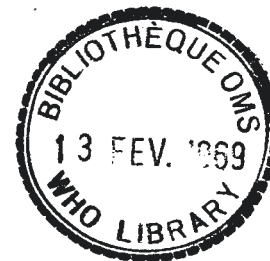




EXECUTIVE BOARD

Forty-third Session

Provisional agenda item 2.4



SMALLPOX ERADICATION PROGRAMME

I. Introduction

The intensified programme of smallpox eradication, decided upon by the Nineteenth World Health Assembly,<sup>1</sup> commenced in January 1967. Funds provided in the Organization's regular budget as well as contributions to the Special Account for Smallpox Eradication and assistance from multilateral and bilateral agencies have permitted the majority of endemic countries to embark on intensive programmes of eradication.

Of 27 countries and territories which presently experience endemic smallpox, 18 have commenced eradication programmes and six will initiate programmes early in 1969. Of the remaining three, Southern Rhodesia records only a few cases annually but Ethiopia and Mozambique experience a moderately high incidence of smallpox. No information has been received as to their intentions to conduct eradication programmes.

Of 40 countries and territories located in endemic regions and at particular risk of introduction of smallpox, 20 have initiated special programmes to increase the immunity of their populations and to strengthen surveillance and reporting. Four additional countries plan to begin programmes during 1969.

This report,<sup>2</sup> presents the current status of smallpox eradication and programme plans for 1969 and 1970.

II. Smallpox Incidence and Programme Development

The annual incidence of smallpox since 1959, according to the most recent information available to the Organization, is presented by continent and WHO region in Tables 1 and 2. These figures are higher than those recorded in previous reports. This is because a number of countries, in developing eradication programmes, reviewed the recorded smallpox incidence in their countries and found that many cases which were recorded at state or provincial levels had not in previous years been recorded by the central government. Accordingly, several countries have submitted revised totals of cases for previous years and these have been incorporated in the present tables.

During 1968 (as of 16 January 1969), 64 374 cases had been reported to the Organization. From previous years' experience, the final total for 1968 is expected to be about 67 000 cases. This is a reduction of about 40 per cent. from the number of cases recorded during 1967 and is a total comparable to that recorded in 1960 and 1964. This reduction in incidence is observed despite a continuing improvement in reporting in many countries. Although partly attributed to effective eradication programmes in progress in many countries, the very low incidence in 1968 may also, in part, reflect longer term cyclical variations in smallpox incidence (Fig. 1).

<sup>1</sup> Resolution WHA19.16, Handbook of Resolutions and Decisions, ninth edition, pp. 41-42.

<sup>2</sup> The designations employed and the presentation of material in this report do not imply the expression of any opinion whatsoever on the part of the Director-General concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

TABLE 1. REPORTED SMALLPOX CASES BY CONTINENT, 1959-1968

Continent	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968*
AFRICA										
North	41	7	8	1	-	-	-	-	-	-
West-Central	9 536	10 893	17 609	17 034	6 700	3 565	6 258	7 568	10 813	5 276
South-East	6 730	5 860	8 095	7 542	10 236	8 920	10 713	6 849	4 450	5 377
AMERICA										
North and Central	-	-	-	1	-	-	-	-	-	-
South	6 974	8 534	9 065	9 868	7 351	3 621	3 514	3 578	4 376	3 155
ASIA	71 310	39 844	53 960	63 692	108 086	58 642	80 902	63 648	102 454	50 564
EUROPE	15	47	24	136	129	-	1	62	5	2
OCEANIA	-	1	-	-	-	-	-	-	-	-
Total	94 606	65 186	88 761	98 274	132 502	74 748	101 388	81 705	122 098	64 374

\* Reports received as of 16 January 1969.

TABLE 2. REPORTED SMALLPOX CASES BY WHO REGION, 1965-1968

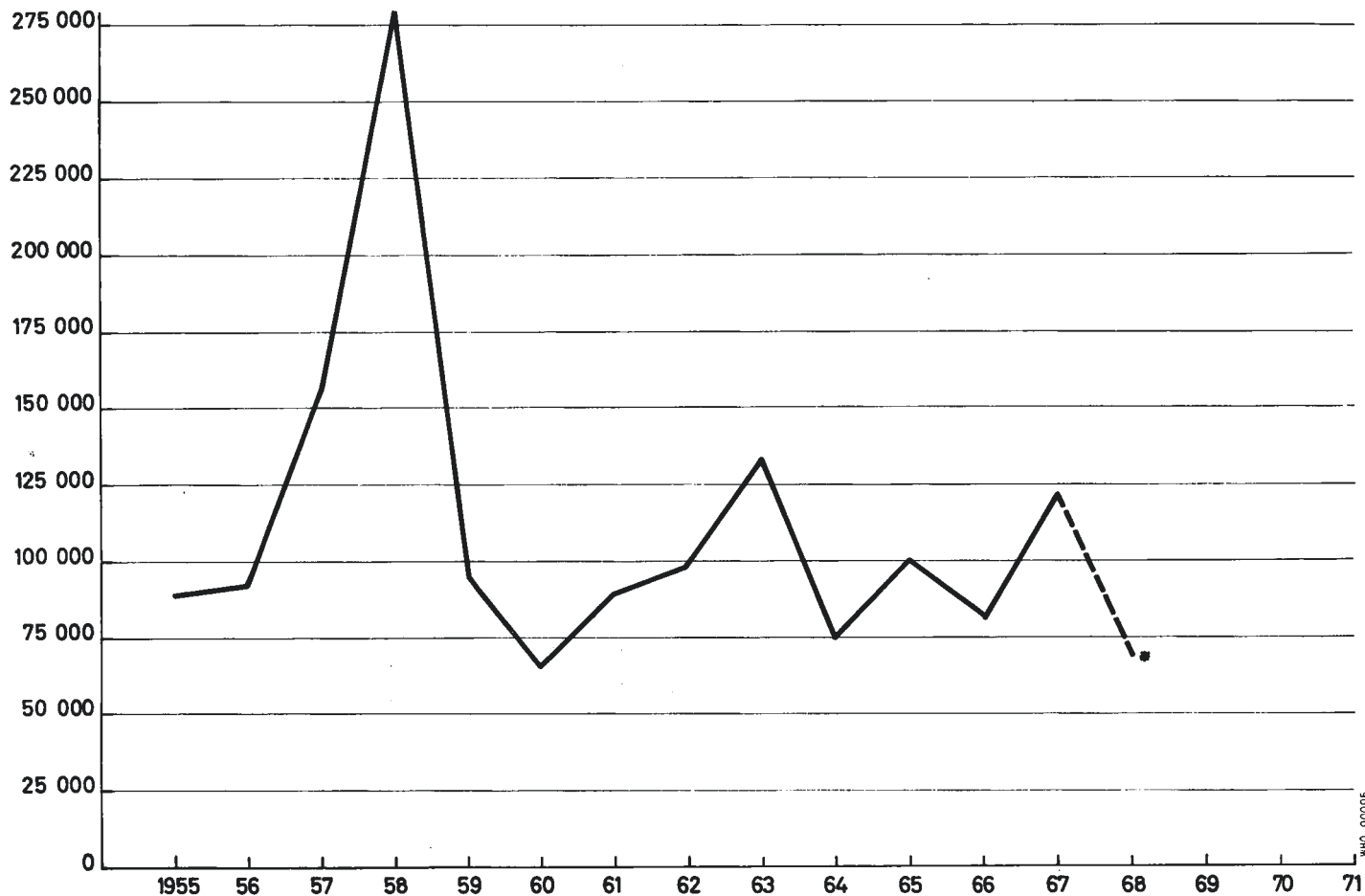
WHO Region	1965	1966	1967	1968*
Africa	16 844	14 135	14 788	10 195
Americas	3 514	3 578	4 376	3 155
Eastern Mediterranean	1 728	6 425	11 724	11 017
South-East Asia	79 301	57 500	91 205	40 005
Europe	1	62	5	2
Western Pacific	-	5	-	-
World total	101 388	81 705	122 098	64 374

\* Reports received as of 16 January 1969.

