



SMALLPOX ERADICATION CAMPAIGN - BRAZIL  
SITUATION IN 1972

INDEXED

by

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INTRODUCTION

Smallpox was introduced into Brazil by the Europeans soon after the discovery of the Americas, becoming endemic in the populations settled in the north-east. With continuing colonization and the development of more favourable areas for agriculture in the south, migrants came from the north, bearing smallpox with them. Early this century, the more serious form, variola major, was replaced by the more benign alastrim (variola minor).

In 1967, Brazil was the only endemic country in South America, campaigns in other countries, implemented since 1950, having virtually achieved eradication elsewhere on the continent. Since 1967, only imported cases were reported by Argentina, Paraguay, Uruguay and French Guiana, all of which originated in Brazil.

In Brazil, notification of smallpox in 1967 was very incomplete. At that time, only 40% of the notifications included information regarding the date of onset, age and sex of the cases. Fifty per cent. of all notifications were from the state of São Paulo, the result of a better health structure and a more efficient reporting system. Field investigations made by CEV (Smallpox Eradication Campaign) showed that in less developed endemic areas, only 2% of all cases were notified. Even in the state of São Paulo, only 10 to 20% of all cases were reported. In addition, due to a system of monthly reporting, there was at least a two to four weeks delay between the occurrence of the case and its notification.

In 1967, the age distribution of cases was as follows: 80% were in children below 15 years of age, 10% in the 10 to 29 year age-group and 10% were over 30 years. However, studies in Rio Grande do Sul State showed that notifications were comparatively more complete for cases in adults. One of 11 cases in persons above 15 years of age was notified while only one case in 34 was notified in persons below 15 years of age. Only 5% of the cases occurred in persons who had ever been successfully vaccinated and these occurred among persons vaccinated 15 to 20 years or more previously. This led us to believe that the protection provided by vaccination was more durable than had been conventionally believed.

Smallpox incidence in Brazil follows a seasonal pattern, with an increase in incidence beginning in May and reaching a peak in September and October, followed by a decline in the late spring and summer.

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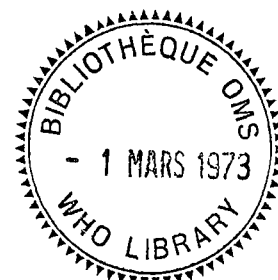
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All outbreaks which were investigated showed that smallpox attacks small groups of houses, usually clustered, making investigation and control comparatively easy. Transmission is more rapid among susceptible persons under 15 years who have more frequent contacts. Adults who spend more of the day away from the house often escape infection or are the last to become infected. However, adults are often the ones responsible for the introduction of the disease into an area.

The case-fatality ratio for smallpox is low in Brazil, being 0.5 to 1% in recent years. Although the overall case-fatality ratio is low, the disease is a serious one for infants under one year, the case-fatality ratio for this age-group being 10 times higher than that for the total population.

#### THE ERADICATION CAMPAIGN

In November 1965, the Government of Brazil, heeding the Nineteenth World Health Assembly's recommendations, signed an agreement with the Pan American Health Organization to carry out an eradication programme. The Organization assisted the programme with technical assistance, audiovisual and vaccination equipment, assistance to vaccine production laboratories, fellowships for training and vehicles.

By Ministerial Decree of 31 August 1966, the Brazilian Government created the Smallpox Eradication Campaign - CEV, a programme that was given priority and adequate financial support.

#### PROGRESS OF THE CAMPAIGN

Following the historical path of smallpox, the campaign began its activities in the north-east region where, since 1962, there had been systematic smallpox vaccination programmes in the states of Sergipe, Pernambuco, Rio Grande do Norte and part of Piauí. In 1967, CEV completed the vaccination coverage in the states of Alagoas, Paraíba, South of Piauí and Maranhão. In these states of the north-east, with the exception of Sergipe, no endemic foci have been detected since 1969. The state of Sergipe, which had been vaccinated in 1963-1964, was reinfected in 1965 from an adjacent locality in the state of Bahia. No further cases occurred until August 1968, when an extensive outbreak occurred in the capital city, Aracaju. In 1969 there was another outbreak in Nossa Senhora das Dores, related to the outbreak of the previous year in Aracaju. A repeat systematic vaccination campaign throughout Sergipe was conducted in October and December 1970 and since then, no further cases have been detected.

In 1967, an outbreak in Brasilia, the national capital, prompted a systematic vaccination campaign in that city and, subsequently, the development of the country's first surveillance unit (UVE). Investigation of the outbreak in Brasilia revealed the sources of infection to be in neighbouring localities in the state of Goiás (Formosa and Luziania). Vaccination in Goiás was begun.

By 31 December 1967, CEV had vaccinated 5.3% of the total population of the country, not including the population vaccinated before 1967.

