

FREEDOM FROM SMALLPOX

Case histories on four countries where cases were missed for extended periods

by

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Introduction

Of the 34 epidemic countries which have become smallpox-free during the past ten years, only four have had the experience of believing that their countries (or, in the case of Indonesia, a major portion of the country) were smallpox-free for extended periods of time, only to be rudely surprised by the sudden discovery of a hidden focus. The four countries are Botswana, Brazil, Indonesia and Nigeria. Reasons for having failed to discover the persistent foci are summarized in this brief review.

Overview

As shown in Table 1, there were six separate periods in the four countries ranging from 10 to 34 weeks when smallpox cases were present but had not been discovered - Botswana alone was unfortunate in experiencing three separate episodes during 1972 but in each of the other countries, there was only one such episode. All of these episodes occurred during the period 1970 to 1972. Once the cases were discovered, containment was effective and, in all instances, the last case was detected less than eight weeks later.

TABLE 1. SUMMARY OF EPISODES IN WHICH SMALLPOX FOCI REMAINED UNDISCOVERED FOR LONG PERIODS

Country	Duration of period of missed focus (weeks)	No. of cases	Date of discovery	Date of last case
Brazil	15	18	2 March 1971	5 March 1971
Botswana				
No. 1	13	19	7 March 1972	15 April 1972
No. 2	27	5 (11-15) <sup>b</sup>	20 September 1972	14 September 1972
No. 3	10	6	21 November 1972	15 November 1972
Indonesia	34 <sup>a</sup>	163	14 December 1971	23 January 1972
Nigeria	22	84	21 March 1970	10 May 1970

<sup>a</sup> Interval between the occurrence of the last case on the main island of Java and discovery of the outbreak. Only four weeks had elapsed since the onset of the last case in Sulawesi which lies far to the north and east.

<sup>b</sup> Five cases detected but six to 10 additional cases are believed to have occurred.

In Indonesia and Nigeria, large numbers of cases had occurred before detection but, in both instances, lower level health staff were fully aware that smallpox was occurring. In Nigeria, information about the cases was known to have been intentionally suppressed while, in Indonesia, administrative confusion in reporting, accounted in major part for the failure of notification.

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In Brazil, one last small focus was discovered during a search-vaccination programme in an area where the programme was known to have been especially poor. The Botswana episodes related to persistent transmission among a small religious group which refused to accept vaccination and deliberately hid cases. The fact that smallpox in Botswana was extremely mild in character further compounded the difficulty of tracing of sources and detection of cases.

#### Summary

Although continuing surveillance activities in recently endemic countries may yet reveal smallpox foci which have remained hidden for longer periods of time than here described, it is noted that 34 weeks is, to date, the maximum period during which outbreaks have persisted unknown to national health officials at a time when the country (or, in this instance, the island of Java) was thought to be smallpox-free. However, as described, even the longest persistent outbreak, the one in Indonesia, was known to local health workers. Botswana, however, holds the record for persistence of transmission unknown to any health officials - a 27-week period between April and September 1972. There, special circumstances accounted for this episode - a religious group, which was resistant to vaccination and which deliberately concealed cases.

In the vast, remote and difficult areas which have become smallpox-free during the past 10 years, it would seem surprising to some that other, longer persistent unknown foci have not been detected. The fact that there have been such few episodes and the fact that, in each instance, unusual circumstances have accounted for their being missed, is a tribute to the quality of surveillance which has been developed in each country and an indication that smallpox foci do not long remain hidden with the surveillance programmes now in existence.

Given the facts, the required two-year interval between onset of the last case in a country and confirmation of eradication would seem more than adequate.

#### Summary report on each of the episodes

##### 1. Brazil

Brazil's last known outbreak occurred in a slum area in Rio de Janeiro, the outbreak having been detected on 2 March 1971, 15 weeks after the last previous known case. In Brazil, it had been recognized that one of the least satisfactory of the programmes of surveillance and vaccination had been that in Rio de Janeiro itself. Early in 1971 with no known smallpox in Brazil, it was decided to undertake a special house by house search and vaccination programme throughout the city. On 2 March, during the last week of this campaign, cases were discovered. In all, 18 cases occurred - the first on 22 December in two groups of houses located less than one kilometre apart. The earliest known case occurred in a mentally disturbed woman and little information could be obtained about her possible source of infection. It was suspected that the source was a patient from an earlier infected area of the city where housing had been demolished and many residents displaced. The very slow, limited spread of disease over a period of three-and-one-half months reflected, in part, the fact that the outbreak occurred during the summer when smallpox transmission is slowest. The last case occurred on 5 March in a child vaccinated during the incubation period.

##### 2. Botswana (Annex I)

On three separate occasions during 1973, Botswana smallpox eradication programme staff believed that smallpox transmission had been interrupted. On 7 March 1973, a case was discovered almost three months after onset of the last known case. By tracing the source of infection, 18 additional cases were found in two different localities which traced back to a religious sect, called the Mazeduru, who refused vaccination, deliberately hid patients with the disease and refused all cooperation with health workers trying to find either current or past cases. Investigation was further complicated by the fact that smallpox in Botswana was exceptionally mild. Patients often developed only a few lesions which were so superficial that on separation of the scabs, there was no evidence of depigmentation nor were

any left with scars. This was a far milder form of smallpox than has been observed either in South America or Ethiopia.

In April, the last known case in these two outbreaks occurred and during six months of search no further cases could be detected. In September, however, another case was found in a mining community called Selibe-Pikwe. During the search four earlier cases were detected and it is suspected that there might have been as many as six to 10 additional cases which were not found. The definite link with the earlier cases was not found this time.

After the case on 14 September, no further cases were discovered until 21 November but once again, smallpox was found in Selibe-Pikwe. The initial case and two earlier cases were in the Selibe-Pikwe community but a second outbreak of three cases was also detected in the capital city, Gaborone, the index case having been infected in Selibe-Pikwe.

Since 21 November 1973, no further cases are known to have occurred in Botswana.

### 3. Indonesia (Annex II)

The last outbreak in Indonesia occurred in Tangerang Regency (population 1 000 000) in villages located some 28 km from Jakarta. It was reported to the National Smallpox Eradication Programme on 14 December 1971, some four weeks after Indonesia's last known case but a full eight months after the last known cases had occurred on the main island of Java. Investigation revealed that one of the Regency's 15 subdistricts had been infected in December 1970 from known outbreaks in West Jakarta. Surprisingly, during the following 12 months, smallpox spread to only three villages in the subdistrict. By 14 December, 132 cases had occurred. From this focus smallpox spread to a village, 80 km away in Pandeglang Regency, causing three cases with onsets between 20 December 1971 and 10 January 1972.

The fact that smallpox had been occurring in the subdistrict was known to the Director of the Health Center and other health staff but due to confusion in reporting practice had not been brought to the attention of higher level health officials. It was discovered accidentally by a Provincial Surveillance Team while on supervision tour. After containment began on 14 December, 28 additional cases occurred, the last on 23 January. Eleven had been vaccinated in the incubation period but too late to prevent smallpox from developing.

To discourage any further tendencies toward concealment of cases, the Government posted and widely publicized the fact that a cash reward would be given to anyone reporting a case but the case on 23 January 1972 proved to be the last.

### 4. Nigeria (Annex III)

The last outbreak in Nigeria was discovered after five months had elapsed during which it was thought that smallpox transmission in Nigeria (as well as in all West Africa) had been interrupted. The outbreak was discovered when a 14-year-old girl was admitted to the infectious diseases hospital in Kaduna, some 400 km north of the hidden focus in Amayo town (population 1400). About this same time, the Senior Health Superintendent for Kwara State visited the town for other reasons and also discovered the outbreak. The outbreak could be traced back to known previously infected villages in an area where the systematic vaccination programme had been poorly conducted.

Throughout the period, local health staff knew that smallpox was still occurring but did not report it to higher level officials, feeling that they could contain the outbreak on their own and fearing criticism if it were known that smallpox was present.

In all, 61 cases occurred in Amayo but cases also spread to Ilorin (9 cases), Lagos (2 cases) and Shagamu (3 cases).

The last case occurred on 10 May 1970, approximately seven weeks after discovery of the outbreak.

