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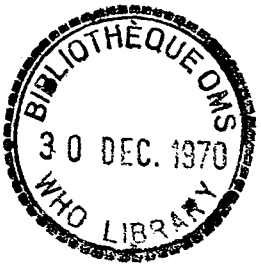

SMALLPOX IN THE MUNICIPIO OF SAO PAULO, BRAZIL 1945-1969: A 25-YEAR REVIEW[a]

by

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INTRODUCTION

The National Brazilian Smallpox Eradication Campaign was established by the Minister of Health in August 1966. Vaccination programmes were first strengthened in the north-eastern states of Brazil and initiated in the West-Central Region and the State of Rio de Janeiro. As the programme was completed in the north-eastern states, field operations were progressively extended to the more populous south-eastern and southern states of Brazil.

In August 1968, in co-operation with the Ministry of Health, the São Paulo State Health Department (Secretaria da Saude Publica e Assistencia Social), initiated a state-wide Smallpox Eradication Campaign. The programme called for the systematic vaccination of residents of all municipios (counties) in the State concluding with the municipio of São Paulo, the capital which was scheduled for vaccination during the months of June and July 1970. As of June 1970, the campaign was on schedule.

With the end of smallpox in sight, the documentation of smallpox occurrence before eradication was felt to be of importance. Although one small village and one institutional outbreak within the municipio of São Paulo have been described,[1-3] a descriptive analysis of of the disease over an extended time period has never been published.

Detailed epidemiologic data on smallpox for the municipio of São Paulo, are available for the 25-year period 1945-1969, while data dealing with age, sex, and mortality by age have been available on a nation-wide basis only since 1967. In addition, adequate nation-wide data to describe seasonal patterns are available for only six years.

Data available for the municipio of São Paulo thus represent the best available data in Brazil to document longer term epidemiological patterns and trends of the disease.

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SOURCE OF DATA

The Epidemiology and General Immunization Section of the Municipio of São Paulo receives daily reports of admissions from the Smallpox Isolation Ward at the Hospital Emilio Ribas and weekly smallpox case reports from all the health centres distributed throughout the municipio. Cases are also reported through maternal and child health care clinics and private physicians.

For every case reported, an epidemiologic case record is completed, and all household contacts are vaccinated. The case record includes such basic epidemiologic information as age, race, sex, residence, date of onset of illness, and clinical status of the patient.

This section has been responsible for communicable disease reporting and disease control since 1938. During the time period under consideration in this report (1945-1969) the Municipio of São Paulo has experienced explosive population and economic growth. As the largest industrial centre in Latin America, São Paulo and neighbouring municipios have acted as a magnet to Brazilians from other States. In 1940, the municipio had a population of 1.3 million. In 1950, the population had grown to 2.2 million, and had reached 3.8 million by 1960. Estimates for 1969 place the population at six million inhabitants. Infant mortality due to infectious and parasitic diseases has steadily declined during this time period, reflecting the industrial and economic development of the municipio.[4]

CASES REPORTED

The number of cases reported and annual case rates since 1945 are shown in Table 1. Case rates were relatively high (between eight and 14 cases per 100 000 population) in the latter half of the 1940's but since 1950 (Figure 1) a downward trend in incidence has occurred. This downward trend was interrupted in 1954, and a five- to six-year epidemic cycle pattern is suggested by peaks in incidence in 1956, 1961, and 1967. The unexpected increase in reported cases in 1969 is believed to reflect the more intensive epidemiologic investigations and improved reporting stimulated by the Smallpox Eradication Campaign field activities.

The cyclical pattern of smallpox in São Paulo closely matches the epidemic cycles seen in India, East Pakistan, and West and Central Africa, where extensive outbreaks occur every four to seven years.[5,6] This periodic cyclical increase is attributed to an accumulation of susceptible persons through birth and migration during the inter-epidemic period until there is a sufficient number to sustain a major epidemic.