Substantial decreases in incidence were recorded in western and central Africa and in Asia. In western and central Africa, active eradication programmes are in progress and fewer cases were recorded by all countries except Togo and Upper Volta. In Asia, the marked decrease in cases is accounted for by a sharp decline in incidence in India which recorded 77 974 cases in 1967 and less than 25 000 cases in 1968. Other countries in Asia showed little change in incidence. In the Americas and in southern and eastern Africa, recorded smallpox incidence was not appreciably different from that observed in 1967.

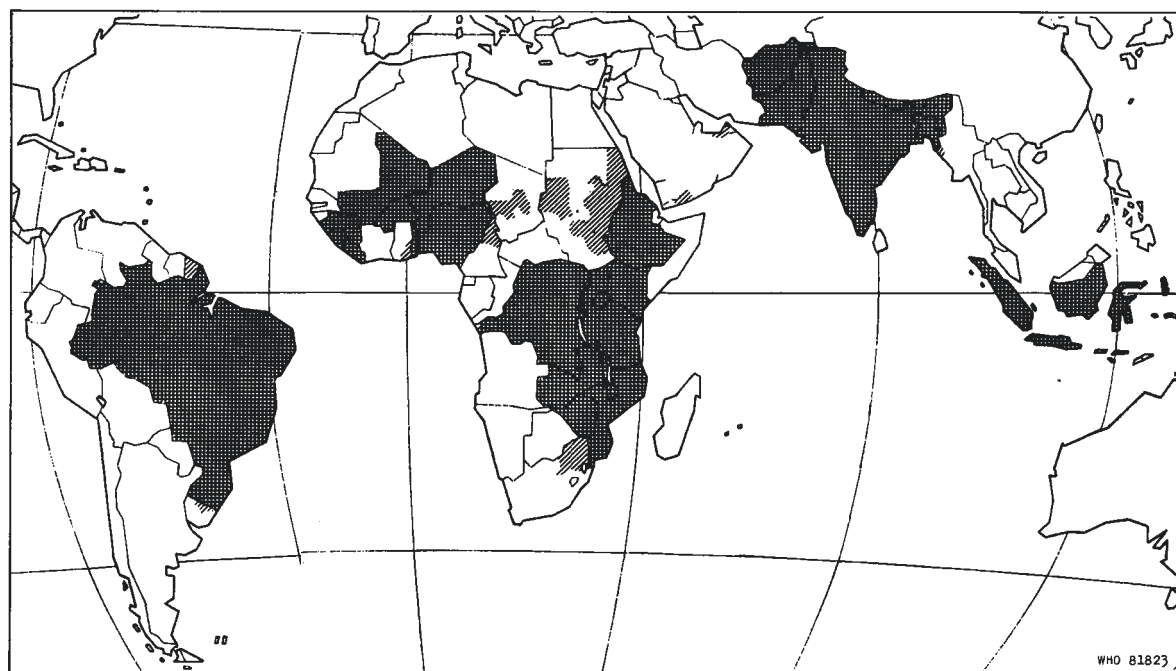
Countries definitely or probably experiencing endemic disease, apart from sporadic introductions, include five in Asia, 21 in Africa and one in South America. During 1968, 12 additional countries experienced 414 cases of smallpox due to importations of the disease. With the exceptions of single cases in the United Kingdom of Great Britain and Northern Ireland and in Belgium, all infected areas were geographically contiguous with endemic countries. Infections in the non-endemic countries derived from seven sources: Brazil, Democratic Republic of the Congo, Ethiopia, Mozambique, Nigeria, Pakistan and Togo.

FIG. 1  
REPORTED CASES OF SMALLPOX IN THE WORLD - 1955 TO 1968



\* Estimate based on present trends

FIG. 2  
AREAS IN WHICH SMALLPOX HAS BEEN REPORTED IN 1968



■ Countries presumed to be endemic for smallpox

▨ Areas into which smallpox has been imported

FIG. 3  
SMALLPOX CASES PER 100 000 POPULATION - 1967

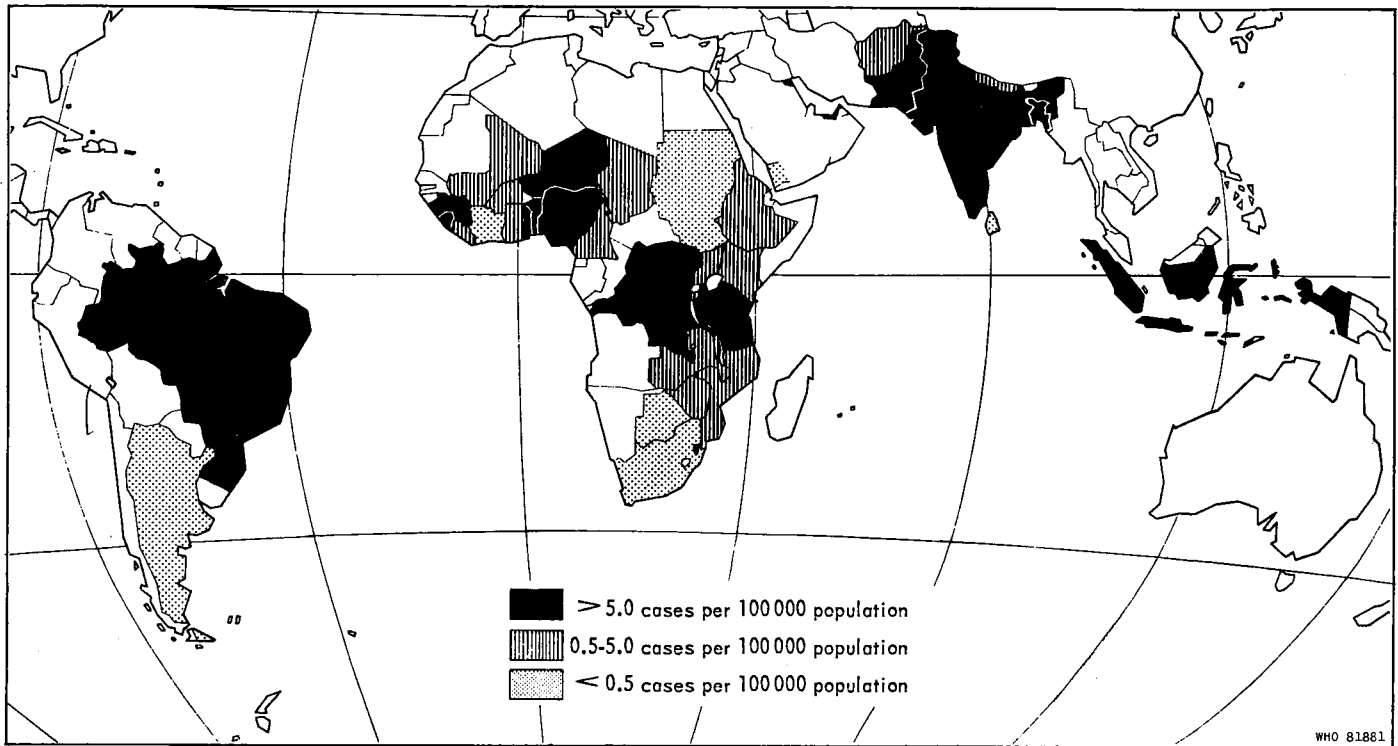
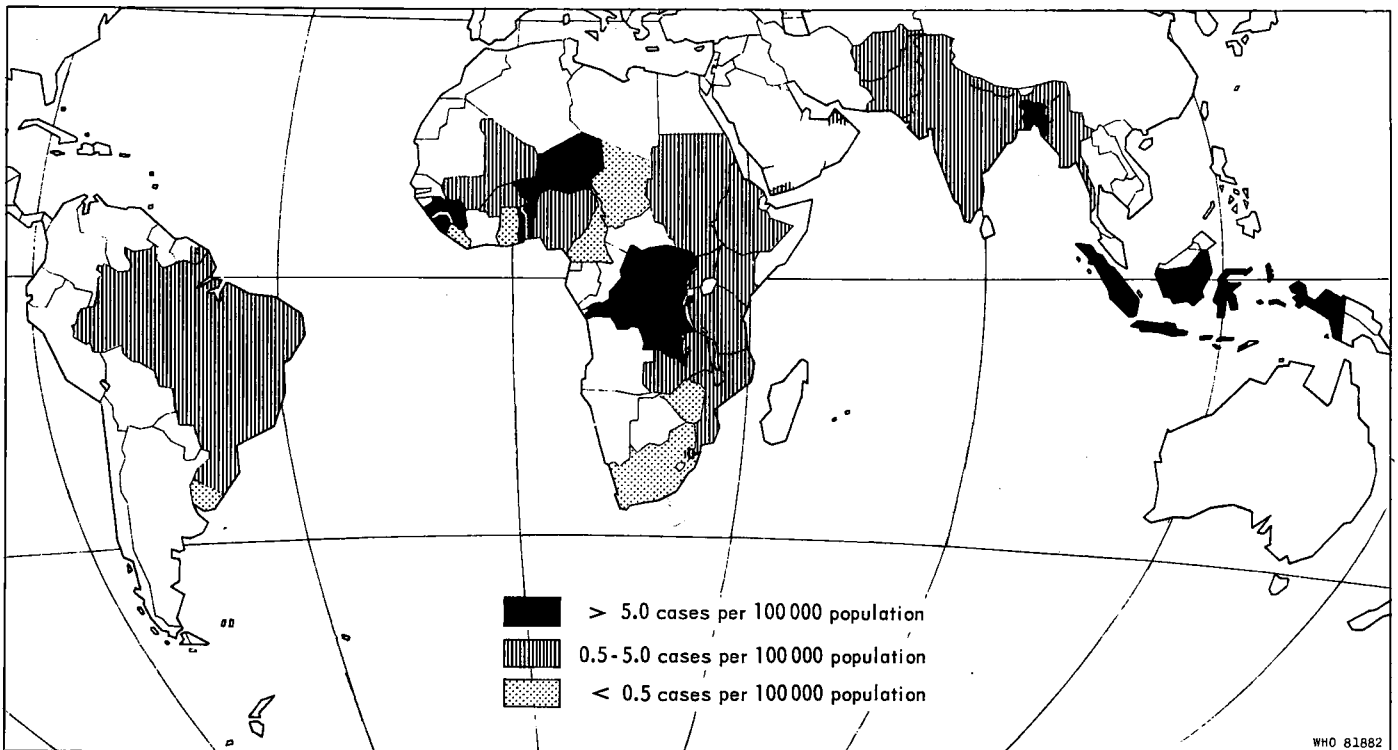