## A PERSISTENT FOCUS OF SMALLPOX IN BOTSWANA

1973

by

G. T. Presthus<sup>1</sup> and J. B. Sibiya<sup>2</sup>Introduction

In 1971, four years after its last known cases, smallpox reappeared in Botswana. The first cases were detected in areas immediately bordering South Africa, and although it was impossible to trace the source of infection of the first cases, it would seem likely that infection did come from South Africa as this was the only nearby country which was infected at that time. A total of 36 cases were recorded in Botswana in 1971, but it was felt that the actual total was much higher.

During 1972, smallpox spread widely throughout the country and, in all, 1056 cases were reported. An intensive eradication programme was begun and by November 1972 it was thought that transmission had been interrupted. However, on 7 March 1973, a 22-year old unvaccinated male was admitted to the Gaborone hospital with the provisional diagnosis of chickenpox. Smallpox Eradication Programme staff were contacted, a specimen was obtained and the diagnosis of smallpox was confirmed. With great difficulty, and only after three weeks of search, was the source determined to be a contact among persons of the Mazezuru religious sect.

Subsequently, during 1973, a total of 30 cases were identified which had occurred in three separate locations. All were among a sect known as the Mazezurus or had acquired smallpox from them. The last known cases experienced the onset of disease on 15 November 1973. The following is an account of, hopefully, the last outbreaks of smallpox in southern Africa.

The Mazezuru (or Zezuru) people

The total population of Mazezuru in Botswana is between 3500 and 5000 people, or less than 1% of the total population of the country. They live in nine different towns in closed or semi-closed communities. All live within 35 miles of the rail line which runs from Capetown to Salisbury passing through the eastern part of Botswana. (Fig. 1) Some Mazezuru are not Botswana citizens and still carry Rhodesian or South African passports from whence they came. They were forced to leave their previous homes because of their reluctance to follow government directives, submit to vaccinations, etc. They do not allow their children to go to school and are totally opposed to preventive or curative medicine. Many are vaccinated, but only after considerable difficulty or out of necessity to cross into South Africa on church or other business.

It is not uncommon for Mazezuru to travel the length of Botswana by train for a visit of a few days to friends or relatives or perhaps to sell a few things. It is of note that in April 1973, nearly the whole Mazezuru population of the town of Palapye took the train to Francistown when they heard that the Health Inspector was coming to vaccinate them against smallpox.

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The Mazezuru women are readily recognized. They wear all-white clothing and are generally employed as small traders selling fruit and handicrafts at train stations and bus stops. The men often have a beard. They are very independent of other people. The women rarely answer questions without the husband present. Cooperation with the smallpox surveillance teams is poor and they have been argumentative to the point of threatening physical violence to surveillance officers.

#### Measures taken after discovery of the first case in March 1973

Following discovery on 7 March of the first known case in Botswana in over three months, strenuous efforts were made to discover the source. A house to house search was conducted in the area surrounding the patient's house. The same was done in the area where he worked and neighbours and friends were questioned at length in regard to suspect cases. The investigations were extended in ever widening circles. One surveillance team and the mobile vaccination team checked Gaberone (population 27 000) and one searched an area 40 miles from Gaberone where the patient had spent one night prior to his illness.

After three weeks of search, a tip from school children led to a Mazezuru household where people with recent pock marks were seen. Two days later an active case was found. This case, an unvaccinated 12-year-old girl, had been hidden in the house by her parents. In subsequent investigations, other cases were found which had come from Shashi, 400 km to the north of Gaberone. This focus was discovered by surveillance teams doing door to door search who found several cases among non-Mazezuru people. They had been infected by Mazezuru living nearby. Thus both foci discovered in March - April were discovered through recognition of cases in non-Mazezurus whose sources of infection were the Mazezuru.

Immediately after the Mazezuru were found to be harbouring infection, all Health Inspectors were notified by cable and asked to search Mazezuru villages in their areas for any evidence of recent smallpox. Within one week all Health Inspectors had replied that none had seen any signs of smallpox.

The leaders of the Mazezuru church were contacted and the dangers of smallpox were discussed. While the leaders did not favour vaccination, they stated that they would permit it, but they would not agree to allow anyone to go to the hospital for isolation purposes. The principal problem, however, was to find the Mazezuru children as they normally fled when they saw vaccinators coming. Later it was learned that while many leaders pretended to cooperate, actually they told the people to flee when they saw us coming.

The radio was used to alert the populace to the danger of acquiring smallpox from the Mazezuru. Their help was requested in finding other cases. Door to door search was used, and in the end was the only way results were obtained. With lack of cooperation by the Mazezuru, it was necessary to maintain a constant presence in all danger areas and to do repeated door to door searches.

In the Gaberone focus, a total of nine cases were eventually identified with onsets dating back to October 1972, at a time when smallpox was known to be endemic in Botswana (Fig. 2). Eight of the nine persons were Mazezurus. Ten additional cases were discovered in the Shashi focus, the earliest having occurred in January. The source of the earliest known case could not be identified. Four of the 10 cases were among the Mazezuru; the remaining six cases occurred in a single non-Mazezuru household.

The onset of the last cases in Gaberone occurred in March and in Shashi in April, but surveillance teams continued to search suspect and possible problem areas. Of principal concern was the rapidly growing mining area of Selibe-Pikwe, whose population had increased from 5000 to 20 000 in only two years. This area, located near Shashi, has a large turnover

of population, especially in the squatter village of Botshabelo (population 15 000) which is part of the Selibe Pikwe complex. In May 1973, a sample survey to assess the level of immunity in this area revealed that 4496 of the 5643 persons examined (80%) bore scars of vaccination. About 500 Mazezurus live in Botshabelo. One approach to surveillance in this area was to post surveillance officers at each of two stand pipes from which those in the village obtained their water. The Mazezurus, however, consistently came to obtain water at night in order to avoid the surveillance officers.

#### Discovery of another focus in September 1973

In September, it appeared increasingly likely that smallpox had been eliminated as almost five months had elapsed since the last known cases. Although the surveillance teams continued to search suspect areas and to vaccinate susceptibles, no cases had been found.

However, in September, a 16-year-old female arrived at the Francistown hospital with classical smallpox, and the diagnosis was confirmed by the laboratory. She was a runaway non-Mazezuru child who had left her village near Francistown to go to Selibe Pikwe. She had become pregnant, contracted smallpox and returned home. At first it was difficult to ascertain exactly where she had been during the weeks previous to onset of illness, so her home village was first checked. Nothing was found and the search concentrated on Selibe Pikwe, where she had been staying in the Mazezuru sector of Botshabelo.

After three weeks' search, two old cases were discovered in Botshabelo. The two were sisters whom the girl admitted she had seen with rash. They both had onsets in August and are assumed to have been the source of infection for the girl who came to the Francistown hospital.

A week later, after repeated house-to-house search, another old case was found, a three-year-old girl whose mother claimed had been vaccinated. Despite extensive questioning, no information could be uncovered to identify her source of infection. Her date of onset was said to be July, and it appeared as though she might have been the source of infection for the two sisters whose onsets were in August. One week later, another old case was discovered, a sister of the case seen the week before. When we had asked about other family members with rash, the answer had always been that there were none. The parents claimed that her rash started in June. This is, however, open to question, as later information revealed.

Information about other cases was never volunteered. We only found them after repeated door-to-door search. It is probable that there were at least six to 10 other old cases which we did not find. Anyone who had suffered or was suffering from smallpox was hidden when the teams came. Children were sometimes sent to another town so that they could not be questioned. Thus all Mazezuru villages were visited several times. One child who had suffered from smallpox and was old enough to answer questions herself, admitted that her mother and father told her not to answer questions.

A typical conversation with a woman found in one compound went something like this after normal greetings.

Question: Have you seen anyone with spots similar to this? (showing identification card).

Answer: No.

Question: No one?

Answer: No one ever.

Question: What about Ethel?

Answer: Oh! yes she had some.

Question: Anyone else?

Answer: No. Never anyone else.

Question: What about Rosemary?

Answer: Oh! yes she had them too.

Question: Anyone else?

Answer: No. Never anyone else.

etc.

#### Discovery of a third focus in December

Five cases were identified as a result of investigations following the September case, the onset of the last case being 14 September. Again, as time elapsed, it appeared that the last focus might have been eliminated. However, on 21 November, an eight-year-old girl was seen in Botshabelo, whose rash was so sparse that the diagnosis was not certain. Scabs were taken and sent to the WHO Reference Laboratory, and from these variola virus was isolated. Two additional cases, a brother and a sister, were subsequently found in the same family - all three children had onsets between 1 and 11 November.