Observations concerning hospitalized cases during the peak years of 1959-1961, as well as an epidemiologic analysis of the spread of smallpox in households during the 1956 outbreak, have been published.[7,8]

SEASONAL DISTRIBUTION

The seasonal incidence in the 10-year period 1959 through 1968 is presented by month of report in Figure 2. A late winter, early spring increase with peak incidence in August through October occurred in nine of the 10 years shown. The lowest incidence is normally observed between March and May. In São Paulo, the early spring increase corresponds with the end of the dry season before the coming of the summer rains (December-February).

Before eradication of smallpox in Venezuela, cases there were concentrated in the first half of the year which is also the dry season.[9] This association of peak smallpox incidence with the dry season is not limited to South America and has been also reported in Asia and Africa.[10-12]

AGE AND SEX

The age and sex distributions of reported cases by five-year periods, are shown in Table 2. During the 25-year period under consideration, smallpox occurred with increasing frequency in pre-school age children (0-4 years). Thirty-one per cent. of all patients were in this age-group during the most recent five-year period under study compared with only 18 per cent. in the first. Conversely, the percentage of patients who were 30 years of age or older decreased progressively from 18 to nine per cent.

In contrast, the proportions of patients in the school age (5-14) and young adult (15-29) age-groups were constant from year to year through the 1960-1964 period with almost no variation. The proportion of cases in these age-groups ranged from 18 to 21 per cent. and 43 to 45 per cent., respectively, of the total cases in each of those five-year periods. However, this pattern changed abruptly in 1965-1969, when 34 per cent. of all cases occurred in the school age-group, and the young adult group contributed only 26 per cent. of the total. In this last five-year period, 65 per cent. of all patients were under 15 years of age; only nine per cent. were over 30 years of age.

From 58 to 68 per cent. of reported cases have been males. This greater proportion of cases in males is due entirely to a preponderance of male patients (two-thirds) among those 20-years of age or older. There is little difference in the sex distribution of patients less than 20 years of age.

It is not certain whether the greater proportion of cases among adult males reflects a greater tendency for cases in men to be reported and/or hospitalized or whether women have a better level of immunization. Another factor to consider is the large adult male population which has immigrated from largely unvaccinated rural areas to find work in São Paulo.

MORTALITY

At least one death due to smallpox was registered in 22 of the past 25 years, with the annual case-fatality rate ranging between 0.4 and 2.4 per cent. Of the 6067 cases recorded during this period, 65 were fatal, for an over-all case-fatality rate of 1.1 per cent. indicative of variola minor.

However, it is important to note that half of the 53 deaths since 1950 were of infants under one-year of age. The case-fatality rate (9.0) for infants was 15 times greater than the rate (0.6) for all others. Cases and deaths are summarized by five-year periods in Table 3.

The São Paulo rates are very much like the annual case-fatality rates seen in the United States of America from 1913-1933, which ranged from 0.3 to 2.2 per cent.[13] In Venezuela, for 1940-1964, the over-all case-fatality rate was 1.8 per cent., with a higher mortality also reported for those less than one-year of age.[9] Although a detailed age distribution is not included for the 13 686 cases of variola minor studied by Marsden, 10 of the 34 fatal cases in his series were in infants.[14]

SUMMARY

During the 25-year period 1945 to 1969, more than 6000 cases of smallpox were recorded in the municipio of São Paulo, Brazil. Smallpox incidence was consistently high in the latter half of the 1940's, but since 1950, epidemics have occurred every five to six years with peaks in 1956, 1961, and 1967. There is a distinct seasonal pattern, with peak incidence in the late winter and early spring, August through October, and lowest levels in March through May.

During the 25-year period, smallpox occurred with increasing frequency in pre-school age children. In 1965-1969, 65 per cent. of all patients were under 15 years of age. Only nine per cent. were over 30 years of age. The fact that a greater proportion of cases were in males is due to almost two-thirds of all adult cases (20 years of age or older) being in males. It is not clear whether the greater proportion of the cases being in males reflects a greater tendency for cases in men to be reported and/or hospitalized or for females to have a better level of immunization.

