

SURVEILLANCE IN THE BRAZILIAN SMALLPOX ERADICATION PROGRAMME  
1970

by

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Introduction

In 1950, the South American countries were the only endemic areas in the Region of the Americas. By 1967, smallpox eradication programmes had eliminated smallpox from all of South America except Brazil.

Brazil, with a population of 95 million, is the largest country in South America and shares a common frontier with all but two of the South American countries. It is politically divided into 27 Federative Units and, geographically, into five regions. States are divided into "municipios", each with its own elected local government.

Since 1963, smallpox incidence had decreased in all of South America except Brazil (Table 1). In 1968 and 1969, 99% of the reported cases were from Brazil and no autochthonous cases of smallpox were reported from any other South American country.

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Historically, in Brazil, smallpox epidemics started in the north-east and spread through population migration from the dry north-east to the more developed industrial and farming areas of the south. Accordingly, in 1961 Brazil initiated eradication pilot projects in the north-eastern states. In late 1965, an agreement was signed between the Brazilian Government and PAHO/WHO for the eradication of smallpox. PAHO/WHO has provided technical assistance and equipment for vaccination and vaccine. A special agreement was signed with the Connaught Medical Research Laboratories, Canada, to periodically test samples of vaccine produced.

The Plan of Operations provided for the attack phase and the surveillance programme to be undertaken simultaneously.

The anticipated advantages of simultaneous operations were as follows:

1. Publicity during the preparatory phase of the systematic vaccination programme would lead to improved reporting of cases both by the community and by the medical profession.
2. Abundant clinical material would be available for the training of field epidemiologists.

Full-scale field operations were started in the north-east region and have been progressively extended to other areas. By 31 October 1970, 18 of 27 States and Territories had completed their programmes and others were in the attack phase: 75 of the 91 million persons in Brazil had been vaccinated. It is expected that the total systematic vaccination programme will be finished within the next few months.

Unfortunately, the surveillance programme has been handicapped by three factors:

1. Because the predominant type of smallpox is variola minor, cases of the disease are not immediately reported. Owing to the extreme mildness of the disease and low mortality, only severe cases are brought to the attention of health authorities. During the attack phase many cases of smallpox have been identified in the vaccination lines.
2. The Epidemiology Units in states were previously staffed by part-time personnel and were able to undertake limited containment activities in the capital city only. Epidemiological data for reported cases were also incomplete. In 1967, information about sex, age and date of onset was available for only 40% of cases. The total surveillance programme therefore had to be developed virtually in the absence of an operational base at the central or local level.
3. State Governments welcomed the mass vaccination programme but were reluctant to assume the continuing responsibility for the surveillance programme. Assistance, both technical and financial, was offered by the central level to facilitate the introduction of this entirely new programme, and was made subject to a legal agreement between the State concerned and the Federal Government.

### The Surveillance Programme

Early in 1967, steps were taken to centralize smallpox case reporting in the CEV (Campanha de Erradicaçao da Variola) headquarters in Rio. Forms for individual reports and also "Weekly Report" forms were designed. All State Health Departments were requested to adopt the "Weekly Report" as the only official form.

In June 1967, the CEV began to issue its "Boletim Semanal da Campanha de Erradicaçao da Variola" in which the collected data are tabulated and analyzed. The "Boletim" is widely distributed and quickly came to the attention of senior officials in the States, who were stimulated to cooperate by the credit given to the published information.

In Brazil, smallpox incidence is lowest in the summer and autumn, increases in the winter, and reaches a peak in early spring (Fig. 1). The age distribution of cases shows that 74% of the cases are under 14 years of age; and only 7% in the group 30 years and above (Table 2). The case fatality rate is low and ranges from 1.7% to 0.5% for all ages. The age specific fatality rate for infants is ten times greater than for adults.