The three most recent cases were discovered to be siblings of the two other girls whose illnesses were said to have occurred in June and July. No history of contact with other smallpox cases could be obtained. However, the possibility must be considered that the two sisters who were discovered only in early November and who were said to have had smallpox in June and July had actually experienced onsets in September and October respectively. Often following variola minor, virtually no trace of a scar or even depigmentation is seen once the scabs have separated and thus, it is not possible on physical examination alone to estimate a date of onset of the illness. Since so much of the information provided us was so misleading, their reported dates of onset must be viewed with scepticism.

In all, five additional cases were found after discovery of the November case. Two of these, as noted, being in Selibe Pikwe and three in Gaberone - the index case in Gaberone having been infected in Selibe Pikwe.

Search and vaccination activities have continued to date, but no further cases have been found. Neighbouring countries were informed of the outbreaks at the beginning and kept fully informed. They, too, searched for cases but found none.

#### Age, sex and vaccination status of cases

As shown in Table 1, 25 of the 30 cases were in children below 15 years of age. None had previously been vaccinated. A 21-year-old woman was the only person with a vaccination scar to develop smallpox. Consistent with previous observations of a very low case fatality rate for smallpox in Botswana, no deaths occurred among these cases.

Overall level of vaccination immunity

Scar surveys were conducted throughout Botswana between January and March 1973 to assess vaccination immunity. In all, 68 065 persons were examined or 11% of the country's estimated population of 630 379. These surveys revealed scars of vaccination among 76% of those 0 to 5 years; 83% among those six to 14 years and 79% of those 15 years and over. Since January 1973, vaccination activities have been intensified. Over 50 000 persons were vaccinated between January and March alone. Vaccination immunity levels in towns where Mazezuru communities are present now exceed 90%.

Conclusion

The need for continuing surveillance following the apparent interruption of smallpox transmission in a country is well illustrated in this series of outbreaks. In these series of outbreaks in Botswana, smallpox was clearly able to persist for a long period in a very tenuous chain of transmission among a small population group, finally and apparently subsiding only at the end of the smallpox season (April to November).

The lack of cooperation by the sect primarily affected made control of the disease extremely difficult. This was further complicated by the exceptionally mild nature of the infection (variola minor), which made detection of recovered cases very difficult and, also, resulted in the disease being regarded as an illness of comparatively little consequence by the population as a whole.

Continuing surveillance is mandatory in Botswana, but if no cases are detected during the May to November 1974 smallpox season, we will be considerably more confident that transmission has been interrupted - and that Phillip Bambuta, a two-year-old resident of Gaborone who became ill on 15 November 1973, was the world's last case of variola minor.

TABLE 1. AGE, SEX AND VACCINATION STATUS OF BOTSWANA CASES - 1973

Age	Male	Female	Total	Previously vaccinated	Deaths
<1	0	1	1	0	0
1-4	4	6	10	0	0
5-14	3	11	14	0	0
15+	1	4	5	1	0
Total	8	22	30	1	0

FIG. 1. BOTSWANA - SKETCH MAP

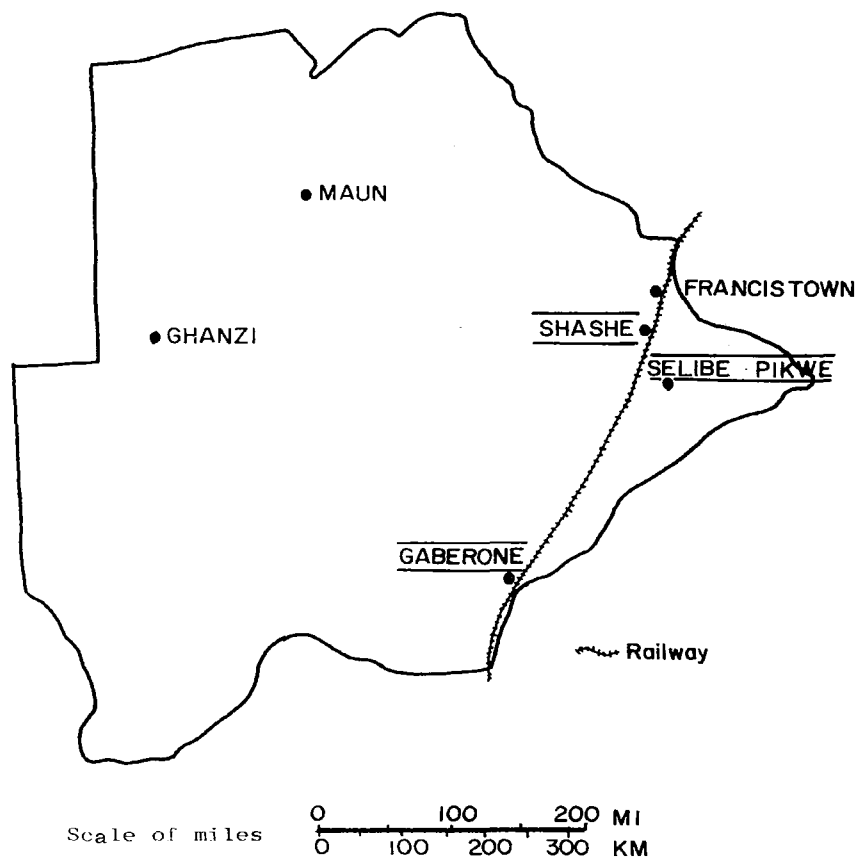
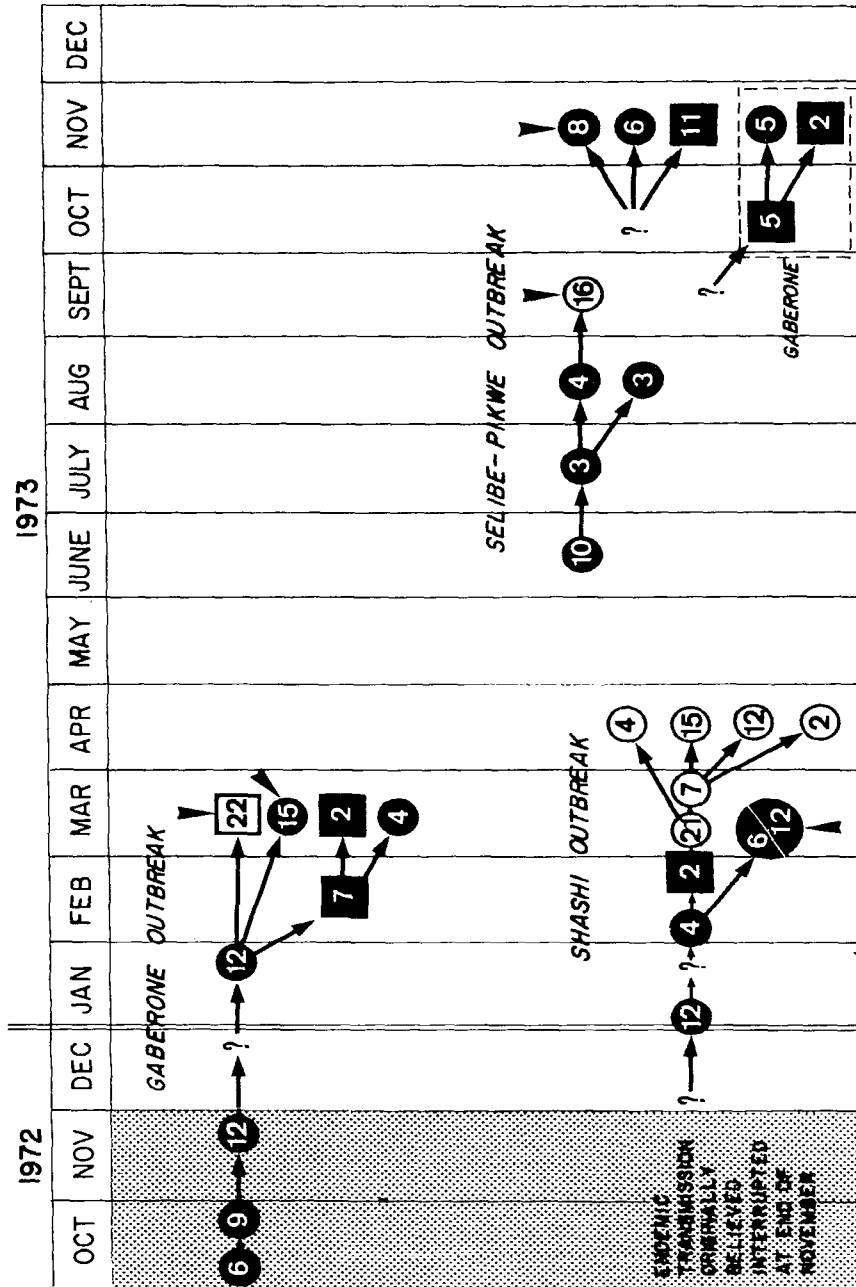


FIG. 2. BOTSWANA: SMALLPOX CASES DISCOVERED IN 1973



3 MALE - age 3      ■ MEMBER OF MAZEZURUS  
3 FEMALE - age 3      ▲ CONFIRMED IN LABORATORY

"TANGERANG-PANDEGLANG", THE LAST SMALLPOX OUTBREAK IN INDONESIA

by

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1. Summary

In Indonesia, after a four-week period of "smallpox-free" status in 1971, an outbreak was detected in December in a regency situated only 28 km from Jakarta, the National Headquarters of the Smallpox Eradication Programme.