The great population conglomerate formed by the states of Bahia, Minas Gerais, Rio de Janeiro and São Paulo, began vaccination programmes in 1968. In order to consolidate the area already vaccinated in Rio de Janeiro State, vaccination in São Paulo State began in adjacent border areas proceeding to the municipios of the interior surrounding the capital city. In this way, the programme converged on the most populated centres, São Paulo and Guanabara (Rio de Janeiro City).

By 12 December 1968, 18.4% of the population of the country had been vaccinated.

In 1969, with more experience in the techniques of systematic vaccination, the programme was extended to the other populous states of the south and in that year, a surveillance programme was initiated. In the states of Minas Gerais and Bahia, which had begun vaccination campaigns somewhat before, teams were organized for surveillance and containment operations. In the states of Paraná and Rio Grande do Sul, vaccination campaigns and surveillance-containment operations were begun simultaneously.

By 31 December 1969, 40.8% of the population had been vaccinated. The surveillance programme which then included the states noted above, as well as all those who had completed the systematic vaccination phase, substantially improved reporting and the number of cases increased to a peak of 7407 in 1969.

In 1970, activities were maintained and teams were rapidly mobilized to deal with problem areas. Smallpox incidence dropped sharply and continued to decline during the usual months of high prevalence. By the end of the year, vaccination campaigns were completed in the population along the coast. A coverage of 90% was achieved.

Vaccination campaigns in the western part of the country and in the northern region (Amazonia) were conducted simultaneously in the states of Mato Grosso, Amazonas, Acre, Pará and the territories of Amapá, Roraima and Rondônia (total population - eight million), with the collaboration of the staff of the Malaria Eradication Campaign.

During 1970, only 1771 cases were reported, the last outbreak having been discovered in a slum area of Rio de Janeiro (Gavea District) which gave rise to a secondary focus discovered in March 1971. The last case in Brazil was detected in April 1971.

In São Paulo, because of the decrease in cases, the smallpox wards of the Hospital Emilio Ribas were closed in March 1970, five months before the end of the campaign.

In brief, the operation was conducted by first interrupting transmission in the peripheral, less developed areas and converging on the more populous and progressive São Paulo and Rio de Janeiro, which were vaccinated almost at the same time. Because of this approach, we felt that the residual foci found in Rio and São Paulo were probably the last in the country.

#### VERIFICATION STUDIES

In 1971, the strategy of the campaign was revised to emphasize more strongly reporting-surveillance-active case search so as to detect residual smallpox foci, if any. Initially, an active search for cases was conducted in selected areas considered to be at highest risk because of the recent occurrence of smallpox, or where many migrants were present.

Investigations were made in:

1. The São Francisco river area, between Manga (Minas Gerais) and Barreira (Bahia) which was the last area to be vaccinated in the programme and where the vaccination teams had found cases of smallpox in all municípios.
2. An area in the Baixada Fluminense, in the municípios next to the state of Guanabara (City of Rio de Janeiro), where lives a greater part of the population of labourers who commute to Rio.
3. The state of São Paulo, which attracts workers from all over Brazil because of its industrial and agricultural development.
4. The Federal District, whose population growth is proportionally the highest in the country and which is gradually being connected through main roads to areas previously of high endemicity.

These investigations were conducted between July and October 1971, during the usual seasonal peak in smallpox. No cases were found. Additionally, it is noted that during the course of systematic vaccination programmes in 1970-1971 in the northern region (Amazon basin), cases were looked for but none were found. Corroboration of these observations was provided by a medical commission of the International Red Cross which visited 50 Indian tribes in the Amazon and found no cases of smallpox.

Between May and September 1971, the north-east region, which had been vaccinated in 1967, was again systematically vaccinated. In this operation, 250 well-trained vaccinators found no cases of smallpox during their vaccination activities.

After one year had elapsed during which not a single case of smallpox had been detected, it seemed increasingly probable that smallpox transmission had been interrupted.

However, following the recommendations of the Smallpox Expert Committee, surveillance activities were further intensified in the search for residual foci in order to confirm that transmission had really been interrupted. The base of the surveillance programmes is the 21 surveillance units (UVE); the UVE of the state of Amazonas has subunits for the state of Acre and the territories of Rondônia and Roraima, and the UVE of the State of Pará, a subunit in the territory of Amapá. The notification network is comprised of 5437 reporting posts supervised and coordinated by the UVE's. Others, such as schoolteachers and students, travelling officers from other agencies (Land Reform, Rural Social Work), collaborate in the search for cases and central level agencies of the Superintendency of Campaigns (SUCAM) give full support, through their field staff.

