 67 780; 1963-64, 33 097; 1964-65, 24 735 (up to 7th 4 weeks' period). (Epidemiological & Vital Statistics Annual & Monthly).

East Pakistan completed a mass vaccination programme in 1964 providing coverage to over 80 per cent. of its 50 million population in 1964 and entered the maintenance phase. Reported cases decreased substantially from 3724 in 1963 to 43 in 1964. However, through August 1965, 147 cases (61 deaths) have been reported. A repeat mass programme may be necessary; at the very least an intensified maintenance and surveillance programme must be developed. Adequate vaccine can be produced locally. In West Pakistan a programme was planned to start in 1965.

In Asia, vaccine must be supplied to all countries for mass campaigns except Indonesia and Pakistan. Within one or two years, however, local vaccine production in India and Burma is expected to meet national demands for maintenance vaccination programmes. Moderately substantial quantities of transport and equipment will be required for all programmes. Supplementary technical personnel for assessment, planning, supervision and the development of surveillance are required to a greater or lesser extent for all countries. The development of effective maintenance programmes and surveillance on a regional basis is needed. Methods to achieve coverage of groups resistant to vaccination in Afghanistan and Nepal must be explored.

Europe

In Table V is shown smallpox incidence in Europe. Since 1959 several countries have reported imported or secondary cases.

TABLE V. SMALLPOX INCIDENCE IN EUROPE

EUROPE	1959	1960	1961	1962	1963	1964	1st 26 weeks 1965 (up to 3/4 July)
Germany, Fed. Rep.	13	-	5	38	-	-	-
Belgium	-	-	1	-	-	-	-
Spain	-	-	17	-	-	-	-
Hungary	-	-	-	-	1	-	-
Poland	-	-	-	32	99	-	-
United Kingdom	1	1	3	66	-	-	-
Sweden	-	-	-	-	27	-	-
Switzerland	-	-	-	1	1	-	-
USSR (Moscow)	-	46	1	-	-	-	-
Total	14	47	27	137	128	-	-

4. PROPOSED PROGRAMME FOR THE GLOBAL ERADICATION OF SMALLPOX

4.1 General considerations

Of the utmost importance and urgency is the development of eradication programmes in all endemic countries at the earliest possible date. In some countries, eradication programmes have been or are being completed; maintenance programmes are in progress. Maintenance programmes, however, are reasonably difficult to carry out effectively; each year that they must be continued only serves to augment the over-all costs of the global programme. At all times during this period, of course, the possibility of reintroduction and re-establishment of endemic smallpox is real.

To initiate and execute the programme calls for a maximum effort on the part of the individual endemic countries, aided appropriately by technical assistance, equipment, vaccine and other supplies. Of major importance is the evolution of maximally effective programmes for surveillance, field investigation and disease containment.

To provide the necessary impetus, direction, co-ordination and supervision requisite for a unified global effort, strengthening of the headquarters and regional staff is proposed. In addition, a technical adviser at the country level is considered essential.

It is expected that in addition early action will be necessary to obtain the large amounts of freeze-dried vaccine requisite for this major undertaking.

For purposes of over-all planning, it is necessary to assume that support for an intensified global eradication effort will be forthcoming from each of the endemic countries. A simultaneous intensified global effort would be technically desirable although logistically impracticable. It is proposed, therefore, that eradication efforts be developed or continued in selected countries during 1967 with the extension of the programme to all endemic countries in 1968 onwards. Although in the smaller countries, nation-wide campaigns can sometimes be achieved in a single year, it is believed that most countries, from the standpoint of

transport and personnel, will find it more convenient to extend the intensified phase of the programme over a three-year period. Assuming this phase to be successful maintenance programmes covering newborn, migrants, specific age-groups, etc. of the population should follow each year thereafter.

It is believed that in the Americas, Africa and perhaps some countries in Asia intensified vaccination campaigns will rely upon the jet injectors for vaccination supplemented appropriately by the multiple pressure method, varying the extent of its use according to the operation areas. Since new techniques are represented and since each country necessarily poses unique problems in transport and operational and field personnel capabilities, it is possible to estimate only approximately the over-all costs required to supplement the possible maximum effort in each country.