The outbreak in that regency (Tangerang, West Java Province) consisted of 160 cases in three infected villages in one of the Regency's 15 subdistricts. The outbreak further spread to Pandeglang Regency (80 km distant), yielding three more cases. Backward tracing revealed that the outbreak originated from the West Java area, infection having been introduced in December 1970.

Outbreak containment followed by an intensive active search throughout Tangerang and Pandeglang regencies rapidly contained the outbreak. The last case occurred on 23 January 1972.

The outbreak was limited to one subdistrict (Sepatan) despite the fact that it had started one year before being detected and that good communications existed between Tangerang and other areas in Indonesia. The Pandeglang outbreak was rapidly contained due to prompt reporting. From one imported case, only two subsequent generations occurred, each with one case.

An active search had been conducted in Tangerang in 1971 (June through August) giving particular attention to those subdistricts infected in 1970 through 1971. As Sepatan sub-district had never reported cases during that period, it was not included in the search programme.

From this bitter experience several methods to improve smallpox surveillance were introduced throughout the country.

2. Introduction

Tangerang Regency is one of 24 regencies/municipalities in West Java, and is inhabited by approximately one million people (Fig. 1). It lies 28 km west of Jakarta and has good communication with the surrounding regencies. West Java Province had been the most heavily infected province in Indonesia. In 1969 the number of reported cases was 11 966 or 68% of all reported cases in Indonesia. Due to intensive surveillance-containment, only two regencies (Bekasi and Tangerang) reported smallpox in 1971 as compared with 24 regencies/municipalities in 1969. Bekasi reported cases up to April while Tangerang reported cases up to early February.

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<sup>5</sup> Chief, Smallpox Eradication Unit, CDC, Jakarta (from February 1972).

<sup>6</sup> Chief, Epidemic Diseases and Quarantine Directorate, CDC, Jakarta.

After four weeks had elapsed without further cases in West Java, an active search was started in June 1971 which lasted until August 1971. In this search, priority was given to areas infected during 1970-1971. Sepatan subdistrict was excluded from this search, as it reported no cases during that period. In each village, 20% of the households were visited. As a result, 796 villages were searched (20% of all the villages in West Java) but no smallpox was detected. In Tangerang, active search was conducted in six of its 15 subdistricts, all of which shared a common border with Jakarta. In those six subdistricts, 38 of 84 villages were selected (Fig. 2).

The outbreak which was discovered on 14 December 1971 involved only three villages, Sarakan, Sangiang and Gaga in Sepatan subdistrict (Fig. 3). In Pandeglang Regency, an imported case from Sepatan gave rise to one more case in the second generation and one in the third generation.

### 3. The outbreak

#### 3.1 Detection of the outbreak

On 14 December 1971 the Project Director of the Smallpox Eradication Programme received a report from the Head of the Tangerang Health Services, stating that there were 45 smallpox cases with six deaths in his area. On the following day, a medical officer investigated to learn the following.

5 December 1971: a villager of Sangiang reported the occurrence of smallpox in his area to the chief of his RT (lowest subdivision of a village). The latter in turn delivered the report to the chief of Sangiang Village on 7 December. The chief of Sangiang Village did not convey the report to his superior (the chief of Sepatan subdistrict) or to the health centre, but directly ordered two malaria workers to perform vaccinations.

10 December 1971: the chief of Sangiang Village reported the outbreak to the Sangiang police officer who then reported immediately to the chief of the health centre of Sepatan subdistrict.

11 December 1971: the chief of Sepatan health centre checked the report and found seven smallpox cases. These cases were immediately reported to the Director of the Tangerang Health Services.

13 December 1971: the smallpox supervisor of Tangerang Regency was sent to confirm the report. He found seven cases in the infectious stage, 11 who had recovered and learned of five deaths.

14 December 1971: containment was initiated by the Tangerang health staff assisted by the Advance Team of Jakarta (Advance Team is a provincial team exclusively responsible for smallpox eradication in four to five regencies), which by chance visited Tangerang on a supervision tour.

#### 3.1.2 Pandeglang outbreak

On 4 January 1972, Smallpox Eradication Programme Headquarters received a smallpox report from the Director of Pandeglang Health Services. On the following day, a headquarters medical officer was sent there and discovered the following.

24 December 1971: upon request of a family in the village of Kupahandap, Cimanuk sub-district, a home visit was paid by the chief of the health centre. Smallpox was suspected and he immediately forwarded the report to the Regency Health Office.

27 December 1971: the Regency supervisor of Pandeglang checked the report and confirmed it as smallpox. A specimen was taken for laboratory confirmation.

28 December 1971: containment was initiated.

### 3.2 Investigation

#### 3.2.1 Tangerang outbreak

The investigation eventually detected, in addition to the 45 cases reported on 14 December, another 115 cases. In all, 15 died. Investigation revealed that the source of infection was an outbreak in West Jakarta Regency. A visit to this area revealed no infectious cases. Two children aged two and four years in Sarakan Village were the index cases of the Tangerang outbreak. These children had spent the night in a household where smallpox cases were present. Sarakan infected Sangiang Village and the disease eventually came back into Sarakan village from Sangiang. Finally Sangiang infected Gaga Village. In Fig. 4, cases are plotted according to their date of onset.

Three hundred and twenty-nine contacts in Tangerang and 54 outside Tangerang (33 in Jakarta; 7 in Bogor; 10 in Krawang; 1 in Serang, West Java Province and 3 in Palembang, South Sumatra Province), were traced and found to have escaped infection.

#### 3.2.2 Pandeglang outbreak

Pandeglang was infected from Sangiang Village. Between 5 and 8 December 1971, an unvaccinated three year-old boy from Kupahandap Village, was brought overnight by his parents to their relatives in Sangiang. They stayed in a house next to that of a smallpox case and paid a visit to this case. The boy developed a rash on 20 December and died eight days later. Scabs taken on 27 December were positive for smallpox. The second case, living approximately 20 m from the first, a two year-old boy, vaccinated during the incubation period, was found on 11 January 1972. He escaped notice during investigation conducted on 5 January. Clinically, he seemed to be a varicella case, although variola was suspected since this second case was a relative of the first and had been brought by his grandmother to spend the night in the house of the first case. The third case, a two-month old boy was reported on 25 January. Rash had developed on 23 January. The boy and his parents live in Pandeglang Village. Tracing revealed that on 10 January his parents had held a small party which had been attended by the second case.

### 3.3 Causes of the delay in reporting

#### 3.3.1 Tangerang outbreak

The delay of one year in reporting in Tangerang was due to a lack of awareness of the population of the need to report, and, more importantly, due to a lack of understanding and cooperation among the health personnel themselves. Investigation revealed that the chief of the Sepatan Health Centre knew that smallpox cases were occurring since December 1970. These cases were reported to the Tangerang Health Service monthly, together with other diseases (not categorized as quarantinable diseases), using a special form (C list). This C list, unfortunately, does not have a special column for smallpox; only varicella is mentioned, as variola should be reported on a special form. The Director of the Tangerang Health Services did not notice the reports of variola as he considered the C list to be a routine report of activities of a health centre, needing no special attention.

Finally, it was admitted that some local officials had taken advantage of the existing epidemic, by charging the population for the vaccinations performed.

