



## CHAPTER 22

# SOMALIA AND DJIBOUTI

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### INTRODUCTION

Unexpectedly, the final episode in the global eradication of smallpox did not take place in one of the countries which had recently been so heavily infected, but in Somalia, whose first endemic cases in 14 years were reported in late September 1976. The reports were received 7 weeks after the last outbreak in Ethiopia, at a time when WHO was preparing to announce that, subject to confirmatory search, the world was free of smallpox. It was a bitterly disappointing setback, coming as it did at the end of a 12-month period that had witnessed the occurrence of the last case of variola major in Asia and the conclusion of a difficult but successful campaign in Ethiopia, then thought to be the world's only remaining endemic country. For Somalia to be identified as the last country with endemic smallpox was an embarrassment to its government. It was especially distressing to Somalia's health services, which for years had been sharply, and sometimes justifiably, critical of the programme con-

ducted in adjacent areas of the Ogaden desert by the Ethiopians.

Since 1969 Somalia had been engaged in a WHO-assisted programme of smallpox vaccination and surveillance which national programme staff believed to be highly successful. As late as August 1975, the national programme director, in a meeting with Ethiopian staff at the border of the two countries, reported that 85% of the population had been successfully vaccinated. Although importations of smallpox had been frequent, most of the cases were said to have been detected within a few days of onset. They had occurred among nomads, who roamed freely across the vast Ogaden desert. Between 1972 and February 1976, 38 imported cases were acknowledged but only 4 secondary cases were said to have occurred. No cases were reported between February and September 1976, although later evidence suggests that it was during these months that endemic smallpox became re-established. In September, Somalia's report of smallpox cases brought the prompt assistance of experienced WHO epi-

demiologists. These staff members were handicapped by not being permitted to visit the sites of outbreaks or to travel widely in search of cases, but with their Somali counterparts they struggled to interrupt what seemed to be a few tenuous chains of transmission in Mogadishu, the capital. By January 1977, it appeared that they had succeeded. However, a country-wide search for cases was called for, and in March the government agreed to cooperate fully in making this possible. The search soon revealed that endemic smallpox extended throughout southern Somalia. Major epidemics followed, and in May the government declared an emergency.

An intensive operation was therefore started which brought support from many countries and agencies and assistance from WHO epidemiologists who had worked in other endemic countries. The government gave its full support, and on 26 October 1977, only 141 days after the emergency had been declared, the world's last case of endemic

smallpox occurred. Meanwhile, more than 3000 cases had been recorded.

This chapter deals with events in Somalia and, briefly, with the situation in the adjacent French Territory of the Afars and the Issas, which became the independent state of Djibouti in 1977 (Fig. 22.1). The latter country, with a population (1977) of 240 000, experienced periodic importations of smallpox from Ethiopia but the disease never became endemic. Outbreaks were controlled by containment vaccination; mass campaigns were conducted every 3 years.

For a detailed account of the Somalia programme, the reader is referred to the book *Smallpox Eradication in Somalia* (Ježek et al., 1981), from which much of the information in this chapter is derived.

## BACKGROUND

The Somali people, who were predominantly nomadic and semi-nomadic pastoralists, roamed across the largely open and unmarked borders of the Horn of Africa in areas that included Somalia, parts of Djibouti, Ethiopia and Kenya. In 1960, when the country became independent, Somalia comprised the former British Somaliland Protectorate and the United Nations Trust Territory of Somalia, once an Italian colony. Thus, English was widely understood in the north and Italian in the south. Following a military coup in 1969, the country was administered by a Supreme Revolutionary Council and renamed the Somali Democratic Republic. The Somali Revolutionary Socialist Party was founded in July 1976 and provided political and administrative leadership throughout the country's 16 regions and 83 districts. The government's idea of uniting all the Somali peoples in one nation, regardless of existing political boundaries, was a source of contention with neighbouring countries throughout the course of the Intensified Smallpox Eradication Programme. This controversy was manifested in the continuing tension between Somalia and Ethiopia and in guerrilla warfare in areas of Ethiopia adjacent to Somalia in which Somali nomads lived.

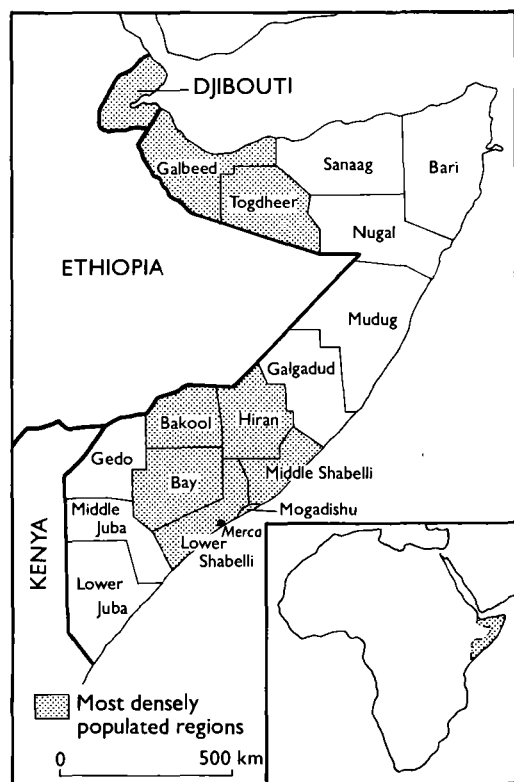


Fig. 22.1. Somalia: Regions and adjacent countries. Before attaining independence in 1977, Djibouti had been the French Territory of the Afars and the Issas.

## Population Movements and Health Facilities

Nomadic pastoralists, who constituted about half Somalia's population (3.1 million

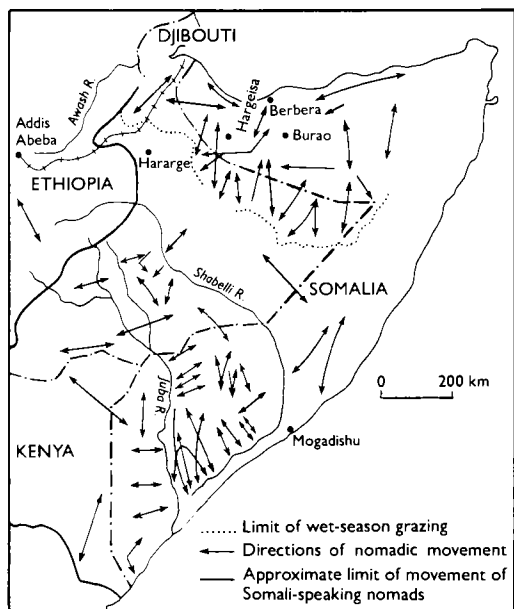


Fig. 22.2. Horn of Africa: approximate area covered by movements of Somali-speaking nomadic pastoralists.

persons in 1975), played an important role in sustaining smallpox transmission, carrying it from one area to another, where it spread among settled populations. An indication of the extent of pastoralism is provided by estimates (1975) of the numbers of live-

stock—3.5 million camels, 15 million goats and sheep, and 4.5 million head of cattle. A large proportion of the settled population was located along the coast in some 60 towns and cities, which were designated as municipal centres. Fewer than 25 of these, however, had more than 5000 inhabitants; by far the largest was Mogadishu (population, 450 000). Small settlements were also found along roads and in an agricultural area in southern Somalia. It was the south that was afflicted by the 1977 epidemic.

The population of Somalia was most heavily concentrated between the Juba and Shabelle rivers in the south and in areas to the south-east of the French Territory of the Afars and the Issas in the north. About 1.5 million people lived in the most heavily populated areas in the south and about 900 000 in the north. The rest were widely scattered over a vast, arid scrub desert in which population densities seldom exceeded 1 or 2 persons per square kilometre. Travel between the northern and southern areas was infrequent. During the dry season, the nomadic population in the north congregated near deep wells, primarily within Somalia; during the March–June rainy season, they travelled south and settled widely over a grassy well-watered plateau area in Ethiopia (Fig. 22.2). In the south, the pattern of movement was more complex. Nomads



Plate 22.1. The unpredictable movements of Somali nomads made the search for cases difficult. Their huts were easily carried on camel-back (A) and quickly erected (B).

located west of the Juba river travelled to more westerly districts and into Kenya in the rainy season. During this period, those living between the two rivers dispersed widely throughout the area because of the hordes of insects, especially the riverine species of tsetse flies, which infested the river banks and localities with standing water. The nomads whose herds consisted only of camels or cattle moved more or less constantly throughout the year. Others, termed "semi-nomads," had mixed herds of camels, cattle, sheep and goats and settled during the crop-growing season to cultivate arable land.

The movements of nomads, particularly in the south, were unpredictable, even from one day to the next. This made it exceptionally difficult to conduct any sort of systematic programme, either of case detection or of vaccination, especially during the rainy season, when roads became all but impassable. The rains fell irregularly, sometimes consisting of scattered localized downpours extending over only a few square kilometres. The different nomadic groups competed for the scarce vegetation and each had several searchers who roamed extensively. When rains fell in an area, the report of a searcher might cause an entire group to dismantle its

camp, pack up its belongings and move 50 kilometres or more over a period lasting several days. Moreover, the nomadic groups, often consisting of only 3 or 4 families, frequently broke up into smaller subgroups for the sake of mobility, and families often shifted from one group to another. Although the women, girls and small children stayed in the camps, the men and older boys accompanied the herds; the younger men, who herded the camels, frequently ranged over great distances.

During the time of the smallpox eradication programme in Somalia, there were 4 other factors which led to substantial movements of population. The first was the seasonal need in the south for large numbers of agricultural labourers, which brought nomads and others from sparsely settled areas to the banana and sugar-cane plantations. The second was severe drought, which occurred throughout the Ogaden desert in 1974–1975 and led to the migration from the Ethiopian portion of the Ogaden of an estimated 200 000–300 000 persons, many of whom were accommodated and fed in refugee camps (Plate 22.2) in Somalia and the French Territory of the Afars and the Issas. The third was the Somali–Ethiopian war, which began



UNHCR / W. GARTUNG

**Plate 22.2.** Laas Dhurre camp, Hargeisa District, Somalia. War and famine drove thousands of refugees out of Ethiopia.

in 1977 and resulted in tens of thousands of refugees fleeing into border areas of Somalia and Djibouti. The fourth was a programme, launched in 1975, to resettle upwards of 100 000 nomads in southern agricultural areas.

Health services in the two countries were much more extensive than in Ethiopia. In Somalia in 1968, there were 21 hospitals and 187 health posts and dispensaries with more than 1300 trained health personnel. In the French Territory of the Afars and the Issas, there were 6 hospitals and 16 dispensaries and a health staff of 450 persons, including 41 physicians. The Somali road network—also more extensive than in Ethiopia—consisted of 2000 kilometres of asphalt-surfaced roads and 4000 kilometres of gravel and earth roads.

#### Smallpox and its Control before 1969

As was the case in most countries, reporting systems in Somalia and the French Territory of the Afars and the Issas were poor and data on smallpox are incomplete. Variola minor was said to have been the predominant form during recent decades and, in some areas, health staff differentiated between the more severe cases, which they called "true smallpox", and the less severe, which they called "alastrim". Because cases of variola minor were often not reported as smallpox, this distinction undoubtedly contributed to underreporting. From the available data, it appears that endemic transmission in Somalia ceased in about 1962 (Table 22.1). The French Territory of the Afars and the Issas—at least since 1930—experienced only rare sporadic outbreaks following importations, but 2 outbreaks, in 1959 and 1966, are of special interest. Both resulted from importations from Ethiopia and occurred over a 2-month period. The first consisted of 110 cases with 13 deaths (11.8%), and the second of 52 cases with 6 deaths (11.5%). The two outbreaks and the report of a single outbreak in Ethiopia in 1964 (Teclerariam, 1965) provide the only documentary evidence of the persistence of variola major in Ethiopia or the Horn of Africa after about 1955. Apart from the 1966 outbreak in the French Territory of the Afars and the Issas, during which the disease was imported into Somalia, no cases of smallpox were recorded in either country between 1963 and 1971.