Late in 1967, an outline of the organization of a Surveillance Programme was prepared for the States in which the mass vaccination programme was completed. It was recommended that the surveillance staff be full-time and be given sufficient freedom of movement to undertake immediate action when reports were received. The staff of each unit consisted basically of a full-time physician trained in smallpox surveillance methodology, five trained vaccinators and two office clerks. When possible, a public health nurse was made responsible for training local health service personnel in vaccination techniques and proper storage of vaccine.

The steps followed in organizing Surveillance Units at the State level were as follows:

#### Training of personnel

Surveillance officers were trained in Sao Paulo where clinical material and laboratory facilities were available.

#### Organization of the reporting system

As mentioned earlier, reporting was deficient. Prior to the campaign, smallpox reports were submitted monthly by the peripheral Health Services, and reached their destination with at least two weeks' delay. It was necessary to establish a system ensuring that information was received in the shortest possible time.

The present structure is as follows: CEV headquarters in Rio de Janeiro centralizes at the national level the reporting of cases from the states and territories. At the state level, the Surveillance Unit is located in the State Health Department, which centralizes reporting within the State. Local health services, both official and private, are considered to be local reporting units. In rural areas, agricultural extension and other field workers are used as collaborating reporting units.

Visits were made to local reporting units by the Chief of the Surveillance Office to discuss the operation of the programme and to explain the changes in reporting responsibilities: 1) "immediate" reporting of suspect cases; 2) weekly reports of all cases registered during the week by name, age and date of onset of the disease; and 3) the importance of negative reporting, an entirely new concept. At this time, individual report forms were delivered. Further visits were made regularly to the reporting posts, and reports were acknowledged.

The reporting network is expanding and weekly reports are coming in regularly. In most instances delays are due to failures of the postal system. At present, however, epidemiological case reports are complete.

There are now 21 State Surveillance Units covering the entire country. The total number of active reporting posts in the country is 1 800.

#### Immediate epidemiological investigation of suspect cases

One possible explanation of deficiencies in reporting was the fact that a report was not always followed by action by the central offices. During the training of Surveillance Officers, the need for immediate response to a report, which was to be considered a "Public Health Emergency", was emphasized.

Every effort is now made to investigate reported cases within 24 hours. In every instance the notifying doctor is contacted in order to facilitate location of the case and to provide him with refresher training in field epidemiology. Laboratory confirmation of suspect cases is required. This approach to doctors has been very successful; they have become interested in the programme and are pleased to participate. Their future participation in the surveillance of other diseases will be more effective.

The impact of surveillance activities is clearly shown in Figure 1. In 1967 we observe the "natural" seasonal curve. Surveillance activities during the second half of 1968 modified the "natural" decline of the curve. The extra peak early in 1969 represents investigations made during the training course in Sao Paulo, but it is in the second half of 1969 that the curve is modified by surveillance and containment operations initiated in four large states. These four states accounted for 72.4% of a total of 7 407 cases reported in Brazil in 1969. Routinely reported cases represented only 5% of the final total in Rio Grande do Sul, and 2.5% in Parana, Minas Gerais and Bahia (Table 3).

#### Containment operations

During the investigation, all household contacts are immediately vaccinated. In rural areas, neighbouring families are also vaccinated regardless of whether or not they are confirmed. Previous smallpox vaccination is verified by the existence of a vaccination scar. Past history of smallpox is also recorded. Other places of possible exposure are also investigated, including schools, places of work, or hospitals, and contacts are vaccinated. During the investigation the inhabitants are continually reminded that with rare exceptions vaccinated people are not infected with smallpox.

During investigation, it was found that about two-thirds of all household contacts were susceptible (Table 4). The incidence of smallpox in persons who had been vaccinated was very low.

The areas investigated are systematically revisited for the purpose of clinical follow-up of contacts and continuation of the investigation if new cases are found. When the outbreak involves another administrative jurisdiction, cross notification is made and a report on the investigation is requested.