### 3.3.2 Pandeglang outbreak

No specific report was sent from the Pandeglang Health Services to headquarters. One of the health staff was given a specimen, taken on 27 December 1971 from the first case to be delivered to headquarters. As it was the end of December, the "holiday atmosphere" was said to account for his taking the specimen to headquarters only on 3 January. As he did not clearly point out what the specimen was about, the headquarters official handling the incoming specimen sent it only on 4 January. Only after the specimen had been forwarded was the accompanying small notice found suggesting the presence of smallpox in Pandeglang. Pandeglang health officials explained that as their area had been free of cases for more than a year, they were seeking laboratory confirmation before openly reporting smallpox.

It is worth noting, that the earlier detection of this outbreak (as compared to Tangerang) was due to a reward promised to anyone who would report a smallpox outbreak which was confirmed by laboratory test. The first case was reported by the chief of the health centre, accompanied by a letter asking for the reward.

After the Tangerang outbreak, it was decided that a reward was one of the best means to quickly discover possible hidden foci and so it was extended throughout Indonesia - a sum of Rp 5000 (approximately US\$ 12).

### 3.4 Outbreak containment

#### Tangerang

Soon after headquarters confirmed the outbreak, containment was initiated by teams consisting of health personnel from Tangerang Regency, Jakarta, West Java, and headquarters. Vaccinations were performed from house to house, recording every family member on specific forms, so that for every person, the age, sex and vaccination status was shown. The outcome of all primary vaccinations was verified during follow-up.

The number of vaccinations performed in each village (Sangiang, Sarakan and Gaga) with the number of smallpox cases is shown below.

	Population	Total vaccinated	Primary vaccination	Revaccination	% unprotected	Cases
Sangiang	3 106	3 155	1 142	2 013	36	131
Sarakan	1 904	1 688	307	1 371	18	17
Gaga	2 792	2 544	917	1 627	36	12

### 3.5 Epidemiological data - Tangerang outbreak

Of the 160 cases in Tangerang, 86 were females and 74 were males. Of the total 68% were in the one to four year age-group while 28%, were in the five to 14 year age-group. The case fatality rate was highest in the under one year group (20%) and 9% overall. Only one of 160 cases had been vaccinated before exposure, a 25-year old woman, who had previously been vaccinated in childhood. Eleven were vaccinated during the incubation period.

AGE, SEX AND CASE-FATALITY RATE - TANGERANG OUTBREAK

Age	Cases			Deaths	Case-fatality rate (%)
	Females	Males	Total		
< 1	5	-	5	1	20
1- 4	51	57	108	12	11
5-14	28	17	45	2	4
> 14	2	-	2	-	-
	86	74	160	15	9

FIG. 1 WEST JAVA PROVINCE - SHOWING TANGERANG AND PANDEGLANG REGENCIES

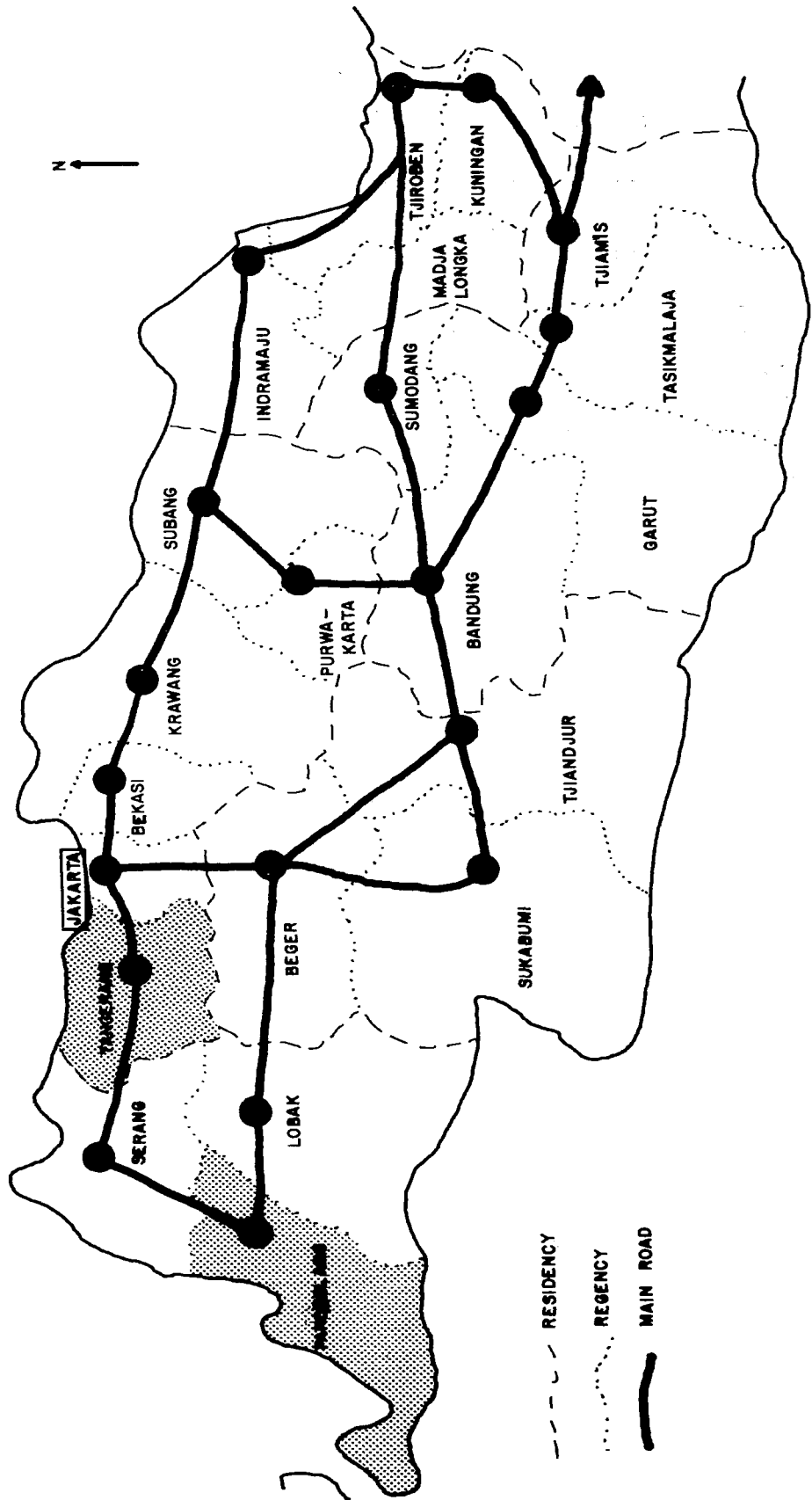


FIG. 2. TANGERANG REGENCY BY SUBDISTRICT - ACTIVE SEARCH IN 1971 (SHADED AREAS)