#### VERIFICATION STUDIES

In 1972, in addition to further development of the reporting network and surveillance system, additional studies were undertaken to verify the absence of smallpox in the country. Priority areas for the intensive search for cases were selected and these were conducted in the same fashion as was done during the study in 1971. Areas selected included those considered to be at special epidemiological risk and areas where the last reported cases occurred during the period 1970-1971. In areas of lesser priority, studies were conducted in search of cases and to assess vaccination status, especially in children.

Table 1 showed the relative priority of the different federal units assessed according to the date of occurrence of the last reported cases (imported or indigenous) and the time of the vaccination programme.

In the search for possible cases of smallpox, inquiry was made of many persons in each community who might have knowledge of possible cases: health officials; civil authorities from various administrative sectors; schools - both teachers and students; population groups considered to be at special risk, e.g. those living around the periphery of large cities; and employees and labourers of factories.

During interview of these persons, use was made of photographs of smallpox cases, in order to help identification of the type of disease which was being sought - a method which had demonstrated its usefulness during the 1971 surveys. Whenever information was received regarding suspect cases, they were immediately investigated to determine the correct diagnosis.

Two problems were encountered in the verification studies. First, in eight states, the schools were in recess thus making coverage somewhat less than we would have liked. Second, those vaccinated only by means of jet-injectors presented vaccination scars that were very small and sometimes difficult to detect. The vaccination scar rates obtained in the surveys thus may be somewhat understated.

The studies were carried out in 25 of the 27 federal units. The federal territory of Fernando de Noronha was not included because it is an island with a well-controlled population. The state of São Paulo, which was totally surveyed in a similar manner in 1971, did not carry out a similar study in 1972. With the extensive surveillance network in this state and the well-organized surveillance programme in which every reported suspect case is specially investigated, it seemed reasonable to conclude that residual foci in this area were most unlikely.

In the 25 federal units, 448 localities were selected for study in accordance with the priorities mentioned above.

In municipal prefectures, 1268 prefects and other officials were interviewed; in the health services, 18 937 people. A total of 157 civil registry offices (cartorios) were also contacted in order to detect possible deaths due to smallpox. In all, 837 034 persons were interviewed (including 107 354 students), individually and collectively (Tables 2 and 3).

During the interviews, a number of suspected cases were reported; all were duly investigated but none were smallpox.

Overall, 79% of those examined had scars of vaccination. Immunity levels were low among those under one year. Levels were also low for children one to four years of age in Paraíba and Ceará where the vaccination campaign had been conducted before 1968 and in the rural areas especially of those states with weaker health structures (Bahia and Minas Gerais). This illustrates the problem of maintaining vaccination immunity once motivation for vaccination has stopped due to the disappearance of the disease. The development of vaccination programmes in which several antigens are given and which is oriented towards the younger age-group, should serve to improve this situation.

#### CONCLUSION

The last reported case of smallpox occurred on 19 April 1971. No cases have been detected during the past 21 months in spite of an active surveillance programme with 21 surveillance units and over 5000 reporting posts scattered throughout the country. It is our belief that smallpox transmission has been interrupted in Brazil.

TABLE 1. CLASSIFICATION OF STATES ACCORDING TO  
RELATIVE RISK OF SMALLPOX - BRAZIL - 1972

I STATES WHICH COMPLETED SYSTEMATIC VACCINATION PROGRAMMES IN 1970 AND EXPERIENCED THEIR LAST CASES EITHER IN 1970 OR 1971			
State	Dates when vaccination terminated	Date of last case	Comment
São Paulo	Aug. 1970	Sept. 1970	Imported case
Bahia	Sept. 1970	Sept. 1970	
Minas Gerais	Sept. 1970	Nov. 1970	
Paraná	April 1970	Aug. 1970	
Rio G. do Sul	Nov. 1970	Nov. 1970	
Sta. Catarina	Sept. 1970	Aug. 1970	
Sergipe	Dec. 1970	Nov. 1970	
Guanabara	Oct. 1971	April 1971	
II STATES WHICH COMPLETED SYSTEMATIC VACCINATION PROGRAMMES BEFORE 1970 AND EXPERIENCED THEIR LAST CASES EITHER IN 1968 OR 1969			
Ceará	Aug. 1968	July 1969	Imported case
Distrito Federal	Aug. 1967	Aug. 1970	
Espírito Santo	Nov. 1969	Nov. 1969	
Goiás	Dec. 1968	Nov. 1969	
Maranhão	June 1969	April 1969	
Paraíba	July 1968	Dec. 1968	
Rio de Janeiro	Mar. 1969	June 1970	
			Imported case
III STATES WHICH COMPLETED SYSTEMATIC VACCINATION PROGRAMMES IN 1971 AND HAVE HAD NO CASES SINCE 1969			
Acre	Jan. 1971	1964	
Alagoas	July 1971	Jan. 1968	
Amapá	Jan. 1971	Oct. 1969	
Amazonas	Jan. 1971	Nov. 1969	
Mato Grosso	May 1971	May 1970	
Para	Jan. 1971	April 1969	
Pernambuco	Aug. 1971	June 1967	
Piauí	Sept. 1971	Nov. 1968	
Rio G. do Norte	Sept. 1971	Dec. 1968	
Roraima	Jan. 1971	Oct. 1969	
Rondônia	Jan. 1971	-	