Table 22.1. Somalia and the French Territory of the Afars and the Issas: numbers of reported cases of and deaths from smallpox, 1962–1978

Year	Somalia		French Territory of the Afars and the Issas (Djibouti)	
	Number of cases	Number of deaths	Number of cases	Number of deaths
1962	221	.. <sup>a</sup>	0	0
1963	0	0	0	0
1964	0	0	0	0
1965	0	0	0	0
1966	2	0	52	6
1967	0	0	0	0
1968	0	0	0	0
1969	0	0	0	0
1970	0	0	0	0
1971	0	0	26	3
1972	5	0	79	0
1973	7	0	14	0
1974	11	0	12	0
1975	14	0	0	0
1976	39	1	0	0
1977	3 229	13	0	0
1978	0	0	0	0
Total	3 528	14	183	9

..<sup>a</sup> = data not available.

The infrequent occurrence of smallpox in the French Territory of the Afars and the Issas and the cessation of transmission in Somalia in 1962 could not be attributed to national vaccination campaigns. Both countries offered vaccination for those travelling abroad and conducted localized vaccination campaigns when outbreaks occurred. The French Territory of the Afars and the Issas carried out its first country-wide campaign in 1966, during which 115 000 people were vaccinated; thereafter, campaigns using freeze-dried vaccine were conducted every 3 years, each resulting in the vaccination of 100 000–120 000 persons. Somalia, using a locally produced liquid vaccine until 1966, vaccinated only 20 000–50 000 persons a year, primarily the inhabitants of major towns who required vaccination certificates for travel. In addition, because of outbreaks, special vaccination campaigns were conducted in 1962 near the Kenyan frontier and in 1966 near the border of the French Territory of the Afars and the Issas and in Mogadishu. During the latter campaign, 194 000 persons were vaccinated, but with vaccine of dubious quality; a study carried out in 1967 revealed that only 14% of those given primary vaccination had had successful takes.

Special vaccination scar surveys (Table 22.2) conducted in 1967 by a WHO medical

Table 22.2. Somalia: results of vaccination scar surveys, by age group, 1967 and 1968

Age group (years)	% of population with vaccination scars, 1967		Age group (years)	% of population with vaccination scars, 1968
	Rural	Urban		Rural
0-7	0	49	0-4	2
8-14	46	52	5-14	37
≥15	58	45	≥15	48

officer and in 1968 by United States Peace Corps volunteers showed that vaccinal immunity was poor even among the rural settled population of Somalia. It was undoubtedly much lower among the nomads.

Until the early 1960s variolation had been widely practised when outbreaks of smallpox occurred. However, no evidence of active variolation was discovered in either country during the 1970s, although as recently as August 1976, Ethiopian staff observed the practice in a Somali-speaking nomad group in the Ogaden desert in Ethiopia (see Chapter 21).

Despite the low level of vaccinal immunity and the proximity of these countries to Ethiopia, which was heavily endemic, the continuing transmission of smallpox had apparently ceased. Imported cases were few, although, because notification systems were poor, it is likely that more occurred than were reported. Long-sustained endemic spread did not, however, develop, the only reasonable explanation for this being that the susceptible population was too widely dispersed for transmission to be sustained. The long absence of endemic smallpox bred an unwarranted confidence among national and WHO staff alike that the disease would not re-establish itself even if it were imported. Similarly, Ethiopian staff were comparatively unconcerned about smallpox among Somali-speaking nomads in Ethiopia and until 1976 gave little priority to their programme in the Ogaden desert.

### THE COMMENCEMENT OF THE SMALLPOX ERADICATION PROGRAMME, 1969

Because of the smallpox situation in the neighbouring country of Ethiopia, the development of an eradication programme in Somalia was considered important. The

government expressed interest, and a WHO consultant visited the country in January 1968 to formulate a plan of operations. This called for a 3-year national vaccination campaign, from 1969 to 1971, coupled with routine assessment of vaccination coverage, as well as the development of a reporting system and surveillance activities. WHO agreed to provide an adviser, vehicles, equipment and vaccine; to meet the necessary operating costs; and to pay a supplementary per diem allowance for all Somali staff when they travelled in the field. Up to the end of 1976, WHO's annual contribution to the programme was modest (Table 22.3) but adequate, in view of the country's small population.

The plan of operations was similar to many other such plans in the Intensified Programme. It called for vaccination to be performed by mobile teams moving in groups from village to village and from house to house. This would serve to protect the settled population, although little thought was given in the plan to the vaccination of nomads, who comprised half the total population. It was decided simply to vaccinate those who were found at water-holes or encountered by chance when the teams were on their travels. From later observation, it was apparent that only a small proportion of the nomads could have been vaccinated by this approach, a deficiency in the campaign which might have been discovered and corrected if the assessment of coverage had been well conducted. The problem was not pursued until 1977.

The vaccination campaign was slow in starting and never functioned well (Table

Table 22.3. Somalia: expenditure by WHO for smallpox eradication and number of doses of vaccine supplied, 1967-1979

Year	Expenditure (US\$)	Number of doses of vaccine
1967-1968	51 184	96 000
1969	25 127	35 000
1970	16 565	370 000
1971	17 445	105 000
1972	32 980	622 000
1973	26 141	624 000
1974	28 306	650 000
1975	51 781	608 000
1976	98 853	1 151 000
1977	2 193 648	3 904 000
1978	1 788 242	1 524 000
1979	2 140 157	—
Total	6 470 429	9 689 000

Table 22.4. Somalia: number of vaccinations performed, 1969–1978

Year	Number of vaccinations
1969	79 974
1970	645 862
1971	475 988
1972	712 045
1973	850 000 <sup>a</sup>
1974	704 207
1975	660 000 <sup>a</sup>
1976	320 000 <sup>a</sup>
1977	994 713
1978	566 203

<sup>a</sup> Includes estimates for one or more months during the year.

22.4). A WHO smallpox adviser arrived in June 1968 to assist with operations, but the campaign was not launched until August 1969. It began in Mogadishu, where 6 teams with 33 workers took nearly 6 months to vaccinate the city's population. Thereafter, 20 vaccinators began work along the Kenyan border, and in May 1970 a group of 12 workers started to vaccinate people in the north of the country. However, the campaign was suspended in November 1970, when cholera began to occur and the teams were directed to administer cholera vaccine. In June 1971 the smallpox vaccination campaign was resumed and by the beginning of 1974, the teams had completed 2 tours of the country. By the end of that year nearly 3.5 million smallpox vaccinations had been recorded, a number which was approximately equivalent to the population.

The number of vaccinations in relation to population would suggest that a reasonably high degree of vaccinal immunity must have been attained by the end of 1974. However, attempts to confirm this by assessment were never diligently pursued. From information that became available in 1977, it would appear that the coverage in settled populations was at best 60–80%; among nomads in the south, it ranged from 10% to 20%.

During 1974 the smallpox vaccination teams were disbanded and their members dispersed throughout the country initially to participate in a national literacy campaign, and then, after a severe drought in 1974–1975, to help in refugee and relief camps. Finally, at the end of 1975 some of the staff returned to full-time duties with the smallpox eradication programme. At that time, 2 teams of 4 persons began a campaign of both smallpox and BCG vaccination, one team working near border areas in the north and

the other in the south. While vaccinating, they searched for cases. With so few personnel engaged, less than one-third of the country could be visited in the course of a year.

No cases were reported in either the French Territory of the Afars and the Issas or Somalia from 1967 until late 1971. However, between November 1971 and July 1976, the two countries together reported 173 cases, the former reporting 131 cases, of which 16 were believed to have been importations from Ethiopia, and Somalia 42 cases, of which 38 were said also to have been imported from Ethiopia. It is probable that there were other cases, since neither country had an organized notification system or an active programme of case detection. Reporting was further compromised because the cases were of the mild variola minor type and some nomadic groups concealed infected persons to avoid being ostracized by other groups, as was the custom when variola major was present.

The first case to be reported for more than 4 years in either country was detected in mid-November 1971 in Djibouti City in a recent arrival from the north of the Territory (Fig. 22.3). Later investigation suggested that smallpox had been introduced from Welo Province, Ethiopia. Other cases soon followed and by the time the outbreak had ended, on 29 February 1972, 104 cases had been documented. Most of them (79) were found in the city itself; the remainder occurred in 4 smaller rural outbreaks. A triennial mass vaccination campaign, scheduled to commence in January 1972, actually began some weeks earlier, and in a matter of a few months, 117 000 vaccinations had been performed.

In October 1972, another imported case from Ethiopia was detected in the French Territory of the Afars and the Issas, but this time secondary spread did not occur. Also in October—for the first time in 6 years—Somalia reported cases; the 5 patients concerned were said to have been infected in Hararge Province in Ethiopia. No secondary cases were reported.

During 1973, cases were imported into both countries. The French Territory of the Afars and the Issas reported 14 cases: 10 represented importations and 4 were among contacts, 3 of whom were infected while hospitalized. Somalia reported 7 cases, of which 6 occurred in the southern part of the country. Their place of origin in Ethiopia was unknown. As in 1972, all were said to have

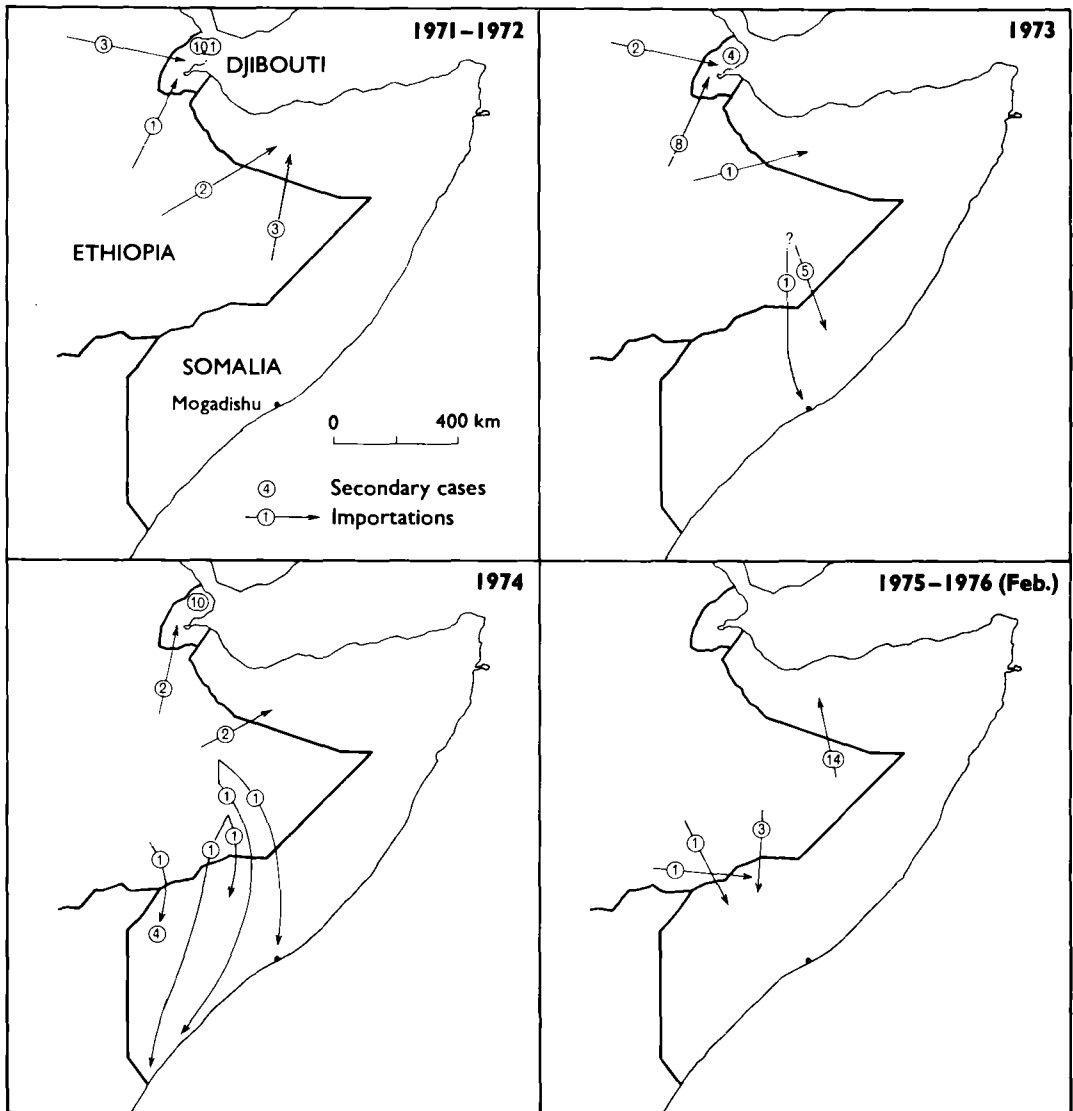


Fig. 22.3. Somalia and Djibouti: reported importations of smallpox, November 1971–February 1976.

been detected within a few days after the onset of rash and no secondary cases were reported.