### Results of investigations

A chronological list of cases is prepared which gives the index case for the outbreak or the coprimary cases for every household. A monthly report form provides standardized evaluation in every State. A summary of important investigations is published in the "Boletim Semanal" as "Epidemiological Notes" and gives credit to the Surveillance Officers who submit reports. This publication is widely distributed among health officers, professors of preventive medicine and communicable diseases, medical societies and, abroad, to all the central health authorities in the South American countries.

### Surveillance Programme in Rio Grande do Sul

The Smallpox Surveillance Programme in Rio Grande do Sul is particularly interesting. Rio Grande do Sul is located at the southern tip of Brazil and shares a common frontier with Uruguay and Argentina. There is considerable traffic across the frontier and, in 1968 Argentina reported imported cases and in 1969, Uruguay reported an imported case. During June 1970, a case was reported in Santo Angelo, Brazil, and when investigated, led to a small town on the Argentinian side. The index case had been infected in a small town in Brazil where she had attended a party. The infection went ping-ponging across the border.

The Unit in Rio Grande do Sul is under a full-time chief medical surveillance officer and three full-time doctors. A public health nurse is in charge of the training programme for personnel of the local health services. Auxiliary personnel consists of one secretary and two clerks.

The State is divided into ten administrative regions. All Regional Chiefs have received training in the epidemiology of smallpox. There are now 226 local reporting units at the municipal level and 95% of them report each week.

During the past year, 145 suspect cases were reported and 132 cases were investigated within the following 24 hours. Seven investigations were not made at the beginning of the programme because field personnel were still being trained. Of the 132 cases investigated, 68 were confirmed as smallpox. These investigations led to the discovery of 1 446 cases, a ratio of 1:21. During the investigations, 29 438 containment vaccinations were performed; 31% of whom were susceptibles.

In 114 infected households, with a population of 720 people, 494 (69%) were found to be susceptible. Among infants, 96% were susceptible; among pre-school children 93%; and in school age children, 86% (Table 5).

Of the 65 originally reported and confirmed cases, 39 (60%) were adults. The high proportion of adult cases reported is believed to be because they were clinically more obvious or more severe. Additionally, employed persons have some kind of medical care. Among 1 311 cases eventually discovered, only 3% of cases in children had been reported and 10% of cases in adults.

In one year of operations, the ratio of reported to discovered cases changed from 1:25 in the fourth quarter of 1969 to 1:17 in the second quarter of 1970; and finally, in the third quarter this ratio was 1:12 (Table 6). Since 28 September 1970 there have been no reported cases of smallpox in the State of Rio Grande do Sul. This is eight weeks before the completion of the systematic vaccination programme.

The influence of surveillance is dramatically shown in Figure 2, where the incidence of smallpox in the State of Rio Grande do Sul is presented by four-week periods. The curve in 1968 is close to the national seasonal pattern. The two peaks in the first half of 1969 reflect the inclusion of cases not previously reported from the peripheral health services, but the upswing in September represents the initiation of surveillance activities. The curve for 1970 is completely modified. Intensification of case-finding activities during the season of low incidence was followed by an actual decline in incidence during the season of maximum incidence. Since 28 September 1970 no active cases have been reported.

### Conclusions

The surveillance programme should be initiated simultaneously with the preparatory phase of the systematic vaccination programme. These simultaneous operations make it possible to train personnel in clinical and laboratory diagnosis because of the existing endemic situation.

The simultaneous operation of the case-seeking programme and the attack phase enables a secondary assessment to be made of the immunity level of the foci and provides an opportunity for an effective mopping-up operation.

An efficient surveillance programme can reduce the transmission of smallpox even before systematic vaccination is completed.

The availability of laboratory diagnostic facilities and laboratory confirmation of cases averts problems with the local physicians. The verification of clinical and epidemiological laboratory findings also helps, indirectly, to improve their diagnostic capacities.

The immediate investigation of reported cases and the efficiency of containment operations makes for a better relationship between the surveillance programme and the local public health officers.