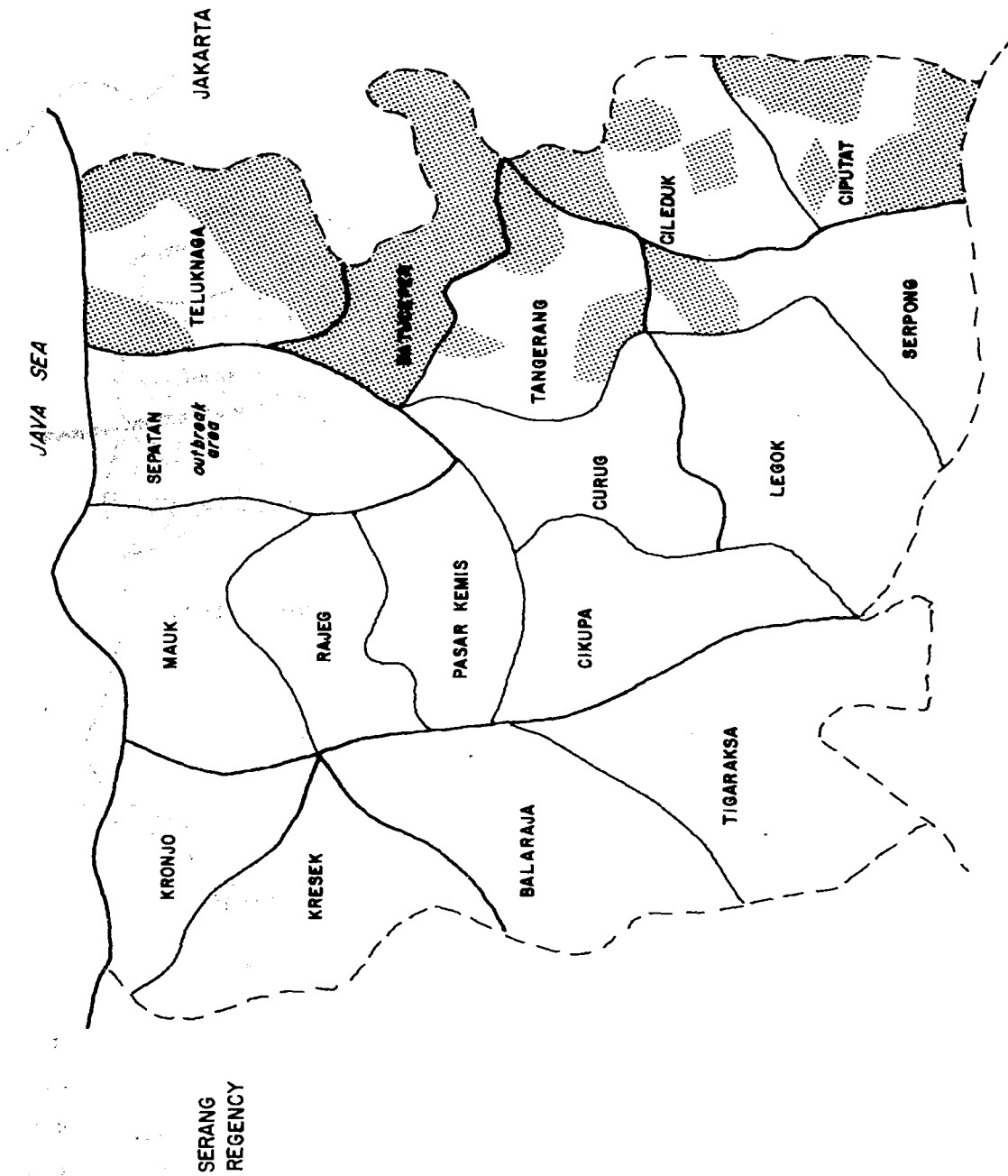


FIG. 3. SAPATAN SUBDISTRICT, TANGERANG  
INFECTED VILLAGES: SARAKAN, SANGIANG AND GAGA

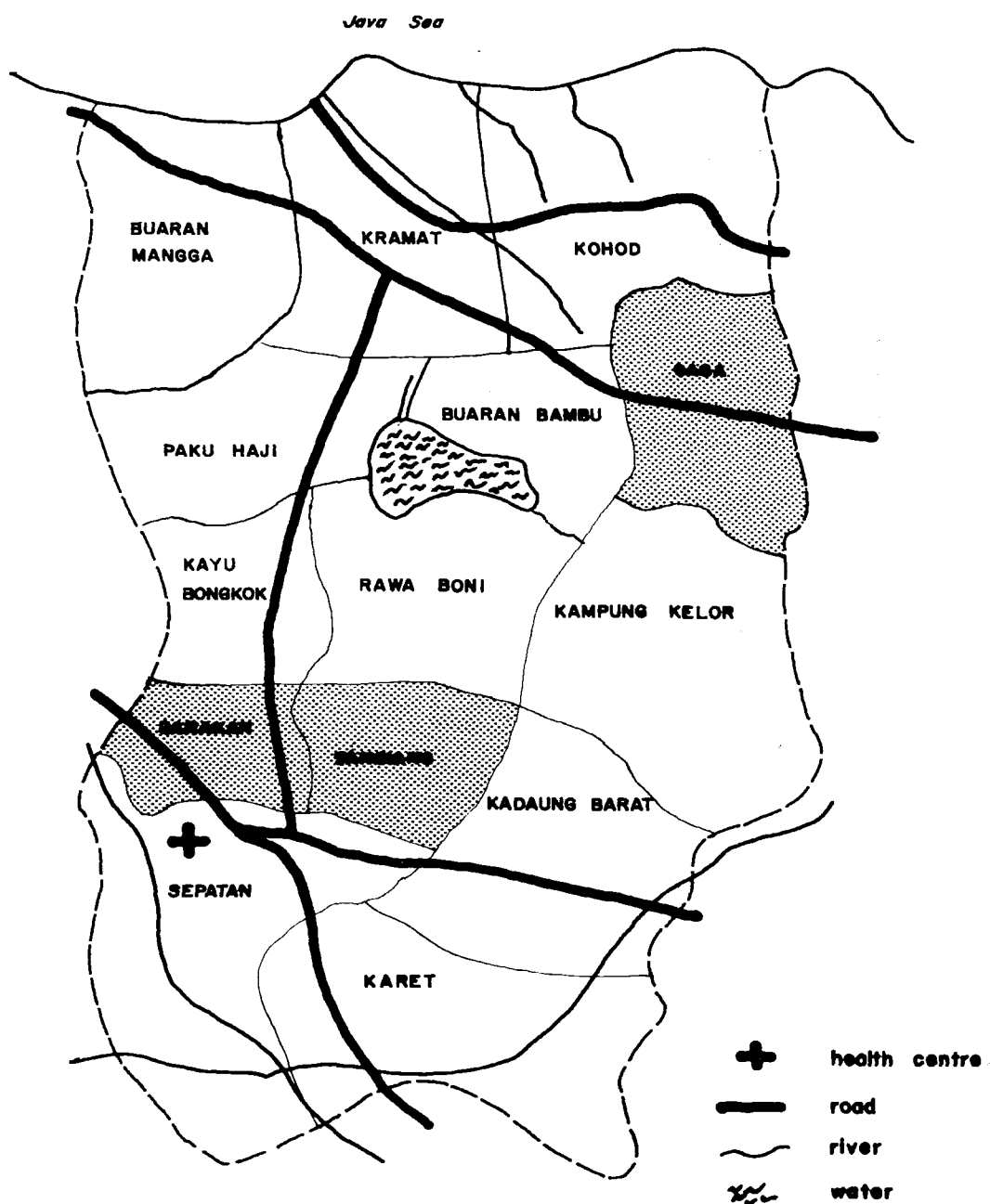
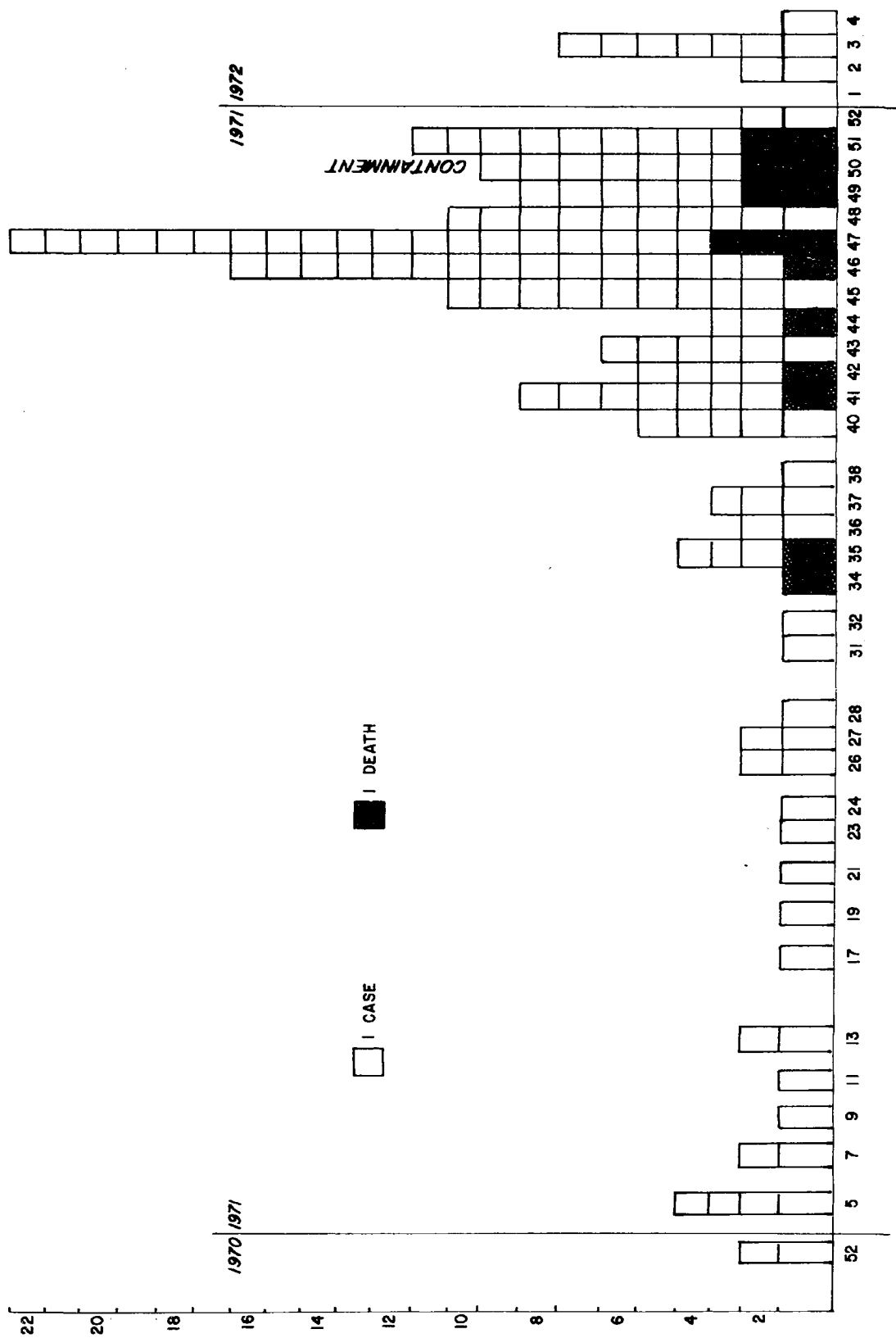