4.2 Specific needs

For the programme in 1967, as mentioned above, attention has been directed to those countries with programmes fully or partially operative, those already prepared to embark on eradication programmes and selected countries strategically located geographically. Proposed for assistance in 1967 are continuing programmes in Asia (Burma, India, Pakistan, Nepal and Afghanistan); Africa (Mali, Sudan, Liberia, Ivory Coast, Togo and Upper Volta); and South America (Bolivia and Peru). Additionally, in South America, Brazil has indicated that it is planning to embark on a more vigorous programme; because of geographical reasons, programmes in Paraguay and Colombia should parallel the Brazilian effort; in Argentina re-establishment of the programme is being considered. In Africa, Nigeria and Sierra Leone have expressed interest in embarking on eradication programmes at an early date. A geographically continuous programme should be initiated in Africa, and all countries in that area should participate.

4.2.1 Individual country requirements

4.2.1.1 Vaccine required

It has been necessary to estimate approximate amounts of vaccine needed in 1967 by two categories, vaccine for multiple pressure or scarification method and vaccine for jet injection. Freeze-dried vaccine prepared for multiple pressure

use and that proposed for use in the jet injectors differs in that the latter is supplied in quantities in vials which, when reconstituted, results in a ten-fold more dilute suspension than that for multiple pressure application. The rationale of a more dilute material for the injectors is based on the fact that essentially all of the virus particles are inoculated as contrasted to multiple pressure or similar methods in which comparatively few particles are actually inoculated with most of the vaccine remaining on the skin surface. Experimental studies have validated this assumption.

Vaccination campaigns employing jet injectors have been evaluated in Brazil and found to be highly effective, notably reducing needs for transport and personnel in addition to reducing the over-all costs of the programme. It is believed that this approach is to be preferred for use generally in South America supplemented by multiple pressure vaccination in approximately 10 per cent. of the population for "mop-up" operations and for vaccination in remote areas. In African countries, where programmes have been severely hindered by a lack of personnel, it is likely that jet injectors are also to be preferred. The experience to date in mass measles vaccine programmes in West Africa tends to substantiate this belief. In Asian countries, variable use may be made of this tool, contingent upon evaluative studies.

Vaccine for multiple pressure use is available in ample quantity in all South American countries, Pakistan and probably in Nigeria in 1967. It is hoped that the USSR will be able to continue its bilateral assistance in providing requisite supplies of vaccine to Burma, India and Afghanistan. Brazilian vaccine, produced at the Oswaldo Cruz Institute, has been evaluated for use in jet injection equipment and appears to be wholly satisfactory.

At this time, it is assumed that about 55 million doses of vaccine during 1967 will have to be supplied to all other countries from outside sources, a portion of which will have to be for jet injector application.

4.2.1.2 Other supplies and equipment needed

Requirements adjudged to be needed have been estimated on the basis of communication from a number of countries. This includes transport, refrigerator, jet guns, camping equipment unit, vaccine kits etc.

4.2.2 WHO staff in headquarters and regional offices

Integrated, well co-ordinated global programmes require the formation of adequately staffed regional offices and headquarters unit. In each regional office (AFRO, AMRO, EMRO, SEARO), a regional adviser is proposed to provide the necessary close co-ordination, consultation, supervision and impetus to the separate programmes. Proposed for headquarters office are the following personnel: three medical officers and administrative assistants, technical assistant and two secretaries. This headquarters unit may be expected to assume principally responsibilities which include: guidance and continuous assessment of the programme as a whole; co-ordination of the regional activities towards global eradication; development of operational assessment, surveillance and diagnostic standard for field use; preparation of materials for periodic publication on the development of smallpox surveillance and operations concerning the current status of the programmes and development of the techniques employed in different areas; and planning, development and co-ordination of research programmes of concern to the continuing programmes.

4.2.3 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.

4.2.4 Training course

It is proposed to hold inter-regional training courses for national and international programme staff for methods of operation, assessment, surveillance and laboratory diagnosis. The courses will be held both for English-speaking countries and French-speaking countries.

4.2.5 Research projects

A number of important technical areas demand intensive study, the results of which should serve further to guide the programme in the immediate years ahead. Among others, these should include epidemiological studies to assess the circumstances and factors necessary for the continued endemic propagation of the disease, the duration of immunity conferred by vaccination under circumstances of natural challenge, comparative studies of strains from different areas, evaluation of chemoprophylactic agents. It is hoped that total or partial financial support for many of these projects would be provided directly to responsible investigators from national funds.

4.2.6 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.