FIG. 4  
SMALLPOX CASES PER 100 000 POPULATION - 1968



A comparison of the maps depicting smallpox rates by country for 1967 and 1968 (Figs 3 and 4) shows a reduction in the number of countries recording 5.0 or more cases per 100 000 population. In 1966, 14 countries recorded rates in excess of 5.0 per 100 000; in 1967, this number fell to 12; and, in 1968, nine countries recorded rates of this magnitude or greater. As noted by the Scientific Group on Smallpox Eradication, intensive investigation of all cases and outbreaks should be carried out when the rate in a country falls below 5.0 per 100 000 population. At present, even of those countries with rates exceeding 5.0 per 100 000 population, five of nine are, in fact, carrying out such investigations.

As in 1967, the highest rates were recorded by countries in western and central Africa. Attack rates in Sierra Leone and Togo considerably exceeded all others; a sharply increased incidence was also noted in the Democratic Republic of the Congo.

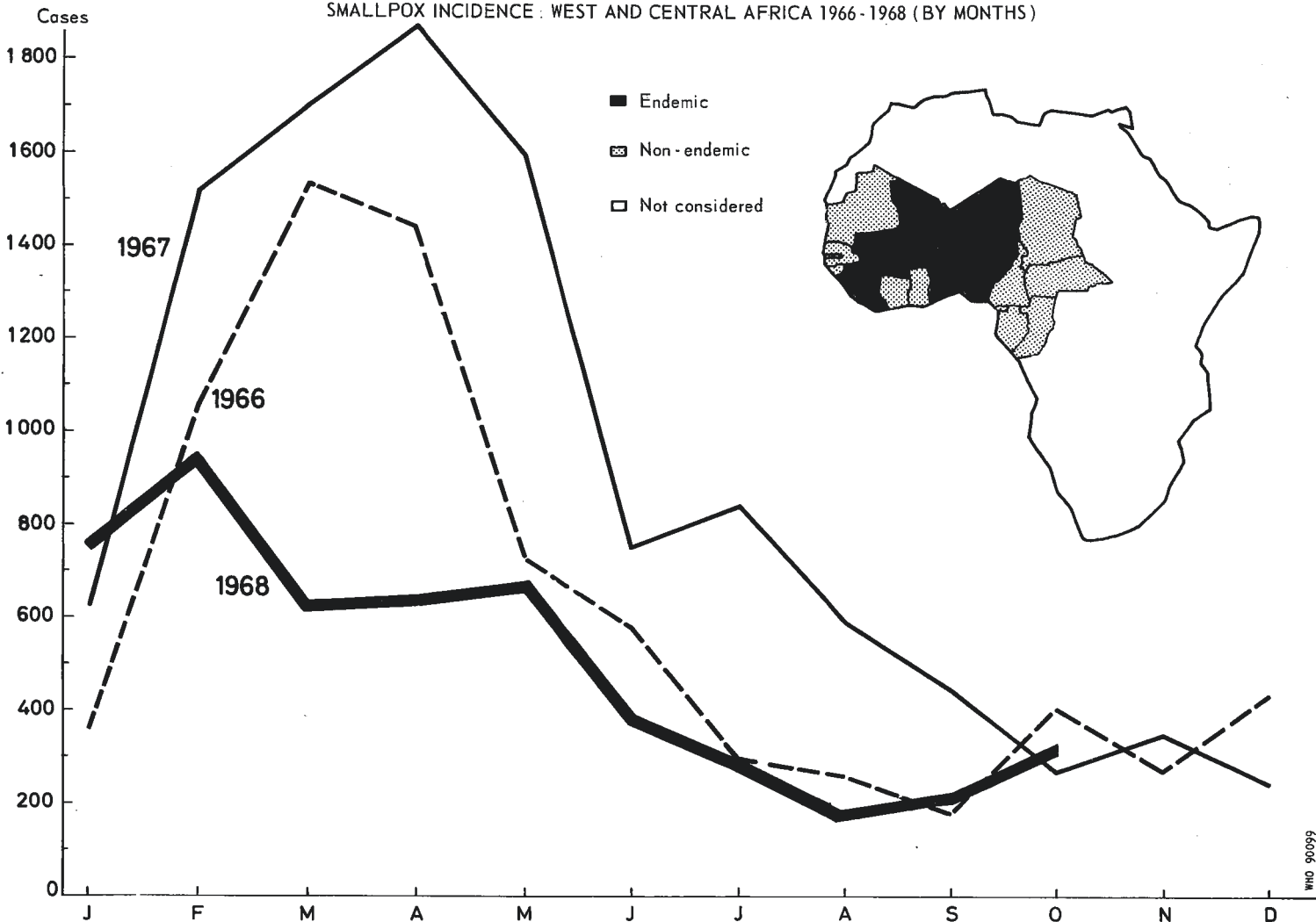
TABLE 3. COUNTRIES AND TERRITORIES REPORTING MORE THAN 5.0 CASES/100 000 - 1966, 1967, 1968\*