In 1974 the French Territory of the Afars and the Issas reported another 12 cases, of which 2 were importations, the remainder resulting from the subsequent spread of infection. These were the last known cases in the Territory. Nine of the 11 cases in Somalia that year occurred in the southern part of the country, in parallel with a spread of smallpox in Ethiopia from the northern mountainous plateau into the southern Ogaden desert. For the first and only time Somalia reported 4

secondary cases, all close contacts in a single household.

From January 1975 to the end of February 1976, Somalia reported an additional 19 imported cases, many of which were in refugees in drought-relief camps, but no secondary cases were said to have occurred.

In 1975–1976, the Smallpox Eradication unit at WHO Headquarters became increasingly sceptical that the reports submitted to WHO from Somalia were complete or fully accurate. It seemed unbelievable that, between October 1972 and February 1976, Somalia could so quickly detect and contain



38 importations, with secondary spread occurring on only one occasion, given the paucity of staff and the lack of an organized surveillance programme. No other country had been so successful in the rapid detection and containment of imported cases. Moreover, data submitted to WHO regarding the dates of onset and dates of detection for 30 of the cases indicated that 20 were supposed to have been detected within 3 days after the onset of rash; yet even the most experienced clinicians had difficulty in identifying cases of smallpox so early in the course of the disease. Even in countries with an adequate surveillance system, cases were rarely detected and diagnosed until a week or more after onset. The reports from Somalia seemed too good to be true. The fact that some of the cases were first reported to WHO in Geneva through one of the embassies in Mogadishu but were not notified officially to the Organization until questions had been raised with the Somali government did nothing to increase confidence in the official reports.

Meanwhile, in letters from Henderson to the WHO regional smallpox adviser, copies of which were sent to the WHO smallpox adviser in Somalia, repeated attempts were made to obtain additional information about the status of the programme and the occurrence of cases, and advice was offered as to the methods that should be adopted in the investigation, containment and notification of outbreaks. One letter, dated 23 February 1976, is of special interest in view of subsequent events:

"The occurrence of 4 importations into Somalia during the course of only a few weeks is both surprising and alarming. It suggests indeed that many more may occur and unless due care is taken, I believe there is a very real risk that Somalia might become epidemic... I am very concerned that Somalia should not become an endemic area just at that point when we believe the problem in Ethiopia is coming under control. The memory of Botswana becoming reinfected just at that point when the last cases in South Africa were occurring is too fresh!"

Somalia reported a case in February 1976 but no others were notified during the next 6 months. No reports were received from embassy sources, which had, in the past, been reasonably prompt and accurate in forwarding information. In retrospect, greater efforts should have been made during this period to assess the problem through per-

sonal visits but because of the complex logistics of the final phase of the Intensified Programme in Ethiopia and a range of activities concerned with the certification of eradication in many different countries, the attention of WHO Headquarters and regional smallpox eradication staff was diverted from a country which was apparently free of the disease.

At some point in 1976 smallpox became re-established in Somalia. It could not be determined exactly when this occurred, and information about the cases could not be obtained. Political problems played a role in inhibiting surveillance and the reporting of cases. In the Ethiopian portion of the Ogaden desert, the Western Somalia Liberation Front had been formed in the early 1970s and a liaison office set up in Mogadishu. Training camps were established in Somalia near the border with Ethiopia, and guerrilla forces as well as nomads began moving back and forth across the border in larger numbers. In 1976-1977, guerrilla warfare steadily intensified, eventually culminating in the occupation of the Ethiopian portion of the Ogaden desert by the Somali army in July 1977.

#### THE SMALLPOX OUTBREAK IN MOGADISHU, SEPTEMBER 1976

After the last known case of smallpox occurred in Ethiopia, on 9 August 1976, 7 weeks passed during which no case was reported from anywhere in the world. Specimens from patients with rash and fever in many countries were received daily by the WHO Smallpox Eradication unit in Geneva and dispatched to the reference laboratories in Atlanta and Moscow. None of them showed evidence of poxvirus until 27 September, when the Atlanta reference laboratory reported the presence of poxvirus in 2 specimens from Somalia. Henderson immediately sent the following cable to Mogadishu:

"POXVIRUS PARTICLES PRESENT BOTH SPECIMENS STOP DIAGNOSIS OF SMALLPOX VIRTUALLY CERTAIN STOP URGENT THAT EVERY CONTACT SINCE RASH ONSET BE FOUND AND VACCINATED INCLUDING ALL HOSPITAL PATIENTS STOP SITUATION MOST CRITICAL SINCE NO SMALLPOX SINCE 9 AUGUST IN ETHIOPIA STOP ESSENTIAL DETERMINE WHERE BOTH PATIENTS WERE EACH DAY FROM SEVEN TO SEVENTEEN DAYS BEFORE ONSET STOP SUSPECT BOTH EXPOSED SAME LOCATION

STOP HIDDEN FOCUS MUST BE PRESENT NEAR BORDER OR POSSIBLY ELSEWHERE STOP THIS COULD BE WORLDS LAST FOCUS STOP ESSENTIAL THIS BE FOUND AND CONTAINED URGENTLY STOP ARITA DEPARTING EARLIEST POSSIBLE FLIGHT TO ASSIST."

Arita departed for Somalia forthwith to help in the investigation, and telephone and telex messages between Geneva and Mogadishu began to be exchanged daily.

By the end of September, 5 patients who had experienced the onset of smallpox between 30 August and 23 September had been placed in an isolation hospital in Mogadishu. The first 2 entered hospital on 1 and 14 September respectively; these were the patients from whom the first specimens had been taken. The remaining 3 were hospitalized between 20 and 25 September.

The 5 patients, ranging in age from 16 to 70 years, were questioned repeatedly by Arita and Somali staff in an effort to determine where they might have contracted the infection. They all claimed to have been living in one or the other of two areas in Ethiopia and said that 8–10 days before the onset of illness they had travelled to the Somali border on foot and thence had taken a bus to Mogadishu, a distance of 400 kilometres (Fig. 22.4). Two patients were said to have reported seeing other people with a similar type of rash in areas of Ethiopia from which they said they had come. The two areas thus identified were situated in the desert, one lying south-west of Dimo, the site of the last known outbreak in Ethiopia, and the other further to the south-east, near the border. The reports were plausible. Ethiopian teams had been actively searching for many months throughout most of the Ogaden except in the province in which the two suspect areas were located. There, search operations had been delayed until August 1976 by guerrilla warfare and were somewhat hampered thereafter.

Arita immediately travelled to the Somali–Ethiopian border to contact WHO epidemiologists working in the Ethiopian part of the Ogaden desert. By conveying to them in detail the information obtained from the 5 patients, he hoped that the focus in Ethiopia might be quickly located and contained. An extensive search in Ethiopia was promptly undertaken by a staff which included 8 Ethiopian sanitarians, 5 WHO epidemiologists and 150 search workers using ve-

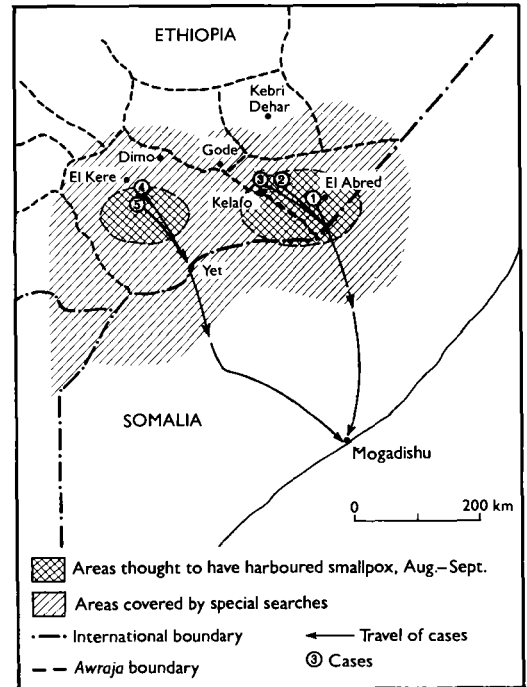


Fig. 22.4. Ethiopia and Somalia: areas thought to have harboured smallpox and areas searched, 1976.

hicles, helicopters and a fixed-wing aircraft. The entire area was searched repeatedly over a 6-month period, but no evidence that smallpox had been present after July 1976 could be found.

A more accurate, although still incomplete, account of what had actually happened did not become available for many months, indeed years. The search for a source of infection in Ethiopia had, in fact, been futile because, by then, endemic smallpox had already become established in Somalia, a fact known both to Somali staff and to the WHO smallpox adviser.

For Somalia at that time to admit to the existence of cases was awkward for both the political leaders and the national health staff. With tension mounting between Somalia and Ethiopia, the periodic meetings of national smallpox eradication staff from the two countries at border posts had become increasingly acrimonious, as each expressed doubts about the quality of the other's programme. In September, Somali programme staff simply did not believe that Ethiopia had become smallpox-free. A letter dated 11 November 1976 from the WHO representative in Somalia to the Director of the WHO Re-

gional Office for the Eastern Mediterranean, reflected the prevailing emotional climate:

“Government authorities have resented the fact that Ethiopia has been declared free from smallpox, almost at the same time as Somalia was declared as the last known infected focus in the world. This is viewed as some kind of international conspiracy and the influx of WHO smallpox experts as adverse publicity for Somalia.”

Reports later received by WHO field staff indicated that other suspected cases of smallpox had been hospitalized as early as June 1976, and less definite information suggested that there had been other unreported cases, indeed sizeable outbreaks, earlier in the year. Somali staff had hoped that containment could be achieved without publicizing the outbreaks, thus avoiding the stigma of Somalia's being identified as the last infected country. As in other countries that sought to contain outbreaks while suppressing information about their existence, the outcome was disastrous.

With smallpox known to have been prevalent in Somalia for many months, it is curious that a decision was made, on 14 September 1976, to obtain specimens from 2 patients and to submit them to WHO for laboratory examination. Three events appear to have been responsible: first, the receipt of a letter from Henderson informing Somali programme staff about a projected news conference to announce that the world's last case of smallpox might now have occurred; secondly, the arrival in Mogadishu of Dr Bert van Ramshorst, a WHO smallpox adviser with the Ethiopian programme who had been seized by the Somali border police; and thirdly, the first occurrence of smallpox cases in the capital city. Henderson's letter, dated 30 August, was addressed to the regional smallpox adviser at the WHO Regional Office for the Eastern Mediterranean in Alexandria, and a copy was sent to Mogadishu:

“As the days go by, it seems increasingly possible that the Bale [Ethiopia] case with onset on 9 August 1976 could be the world's last case of smallpox ... my guess would be that it will be difficult to have reasonable confidence about this until late October. When we do reach [that] point, the Director-General would like to make a major announcement with maximum possible news coverage ... Such an announcement conceivably could be made jointly with the Secretary-General at the [United Nations] General Assembly ... one would not wish to make an announcement that there are

no known smallpox foci without having reasonable confidence that another outbreak would not emerge one or two weeks later. We know, of course, that we cannot have full confidence until at least two years have elapsed. . . [but] the provisional announcement, which would be highly newsworthy, could come, I believe, as early as late October.”

That the programme in Ethiopia might be better than Somali officials had believed was confirmed by Dr van Ramshorst. The report of the WHO smallpox adviser in Somalia, dated 16 September 1976, to the regional director is of interest:

“Dr van Ramshorst crossed into the Somali territory on the afternoon of 8 September 1976 near Abu Duaaq. He was detained by border police and handed over to security authorities who brought him to Mogadishu the same night. He was in Mogadishu from 9 to 13 September before RR UNDP [Resident Representative, United Nations Development Programme] was informed about his detention ... During Dr van Ramshorst's stay in Mogadishu, we have made some useful exchange of information ... I was able to arrange a meeting with the Minister. The Minister was favourably impressed with the zeal and enthusiasm demonstrated by Dr van Ramshorst in the pursuance of the objectives of the programme ... for the first time the Somali health authorities have now appreciated the effort that is being put into the programme on the other side of the border.”

The possibility that Ethiopia might be free of smallpox could no longer be discounted. The discovery of smallpox cases in Somalia after an announcement by the Director-General of WHO that smallpox appeared to have been eradicated would have been most embarrassing. The concealment of the outbreak in Somalia could continue no longer.