FIG. 4. CASES BY WEEK OF ONSET - SANGIANG, SARAKAN AND GAGA VILLAGES  
 (Week 52, 1970 - Week 4, 1972)



RECURRENCE OF SMALLPOX IN NIGERIA 1970  
(Prepared from data submitted by the Ministry of Health, Nigeria)

by

Dr W. H. Foege<sup>1</sup>

### Introduction

On 21 March 1970, an unvaccinated 14 year-old girl was admitted to the infectious disease hospital in Kaduna, Nigeria with classical smallpox in the pustular stage. What made this unusual was the fact that smallpox had not been recorded in West and Central Africa for five months. Clearly, this constituted an importation of the disease or smallpox had continued undetected for five months in a country which generally has a good smallpox surveillance system.

### Background

In early 1967, vaccination programmes began as part of a regional effort in 20 West and Central African countries to eradicate smallpox within a five-year period. The area involved has a population of approximately 120 million people. The 20 countries reported an average of 10 149 cases of smallpox a year from 1962 to 1967. Pock mark surveys have indicated that less than 10% of smallpox cases were in fact reported, therefore, it is estimated that at least 100 000 cases of smallpox occurred each year in the West and Central African area. Between January 1967 and December 1969, 100 million persons were vaccinated against smallpox and reported cases of smallpox ceased in October 1969.

Nigeria, a country of 55 to 60 million people, reported an average of 3622 cases of smallpox each year from 1960 to 1967. Again, scar surveys indicate the actual number was at least 36 000 cases per year. By the end of 1969, Nigeria had vaccinated 50 million persons and no smallpox cases had been reported since October 1969. During late 1969 and early 1970, approximately 10 suspected cases of smallpox were investigated each month by Nigerian health officials, but the suspected cases were always found to be something other than smallpox.

### The outbreak

Investigation of the case admitted to the infectious disease hospital revealed the patient had travelled from Amayo to Kaduna one week prior to the onset of symptoms (Fig. 1). This information was forwarded to Kwara State, the administrative unit in charge of Amayo. An investigation team was sent to Amayo where they discovered a widespread smallpox epidemic. What had gone wrong to permit an epidemic despite a mass vaccination campaign?

The mass vaccination attack phase in Kwara State extended over eight months from November 1968 to June 1969. Many problems were encountered which resulted in some of the lowest vaccination coverages reported in the entire country. Coverage rates of 50% or less were recorded. Vaccination teams concentrated on larger villages which resulted in extremely low coverage rates in small villages and isolated hamlets. Amayo village, the site of the epidemic, was a vaccination site but only 500 people were vaccinated out of a population of 1400 persons. A repeat vaccination effort resulted in less than 100 additional vaccinations. At the time of the outbreak, the immunity level in Amayo town was less than 50% and even lower in surrounding hamlets. This poor vaccination coverage set the stage for a continuing smallpox problem.

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In early 1969 smallpox was recorded in Nigeria but at much reduced levels as compared to previous years. In February 1969, smallpox was reported from Idofian a few miles from Amayo. In March, cases were reported from nearby Faloku and from Omupo. Transmission evidently continued at a low level during the rainy season (April to October) despite the lack of reports. During October an unvaccinated six year-old male travelled from Fufu Village to Amayo where he developed smallpox. He in turn infected three other unvaccinated persons, two from his compound and one from an adjacent compound.

The outbreak continued at a very low level (Fig. 2) until the first week in February 1970 (week 15 of the outbreak) when an increase in cases began, soon to average more than one new case a day. In February and March, adjacent villages and hamlets also became involved yet no cases were reported to the Ministry of Health.

Four patients travelled from the Amayo area during the incubation period. Three of the four returned to Amayo before developing symptoms or during the first day of rash. The fourth travelled to Kaduna, as noted earlier, to bring the outbreak finally to the attention of health authorities 22 weeks after it started. Only one case occurred in Amayo more than one week after control measures were instituted. A total of 61 known cases were recorded in Amayo.

What were some of the characteristics of the outbreak? First, the overall immunity level in infected compounds was only 50% (Table 1). Note the very low immunity levels in children under the age of 15. As might be expected in this situation, the epidemic was a paediatric problem (Table 2), with 65% of cases in the five to 14 age-group.

Another finding of note was the high attack rate in the age-group five to 14 even when correcting for the differing immunity levels by age-group. In Table 3, attack rates per 100 susceptibles are given by age-groups. Only one of 54 susceptible adults over the age of 30 developed smallpox even when living in a compound harbouring a smallpox patient. This finding, that smallpox transmission was easier in younger age-groups was supported by the fact that in 21 instances smallpox was introduced to a compound but did not spread. The average number of susceptibles under age 30 in these 21 compounds was 2.1 persons. In 13 compounds where spread did take place the average number of susceptibles under age 30 was 4.6 persons.

Investigation of the Amayo outbreak led health authorities in Nigeria to find three additional outbreaks believed to have their origins in the outbreak which persisted in the Amayo area. Nine cases were reported in Ilorin, two in Lagos and three in Shagamu (Fig. 1).

Control efforts involved both mass vaccination activities as well as efforts to find and vaccinate susceptibles on a compound-by-compound basis. Experiences clearly indicate that a careful search for susceptibles in the immediate area involved is essential for proper investigation and effective control. No cases of smallpox have been detected in Nigeria since May 1970.

#### Implications

First, a mass vaccination campaign is not sufficient in itself to eradicate smallpox.

Second, the absence of reports should not be interpreted to mean the absence of disease. The combination of poor coverage during the vaccination campaign and known smallpox in early 1969, should have raised suspicions regarding the possibility of smallpox in the area.

Third, if assessments are to be worthwhile they must result in corrective action. In this case repeated efforts including house-to-house campaigns were indicated in early 1969.

Fourth, increased emphasis on surveillance should take place when an area is believed free of smallpox. Transmission at low levels and in remote areas has been repeatedly

observed. A high index of suspicion is required to find these foci before they become larger epidemics.

Perhaps most important is the fact that the value of an investigation cannot be over-estimated. A single case of smallpox in this instance led to the discovery of four outbreaks with a total of 75 cases of smallpox.