Country or Territory	1966	1967	1968
Brazil	4.3	<u>5.1</u>	3.6
Burundi	<u>11.1</u>	2.2	<u>6.8</u>
Congo (Democratic Republic)	<u>12.0</u>	<u>9.0</u>	<u>22.6</u>
Dahomey	<u>22.0</u>	<u>32.9</u>	<u>14.0</u>
Guinea	1.8	<u>41.4</u>	<u>8.6</u>
India	<u>6.5</u>	<u>15.3</u>	4.6
Indonesia	<u>23.0</u>	<u>11.8</u>	<u>13.6</u>
Mali	<u>6.0</u>	3.5	1.2
Niger	<u>33.4</u>	<u>33.6</u>	<u>18.6</u>
Nigeria	<u>8.4</u>	<u>8.0</u>	2.9
Pakistan, East	<u>5.7</u>	<u>11.1</u>	<u>15.6</u>
Pakistan, West	<u>6.2</u>	<u>9.9</u>	2.6
Sierra Leone	<u>12.2</u>	<u>69.6</u>	<u>45.6</u>
Swaziland	<u>7.7</u>	4.1	3.5
Togo	<u>11.9</u>	<u>17.7</u>	<u>41.5</u>
Uganda	<u>7.9</u>	4.6	0.7
United Republic of Tanzania	<u>25.6</u>	<u>13.4</u>	3.6

\* In 1966, the French Territory of the Afars and the Issas, and in 1967, the Trucial States and Kuwait reported rates in excess of 5.0/100 000 as a result of brief outbreaks of introduced smallpox.

FIG. 5

SMALLPOX INCIDENCE : WEST AND CENTRAL AFRICA 1966-1968 (BY MONTHS)



1. Africa - Western and Central

During 1968, smallpox incidence declined sharply in the 21 countries of western and central Africa (Fig. 5). Except for Togo and Upper Volta, all countries recorded fewer cases than during 1967 (Table 4). The appreciable decline in cases despite substantially more complete notification, led to the initiation in August of an intensive programme of case investigation and outbreak containment throughout this area. By this means it was hoped that transmission might be interrupted by the end of 1968 or early 1969. As of December, however, troublesome foci of infection persisted in Togo, Dahomey, Nigeria and Niger.

Systematic vaccination programmes continued in virtually all countries. Most vaccinations were performed by jet injection. By the end of 1968, over 62 million of the 119 million persons in this area had been vaccinated. International assistance in this effort is provided principally by the United States of America with additional support to 11 countries given by WHO.

WHO provided special assistance to Guinea to assist in establishing a vaccine production centre; bilateral assistance was also given to Nigeria to assist in strengthening and augmenting their vaccine production laboratory. WHO has planned for these countries during 1969 a seminar to discuss intercountry co-ordination in the termination of smallpox transmission in this area and to discuss longer term programmes for surveillance and maintenance vaccination.

TABLE 4. AFRICA (WEST AND CENTRAL) - SMALLPOX INCIDENCE AND PROGRAMME ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES AND TERRITORIES

Country or Territory	1968 Population (000)	Smallpox cases reported				Eradication* activities		Vaccinations** performed (000)	
		1965	1966	1967	1968***	1968	1969	1967	1968
<u>Endemic or status uncertain</u>									
Dahomey	2 578	168	530	813	367	X	X	702	( 871) <sup>11</sup>
Guinea	3 795	96	65	1 530	328	X	X	201	(1 654) <sup>11</sup>
Liberia	1 131	40	32	6	5	X	X	44	( 226) <sup>11</sup>
Mali	4 835	659	281	164	58	X	X	1 028	(1 101) <sup>11</sup>
Niger	3 642	463	1 147	1 181	678	X	X	1 610	( 977) <sup>11</sup>
Nigeria	63 109	4 566	4 924	4 753	1 824	X	X	9 560	(22 695) <sup>11</sup>
Sierra Leone	2 476	60	293	1 698	1 129	X	X		( 857) <sup>11</sup>
Togo	1 765	13	199	304	733	X	X	605	( 486) <sup>11</sup>
Upper Volta	5 155	14	76	90	100	X	X	1 394	(2 004) <sup>11</sup>
Total	88 486	6 079	7 547	10 539	5 222			15 144	30 871
<u>Non-endemic but at particular risk of small-pox importation</u>									
Cameroon	5 590	-	3	72	25	X	X	1 815	(1 625) <sup>11</sup>
Central African Republic	1 500	-	-	-	-	X	X	381	( 390) <sup>11</sup>
Chad	3 461	73	-	86	5	X	X	1 387	(1 254) <sup>11</sup>
Congo, Republic of	872	89	2	-	-	X	X	162	( 805) <sup>11</sup>
Equatorial Guinea	282	-	-	-	-	XX	XX		
Gabon	477	1	-	-	-	X	X	225	( 89) <sup>11</sup>
Gambia	350	6	3	-	-	X	X	231	( 170) <sup>11</sup>
Ghana	8 355	7	13	114	24	X	X	1 318	(1 842) <sup>11</sup>
Ivory Coast	4 102	3	-	2	-	X	X	1 580	(1 632) <sup>11</sup>
Mauritania	1 122	-	-	-	-	X	X		
Portuguese Guinea	529	-	-	-	-	XX	XX		( 8) <sup>3</sup>
Senegal	3 762	-	-	-	-	X	X	383	(1 466) <sup>11</sup>
Total	30 402	179	21	274	54			7 482	9 281

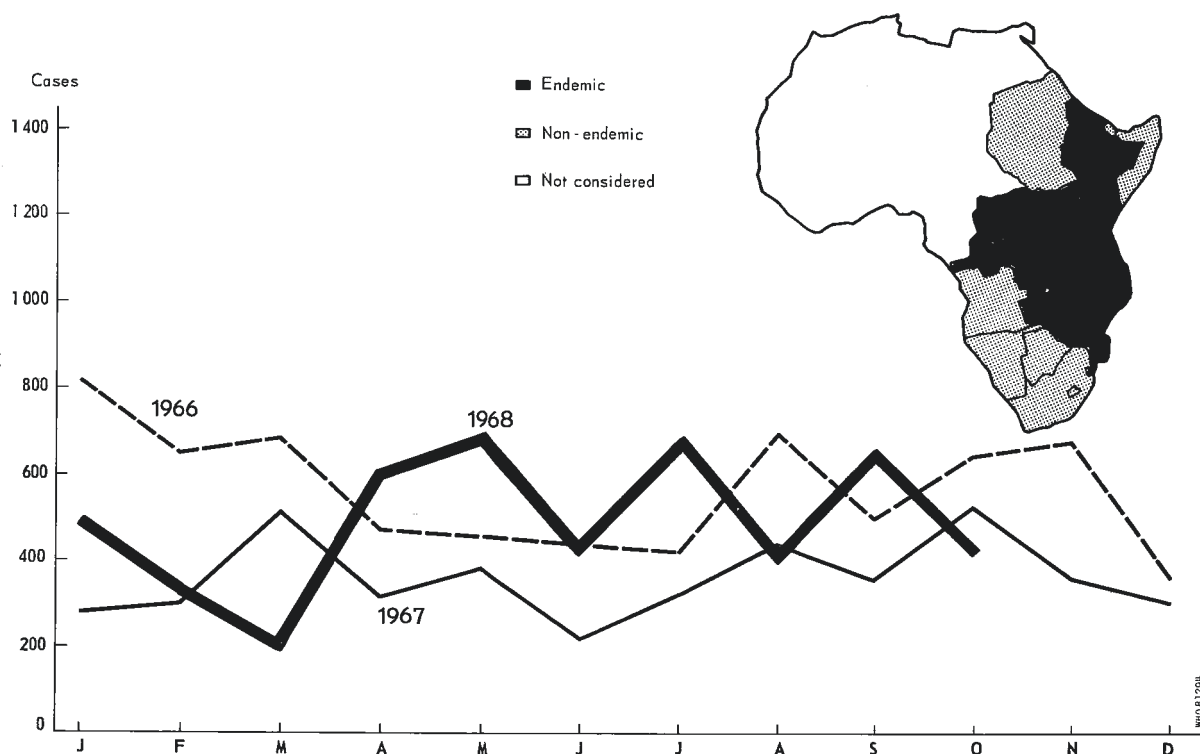
\* X = systematic programmes in operation or to be initiated or intensified.