### Initial Containment Measures

Somali programme teams assisted by 2 WHO advisers endeavoured to find the source of infection of the 5 cases and, still believing that it was in Ethiopia or along the Somali side of the border, undertook a 3-day search in border areas in Somalia, from 3 to 6 October 1976, but discovered no cases. They reported that 80–90% of the villagers whom they saw had vaccination scars. A more intensive search was deemed necessary, and 32 staff and a WHO epidemiologist, provided with 4 vehicles, were assigned to the task. The



WHO / J. MAGEE

**Plate 22.3.** The WHO smallpox recognition card was abundantly used by the Somali search teams inquiring about possible cases of smallpox.

search began on 9 October and was completed on 2 November. It ranged over an area about 500 kilometres long by 100 kilometres wide but revealed no cases. In all, some 12 000 persons were seen in approximately 30 different villages; 74% had vaccination scars. Of 1200 nomads seen at watering-places, 68% had previously been vaccinated. All denied having seen cases of smallpox for 2 years or more.

Meanwhile, house-to-house night-time searches were conducted in Mogadishu on 18 and 25 October (Fig. 22.5) utilizing 60 programme staff in the northern part of the city, in which the cases had been discovered, and 2000 other staff, including police, to search the other areas.

Cases continued to be admitted to hospital and by the end of October, 20 had been officially reported (Fig. 22.6). The sources of infection of only 10 cases could be documented. Careful investigation, search and vaccination in and immediately around the dwelling of each patient were urgently required. The WHO epidemiologists were skilled in this approach but were not permitted to accompany Somali health staff in visits to houses in the city or in questioning

patients at the hospital. Containment was less than optimum because vaccination was conducted only during the daylight hours, when most adults were away from home. To help in detecting cases, WHO staff proposed that a reward should be offered to anyone reporting a case, but this proposal was not accepted.

The persistence of cases led to a city-wide vaccination campaign extending from 28 October to 15 November, and this was followed on 16 November by yet another night search. Only 9 cases of smallpox were reported in November, and for 8 of them the source of infection could be clearly identified. It was hoped that the outbreak might be coming to an end but, as it was later learned, the notification of cases continued to be suppressed. Smallpox patients were then being admitted to two different parts of the hospital, one in which cases were officially reported and another in which they were not. Officially 34 cases were registered as having been hospitalized in 1976; the unofficial hospital register, not made available until 1978, showed the actual number to have been more than 500.

The continuing failure to discover the source of infection of what was thought to

have been the first 5 importations into Mogadishu was most disturbing at the time. It was claimed that the foci had been in Ethiopia but no evidence of smallpox had been found there since early August. The most reasonable explanation, seemingly, was that the cases had occurred among nomadic groups which had moved elsewhere before the search. With the passage of time, it was thought that such groups might well have penetrated far into Somalia. Search of the border regions in

Somalia had failed to detect cases and none had been reported subsequently by 5 Somali mobile teams then working outside Mogadishu. However, no systematic search had yet been conducted in the 5 other administrative regions of southern Somalia. Accordingly, WHO proposed to the health authorities that such a search should be undertaken, with support from 2 additional experienced WHO epidemiologists who had recently arrived in Mogadishu. A plan was elaborated by Somali and WHO staff which called on WHO to provide 10 more vehicles, to be obtained through emergency local purchase in Kenya, and to cover the necessary local costs. An expenditure of US\$350 000 was envisaged. On 11 November the Director-General of WHO, in a telegram to the Minister of Health, approved the expenditure, ending on the encouraging note that it was to be hoped that the concerted effort over the next 2 months would be sufficiently intensive to identify clearly and to interrupt the links in the chain of transmission. If this proved successful and it could be asserted with confidence that no hidden foci existed, he would plan to make a formal announcement at the January 1977 meeting of the WHO Executive Board that the world's last smallpox foci had been eliminated. The Minister, in his reply three days later, affirmed the government's commitment: "... we shall spare no efforts to mobilize all available resources. . .", but he pointed out that Somalia would not have had the problem if Ethiopia

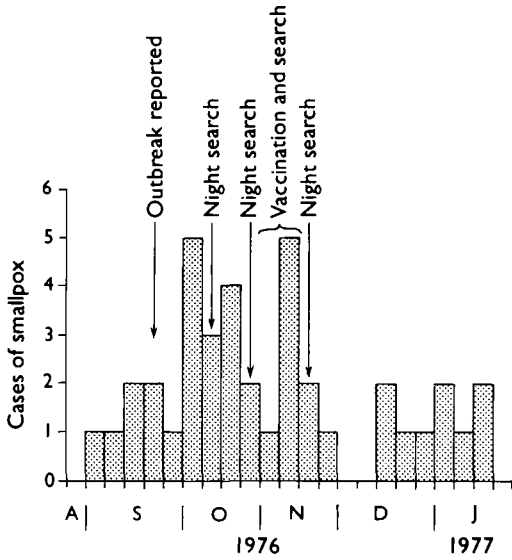


Fig. 22.5. Mogadishu: number of reported cases of smallpox, by week of onset, September 1976–January 1977.

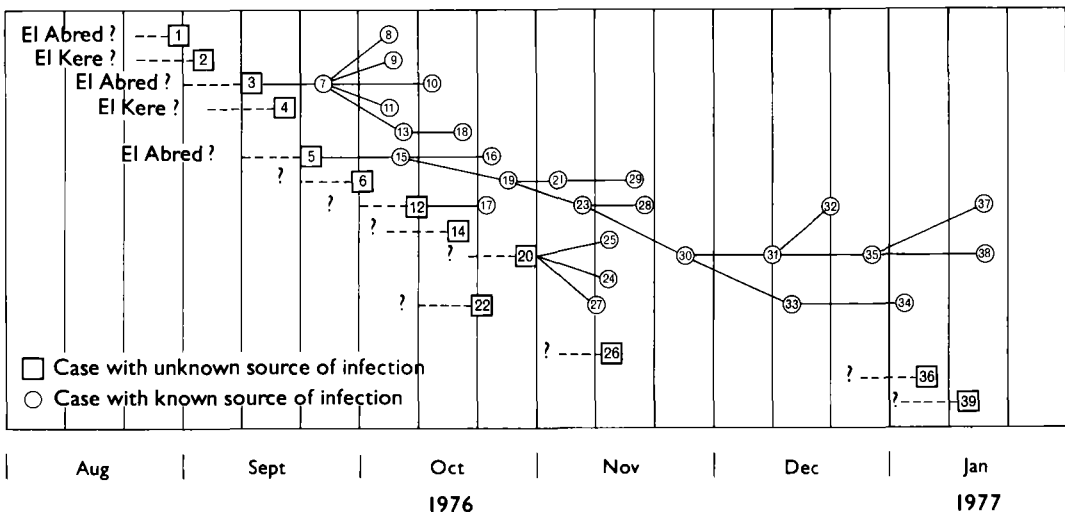


Fig. 22.6. Mogadishu: ostensible chain of transmission of smallpox, September 1976–January 1977.

had acted prudently; he requested that US\$2 000 000 should be made available.

Permission to search in the 5 regions was not, however, forthcoming. It was therefore proposed that Ladnyi, at that time an Assistant Director-General of WHO, should visit Somalia early in December to discuss the problem. With Ladnyi's impending visit, permission was given for the WHO epidemiologists to make 1-day visits to each of the regions in the south; later, on 15 December, they were allowed to make such visits in the northern regions. Little could be done in the way of search during such brief visits but at least the WHO staff were thus enabled to make personal contact with the regional health authorities and to discuss the need for case detection—though everyone they spoke to denied that smallpox was present.

As a consequence of Ladnyi's visit, permission was given for WHO staff to visit the hospital regularly with Somali counterparts and to undertake investigations throughout the city. Thereafter, the transmission of smallpox in Mogadishu subsided rapidly. However, despite the visit, WHO staff were not allowed to participate in a search in other parts of the country. The Minister insisted that not less than US\$2 000 000 would have to be provided before a search could begin. WHO staff considered this to be an exorbitant sum; moreover, it far exceeded the amount of money WHO then had at its disposal for smallpox eradication.

Although a national search for cases could not be undertaken, the situation appeared to improve from January to mid-March 1977. In Mogadishu, the vaccination of contacts and close neighbours of patients began to be conducted at night as well as during the day, and on 17 January 1977, the last case was reported. Repeated night searches of the entire city in January and again in February failed to detect further cases. Sanction for an organized national search was finally given on 21 January, during the fifty-ninth session of the WHO Executive Board, when the Director-General, the Director of the WHO Regional Office for the Eastern Mediterranean, Ladnyi and staff of the Smallpox Eradication unit held a private meeting with a member of the Board from Somalia. He agreed that 6 more experienced epidemiologists should be recruited immediately by WHO to serve as advisers in each of 6 regional administrative areas in southern

Somalia and to help in conducting an intensive search commencing late in March. WHO agreed to provide the proposed US\$350 000 in additional funds to cover expenditure on transport and supplies and local costs. It was also agreed that a special meeting would be convened in March to coordinate what was hoped would be final search activities throughout Ethiopia, Kenya, Somalia and the Sudan to confirm that eradication had been achieved.

The development of the programme in Somalia at this time was greatly facilitated by the appointment in February of a new national Smallpox Eradication Programme Manager for Somalia, the knowledgeable Dr Abdullahi Deria, who had just returned to the country from a course of study in tropical medicine. With Dr Ehsan Shafa, of the WHO Smallpox Eradication unit, he immediately set to work to draw up a search plan. So far as WHO staff then knew, only 39 cases of smallpox had been admitted to the hospital in Mogadishu, and although everyone was aware that some additional cases had occurred, it seemed unlikely that a national search would turn up large numbers of outbreaks. To facilitate the detection of cases, Dr Deria and Dr Shafa decided that, beginning in March, a reward of 200 Somali shillings (US\$32) would be offered to anyone reporting a case.



WHO / E. SHAFI

**Plate 22.4.** This man reported a case that proved to be smallpox and received the reward of 200 Somali shillings.

A disturbing event during this period was the discovery on 30 January 1977 of an outbreak in Kenya. The first case had occurred on 26 December 1976 in a Kenyan village near the Somali border, introduced by a young man returning from a religious school in Mogadishu. Shortly after becoming ill, he had returned to Somalia but no one knew where he had gone. Meanwhile, he had infected 4 other persons—his sister and her 3 children. Possible areas in and around Mogadishu were searched, but to no avail. In February, when it was learned that he might have gone to a town 80 kilometres north of the city, a Somali-WHO team investigated this area, but again, neither the patient nor any evidence of smallpox was found. It is not known what relationship, if any, the index case bore to outbreaks which were found subsequently. In part, this was because the government asked that when the 6-month national search was undertaken, cases and outbreaks which had occurred previously should not be documented.

#### **First Coordination Meeting, March 1977**

To coordinate the forthcoming inter-country search programme, Arita, with assistance from Dr Wilfred Koinange, Director of Health Services of Kenya, convened a meeting in Nairobi on 15 March 1977 of health staff from Ethiopia, Kenya, Somalia, and the Sudan. At that time, more than 2 months had elapsed since a case had last been notified. Each of the delegates reported on the nature and extent of his country's surveillance programme and expressed hope that smallpox transmission had been interrupted. Dr A. I. Idris from the Sudan, who was still sceptical, pointed out that, however satisfactory surveillance appeared to be, no link had been discovered between the outbreak in Kenya and the last outbreaks in Mogadishu. To him this indicated that other undetected cases must have occurred, and until the chains of transmission had been clearly identified efforts could not be relaxed. It was a prophetic observation.

The participants all agreed to undertake similar types of search programmes over the succeeding 6 months, involving house-to-house searches for cases and special searches among nomads, the collection of specimens from cases both of chickenpox and of suspected smallpox, and notification through

WHO Headquarters in Geneva of rumours of outbreaks in other countries. Priority would be given to the Ogaden desert area. In Ethiopia a thorough search of the area would be carried out every 4-6 weeks employing 224 search workers, 16 supervisors and 4 WHO epidemiologists, provided with 18 vehicles and 2 helicopters. Kenya planned to utilize 320 public health staff and 64 locally recruited workers with 16 vehicles. In Somalia 300 search workers, 10 Somali supervisors and 7 WHO advisers with 19 vehicles would be deployed. The group agreed to meet again 6 months later to assess the situation and to decide on future action. Staff from Djibouti would also be invited to that meeting to ensure full coordination of all activities throughout the entire area.