5. TEN-YEAR PROGRAMME

A plan has been prepared mainly according to the reassessed material given to headquarters from the regional offices up to 18 November 1965. For those countries from which there is no information available it is proposed that the campaign should start in 1968 with the three to four years' attack phase and the successive maintenance vaccination programme. The maintenance phase should continue until the disease has been eradicated. However, in this plan the duration of the maintenance phase, as an objective of international assistance, is considered to last four years because at the latter stage of the programme the incidence of smallpox will be considerably reduced, and it is expected that the programme will be carried out by the countries without substantial material assistance from outside sources.

The plan includes the phasing of the programme proposed for the individual countries in each region and general cost estimates of the programme each year during the ten-year plan.

5.1 The phasing of the programme

African Region

The programme of the African Region is divided into West Africa and East Africa.

West Africa

In Table VI is shown the phasing of the programme proposed in West African countries. Dahomey, Ivory Coast, Liberia, Mali, Nigeria, Sierra Leone, Togo and Upper Volta are included in the countries where the campaign will start with WHO assistance in or before 1967. In these countries the smallpox control or eradication programmes have been underway or are at preparatory stages at present. The periods of the programme in individual countries will vary depending upon the progress which has been made so far.

Relatively intensive smallpox control programmes have been carried out, mainly by the Services des Grandes Endemies, in French-speaking countries, including Cameroon, Central African Republic, Chad, Gabon, Guinea, Mauritania and Niger in recent years. Some of these countries have already proposed carrying out the programme in 1966 or 1967 (Central African Republic, Guinea, etc.). In the Congo (Democratic Republic) it was proposed that the pilot project should be carried out

TABLE VI. PHASING OF THE PROGRAMMES - WEST AFRICAN COUNTRIES^a

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Cameroon	*	**	**	**	***	***	***	***		
Central African Republic	*	**	**	**	***	***	***	***		
Chad	*	**	**	**	***	***	***	***		
Congo (Brazzaville)	*	**	**	**	***	***	***	***		
Congo (Democratic Republic)	*	**	**	**	**	***	***	***	***	
Dahomey	**	**	**	***	***	***	***			
Gabon	*	**	**	**	***	***	***	***		
Gambia	*	**	**	**	***	***	***	***		
Ghana	*	**	**	**	***	***	***	***		
Guinea	*	**	***	***	***	***				
Ivory Coast	***	***	***	***						
Liberia	**	**	**	***	***	***	***			
Mali	**	**	***	***	***	***				
Mauritania	*	**	**	**	***	***	***	***		
Niger	*	**	**	**	***	***	***	***		
Nigeria	**	**	**	***	***	***	***			
Senegal	*	**	**	**	***	***	***	***		
Sierra Leone	**	**	**	***	***	***	***			
Togo	**	***	***	***	***					
Upper Volta	***	***	***	***						

^a Excluding Portuguese Guinea and the Spanish Equatorial region. It is anticipated that eradication programme can be carried out in these territories with national financing only.

* Preparatory stage or national control programme in operation.

** Attack phase.

*** Maintenance phase with international assistance.

in 1966 and the campaign will start in 1967 in provinces where the situation is at the right stage for commencement of the programme. However, all this information was not available when the 1967 budget was prepared. Assistance is proposed for these countries from 1968 onwards. Also, it is certain that some of these countries will start or continue the programmes in 1966 or 1967.

Little information is available from the remaining countries such as Congo (Brazzaville), Gambia, Ghana and Senegal. In the plan it is proposed that an attack phase should be carried out starting in 1968 in the above-mentioned countries and maintenance programmes will follow.

East Africa

In Table VII is shown the phasing of the programme proposed for East African countries, Burundi, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia. At present detailed plans are not available from these countries. In this plan it is expected that the countries should start three years' attack phases simultaneously in 1968 and successive maintenance programme will follow.

Region of the Americas

In Table VIII is shown the phasing of the programme planned for Latin American countries. Argentina and Peru are expected to carry out a two years' mass vaccination programme covering especially the population in the area of the borders which are at risk of introduction of smallpox cases. In both these countries, after the campaign a one-year programme for mopping-up operations is proposed. In Bolivia, Colombia and Paraguay a three years' attack phase programme is proposed starting in 1967. In Brazil a three years' attack phase is planned to start in 1967 and the project will be continued to a maintenance programme as Brazil is the principal endemic country in America.