XX = continuation of existing programmes of vaccination.

\*\* Parentheses indicate that information is incomplete for the year; superscript above parentheses represents the number of months for which information is available.

\*\*\* Reports received as of 16 January 1969.

FIG. 6  
SMALLPOX INCIDENCE: EAST AND SOUTH AFRICA 1966-1968 (BY MONTHS)



## 2. Africa - Eastern and Southern

Recorded cases of smallpox in eastern and southern Africa increased during 1968 (Fig. 6). During 1968, 5377 cases were reported to WHO compared to 4450 cases during 1967. This increase is principally accounted for by the Democratic Republic of the Congo which recorded 70 per cent. of all cases. As a group, the other countries in eastern and southern Africa have shown a steady decrease in reported incidence during the past four years.

Year	Total cases	Cases reported in the Dem. Rep. of the Congo	Cases reported by other countries
1965	10 713	3 783	6 930
1966	6 849	1 913	4 936
1967	4 450	1 479	2 971
1968	5 377	3 774	1 603

These data, however, must be interpreted cautiously for reporting is still very incomplete in several countries and few have yet endeavoured to establish a comprehensive surveillance programme.

Eradication programmes have begun with WHO assistance in the Democratic Republic of the Congo, Sudan, the United Republic of Tanzania and Zambia; several others are expected to begin in 1969. As is apparent from Table 5, Zambia alone among the endemic countries appears to be making satisfactory progress in systematic vaccination and in the development of a surveillance programme. Efforts in all countries of this area need to be augmented. Of particular concern is Ethiopia. In this country, reporting is acknowledged to be very incomplete and no programme has been initiated or planned. Outbreaks in Sudan and probably Yemen and Southern Yemen originated from Ethiopia.

To facilitate the work of the countries in eastern Africa, WHO conducted a seminar on smallpox eradication in November 1968, in which 12 countries participated.

With WHO and UNICEF technical and material assistance, freeze-dried vaccine of excellent quality is now being produced in Kenya and vaccine quality in Ethiopia has been improved; laboratories in Rwanda and the Democratic Republic of the Congo will be offered assistance by WHO during 1969.



TABLE 5. AFRICA (EAST AND SOUTH) - SMALLPOX INCIDENCE AND PROGRAMME ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES AND TERRITORIES

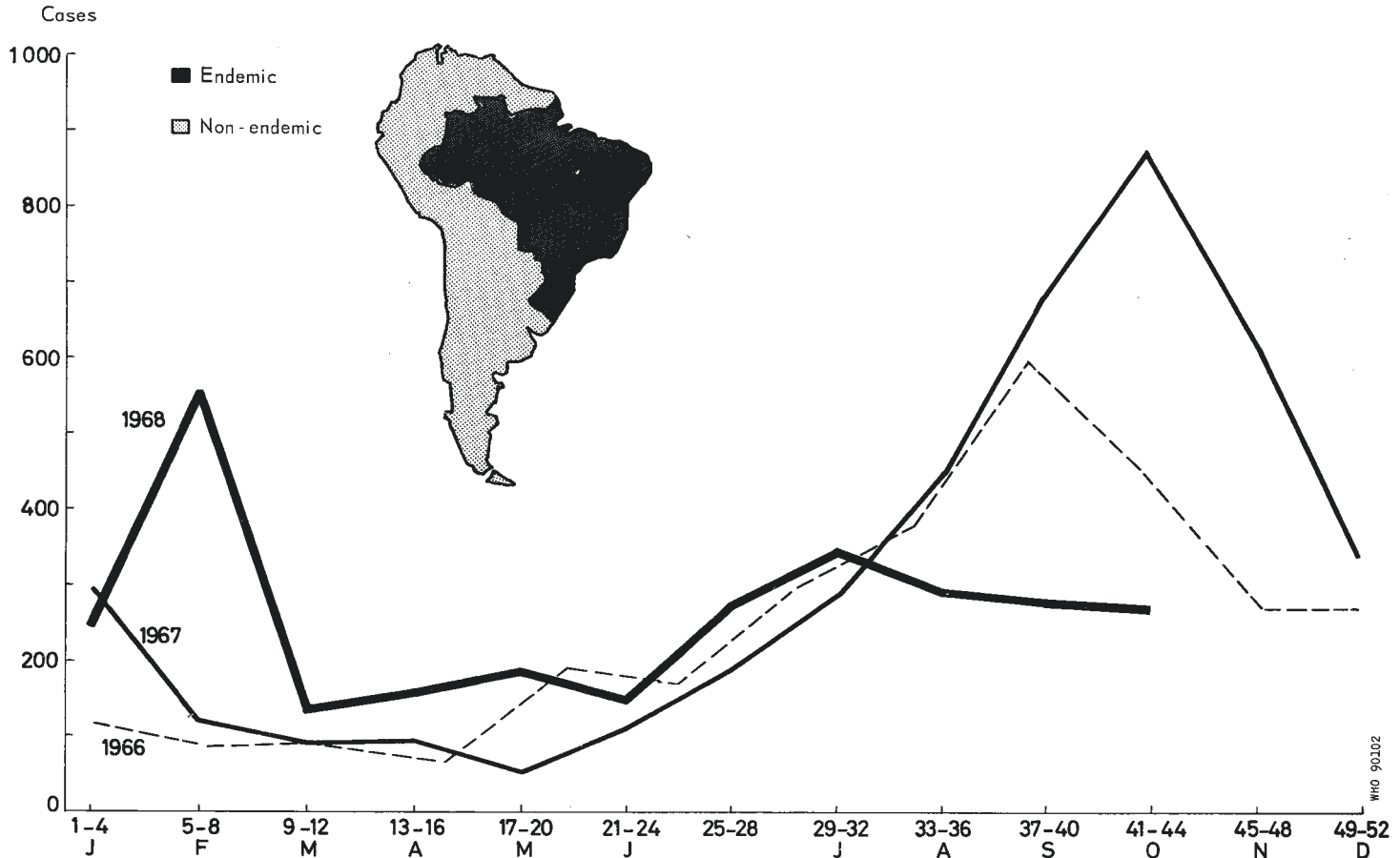
Country or Territory	1968 Population (000)	Smallpox cases reported				Eradication* activities		Vaccinations** performed (000)	
		1965	1966	1967	1968***	1968	1969	1967	1968
<u>Endemic or status uncertain</u>									
Burundi	3 407	1 213	363	74	230	XX	X		
Congo, Democratic Republic of	16 713	3 783	1 913	1 479	3 774	X	X	302	(1 509) <sup>9</sup>
Ethiopia	23 879	58	228	466	354	XX	XX		( 825) <sup>4</sup>
Kenya	10 246	276	159	153	81	XX	X	1 179	( 718) <sup>6</sup>
Malawi	4 233	226	88	38	61	XX	X	675	( 327) <sup>6</sup>
Mozambique	7 209	115	19	104	146	XX	XX	167	
Rwanda	3 408	5	-	-	-	XX	X	(187) <sup>6</sup>	
Southern Rhodesia	4 670	40	33	26	12	XX	XX		
Swaziland	396	85	29	16	14	X	X		
Uganda	8 132	1 362	614	365	54	XX	X	958	( 339) <sup>6</sup>
United Republic of Tanzania	12 526	2 762	3 027	1 629	447	X	X	2 451	( 980) <sup>9</sup>
Zambia	4 069	528	63	47	33	X	X	1 184	( 652) <sup>6</sup>
<b>Total</b>	<b>98 888</b>	<b>10 453</b>	<b>6 536</b>	<b>4 397</b>	<b>5 206</b>			<b>7 103</b>	<b>5 350</b>
<u>Non-endemic but at particular risk of smallpox importation</u>									
Angola	5 367	-	3	-	-	XX	XX		(1 335) <sup>6</sup>
Botswana	611	-	-	1	-	XX	XX	49	
Fr. Ter. of the Afars and the Issas	90	-	52	-	-	XX	XX		
Lesotho	911	-	-	-	-	XX	XX		
Somalia	2 750	-	2	-	-	XX	X		( 22) <sup>3</sup>
South Africa	19 183	191	256	43	67	XX	XX		
Sudan	14 757	69	-	9	104	X	X	825	(2 037) <sup>8</sup>
<b>Total</b>	<b>43 669</b>	<b>260</b>	<b>313</b>	<b>53</b>	<b>171</b>			<b>874</b>	<b>3 394</b>

\* X = systematic programmes in operation or to be initiated.  
XX = continuation of existing programmes of vaccination.