#### **EPIDEMIC SMALLPOX IN SOMALIA, MARCH 1977**

Shortly after the Somali smallpox eradication staff returned from the Nairobi meeting, Dr Deria reported to the WHO advisers that 2 cases of smallpox had been discovered in Bakool Region, near the Ethiopian border—the first outbreak to be officially reported outside Mogadishu. A joint Somali-WHO team visited the area and was told that the first patient had been in an Ethiopian village 2 weeks earlier. Ethiopia was immediately notified but investigation revealed no evidence of smallpox in the designated village either at that time or in the past. A few days later, another case was reported from a village much further south but no source of infection could be identified. On 24 March, yet another case was reported. By mid-April there were 29 cases, and more were being discovered daily as the search programme was gradually intensified. Villagers revealed the disturbing information that smallpox outbreaks had occurred outside Mogadishu in 1976, but these had never been notified. Indeed, an outbreak of 17 cases in November and December 1976 was found to have been verified by both the regional medical officer and the WHO smallpox adviser but not officially reported.

Meanwhile, experienced WHO staff members working in India, including Dr M. K. Al Aghbari, Dr W. Hardjotanojo and Mr R. J. Hatfield, were mobilized and sent to Mogadishu in March. However, they were too few to cope with the situation. In April, Arita

### A Unique Approach to Case Detection

In March 1977, the suppression of information and the concealment of cases continued to be widespread despite the new instructions of the Ministry of Health. One of the first to break this barrier was an ingenious Sudanese sanitarian, Mr Abdul Gadir El Sid, who was serving as a WHO consultant. On entering a village for the purpose of investigating suspected cases, he saw several persons with facial pockmarks suggestive of recent smallpox but was confronted with unanimous denial by the villagers that cases had recently occurred. Taking over the vehicle from his driver, he deliberately drove it into deep mud. A large crowd came from the village to help to extricate the car, and among them were 4 persons with active smallpox.

hurriedly flew from Geneva to Mogadishu, and with the agreement of the government immediately took measures to recruit 8 additional WHO epidemiologists to complement the 7 provided by the Organization who were already working there. It was the first step towards a greatly intensified effort (Table 22.5). In April alone, 157 cases were documented in more than 40 outbreaks (Table 22.6). However, the discovery of cases and the containment of outbreaks among

nomads were proving to be extremely difficult. The encampments were often hard to locate in the high scrub; the groups were small, averaging no more than 30-40 persons; and less than 25% remained in a given location for more than a week. Meanwhile, search in Ethiopia was increasingly hampered by guerrilla warfare and border hostilities. The final goal of global smallpox eradication, which only weeks before had seemed imminent, was once again in doubt.

Table 22.5. Somalia: number of field staff, by category and by month, 1977

Month	Epidemiologists		Team leaders	Supervisors	Surveillance agents	Others (incl. watchguards)	Total
	WHO	National					
March	4	8	-	10	110	6	138
April	7	10	6	20	290	48	381
May	15	13	36	70	1 315	245	1 694
June	18	22	54	113	2 509	585	3 301
July	20	24	50	146	2 138	189	2 567
August	20	27	55	148	2 191	110	2 551
September	18	27	47	153	1 755	81	2 081
October	19	27	73	213	1 298	46	1 676
November	21	28	71	240	1 398	32	1 790
December	20	20	71	250	1 010	0	1 371

Table 22.6. Somalia: reported smallpox cases by month and region, 1977

Region <sup>a</sup>	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Bakool	0	0	2	12	116	246	122	19	1	0	0	0	518
Bay	0	0	1	44	189	836	410	129	34	3	0	0	1 646
Galgadud	0	0	0	3	2	0	0	0	0	0	0	0	5
Gedo	0	0	0	0	3	110	70	21	12	10	2	0	228
Hiran	0	0	0	43	36	7	10	1	0	0	0	0	97
Lower Juba	0	0	0	1	2	3	0	0	0	0	0	0	6
Middle Juba	0	0	0	19	27	11	3	3	22	3	0	0	88
Mogadishu	5	0	0	2	1	1	1	0	0	0	0	0	10
Lower Shabelli	0	0	0	15	62	92	1	37	49	11	1	0	268
Middle Shabelli	0	0	0	18	198	82	55	9	0	0	0	0	362
Togdheer	0	0	0	0	0	0	0	1	0	0	0	0	1
Total	5	0	3	157	636	1 388	672	220	118	27	3 <sup>b</sup>	0	3 229

<sup>a</sup> No cases were reported in Bari, Galbeed, Mudug, Nugal or Sanaag Regions.

<sup>b</sup> Although reported in November, all 3 cases experienced the onset of illness before 27 October.



### The Emergency Programme, May 1977

In May 1977, delegates attending the Thirtieth World Health Assembly heard reports on the smallpox situation in Ethiopia, Kenya and Somalia and expressed considerable apprehension. The number of cases in Somalia was increasing each week, and with hostilities between Ethiopia and Somalia escalating, the prospects for control, let alone eradication, were not encouraging. Not only were Kenya and Ethiopia at risk of reinfection, but in the autumn, during the annual pilgrimage to Mecca, other countries would be at similar risk. Since variola minor—the predominant form—was clinically so mild, concern was expressed that pilgrims might travel to Mecca even though they were ill, and while there would spread it to other pilgrims, coming from Asia and other parts of Africa. The Health Assembly accordingly adopted a resolution (WHA30.52), which stated:

“Recognizing that, while smallpox is now reported from only a single country in north-eastern Africa, continuing smallpox transmission in that area represents considerable danger for adjacent countries owing to nomadic population movements. . .

“REQUESTS all Member States to continue to give financial support to the smallpox eradication programme, either through the Special Account for Smallpox Eradication of the Voluntary Fund for Health Promotion or on a bilateral basis, in order that the last known smallpox foci can be eliminated as rapidly as possible. . .

“URGES all governments to make full use of the expertise of international and national personnel with experience in smallpox surveillance and in containment measures as may be required effectively to interrupt transmission of the disease. . .”

Additional resources were urgently required but voluntary contributions from governments would inevitably take some time to become available, and WHO's funds for smallpox eradication were running low. Moreover, at least a year would elapse before vitally needed vehicles could be delivered from the factory. On 16 May WHO telephoned the Office of the United Nations Disaster Relief Co-ordinator (UNDRO) in Geneva to seek help. UNDRO indicated that it would be willing to make a world-wide emergency appeal if Somalia would officially declare the epidemic a disaster requiring the expenditure of resources beyond the country's means (WHO/SE/77.99, Hauge & Wickett).

The agreement of the United Nations Development Programme's Resident Representative in Somalia that the resources requested were appropriate to the emergency was also necessary. A telex was immediately sent to Mogadishu, and on 18 May the government officially declared the situation to be a disaster and appealed for assistance. After a detailed list of urgently needed supplies had been prepared, UNDRO endorsed the request, and on 27 May issued an appeal to possible donors. Within the week, cash donations and contributions in kind amounting to some US\$400 000 were received from Canada, the Netherlands, Norway, Sweden, the United Kingdom and the League of Red Cross and Red Crescent Societies. The total amount provided eventually reached US\$459 750. In addition, Dr William Foege, Director of the United States Center for Disease Control, who was attending the Thirtieth World Health Assembly, offered to assign 5 epidemiologists forthwith to provide assistance over the following 3 months.

To procure and deliver 16 vehicles and tons of camping equipment, transceivers and other supplies, such as tires and spare parts, posed another problem. Two airlines which normally provided a service to Somalia suspended shipments in May because of fear of the outbreak of war. An emergency airlift was required and this was provided by Canada, Sweden and the United Kingdom. Vehicles which had already been delivered to UNICEF for an emergency reserve, plus others in the possession of the United Kingdom government and the League of Red Cross and Red Crescent Societies, were earmarked for use. Procurement and supply staff from UNDRO and WHO, working with their counterparts in various countries, hurriedly assembled materials, and in 4 special flights over the period 4–14 June the whole consignment was delivered. On 8 June the 5 epidemiologists from the USA arrived, and on 9 June the French government delivered by air 3 teams with 2 vehicles and supplies. Four persons from OXFAM, the British private charitable organization, arrived later that month. By mid-June more than 3000 national staff, primarily locally recruited workers, assisted by 23 epidemiologists working for WHO and 52 vehicles, were in the field.

Ježek and Dr B. Kříž had arrived in Mogadishu on 10 May. The former assumed the senior leadership role for WHO and the latter took immediate responsibility for the

emergency operation in Bay Region, the most affected area. On 21 May, the Somali government agreed on a detailed emergency programme to be conducted throughout the 10 regions in the south (later, as additional resources became available, the programme was extended to the northern regions). Sixteen health assistants were trained and designated as regional epidemiologists, operational offices were established in each affected district and all possible health staff were assigned on an emergency basis to search systematically for cases and to vaccinate all persons within a radius of 5–10 kilometres from the site of an outbreak. One or more WHO epidemiologists worked in each region. Regional party secretaries worked with them to mobilize party workers and assistance was offered by the Somali Women's Democratic Organization, the Somali Workers' Organization, and the Somali Youth League.

In Mogadishu the central programme office was reorganized and reinforced with a WHO administrative officer from the Bangladesh programme, a transport and supply officer and, later, a finance officer. In April, the publication of a weekly surveillance report began. Training programmes, launched in May in Mogadishu, were conducted thereafter in every region. Monthly meetings of all senior staff throughout Somalia began in June; they were attended by the Minister of Health and by Arita, who travelled every month from

Geneva for the purpose.

Operations were initially concentrated in southern Somalia. Most of the outbreaks were centred in the area between the Juba and Shabelli rivers, the most fertile and heavily populated area in the country. The area was criss-crossed by watercourses which flowed briefly during the seasonal rains, only occasionally reaching the sea. The rains, from March to June, were heavy in 1977, creating large marshy areas and washing away roads. Searching the areas was difficult because of the lack of maps and the fact that half the population consisted of nomadic peoples who moved frequently over long distances through the dense scrub. Work in the field was further complicated by the need to provide tents to accommodate all but the locally hired nomads and to obtain food to supplement the limited available supplies of milk and goat meat as well as jerrycans for drinking-water. Moreover, because of the prevalence of wild animals, at least 2 persons had to travel together and construct a thorn barricade around their campsite each night. Communication between personnel in the field and the staff in Mogadishu was difficult at best, a problem which could have partly been resolved by employing transceivers. However, with the invasion of the Ethiopian part of the Ogaden desert by the Somali army only a few months away, the use of transceivers was forbidden. Except for this



C. WILSON, 1978



J. F. WICKETT, 1977

**Plate 22.5.** **A:** Rodney J. Hatfield (b. 1949), a WHO administrative officer, established critically needed motor vehicle maintenance and repair workshops in Somalia and Bangladesh. **B:** Bohumír Kříž (b. 1936), a veteran WHO epidemiologist from the smallpox eradication programmes in Asia, assumed responsibility in May 1977 for emergency operations in Bay Region, the epicentre of the smallpox epidemic in Somalia.

### Vehicle Maintenance in Somalia

The availability of serviceable vehicles was especially vital in Somalia, in which the population was sparse and distances were great. When the emergency programme began in May, only 19 vehicles were in use, 11 of which were more than 5 years old. By July, a fleet of 50 4-wheel-drive vehicles was in operation. To oversee their maintenance and repair, Mr Rodney Hatfield, a veteran of smallpox eradication programmes in India and Bangladesh, was brought to Mogadishu. A valuable paper (WHO/SE/80.155, Hatfield) documents the problems of transport operation and the solutions adopted.

An initial difficulty consisted in obtaining spare parts. This was partially alleviated when substantial stocks, consigned to WHO programmes, were found in the Mogadishu customs office; some had been left in the stores for as long as 3 years. Additional orders were placed for delivery by sea and air. They included special 10-ply truck tires which were required because of the thorn scrub and the frequency of punctures.

Until February 1978, commercial garages had repaired and maintained vehicles for a negotiated price. The expenses were reduced when a WHO workshop was established in February, but even then it proved more costly than had been expected to keep the vehicles on the road. Mr Hatfield found that the servicing of a vehicle cost US\$70 per 1000 kilometres for the first 48 000 kilometres and US\$120 per 1000 kilometres for the next 42 000 kilometres. Over 100 000 kilometres, the total costs of labour and spare parts began to approach the cost of the vehicle. By the time vehicles had logged 150 000 kilometres, the cost of maintenance and repair was prohibitively high, making them unacceptable for unrestricted service.

restriction, government staff supported the programme, permitted travel to any area and made adequate supplies of petrol available.