TABLE 1  
REPORTED CASES OF SMALLPOX IN THE AMERICAS, 1962-1968

Country	1962	1963	1964	1965	1966	1967	1968
Argentina	2*	-	13*	15*	21	23*	-
Bolivia	-	-	5	-	-	-	-
Brazil	9 692	6 447	3 160	3 304	3 531	4 353	3 844
Colombia	41	4	21	149	8	-	-
Ecuador	204	45	42	-	-	-	-
French Guiana	-	-	-	-	-	-	1*
Paraguay	-	-	7	32	5	-	-
Peru	-	865	454	18	13	-	-
Uruguay	1*	1*	3*	1*	-	-	2*
Total	9 940	7 362	3 705	3 519	3 578	4 376	3 847
% in Brazil	97.3	87.6	85.3	93.9	98.7	99.5	99.9

\* Importations

TABLE 2

AGE DISTRIBUTION OF 6 795 REPORTED SMALLPOX CASES, BRAZIL - 1969

Age Group	Number of Cases			No. of Deaths
	Male	Female	Total	
<1.	125	122	247	12
1-4	800	778	1 578	10
5-14	1 581	1 596	3 177	5
15-29	639	646	1 285	8
30+	254	211	465	2
Unknown	20	23	43	0
Total	3 419	3 376	6 795	37

Note: Of the 247 infants, 112 were less than six months old; 52 were less than three months old. Thirty-seven deaths from smallpox were recorded among 6 795 cases reported in 1969, a death/case ratio of 0.5%. There were 12 deaths among the 247 cases in infants and the death/case ratio was 4.9%.

TABLE 3

PROPORTION OF SMALLPOX CASES FOUND DURING INVESTIGATION  
OF REPORTED CASES, BRAZIL - 1969-1971

State	No. Cases Reported	No. Cases Investigated	Cases Found During Investigation	% Reported	Ratio
Parana	17	17	706	2.4	1:41
Rio Grande do Sul	68	68	1 446	4.7	1:21



TABLE 4

SUSCEPTIBILITY OF HOUSEHOLD CONTACTS OF SMALLPOX CONTACTS  
PARANA AND RIO GRANDE DO SUL, BRAZIL - 1970

State	No. of Households	Total No. of Persons	Susceptibles*	%
Parana	250	1 492	952	63.8
Rio Grande do Sul	114	720	494	68.6

\* Susceptibles defined as persons without a vaccination scar and no history of smallpox.