\*\* Parentheses indicate that information is incomplete for the year; superscript above parentheses represents the number of months for which information is available.

\*\*\* Reports received as of 16 January 1969.

FIG. 7  
SMALLPOX INCIDENCE : SOUTH AMERICA 1966-1968



3. South America

Brazil is presently the only endemic country in the Americas. During 1968, 3152 of the 3155 cases recorded in the Americas were in Brazil. The remaining three cases resulted from introductions into Uruguay and French Guiana. During the first six months of 1968, notifications of smallpox cases in Brazil were approximately 50 per cent. higher than during the preceding two years (Fig. 7). Although case detection activities continued to be strengthened during 1968, the expected seasonal increase in smallpox was less than anticipated.

Vaccination activities in Brazil have steadily increased in tempo. At the beginning of the year, 500 000 were being vaccinated each month; by the end of the year, this figure had increased to 1 300 000 per month and is projected to reach 2 000 000 each month early in 1969. In addition, approximately eight to 10 million persons are being vaccinated annually through the general medical services. Trained assessment teams appraise the extent of coverage and vaccination take rates in each area systematically vaccinated. A special surveillance and case investigation programme is being organized to take effect in March 1969, at which time each case and outbreak will be investigated by specially trained surveillance teams.

Other countries adjacent to Brazil have initiated special vaccination programmes to improve their immunity level and to strengthen their surveillance activities. A network of laboratory diagnostic services has also been established.

With additional equipment provided by WHO and with the advice of consultants and fellowship training provided through the University of Toronto (Canada), the quality and quantity of vaccine is being steadily improved in the 11 laboratories producing freeze-dried vaccine in South America.

TABLE 6. THE AMERICAS - SMALLPOX INCIDENCE AND PROGRAMME ACTIVITIES IN SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES AND TERRITORIES

Country or Territory	1968 Population (000)	Smallpox cases reported				Eradication activities*		Vaccinations performed (000)**	
		1965	1966	1967	1968***	1968	1969	1967	1968
<u>Endemic</u>									
Brazil	88 224	3 299	3 531	4 353	3 152	X	X	6 596	(11 054) <sup>11</sup>
<u>Non-endemic but at particular risk of smallpox importation</u>									
Argentina	23 376	15	21	23	-	X	X	(2 955) <sup>10</sup>	( 324) <sup>6</sup>
Bolivia	3 854	-	-	-	-	X	X	1 032	( 142) <sup>5</sup>
Chile	9 123	-	-	-	-	X	X		( 681) <sup>6</sup>
Colombia	19 805	149	8	-	-	X	X	2 149	( 4 662) <sup>11</sup>
Ecuador	5 695	-	-	-	-	X	X		( 565) <sup>7</sup>
French Guiana	39	-	-	-	1	XX	XX		
Guyana	698	-	-	-	-	XX	XX		
Paraguay	2 228	32	5	-	-	XX	X	( 130) <sup>10</sup>	( 74) <sup>6</sup>
Peru	12 769	18	13	-	-	X	X	( 957) <sup>10</sup>	( 894) <sup>9</sup>
Surinam	376	-	-	-	-	XX	XX		( 12) <sup>6</sup>
Uruguay	2 816	1	-	-	2	X	X		( 36) <sup>6</sup>
Venezuela	9 679	-	-	-	-	X	X	1 502	1 695
Total	90 458	215	47	23	3			8 725	9 085

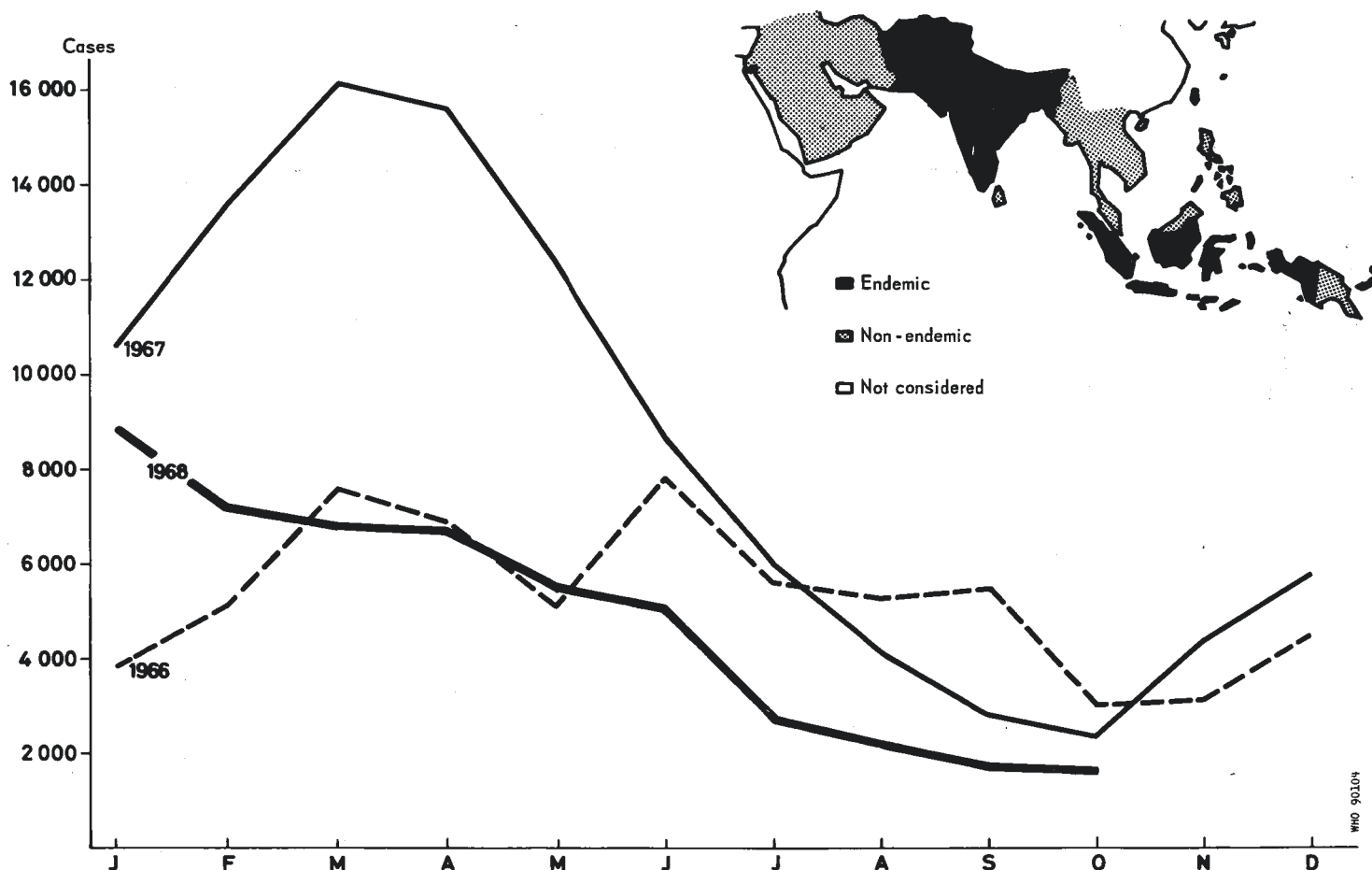
\* X = systematic programmes in operation or to be initiated.