A complete search was planned to take place twice a month from May to December in all high-incidence areas, once a month in low-incidence areas, and every other month in areas thought to be free of smallpox. The search programme required ingenuity in planning if all or even most nomadic groups were to be found. Gradually, a routine was established which required, first, the preparation of a sketch-map so that specific areas with landmarks could be identified and assigned to each search group. In settled areas, conventional approaches were adopted in which workers displayed the WHO smallpox recognition card and asked about possible cases at each house and in schools, markets, health units and tea-shops. In such areas, one worker could visit from 50 to 100 houses per day. For the nomadic areas, other methods were required. The initial, and simplest, approach consisted in assigning to each area of 10–15 square kilometres a literate health worker from the region and a nomad familiar with the surroundings. By inquiring in settled villages and by sighting smoke from morning camp-fires and finding the fresh faeces of domestic animals and other tracking signs,

they endeavoured to locate each nomadic group within the area. Supervision of this type of search proved difficult, however, and even for nomads who knew the area, it was not easy to locate the groups because of the high scrub and the unpredictable nomadic movements. A second approach, termed the “drop and move” method (Fig. 22.7), consisted in transporting 2-person teams to points along a road and instructing them to identify and question all groups of nomads encountered during a journey of 50–150 kilometres on foot across the desert to a known landmark. This method provided greater certainty that a geographical area had been covered, but the workers were almost as difficult to supervise. As the programme progressed, and larger numbers of staff became available, a technique called the “criss-cross” search evolved. This required teams to move each day from one landmark to another across a defined area during a 3–5-day period. The search was designed in such a way that the teams would cross each other's paths at different times. Landmark check-points (usually villages) were visited by more than one team on different days, thus permitting each team to check on the work of others.

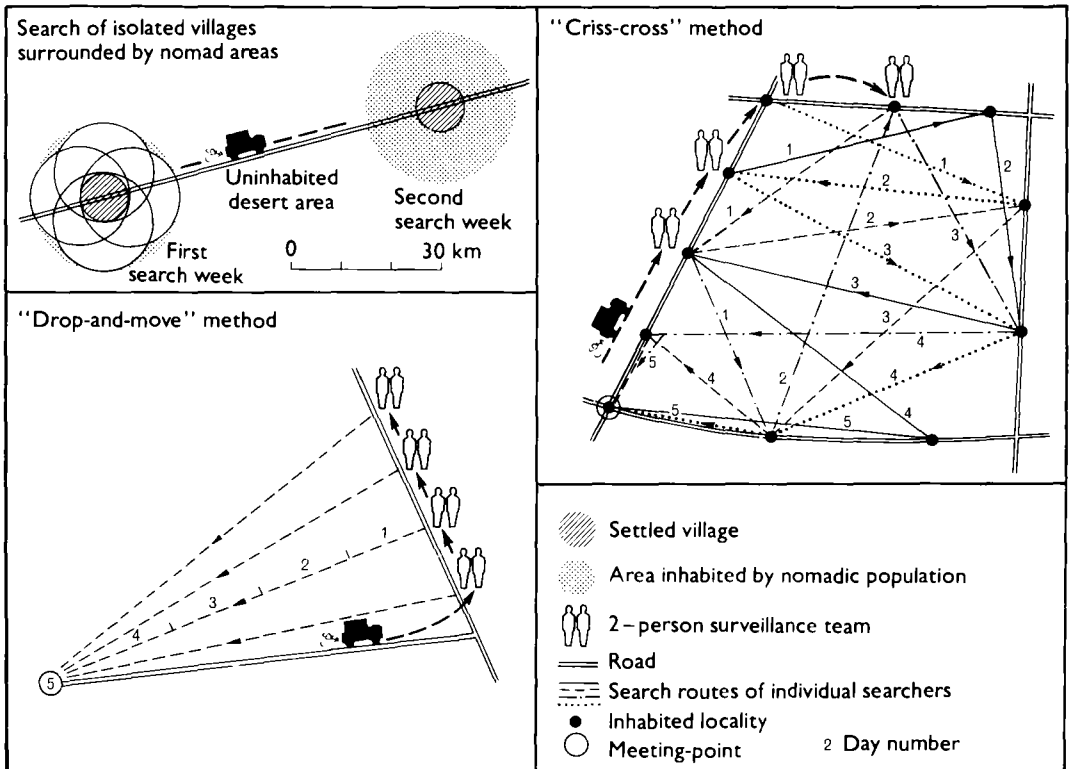
Vaccinial immunity among nomads was often found to be as low as 10%; therefore, to



BY COURTESY OF V. ZIKMUND, 1976

**Plate 22.6.** Vladimir Zikmund (b. 1925) worked as a WHO epidemiologist in many southern Indian states from 1971 to 1975 before joining the emergency effort in Somalia.

diminish the probability of continuing transmission should smallpox cases recur, vaccination was initially offered by all search teams. In most areas, it was readily accepted, but in others the nomads fled into the bush, thus precluding their being examined for possible smallpox. For this reason vaccination was suspended in some areas except when outbreaks were found. Among both Somali and WHO staff, the efficacy of combining vaccination with the search for cases was frequently debated, and the practice differed somewhat from area to area. It soon became apparent, however, that the epidemiology of variola minor in Somalia was different from that observed in other parts of the world and differed significantly from that of variola major. Outbreaks in small groups did not terminate quickly but, rather, persisted for long periods among comparatively small nomadic bands. On 5 occasions, smallpox was found to have persisted for 3 months or longer in groups of less than 100 persons



**Fig. 22.7.** Somalia: smallpox search methods. Surveillance workers were expected to walk 15–20 kilometres a day.

Table 22.7. Somalia: prolonged transmission of smallpox among groups of nomads

Outbreak	Population of nomadic group	Number of cases	Number of days between first and last cases
1	55	14	163
2	44	19	155
3 <sup>a</sup>	35	24	152
4 <sup>a</sup>	98	20	106
5	75	23	95

<sup>a</sup> Outbreaks 3 and 4 were interrupted by containment.

(Table 22.7). Because of the difficulties of locating such groups and keeping them under surveillance, the decision was made to vaccinate wherever a search was conducted so as to increase the overall levels of vaccinal immunity. This, it was hoped, might serve to retard or stop transmission more quickly. Vaccination scar surveys performed in the south showed levels of vaccinal immunity of 70% or higher by August 1977 and 90% or higher by September. Only 141 days after the emergency programme began, the last known case of smallpox occurred.

Outbreak-containment practices in settled areas were similar to those which had evolved during the programme in Asia. The patient was isolated, a list of village residents was

compiled and all were vaccinated, and a team was posted to the village until the patient recovered in order to vaccinate visitors and to conduct continuing search and vaccination within a radius of 5–10 kilometres. Major differences of opinion arose, however, among both Somali and WHO staff as to where the patient should be isolated. Traditionally, patients in Somalia had been isolated in camps situated, in some instances, as far as 100 kilometres from their homes. Adult patients and their families, especially among the nomads, often objected to this practice; in consequence, cases went unreported and sometimes were hidden from search teams. During the early phases of the emergency programme, few of the isolation camps were well organized or provided adequate food or shelter. Accordingly, many patients who suffered from the mild illness characteristic of variola minor decided to leave the camps before recovery and, because they were inadequately guarded, did so with ease. Moreover, procedures to ensure the vaccination of family members who accompanied patients with smallpox or other skin infections were lax. As a result, the isolation camps, like hospitals in other countries, initially played an important role in disseminating smallpox.

### Observations on Surveillance among Nomads

Dr B. Kříž, an epidemiologist from Czechoslovakia who had worked previously in Asia, made a number of interesting observations regarding surveillance techniques among nomads.

In bush areas in which nomads were semi-permanently settled, he discovered that they were usually easily located. Inhabitants of the nearest villages were generally well informed as to where and how many nomads were settled nearby. Village headmen, members of the village political committee and shopkeepers could provide this information. Because even relatively small areas of the bush—say, 10 square kilometres—had their own names, the nomads could be located if a map were prepared which showed the names of such places, water-holes, tall trees and roads.

In areas only temporarily inhabited during the dry season, the problem was different because the nomads were constantly on the move and there were few settled inhabitants. In places where water-holes were scarce, a well-motivated “government water-hole watchguard” was extremely useful. In some regions, however, water-holes were so numerous that water-hole surveillance was neither practicable nor useful. Market searches were also of limited value. Frequently, only female nomads visited the market but they were not easy to converse with and usually avoided giving information. In such areas, the so-called “criss-cross” technique of search (see Fig. 22.7) was essential.

To monitor nomadic movement and surveillance, it was found useful to give to the headman of a group a small WHO smallpox recognition card with the name of the place and the date when the card was given. This was widely accepted, and as its value in assessing search activities became apparent a specially designed durable card was prepared.

The alternative to isolating the patient in a special camp was to isolate him in his house, as had been the practice in Asia. In settled areas, this could be done using vaccinators as watchguards to ensure that the patient remained in the house and that all visitors were vaccinated. The task was much more difficult with nomads, who moved their camps every week or two. Moreover, the custom of visiting the sick contributed to the spread of smallpox. Hence, a special study was conducted in nomadic areas to determine what procedure would be the most culturally acceptable (Foster & Deria, 1983). It was decided that the best solution would be to construct a *baro*—a circular barrier of thorn bushes normally used to hold and protect animals at night. Accordingly, in most areas patients were isolated in a *baro*, 10–20 metres in diameter, containing a lean-to shelter and latrine. From funds provided by WHO, each patient was given 5 Somali shillings (US\$0.80) a day as an incentive to remain in the shelter, and 2–4 members of the nomadic group were paid 5 Somali shillings a day to build the *baro*, to enforce isolation, to provide food and water

and to vaccinate those at the encampment. When the nomads decided to move, a surveillance agent travelled with them in order to detect any additional cases and to ensure that any persons with whom they came in contact were vaccinated.

In some areas, isolation camps continued to be used but conditions in them were improved and supervision was strengthened. Patients were found to cooperate more readily if, on discharge, they were given new clothes—a practical public health measure because it permitted the old clothes to be burned, thus averting the risk of the spread of infection by fomites. Moreover, as one observer noted, the new clothes served as “a moving poster” which promoted the use of the isolation camps.

#### The Epidemic, March to October 1977

The epidemic, first recognized in mid-March, rose to a peak in June (Fig. 22.8). Although reports had been suppressed until March, it did not appear that the smallpox



T. S. JONES

**Plate 22.7.** A Somali guards the entrance to a hut in which a nomad with smallpox is isolated. These huts were built away from the encampments and enclosed by a thorn-bush barrier to keep out wild animals as well as visitors.

incidence in January and February had been high. The rise in incidence coincided with the beginning of the March rains, when nomadic movement greatly increased. A 15-day religious festival in March held in southern Bakool Region, which was attended by more than 15 000 persons, contributed to the spread. This area, with the adjacent Baidoa

District in Bay Region, became the epicentre of the epidemic (Fig. 22.9) and 4% of the population contracted smallpox. The number of reported cases increased sharply in April and May, when the information spread rapidly that a reward was being given to anyone reporting an outbreak of which the authorities were unaware. In many areas, two-thirds of the outbreaks came to light in this manner, the remainder being discovered by teams during search or being reported by government officials.

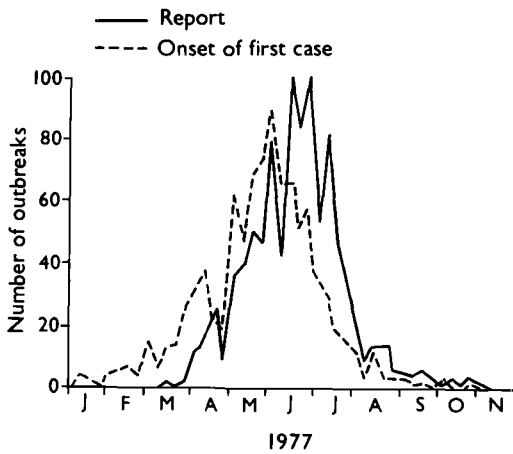


Fig. 22.8. Somalia: number of newly detected outbreaks, by week of report and by week in which the first case had onset of rash.