TABLE 5

CONTACTS IN 114 HOUSEHOLDS DISTRIBUTED ACCORDING TO AGE GROUP  
AND SUSCEPTIBILITY TO SMALLPOX, BRAZIL - 1970

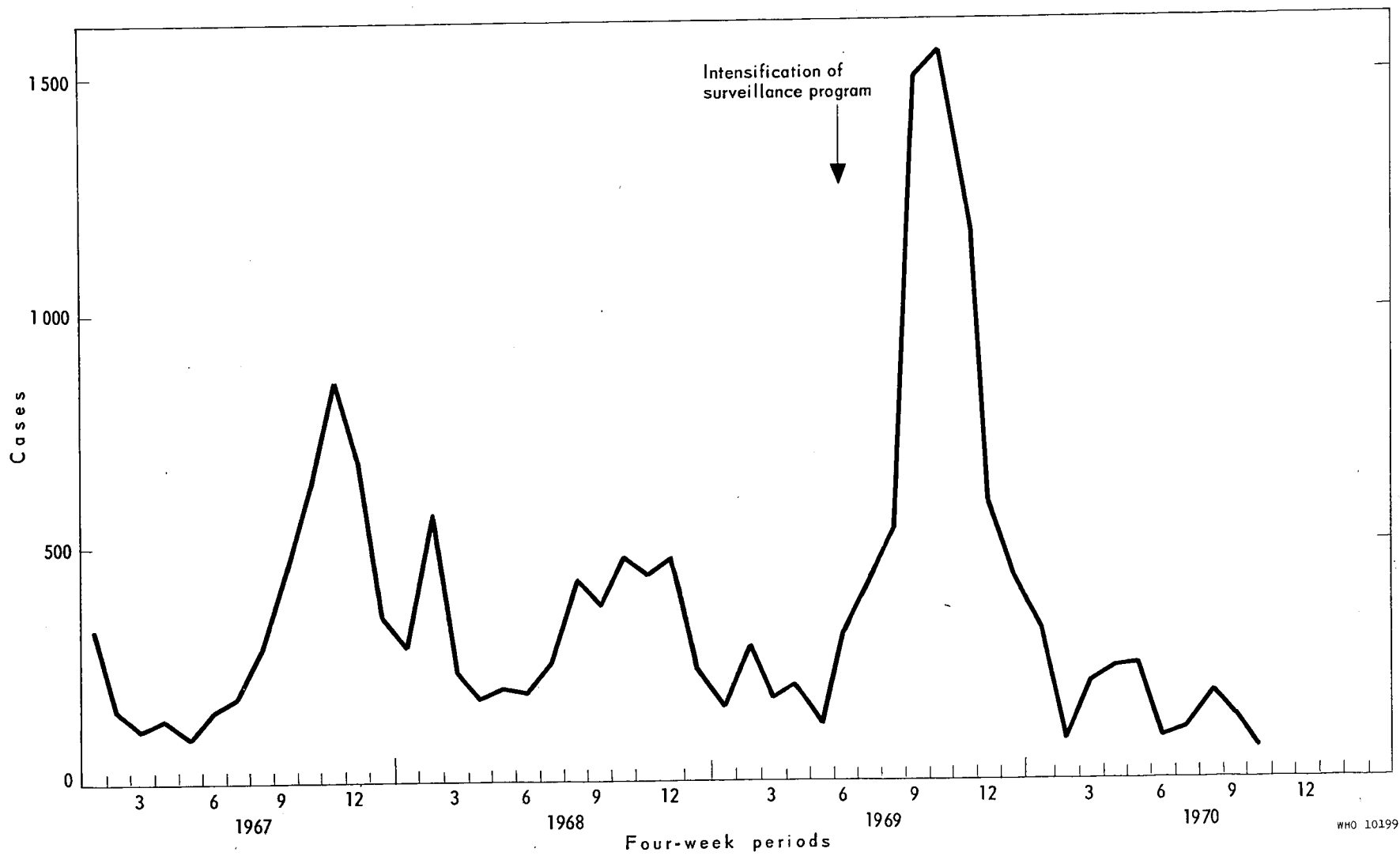
Age Group	Total No. of Persons	Susceptibles	%
< 1	25	24	96.0
1-4	70	65	92.9
5-14	253	218	86.2
15+	372	187	50.3
Total	720	494	68.6

TABLE 6

SURVEILLANCE PROGRAMME IN THE STATE OF RIO GRANDE DO SUL, BRAZIL  
SEPTEMBER 1969 - OCTOBER 1970

Year	Period	Cases Reported	Smallpox Cases Confirmed	Smallpox Cases Found	Ratio Confirmed/Reported	Usual Seasonal Incidence
1969	Oct/Dec	31	24	596	1:25	
1970	Jan/Mar	29	12	360	1:30	Low
1970	Apr/Jun	35	19	329	1:17	Medium
1970	Jul/Sep	37	13	161	1:12	High

FIG. 1  
SMALLPOX CASES REPORTED IN BRAZIL, BY FOUR-WEEK PERIODS, FROM JANUARY 1967 THROUGH OCTOBER 1970



WHO 10199

FIG. 2

SMALLPOX CASES REPORTED IN THE STATE OF RIO GRANDE DO SUL  
BY FOUR-WEEK PERIODS, JANUARY 1967 - OCTOBER 1970