XX = continuation of existing programmes of vaccination.

\*\* Parentheses indicate that information is incomplete for the year; superscript above parentheses represents the number of months for which information is available.

\*\*\* Reports received as of 16 January, 1969.

FIG. 8  
SMALLPOX INCIDENCE: ASIA 1966-1968 (BY MONTHS)



#### 4. Asia

During 1968, the countries of Asia recorded 50 564 cases of smallpox, almost 80 per cent. of the world's total. India, Indonesia and Pakistan reported almost 99 per cent. of the cases in Asia. In 1968, all countries in this area worked actively to improve their reporting and surveillance programmes. Increases in reported cases in Afghanistan, Indonesia and Nepal are attributable to this activity. Widespread outbreaks, however, occurred in East Pakistan and bordering areas of India and cases were introduced into an adjacent district in Burma. For India as a whole, a sharp decrease in cases was noted, the incidence being the lowest ever recorded. The decrease in cases occurred coincident with a number of steps which were taken to improve the programme. These included a special emphasis on primary vaccination and on surveillance and case containment activities, and termination of all use of liquid vaccine. Whether the decrease is due to these or other factors or reflects a longer term cyclical trend remains to be appraised in the light of future years' experience.

In the endemic countries, programmes assisted by WHO are now in operation in Afghanistan, Indonesia, Nepal and East Pakistan. It is expected that the programme in India will be intensified during 1969 with WHO support and that a programme will be initiated in West Pakistan.

Vaccine production facilities are being expanded and improved with WHO and UNICEF assistance in Burma, Ceylon, India, Indonesia, Iran, Pakistan, Syria and Thailand. Several of these are already producing substantial quantities of freeze-dried vaccine.

TABLE 7. ASIA - SMALLPOX INCIDENCE AND PROGRAMME ACTIVITIES IN  
SMALLPOX ENDEMIC AND NEIGHBOURING COUNTRIES AND TERRITORIES

Country or Territory	1968 Population (000)	Smallpox cases reported				Eradication*		Vaccinations** performed (000)	
		1965	1966	1967	1968***	1968	1969	1967	1968
<u>Endemic</u>									
Afghanistan	16 066	74	77	211	281	X	X	880	( 594) <sup>7</sup>
India	523 382	33 402	32 616	77 974	24 002	XX	X	87 884	(47 530) <sup>8</sup>
Indonesia	112 742	45 701	24 637	12 875	15 388	X	X		
Nepal	10 699	70	164	144	153	X	X	( 186)	( 1 014) <sup>11</sup>
Pakistan - East	59 407	316	3 207	6 377	9 259	X	X	27 735	(22 668) <sup>7</sup>
- West	50 104	1 285	2 935	4 818	1 297	XX	X	22 681	(12 357) <sup>9</sup>
<b>Total</b>	<b>772 400</b>	<b>80 848</b>	<b>63 636</b>	<b>102 399</b>	<b>50 380</b>			<b>(139 366)</b>	<b>84 163</b>
<u>Non-endemic but at particular risk of smallpox importation</u>									
Burma	26 353	53	6	-	181	X	X		
Ceylon	12 046	1	-	1	-	XX	XX		
Iran	27 099	-	-	-	-	XX	XX		
Kuwait	560	-	-	41	-	XX	XX		
Malaysia	10 379	-	5	-	-	XX	XX		
Saudi Arabia	7 109	-	-	-	-	XX	X		
Southern Yemen	1 196	-	-	-	1				
Trucial States	143	-	-	10	2	XX	XX		
Yemen	5 161	-	1	3	-	XX	X		
<b>Total</b>	<b>90 046</b>	<b>54</b>	<b>12</b>	<b>55</b>	<b>184</b>				

\* X = systematic programmes in operation or to be initiated or intensified with WHO assistance.

XX = Continuation of existing programme of vaccination.

\*\* Parentheses indicate that information is incomplete for the year; superscript above parentheses represents the number of months for which information is available.

\*\*\* Reports received as of 16 January 1969.

### III. General Programme Development

#### 1. Programme Operation

Initial efforts in the eradication programme were directed toward the development of the technical and operational strategy. These were fully discussed by a Scientific Group on Smallpox Eradication which met in October 1967 and presented in a report (Technical Report Series No. 393) which has been widely distributed. A "Handbook for Smallpox Eradication" which discusses in detail all phases of the programme has also been made widely available. This will be revised during 1969 to take into account the experience of the past two years. A special manual which discusses the theory and practice of surveillance-containment operations is under preparation and will be available for distribution early in 1969.

Special seminars dealing with programme execution were conducted in Bangkok in December 1967 for countries in Asia, and in Kinshasa in November 1968 for countries in eastern and southern Africa. Additional seminars are planned for 1969 for the countries of western and central Africa and, in 1970, for the endemic countries of Asia. In co-operation with the National Communicable Disease Center, Atlanta, United States of America, a four week course in smallpox eradication methodology was conducted in 1967 and 1968 and will again be presented in 1969.

#### 2. Vaccine Supply

Because of the critical need for adequate supplies of freeze-dried vaccine which meet standards established by WHO, major efforts have been devoted to this problem. Assistance in the form of consultation, vaccine testing, equipment (in conjunction with UNICEF) and antigens for testing have been provided to laboratories throughout the world. To date, WHO consultants have visited 24 production laboratories; equipment, special reagents and testing materials have been provided to 30 laboratories. All countries have been urged to submit vaccine specimens regularly for testing purposes. These are tested either at the Rijks Institute, Netherlands, or the University of Toronto, Canada. This service has been increasingly used as shown in the table below:

	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
No. of samples tested	12	43	83	167

A group of specialists in freeze-dried smallpox vaccine production met in April 1968, and developed a detailed manual describing the production of freeze-dried smallpox vaccine as grown on animal skin. This manual has been distributed to laboratories throughout the world.

The needs for freeze-dried smallpox vaccine still exceed the production capacity in most endemic countries; other countries not sufficiently populous to support a vaccine production laboratory depend on vaccine donations to execute their programmes. Bilateral donations by the USSR of approximately 100 million doses per year, by the United States of America of approximately 40 million doses per year for countries in western Africa, and by Brazil and Argentina of several million doses of vaccine to countries in the Americas, take care of most of the need. In addition, 11 countries have made donations to the Special Account for Smallpox Eradication. The amount of vaccine distributed by WHO through the Special Account has steadily increased as shown below:

	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
No. of doses distributed (in 000's)	2 290	3 767	13 008	19 746

It is satisfying to note that almost all vaccinations now performed in endemic countries are performed with freeze-dried vaccine which conforms to the potency standards recommended by WHO. At the inception of the programme two years ago, it is doubtful that more than a quarter of the vaccinations in endemic countries were performed with satisfactory vaccine.

### 3. Vaccination Technique

Recommended vaccination techniques have been altered substantially to provide simpler methods which assure higher take rates and use smaller quantities of vaccine.

In 1967, the foot-operated jet injector was first employed for routine field operations after several years of testing and evaluation. It is now in widespread use in Brazil, in countries of western and central Africa, and in the Democratic Republic of the Congo. It is being employed also in several other countries for special programmes of epidemic containment and for vaccination of large groups.

Early in 1968, after a number of special field studies, the bifurcated needle was introduced for field use and has now been adopted in essentially all programmes. Vaccination with this needle is performed by the multiple puncture technique employing one-fifth as much vaccine as is required for conventional vaccination. The technique was further simplified when it was shown that cleansing of the skin prior to vaccination was unnecessary. Employing bifurcated needles, vaccinators in African countries have been able to vaccinate 400-500 persons daily.

By the end of 1969, virtually all vaccinations in endemic countries will be performed either with the jet injector or the bifurcated needle, techniques unknown to routine vaccination programmes prior to the beginning of the global eradication effort.