The number of new outbreaks occurring during April and May far exceeded the capacity of the few advisers and an as yet untrained staff to cope with them. With the declaration of the emergency in May and the influx of personnel and resources in June, the epidemic began to come rapidly under control. As political leaders and numerous volunteers actively participated, the interval between the onset of the first case and the detection of outbreaks decreased, as did the interval between the first and last cases in the outbreaks (Table 22.8). The outbreaks were more effectively contained, and, in consequence, became smaller (Table 22.9) and

Table 22.8. Somalia: interval between onset of the first and last cases in the same outbreak, by month of onset, 1977

Month of onset of outbreaks	Number of outbreaks <sup>a</sup>				
	Total	≤ 14 days	15-30 days	30-60 days	> 60 days
January-March	90	17	8	30	35
April	130	62	29	31	8
May	267	145	60	55	7
June	272	208	52	10	2
July	128	104	15	8	1
August	34	26	6	2	0
September	6	2	4	0	0
October	4	4	0	0	0

<sup>a</sup> For which data are available.

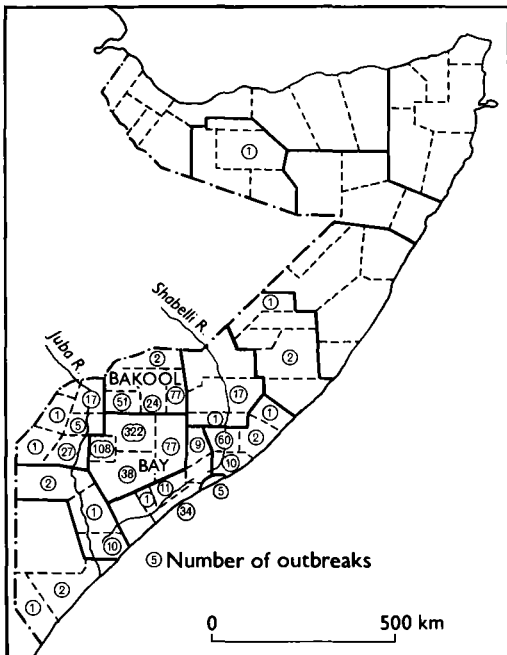


Fig. 22.9. Somalia: number of smallpox outbreaks, by district, 1977.

Table 22.9. Somalia: distribution of smallpox outbreaks, by size and month, 1977

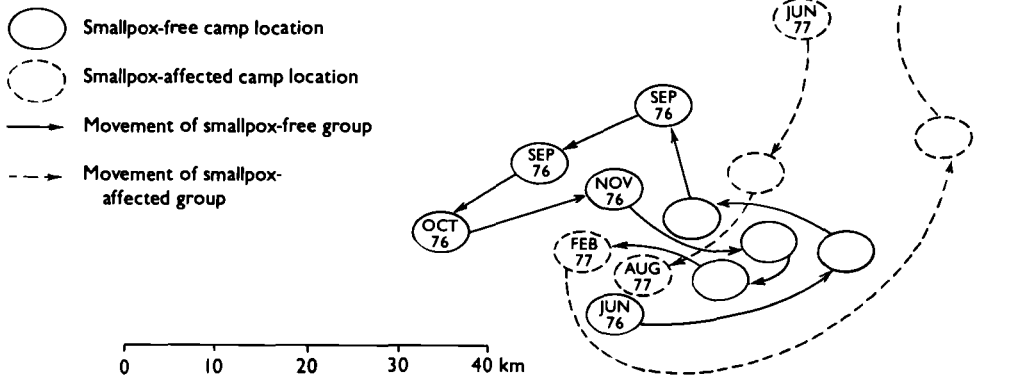
Month of onset of outbreaks	Total number of outbreaks	Number of cases in the outbreak			
		1	2-4	5-9	≥ 10
January-March	93	9	39	25	20
April	132	44	54	28	6
May	277	89	107	62	19
June	272	124	109	32	7
July	128	77	45	1	5
August	34	19	10	2	3
September	6	2	2	1	1
October	4	4	0	0	0

### Persistent Transmission among Nomads

Dr Stanley Foster, formerly a senior WHO smallpox adviser in Bangladesh, with Mr Abdul Gadir El Sid, previously with the eradication programme in the Sudan, painstakingly documented the movements of one group of 44 nomads from June 1976 to the end of August 1977 (Foster et al., 1978). During this period, the nomads ranged over an area of about 70 kilometres by 35 kilometres (see illustration below). Only 7 members of the group had previously been vaccinated. In February 1977, the first case of smallpox occurred. The disease spread slowly among the group with only 1 or 2 cases in a generation of transmission. In all, 19 cases occurred over a 5-month period.

#### *Somalia: Mandeelo group migration, Bakool Region, June 1976–August 1977*

Total population: 46  
Unvaccinated: 34  
Smallpox cases: 19  
Duration of outbreak: 5½ months



soon disappeared from the larger towns and villages (Table 22.10). In April 50% of the outbreaks occurred among nomads, a proportion which rose to 75% in June and to more than 90% in July. In all, 570 out of 843 outbreaks for which data are available were among nomads.

Table 22.10. Somalia: number of smallpox-affected localities, by population size and month, 1977

Month <sup>a</sup>	Population					Total
	<50	50-99	100-499	500-999	≥1000	
January-March	6	3	41	15	10	75
April	7	16	49	9	16	97
May	50	51	113	9	7	230
June	82	55	77	5	4	223
July	57	30	32	2	2	123
August	9	15	8	0	0	32
September	2	2	2	0	0	6
October	2	1	0	0	1	4
Total	215	173	322	40	40	790

<sup>a</sup> When locality was first affected.

By late August surveys showed that 77% of the settled population and 70% of the nomads knew of the reward for reporting a case, and the epidemic had subsided to very low levels. At the end of October the last outbreak was contained. In all, 3229 cases had occurred in 947 different outbreaks. All except 5 of the cases during 1977 were outside Mogadishu. Most cases occurred in the Bay Region; few were detected outside the area between the Juba and Shabelli rivers or along their banks. Only 1 outbreak, a documented importation from southern Somalia, was discovered in the country's 6 northern regions (Fig. 22.9).

#### Surveillance among Nomads in Adjacent Areas of Ethiopia

With outbreaks occurring so close to the border with Ethiopia, and nomads moving freely from one country to another, surveil-



lance in Ethiopia became vitally important. Despite heightening tension between Somalia and Ethiopia and increased guerrilla warfare, Ethiopian staff continued work in the Ethiopian part of the Ogaden desert up to the end of June 1977. Between April and June, they investigated 32 rumours of cases reported by Somali staff and 136 rumours emanating from within Ethiopia. Most of these rumoured cases (96), on investigation, proved to be obvious cases of chickenpox or other skin infections. Numerous specimens were obtained but none contained variola virus. In July the Somali army occupied most of the Ogaden, and at this time surveillance by Ethiopian health staff ceased.

Surveillance in the Somali-occupied areas of the Ethiopian Ogaden provided a new challenge. Neither Somali health staff nor WHO epidemiologists were permitted into this area by the military. No surveillance was carried out for almost 2 months, but late in August an innovative "across the border" surveillance programme began. Five headquarters posts were established at different points along the border, each with Somali staff and an experienced WHO adviser: Dr M. N. El Naggar (Egypt), Mr Carl Hasselblad (USA), Dr Bert van Ramshorst (Netherlands), Dr J.-P. Ryst (France) and Dr J. S. Weisfeld (USA). Because some of the WHO staff had worked in this area previously as advisers to the Ethiopian programme, it was comparatively easy for them to recruit as supervisors and searchers the people who had previously been employed in the Ethiopian programme. With maps already available to them, it was possible to design a systematic search programme which was conducted largely on foot. Specimens were collected from all persons experiencing fever with rash and the specimens were brought back to the border posts. Between August 1977 and February 1978, 410 rumours were investigated and 151 laboratory specimens were obtained.

Independent assessment of the extent of activity of the search workers required different methods. One approach was to require each supervisor and search worker to keep a daily log-book in which he listed all the places visited and entered the full details of each person with fever and rash. The validity of the entries was then checked by other staff. On other occasions, workers were instructed to leave in each village coded WHO smallpox recognition cards. A second

group visited the villages at a later date and retrieved them.

Most of the local staff in this programme performed well but some of them believed that their employment had to be justified by the discovery of rumours of smallpox cases which they would then have to investigate. Thus, throughout this period, there was a continuing and alarming flow of reports of possible cases of smallpox. Fortunately, however, an independent check could be made through an examination of the specimens obtained. None revealed the presence of smallpox.

Towards the end of 1977, concern about military security eased, but diplomatic restrictions prevented WHO staff from officially entering the areas of the Ogaden occupied by the Somali army. However, the group engaged was more concerned about smallpox than about diplomatic protocol and took it upon themselves to travel extensively throughout the Ogaden, beginning in November 1977. Areas in which outbreaks had been reported by the search workers were revisited and confirmed to be free of smallpox. This activity ceased in March 1978, when fighting again increased, causing large numbers of refugees to cross into the border areas of Somalia, many being housed in refugee camps. In a thorough investigation of these camps no one was encountered who had seen cases of smallpox since 1974 (Table 22.11).

The report describing in detail the extent of surveillance activities in the Ethiopian Ogaden during the period of occupation by the Somali army was to prove invaluable to the International Commission for the Certification of Smallpox Eradication in Ethiopia. However, even as late as October 1979, the report was considered politically sensitive and its distribution was restricted to only a few people. This caused some individuals, who had access only to publicly available

Table 22.11. Somalia: results of survey of refugee camps, February 1978

Administrative region	Number of camps	Number of people examined	% with vaccination scar	Year when smallpox was last seen
Galbeed	1	560	91	1974
Galgadud	2	1 536	58	1974
Gedo	4	8 851	66	1971-1974
Hiran	5	1 875	62	1974
Total	12	12 822	-	-

information, to question the Commission's ability to be certain of the status of the Ogaden.

### The Last Smallpox Outbreak, October 1977

By the end of September 1977, the optimistic view prevailed that the discovery and containment of the world's last smallpox outbreak were at hand. On 26 September, the second intercountry coordination meeting was convened in Nairobi with representatives from Djibouti, Ethiopia, Kenya, Somalia and the Sudan. All these countries pledged a continuing intensive effort to achieve the elusive goal of eradication. At that time there were only 29 villages in Somalia known to be infected, of which 21 had active cases. Heavy rains again prohibited the use of vehicles throughout much of the area, but with large numbers of staff available it was possible to travel by foot or on camels and donkeys in carrying out the work of search and containment. Meanwhile, search in Ethiopia and Kenya continued but no cases were found.

Between 1 and 23 October, 5 more outbreaks were discovered in southern Somalia, of which 3 consisted of only a single case;

the date of onset of illness in the last patient was 18 October. With a growing recognition that each outbreak contained might be the last, staff worked with an intensity never before attained. A special team arrived to make a documentary film of the programme, later released by WHO and entitled "The Search". Finally, on 31 October, yet one more case was discovered, not among nomads but in the busy regional port of Merca, a town of 30 000 inhabitants (Deria et al., 1980). The patient should have been protected by vaccination long before; after becoming ill he was in face-to-face contact with tens, perhaps hundreds, of people.

As in many other countries, the last outbreak was unusual. The patient, Ali Maow Maalin, was a 23-year-old cook who had become ill with fever on 22 October and developed a rash on 26 October. Although previously employed as a temporary vaccinator in the smallpox eradication programme and more recently as a cook in a hospital in Merca, he had never been successfully vaccinated.

On 12 October, 2 smallpox patients from a nomad encampment, some 90 kilometres from Merca, had been sent at night by vehicle to an isolation camp near the town. The vehicle stopped at the Merca hospital to seek



**Plate 22.8.** Participants in the second intercountry coordination meeting, Nairobi, 26–28 September 1977. *Left to right, front row:* Girma Teshome (Ethiopia), R. O. Hauge (WHO), Tesfaye Temelso (Ethiopia), Unidentified participant, M. A. Strassburg (WHO), D. W. O. Alima (Kenya), Unidentified participant; *middle row:* E. Shafa (WHO), B. O'Keefe (Kenya), P. Chasles (WHO), W. Koinange (Kenya), I. D. Ladnyi (WHO), B. Teelock (WHO), I. Arita (WHO), C. Algan (WHO), Z. Islam (WHO), N. C. Grasset (WHO); *back row:* Z. Ježek (WHO), I. O. Mwatete (Kenya), Yemane Tekeste (Ethiopia), M. Dutta (WHO), M. K. Al Aghbari (WHO), A. H. El Sayed (Sudan), A. Deria (Somalia), M. N. El Naggar (WHO), M. A. Gure (Somalia), V.J. Radke (WHO).

directions and Mr Maalin volunteered to accompany its occupants to the smallpox office, some 100 metres away. One of the 2 patients, a 6-year-old girl, was severely ill and died 2 days later. Mr Maalin was exposed for only a few minutes.