The annual case-fatality rate ranged from 0.4 to 2.4 per cent. with an over-all ratio of 1.1 per cent., indicative of variola minor. More detailed analysis by age shows the case-fatality rate for infants to be 15 times greater than the rate for all other age-groups.

TABLE 1. REPORTED SMALLPOX CASES AND ANNUAL CASE RATES
MUNICIPIO OF SAO PAULO, BRAZIL, 1945-1969

Year	Estimated[a] population (thousands)	Number of cases	Case rate[b]	Year	Estimated[a] population (thousands)	Number of cases	Case rate[b]
1945	1745	166	9.5	1960	3825	307	8.0
1946	1828	209	11.4	1961	3882	418	10.8
1947	1911	145	7.6	1962	4099	293	7.1
1948	1994	278	13.9	1963	4329	252	5.8
1949	2077	181	8.7	1964	4571	235	6.1
1950	2198	268	12.2	1965	4827	173	3.6
1951	2290	124	5.4	1966	5098	225	4.4
1952	2382	140	5.9	1967	5383	650	12.1
1953	2474	45	1.8	1968	5685	384	6.8
1954	2567	77	3.0	1969[c]	6003	534	8.9
1955	2682	162	6.0				
1956	2786	247	8.9				
1957	3148	70	2.2				
1958	3316	215	6.5				
1959	3490	278	8.0				

[a] Estimated mid-year populations from the Anuario Estatistico, Instituto Brasileiro de Estatistica.

[b] Cases per 100 000 population.

[c] Preliminary.

TABLE 2. REPORTED SMALLPOX BY AGE-GROUP AND BY SEX
MUNICIPIO OF SÃO PAULO, BRAZIL
1945-1969 BY FIVE-YEAR PERIODS

Age (years)	Number of cases					Percentage distribution				
	1945-49	50-54	55-59	60-64	65-69	1945-49	50-54	55-59	60-64	65-69
<1	172	46	37	93	113	17.6	7.0	3.8	6.2	5.8
1-4		91	178	298	497		13.9	18.5	19.8	25.1
5-14	208	136	184	270	661	21.2	20.8	19.1	17.9	33.8
15-29	423	284	422	677	509	43.2	43.4	43.8	45.0	26.1
30-44	117	73	107	126	116	12.0	11.2	11.1	8.4	5.9
45+	59	24	36	41	58	6.0	3.7	3.7	2.7	3.0
Unk.	0	0	8	0	12	0	0	0	0	0
Total	979	654	972	1505	1966	100.0	100.0	100.0	100.0	100.0
Males	584	448	620	951	1141	59.7	68.5	63.8	63.2	58.0
Females	395	206	352	554	825	40.3	31.5	36.2	36.8	42.0

TABLE 3. SMALLPOX DEATHS AND CASE-FATALITY RATES (CFR)
MUNICIPIO OF SÃO PAULO, BRAZIL
1945-1969 BY FIVE-YEAR PERIODS

Five-year period	Total			≥One-year of age			<One-year of age		
	Cases	Deaths	CFR (%)	Cases	Deaths	CFR (%)	Cases	Deaths	CFR (%)
1945-49	979	12	1.2						
1950-54	654	11	1.7	608	4	0.7	46	7	15.2
1955-59	972	8	0.8	935	5	0.5	37	3	8.1
1960-64	1505	17	1.1	1412	9	0.6	93	8	8.6
1965-69	1966	17	0.9	1853	9	0.5	113	8	7.1
Total	6076	65	1.1	4808	27	0.6	289	26	9.0