TABLE 1. ESTIMATED PRE-EPIDEMIC SMALLPOX IMMUNITY IN "INFECTED" COMPOUNDS  
AMAYO, NIGERIA - SEPTEMBER 1969

Age-group	No.	No. immunes	% immune
< 1	15	3	20.0
1- 4	40	14	35.0
5-14	65	12	18.4
15-29	50	36	72.0
30 +	140	86	61.4
Total	310	151	51.3

TABLE 2. AGE AND SEX DISTRIBUTION OF 61 SMALLPOX CASES  
AMAYO, NIGERIA - 1969-1970

Age	Males	Females	Total
< 1	2	1	3
1- 4	6	5	11
5-14	22	18	40
15-29	4	2	6
30 +	1	0	1
Total	35	26	61

TABLE 3. AGE-SPECIFIC ATTACK RATE PER 100 SUSCEPTIBLES IN INFECTED COMPOUNDS  
AMAYO, NIGERIA - 1969-1970

Age-group	No. susceptible	No. infected	Attack rate per 100 susceptibles
< 1	12	3	25.0
1- 4	26	11	42.3
5-14	53	40	75.5
15-29	14	6	42.9
30 +	54	1	1.9
Total	159	61	38.4

FIG. 1  
DIAGRAM OF CITIES INVOLVED IN THE SMALLPOX EPIDEMIC  
OCTOBER 1969 - APRIL 1970, AMAYO, NIGERIA

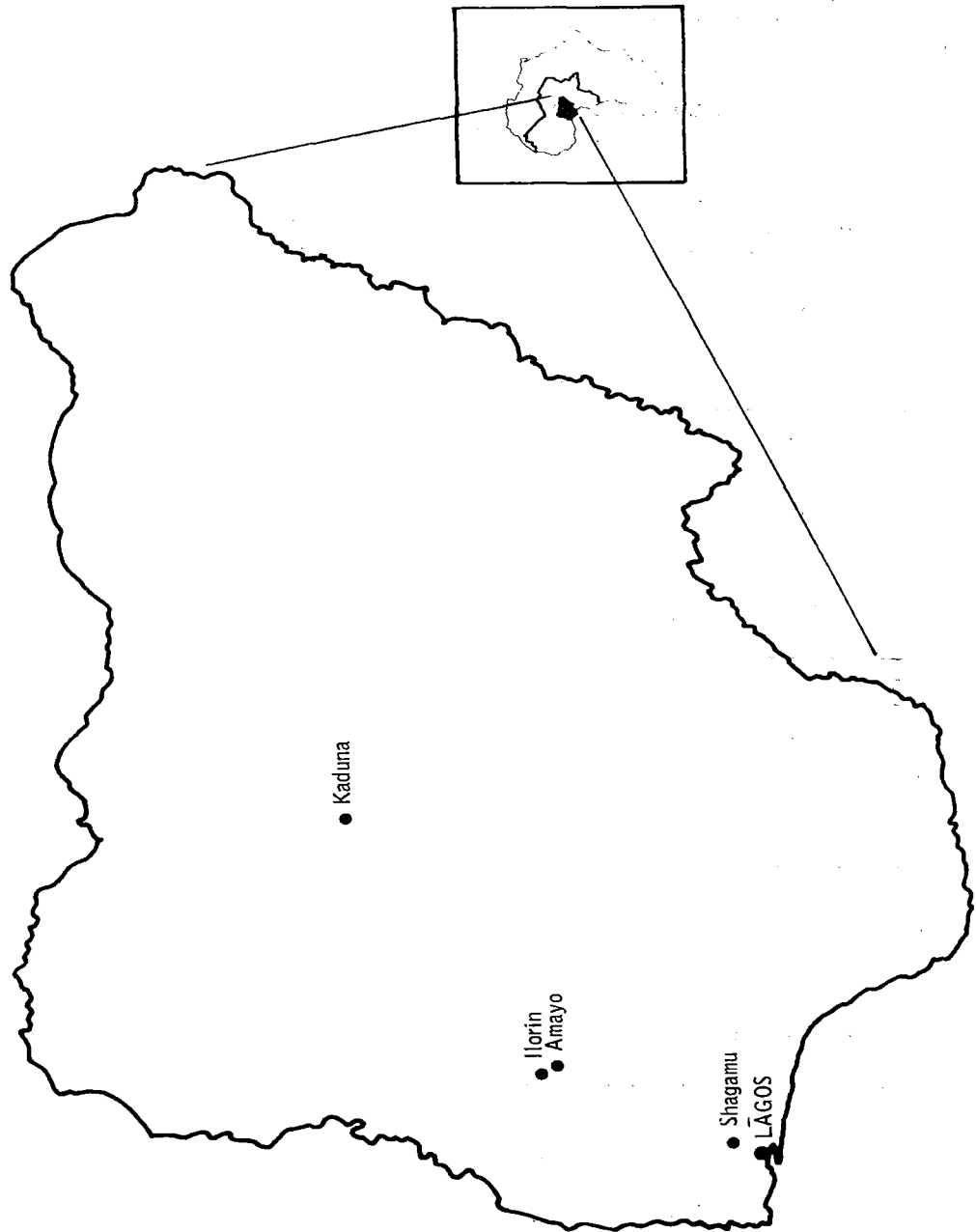
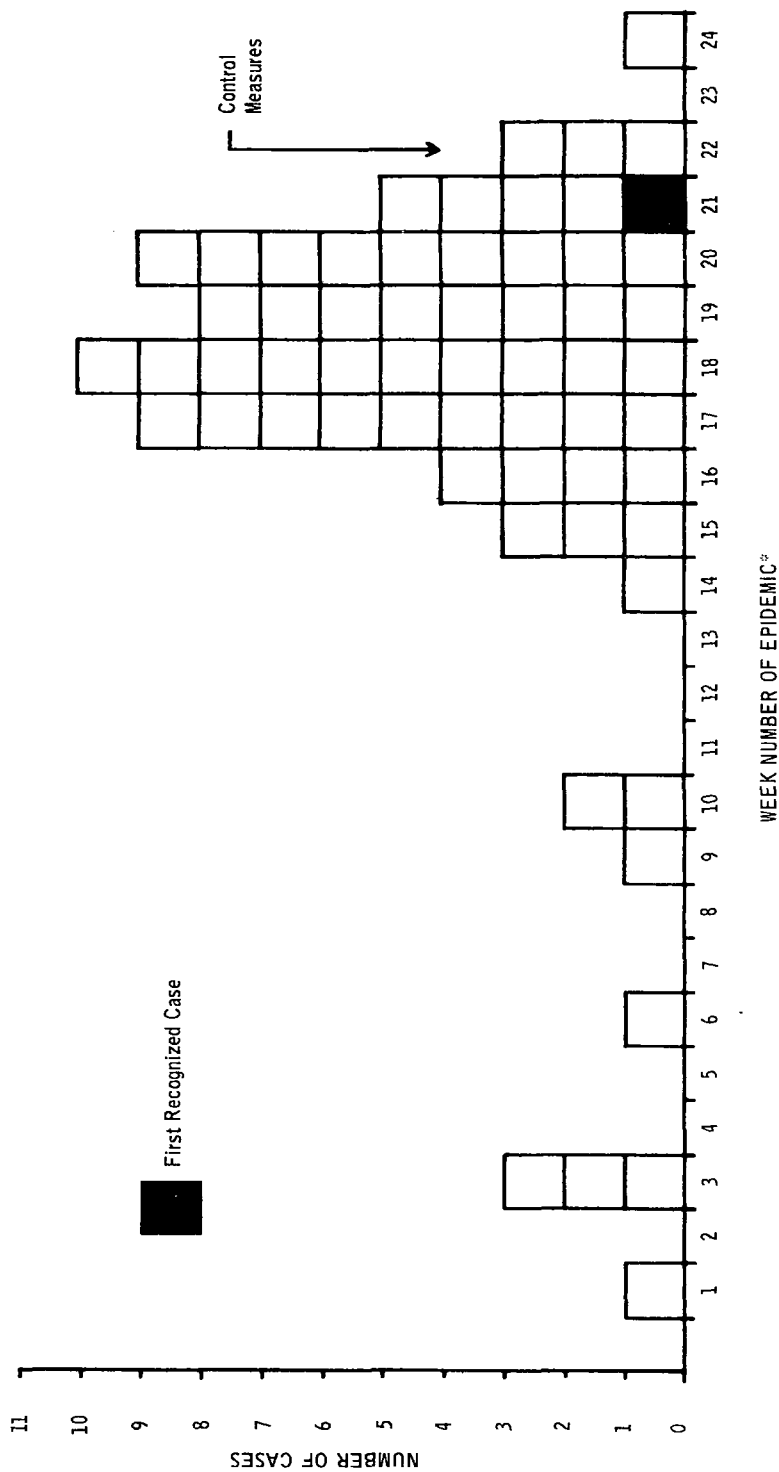


FIG. 2  
 EPIDEMIC OF SMALLPOX, AMAYO, NIGERIA  
 OCTOBER 1969 - APRIL 1970



\* \* \*

\* First week of epidemic was October 26-November 1.