Eastern Mediterranean Region

In Table IX is shown the phasing of the programmes proposed for the Eastern Mediterranean Region. In Ethiopia the project is being discussed with the Government. A pilot project is proposed to be held in 1966 and the campaign may start in 1967 but the main assistance is proposed from 1968 onwards. Sudan has been carrying out the vaccination campaign in recent years. However, it is considered

TABLE VII. PHASING OF THE PROGRAMMES - EAST AFRICAN COUNTRIES^a

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Burundi	*	**	**	**	***	***	***	***		
Kenya	*	**	**	**	***	***	***	***		
Malawi	*	**	**	**	***	***	***	***		
Rwanda	*	**	**	**	***	***	***	***		
Tanzania	*	**	**	**	***	***	***	***		
Uganda	*	**	**	**	***	***	***	***		
Zambia	*	**	**	**	***	***	***	***		

^a Excluding Angola, Basutoland, Bechuanaland, Mozambique, Southern Rhodesia, Swaziland and the Union of South Africa. It is anticipated that eradication programme can be carried out in these countries and territories with national financing only.

* Preparatory stage or national vaccination programme in operation.

** Attack phase.

*** Maintenance phase with international assistance.

TABLE VIII. PHASING OF THE PROGRAMMES - THE AMERICAS

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Argentina ^a	**	**	***							
Bolivia	**	**	**							
Brazil	**	**	**	***	***	***	***			
Colombia	**	**	**							
Paraguay	**	**	**							
Peru ^a	**	**	***							

^a Mainly mopping-up operation in maintenance phase.

** Attack phase.

*** Maintenance phase with international assistance.

TABLE IX. PHASING OF THE PROGRAMMES - EASTERN MEDITERRANEAN

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Ethiopia	*	**	**	**	***	***	***	***		
Sudan	**	**	**	***	***	***	***			
East Pakistan	***	***	***	***						
West Pakistan	**	**	***	***	***	***				

* Preparatory stage.

** Attack phase.

*** Maintenance phase with international assistance.

that a three years' attack phase should be carried out, starting in 1967. In both countries maintenance programmes will follow. In East Pakistan, after completing the mopping-up and assessment programme in 1966, the maintenance programme is expected to start in 1967. In West Pakistan the attack phase is planned to be completed in 1968 and the maintenance programme will follow.

The phasing of the programmes in Ethiopia and Sudan should be considered on the same basis as East African programmes and Pakistan on the same basis as South-East Asia programme.

South-East Asia Region

In Table X is shown the phasing of the programmes proposed in South-East Asia. The WHO-assisted projects started in Afghanistan in 1962 and in Nepal in 1961. Since the period of the programme has been prolonged, the effective herd immunity has not yet been established in the population. Therefore, it is proposed that the attack phase should start in both countries in 1967 with three years' duration in Afghanistan and four years' in Nepal. Burma is expected to complete the attack phase in 1966 and to start the maintenance programme in 1967 onwards. In India, the attack phase was expected to be completed in 1966 but it is assumed that the programme will have to be continued in 1967 in the form of mopping-up operations. In 1968 India is expected to enter the maintenance vaccination programme. In Indonesia the programme would be at a preparatory stage in 1967 and it is expected that Indonesia will start a campaign in 1968 and complete the attack phase within a three-year period in the framework of their relatively developed health services. The maintenance phase will follow.

5.2 General cost of the programme

In Table XI is shown the broad estimate of the population proposed for vaccination with international assistance during the next 10 years, based on the phasing of the programme of individual countries in respect of the region.

The population in endemic countries is estimated as 1100 million in 1966, 1210 million in 1970 and 1350 million in 1974. In 1967, 21 countries are planned to participate in a global eradication programme with international assistance by vaccinating approximately 220 million people. In 1968 the remaining endemic countries are expected to join the programme. The number of vaccinations proposed will reach

TABLE X. PHASING OF THE PROGRAMMES - SOUTH-EAST ASIA

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Afghanistan	**	**	**	***	***	***	***			
Burma	***	***	***	***						
India	**	***	***	***	***					
Indonesia	*	**	**	**	***	***	***	***		
Nepal	**	**	**	**	***	***	***	***		

* Preparatory stage.

** Attack phase.

*** Maintenance phase with international assistance.

TABLE XI. ESTIMATED NUMBER OF VACCINATIONS WITH INTERNATIONAL ASSISTANCE IN TEN-YEAR PROGRAMME

WHO Region	Population estimated (millions)			Estimated number of vaccinations with international assistance (millions)										
	1966	1970	1974	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	Total
Africa	170	190	220	20	60	80	60	50	50	50	30	10	-	410
Americas	140	160	180	40	60	60	30	30	30	30	-	-	-	280
Eastern Mediterranean	140	150	170	30	40	40	50	20	20	10	10	-	-	220
South-East Asia	650	710	780	130	150	170	170	150	40	40	30	-	-	880
Total	1 100	1 210	1 350	220	310	350	310	250	140	130	70	10	-	1 790

approximately 310 million in 1968. The programme is phased to develop to its height in 1969 when 350 million vaccinations are expected. From 1970 the number of vaccinations will gradually decrease since the project will be completing the attack phase and entering the maintenance programme. In the latter stages of this ten-year period, the vaccination figures for international assistance would be 250 million in 1971, 130 million in 1973 and 10 million in 1975.