### 4. Surveillance of Smallpox

#### 4.1 Reporting of cases

Since the inception of the global programme, the importance of more complete reporting of cases of smallpox has been stressed and the majority of countries have made special efforts to strengthen their reporting and surveillance activities. In addition to various administrative measures to assure the regular notification of cases from health facilities throughout their countries, several have initiated the telegraphic reporting of cases; special case investigation teams have been established in many areas (see Section IV); and smallpox surveillance reports are now published regularly by five of the endemic countries.

To facilitate the more rapid exchange of current information regarding the global status of smallpox and eradication activities throughout the world, WHO has, since June 1968, prepared a special surveillance report on smallpox which is published every two weeks in the Weekly Epidemiological Record. To permit more rapid and detailed analysis of disease trends, smallpox morbidity data will be recorded and tabulated by computer beginning in 1969.

Intercountry co-ordination of surveillance as well as vaccination activities is assuming increased importance. Throughout Africa particularly, it has become apparent that, not infrequently, cases occurring in one country have been infected in a neighbouring country. Intercountry notification of cases needs to be improved as well as co-ordination of containment activities and vaccination programmes. This is required both in Asia and in Africa. Special WHO teams to facilitate this activity are proposed for 1970.

#### 4.2 Clinical diagnosis

Reliable reporting rests in large measure upon the accurate clinical diagnosis of the disease. As smallpox incidence diminishes, the problem of correct clinical diagnosis becomes greater. To assist health personnel and others responsible for the reporting of smallpox,

WHO plans to produce a series of teaching aids, including posters and slides, which show cases of smallpox and varicella at different stages of the evolution of the rash. During October 1968, a WHO staff member and a photographer obtained 4000 pictures of African patients with smallpox and varicella. These are now being prepared for distribution in various forms for training purposes. It is anticipated that a similar series of photographs of Asian patients will be obtained during 1969.

#### 4.3 Laboratory diagnosis

When the number of cases in a country is large, laboratory diagnosis of individual cases contributes little since clinical identification of cases is sufficiently reliable. However, as the cases become few in number, each case assumes a greater importance; at the same time, clinical recognition becomes more difficult. Laboratory confirmation of cases when they are few in number is thus most important. A number of the endemic countries are now recording so few cases that all or most should be confirmed by virus isolation.

A network of diagnostic laboratories to provide geographically convenient diagnostic services to every country is being developed by WHO. It is planned for each participating laboratory to be able to conduct at least three basic examinations for the identification of variola virus; a microscopic smear examination, a precipitation-in-gel test and definitive identification through virus isolation on the chorioallantoic membrane of chick embryos. A 48-page manual has been prepared entitled "Guide to the Laboratory Diagnosis of Smallpox" which describes in detail and pictorially each of the tests noted. Arrangements have been made with collaborating laboratories to produce requisite antisera and antigens and additional materials for each of the tests have been procured.

Training courses have already been conducted in the Americas and a network of 12 diagnostic centres established. During 1969 and 1970, it is planned for additional courses to be conducted in other regions. Following the training course and the designation of laboratories as diagnostic centres, arrangements are being made to distribute twice each year to each of the laboratories specimens as "unknowns" to ensure that each of the laboratories has retained its competence or, if not, to assist in retraining the technicians concerned.

#### 5. Research

Several studies are in progress relating to cheaper, more effective devices for vaccine administration by jet injection. Further studies of the epidemiology and patterns of spread of smallpox will be initiated in 1969 and extended in 1970. These studies, designed to determine the precise patterns of spread of smallpox, will facilitate programme operations by identifying those groups requiring special attention in the immunization programme and measures to be taken in disease containment activities. Other studies in progress or to be initiated include those dealing with comparative characteristics of vaccine strains to determine those most suitable for use; appraisals of the safety, efficacy and stability of smallpox vaccines propagated in tissue culture; and operational studies to determine the most efficient and economical means of conducting vaccination programmes. Studies of the properties and behaviour of monkeypox virus have been under way in a number of laboratories. Responsible investigators in each of these laboratories will be meeting informally with WHO staff in Moscow during March 1969, to appraise the present status of knowledge of the problem and to chart future studies. Promising chemoprophylactic and chemotherapeutic agents will be tested and evaluated.

#### 6. Collaboration with other agencies

The League of Red Cross Societies continues to give support to the programme contributing, through national societies, assistance in health education and publicity, and vaccination clinics.



The possible use of food subsidies as additional support for field personnel is being evaluated in several countries in co-operation with the World Food Programme.

#### IV. Methodology of Eradication

The experience of the past two years has indicated a need to modify the strategy of eradication programmes from that originally described two years ago. At the inception of the global programme, a principal emphasis was placed upon the development in each endemic country of a systematic vaccination programme. As immunity levels increased, smallpox incidence was expected to decrease to the point where case investigation and containment activities could be undertaken for each reported case and outbreak. In brief, a two-phase approach was envisioned; a primary phase in which the systematic vaccination effort would constitute the major activity and a secondary phase in which the surveillance-containment component would assume the principal focus of attention. In advocating this approach, it was assumed that in most endemic countries the incidence of smallpox was far higher than reported and that it was widely prevalent throughout the country. These assumptions led to the conclusion that case investigation and containment activities could not exert a significant effect on the endemic reservoir of disease until smallpox incidence had been markedly reduced through the systematic vaccination programme.

During the past two years, special studies and intensified surveillance programmes have revealed that although smallpox is underreported in all endemic countries, the estimated incidence is much lower than was anticipated. In 1968, only three countries recorded rates exceeding 20 cases per 100 000. Even where reporting had been considered to be very poor, smallpox scar surveys have revealed that at least 10 per cent. of cases have been recorded. Surveys of immunity based on vaccination scars have revealed a generally higher level of vaccination coverage than had been anticipated. In brief, population immunity at the commencement of programmes has been better than had been anticipated and, undoubtedly in consequence, the reservoir of infection lower.

It was also found that even in areas where the incidence was high, smallpox occurred predominantly as focal outbreaks rather than as widely dispersed, scattered cases. At any given time, comparatively few villages or districts in an area were infected.

Studies conducted during outbreaks in different parts of the world also revealed that transmission of the disease occurred principally as a result of close contact between cases and susceptible persons. Most cases resulted from contact in the home, school or hospital. Only a comparatively small percentage resulted from more casual contact in markets and public places. Tracing of the chain of transmission of disease was generally more feasible than had been appreciated and it was realized that containment measures were more likely to be successful.

These observations led to the realization that case investigation and containment activities were feasible and could be effective from the inception of eradication programmes. While the systematic vaccination effort is important and necessary to introduce barriers to impede the spread of disease, interruption of transmission can be accelerated if a comparatively few surveillance-containment teams can be added to attack selectively individual foci of infection to interrupt transmission wherever the disease occurs.

Pilot projects to test these assumptions are in progress on a major scale in the countries of western and central Africa and, on a more limited scale, in other areas. While none of these areas are yet smallpox-free, the strategy appears to be effective.

These pilot projects have also indicated that the few specially trained teams which are operative, working under the direction of state and national smallpox eradication authorities, have served to stimulate local health units to report more promptly and regularly because of their immediate response when cases are reported. It has been found that a team of three to four persons can investigate a case or outbreak and take effective containment measures in a

period of two to five days. A single team can thus deal with eight to 10 outbreaks per month. Depending on disease incidence, one team is able to cover a population area of from two to 30 million persons. Thus, the number of teams required for this component of the programme is not large and the additional costs to establish this activity are not great compared to the over-all cost of the programme.

In addition to the programmes in western and central Africa, pilot projects employing such teams are being conducted in India, Afghanistan and Indonesia and plans have been made for similar teams in Brazil and Pakistan.

A manual of operations for surveillance containment teams has been developed by WHO and assistance in establishing this component of the programme will be provided to other countries during 1969 and 1970.