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FIG. 1

ANNUAL SMALLPOX CASE RATES
MUNICIPIO OF SAO PAULO, BRAZIL – 1945-1969

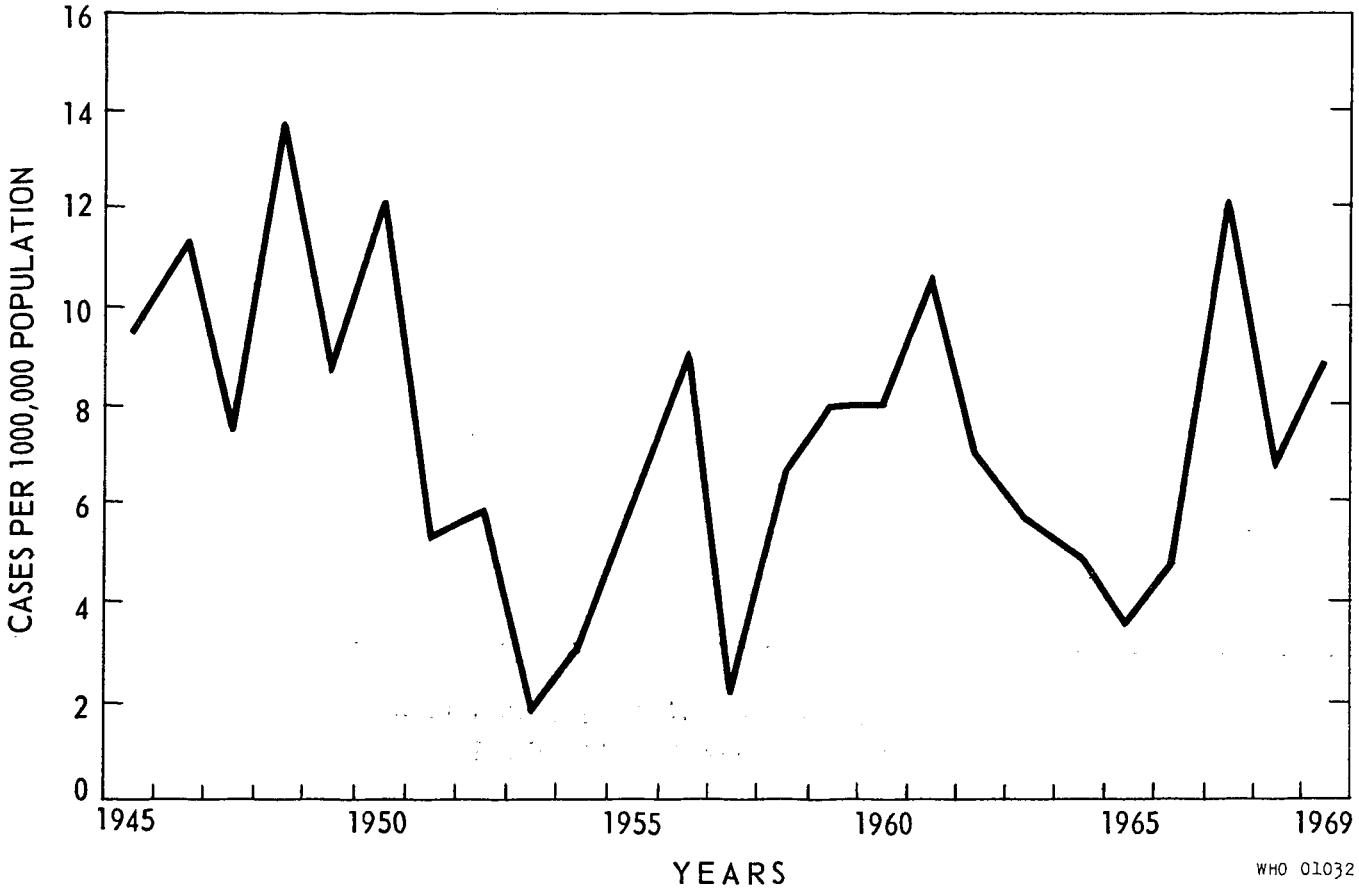

FIG. 2
SMALLPOX BY MONTH OF REPORT
MUNICIPIO OF SAO PAULO, BRAZIL: 1959 – 1968