TABLE 2. PERSONS INTERVIEWED DURING THE VERIFICATION STUDIES  
BRAZIL - MARCH-OCTOBER 1972

Federal Units	Number of municipalities studied	Population interviewed <sup>a</sup>	Without vaccination scar	% without scar
<u>North</u>				
Rondonia	1	2 406	328	13.6
Acre	4	2 064	177	8.5
Amazonas	18	11 838	3 107	26.2
Roraima	-	-	-	-
Para	7	22 577	3 769	17.6
Amapa	3	5 736	1 240	21.6
<u>Northeast</u>				
Maranhão	16	19 629	3 416	17.4
Piauí	19	19 981	2 520	15.7
Ceará	16	57 729	18 033	31.2
Rio G. do Norte	17	13 507	3 729	21.6
Paraíba	19	88 277	24 943	28.3
Pernambuco	14	52 372	9 866	18.8
Alagoas	17	93 614	22 799	24.4
Sergipe	95	23 666	3 479	14.7
Bahia	27	39 337	16 121	41.0
<u>Southeast</u>				
Minas Gerais	7	34 676		
Espírito Santo	22	15 548	3 612	23.2
Rio de Janeiro	15 <sup>a</sup>	77 011	5 814	7.5
Guanabara	7 <sup>a</sup>	63 739	7 967	12.5
São Paulo	-	-	-	-
<u>South</u>				
Paraná	34	31 090	7 818	25.1
Sta. Catarina	18	9 021	1 693	12.1
Rio G. do Sul	33	32 219	7 309	22.7
<u>West Centre</u>				
Mato Grosso	19	22 906	6 459	28.2
Goiás	14 <sup>b</sup>	32 679	4 789	14.7
Distrito Federal	6 <sup>b</sup>	19 277	2 636	12.3
Total:	448	768 680	161 824	21.0

<sup>a</sup> Includes political and health authorities, workers and others.

<sup>b</sup> Guanabara - Administrative areas: In Distrito Federal - Brasilia and five satellite cities.

TABLE 3. NUMBER OF ELEMENTARY STUDENTS AND TEACHERS INTERVIEWED  
DURING THE VERIFICATION STUDIES  
BRAZIL - MARCH-OCTOBER, 1972

Federal Units	School registration at beginning of year <sup>a</sup>	Number of students interviewed <sup>b</sup>	% of elementary school population
<u>North</u>			
Rondônia	11 983	1 504	12.5
Acre	24 140	1 561	6.5
Amazonas	107 884	1 263 <sup>e</sup>	1.3
Roraima	6 909	-	-
Para	306 858	12 299	4.2
Amapa	20 234	2 712	13.0
<u>Northeast</u>			
Maranhão	304 199	1 722	0.5
Piauí	192 616	1 195	6.0
Ceará	421 947	24 <sup>c</sup>	-
Rio G. do Norte	210 662	- <sup>(a)</sup>	-
Paraíba	272 582	279 <sup>c</sup>	0.1
Pernambuco	635 082	6 585	1.0
Alagoas	182 339	651 <sup>c</sup>	0.4
Sergipe	102 173	550 <sup>c</sup>	0.2
Bahia	786 511	3 045	0.5
<u>Southeast</u>			
Minas Gerais	1 830 082	8 958	0.4
Espírito Santo	243 539	1 758	0.7
Rio de Janeiro	708 971	19 281	2.4
Guanabara	533 456	8 948	2.0
São Paulo	2 209 423	- <sup>d</sup>	-
<u>South</u>			
Paraná	933 125	655 <sup>c</sup>	-
Sta. Catarina	467 859	447 <sup>c</sup>	-
Rio G. do Sul	1 102 600	16 687	4.0
<u>West Centre</u>			
Mato Grosso	214 805	- <sup>c</sup>	-
Goiás	398 757	16 785 <sup>c</sup>	4.5
Distrito Federal	65 607	445 <sup>c</sup>	0.6
Total	12 294 343	107 354	0.6

<sup>a</sup> IBGE yearbook data (1969).

<sup>b</sup> The interviews were conducted among students in the 3rd, 4th and 5th grades.

<sup>c</sup> Studies conducted during the school vacation period. Students here were interviewed in the community.

<sup>d</sup> Verification study not carried out (see text).

<sup>e</sup> Number of students interviewed not separately recorded.