On 22 October he felt feverish and left the hospital for his home, about 200 metres away, in a densely populated area of Merca. During the next 3 days he was visited by many friends and neighbours as well as by hospital employees. He was admitted to the hospital on 25 October with a presumptive diagnosis of malaria, and received numerous visitors, walked freely through the hospital and even went outside the compound to obtain his salary payment. On the following evening he developed a rash which was diagnosed as chickenpox, and on 27 October he was discharged. Feeling ill, he remained at home although, again, he received many visitors. By 29 October he suspected that he had smallpox but, fearing to be sent to the isolation camp, did not inform the authorities. On 30 October, a male nurse at the hospital reported Mr Maalin to the regional health superintendent and to the smallpox eradication staff, who confirmed the diagnosis and sent Mr Maalin to the isolation camp. Unlike the cases of recent months, almost all of which had occurred among small isolated groups of nomads with few close contacts, Mr Maalin had been in contact with numerous people, only some of whom could be identified by name.

The hospital was immediately closed to new admissions, all patients were vaccinated and quarantined at the hospital, all health staff were vaccinated, warning signs were placed around the compound, and a 24-hour police guard was posted. Vaccination teams, consisting of 2 smallpox eradication staff, a policeman and a local political leader, listed by name and vaccinated everyone in the 50 houses surrounding Mr Maalin's home and later in the 792 houses comprising the ward in which he lived. Teams then undertook a search of the entire town each week during the succeeding 6 weeks. With police assistance, a check-point was established on the road into Merca and 3 check-points were set up on footpaths also leading into it so that all persons leaving or entering the town could be stopped and vaccinated. In all, 54 777 persons were vaccinated during the 2-week period from 31 October to 14 November. Meanwhile, meetings were held throughout Merca

to inform the general public of the outbreak and to stress the need to report cases with rash and fever. The reward of 200 Somali shillings for reporting a case was widely publicized.

Efforts were made to identify all the personal contacts of Mr Maalin as well as those who had been in the same building with him at any time during his illness. In all, 91 face-to-face contacts were identified; 58 had been successfully vaccinated within the preceding 3 years; 21 had been successfully vaccinated more than 3 years earlier; and 12 had no vaccination scar. Of these 12, 6 were hospital employees, 5 were hospital patients or visitors and 1 was a personal friend. It was possible to get in touch with virtually all these people within 24 hours, although some lived as far as 120 kilometres away. They were vaccinated and placed under surveillance for 18 days, and their temperatures were taken daily in order to detect any illness as quickly as possible. Five persons under surveillance developed fever during this period and were isolated in their homes but none developed rash. Seventy other persons were identified who had been in the hospital at the same time as Mr Maalin but did not recall seeing him. All had been vaccinated previously; none developed fever during the surveillance period.

Subsequently, a house-to-house search was conducted each month for 5 months throughout the entire Lower Shabelli Region, in which Merca is situated. No further cases were found.

Finally, on 29 December 1977, 2 months after Mr Maalin had first become ill and a country-wide search for cases had been completed, it was decided that the Merca outbreak—the last one remaining on the list of pending outbreaks—could be removed from the list. Then began a 2-year period of intensive surveillance throughout the countries in the Horn of Africa to confirm that eradication had been achieved. Because of the discovery of 2 hitherto unknown foci following apparently smallpox-free intervals of 7 weeks or more (late in September 1976 and in March 1977), the surveillance was diligent. However, the Merca outbreak proved to be the last naturally occurring outbreak and Ali Maow Maalin's illness the last case.

#### MORBIDITY AND MORTALITY DATA, 1977

Data on the age of onset and outcome of illness are available for 3022 of the 3229 cases

Table 22.12. Somalia: reported number of cases of smallpox, by age group, 1977

Age group (years)	Cases <sup>a</sup>		Percentage age distribution of general population
	Number	%	
<1	47	2	4
1-4	506	17	12
5-9	560	18	15
10-14	501	17	15
15-19	406	13	14
20-29	448	15	14
30-39	259	9	11
40-49	148	5	7
50-59	78	3	4
≥60	69	2	4
Total	3 022	100	100

<sup>a</sup> Details are not available for 207 other cases reported in 1977.

that occurred in Somalia in 1977. The age distribution of cases is especially interesting in that it parallels closely the age distribution of the population at large (Table 22.12). This finding might be expected in a population with little immunity either from smallpox or from vaccination. As has been noted previously, most cases occurred among nomads whose vaccinal immunity was not more than 10-20% when the epidemic began, and although the level of vaccinal immunity rose to more than 90% by September 1977, most cases had already occurred by then. Facial pockmark surveys conducted in 1978 revealed that for most southern Somali nomads smallpox was a new experience, the last large outbreaks having occurred in 1938, nearly 40 years earlier.

Only 13 deaths were recorded—a case-fatality rate of 0.4%, characteristic of variola minor. Six of the 13 individuals who died were infants less than 1 month old, 1 was a case of fetal variola, 4 were children between 1 and 6 years of age, 1 was a 49-year-old man, and 1 was a 90-year-old woman. None of them had ever been vaccinated.

## CONCLUSIONS

From the time the Intensified Programme began, smallpox eradication staff had speculated as to where the last case might occur—no one had expected that it would be Somalia. Rugged, mountainous areas with a paucity of health services, such as Afghanistan or Ethiopia, or densely populated areas, such as Bangladesh or India, in which smallpox spread very rapidly, appeared to be

far more likely possibilities. Somalia, with its sparse population and a more extensive network of health services than many other endemic countries, was an improbable candidate. This opinion was reinforced in 1974, when programme staff reported that the second country-wide vaccination campaign had been completed and that the total number of vaccinations performed during the two campaigns was equivalent to the population of the country.

In retrospect, the epidemic in Somalia could and should have been prevented. The first mistake was the assumption by both national and WHO smallpox eradication staff that continuing transmission of smallpox would be difficult, if not impossible, among pastoral nomads in the sparsely populated Ogaden desert. At the time, the assumption seemed reasonable. Somalia, after all, had become free of smallpox in 1962, in the absence of any national vaccination campaign, and at a time when the health services were using a poor-quality thermolabile vaccine and the numbers of people vaccinated were comparatively few. Because of this, the Ethiopian programme had concentrated its best staff and the bulk of its resources in highland areas rather than in the Ogaden. However, because of natural population growth, an augmentation of the normal nomadic population by refugees, and an increased concentration of people at feeding-camps and water-holes on account of warfare, drought and famine, the potential for continuing transmission of the virus was greater than it had been before. The second mistake was the failure to provide better WHO support to Somalia in strengthening its surveillance programme, at least after 1972, when importations began to be reported. Other activities were assigned a higher priority, in part because of the belief that transmission in Somalia could not be long sustained, especially after its extensive vaccination campaign, and in part because of the need to devote all possible resources to the intensified programmes that had begun in Asia in 1973 and in Ethiopia in 1975. The third mistake was the suppression of notifications by Somali programme staff and even the WHO smallpox adviser on the grounds that they were facing only a minor problem, which could be contained without officially acknowledging it. The staff's lack of experience in the investigation and control of outbreaks because of the long absence of

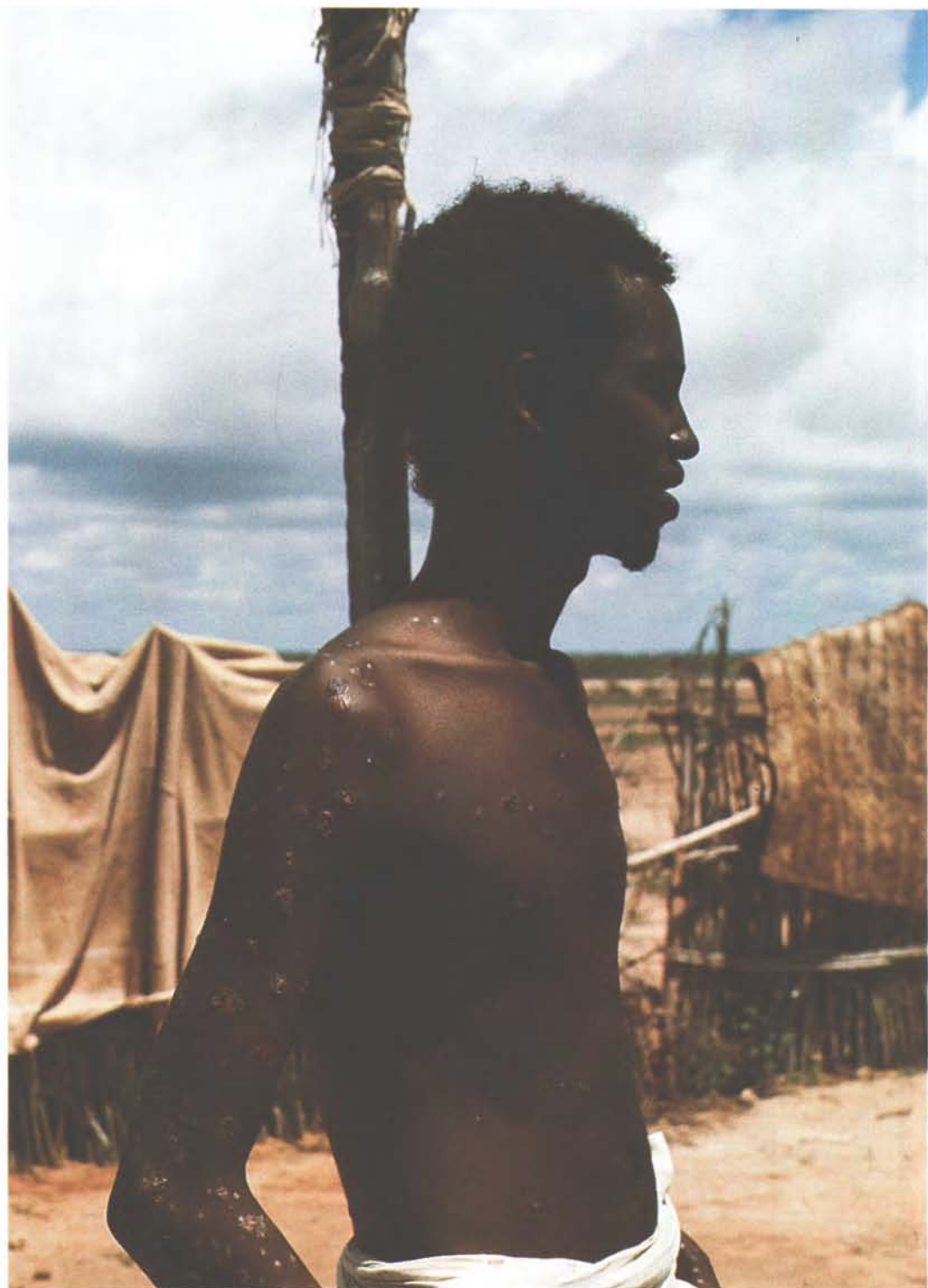


C. WILSON



V. ZIMMUND

**Plate 22.9.** **A:** Airlifted vehicles being unloaded in Mogadishu for the emergency programme in Somalia in 1977. **B:** Somali search teams inquiring for rumours of possible cases of smallpox.



WHO / J. F. WICKETT

**Plate 22.10.** Ali Maow Maalin, the last case of naturally occurring smallpox in the world, developed a rash on 26 October 1977, in the town of Merca in Somalia.

endemic smallpox, coupled with its inability to request assistance in a situation that had not been reported, permitted a localized problem to grow into a major epidemic. The outbreak was centred in an area which, through resettlement and agricultural development, had become steadily more populated. Few cases of smallpox had occurred in the area for perhaps 40 years and an ineffective vaccination campaign, inadequately assessed, had reached only a small proportion of the inhabitants.

When the problem was finally acknowledged and an emergency declared, only 141 days were to elapse until the last case was

detected and the outbreak contained. The emergency programme, conducted under the most difficult conditions, was as well executed as any national plan of operations in the Intensified Programme. A determined Somali staff aided by experienced WHO advisers worked day and night, drawing on the experience of 10 years of field activities and motivated by the imminence of the ultimate goal of global eradication. And so the final chapter was written: Ali Maow Maalin represented the last case of smallpox in a continuing chain of transmission extending back at least 3000 years.