Several attempts have been made to obtain specific information on the cost of the programme. These include theoretical assumption of the cost in African countries, information regarding the reassessed support proposed from the present programme in such countries as India, Afghanistan, Burma and Nepal and also reviewing the past experience of the project of several countries in Latin America and parts of Africa. It is reaffirmed that the cost of the campaign should be broadly estimated on the basis of 10 cents per vaccination and the general cost for each campaign can be distributed as 70 per cent. for the expenditure of national sources and 30 per cent. for external technical assistance, vaccine, transport, supplies and equipment. From past experience it is considered that a 30 per cent. share of the general cost from outside would enable the endemic countries to establish and implement a successful vaccination programme. In addition, it is proposed that although the international assistance will cease after a four years' maintenance programme, the surveillance activities and urgent containment measures of possible outbreaks should be supported by international assistance on a global basis. For this purpose, an amount of funds should be provided each year from 1972 to 1976. The yearly cost from outside sources could be reduced by taking into consideration that India, Burma, Nigeria and Kenya may be able to produce the necessary amount of vaccine for the campaign from 1968 onward.

The cost of the programme in each year has been estimated as shown in Table XII. During the 10 years, it is expected that 1790 million vaccinations will be carried out, covering the entire population of endemic countries from the attack to the maintenance phase of the campaign. The cost is estimated at \$ 180 million with a distribution of \$ 22 million in 1967, \$ 31 million in 1968 and \$ 35 million in 1969. From 1970, along with the decrease of the number of vaccinations, the cost will decrease as indicated: \$ 25 million in 1971, \$ 13 million in 1973 and \$ 1.5 million in 1975. With regard to the share of international assistance including WHO, it was estimated

TABLE XII. GENERAL COST ESTIMATE FOR TEN-YEAR PLAN
(US\$ million)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	Total
Total cost estimated	22.0	31.0	35.0	31.0	25.0	14.0	13.0	7.0	1.5	0.5	180.0
Share of international assistance	6.6	7.7	8.9	7.7	5.9	4.1	3.8	2.5	0.8	0.5	48.5

altogether as \$ 48.5 million during the ten-year plan, i.e., principally 30 per cent. of the general cost and costs for surveillance activities in the latter stage. This \$ 48.5 million will be distributed as \$ 6.6 million in 1967, \$ 7.7 million in 1968 and will reach its height in 1969 with \$ 8.9 million. From 1970, the cost will decrease, for example, to \$ 5.9 million in 1971, \$ 3.8 million in 1973 and \$ 0.8 million in 1975.

With regard to the \$ 6.6 million from outside sources in 1967, WHO has proposed to provide \$ 2.6 million for technical assistance, supplies and equipment for the programme of 21 countries.¹ The balance of these two amounts is expected to be covered on a bilateral basis by other international agencies, present existing resources in individual countries or by integration of the project, multi-purpose projects and other different approaches of the project, depending upon the different situation of individual countries and respective regions. If, as it is hoped, the USSR would continue to contribute vaccine to India, Afghanistan and Burma on a bilateral basis, this would meet considerable part of this expenditure.

On the whole, it can be stated that if the implementation of the programme is delayed or prolonged, then a greater number of the population than here estimated would need to be vaccinated, resulting in further increase of the cost of the programme.

¹ Off. Rec. Wld Hlth Org., 146, Annex 3, Part VI, 521-528.

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SMALLPOX ERADICATION

English Text (page 38)

Third last paragraph, second last line: Delete "1961" Insert "1971"

Penultimate paragraph:

Delete first sentence, with footnote.

Insert: "With regard to the \$ 6.6 million from outside sources in 1967, an amount of \$ 2.4 million has been included under the Special Account for Smallpox Eradication to meet the first year's costs, as presented in Annex 3, pages 521-527 of Official Records No. 146; and a further amount of approximately \$ 0.2 million is expected to be provided from other funds administered directly or indirectly by the World Health Organization."

Delete "of these two amounts" in the following sentence of the penultimate paragraph.

