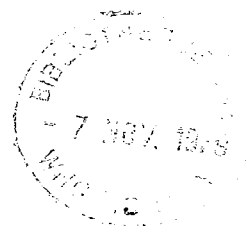


# SMALLPOX ERADICATION IN SOMALIA

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REPORT TO  
THE INTERNATIONAL COMMISSION  
ON THE  
SMALLPOX ERADICATION PROGRAMME  
IN SOMALIA



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FOREWORD

JAMHUURIYADDA DIMOQRAADIGA SOOMAALIYA  
WASAARADDA CAAFIMAADKA  
«000»



جمهورية الصومال الديمقراطية  
وزارة الصحة  
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Minister's Office  
Lam. \_\_\_\_\_ Waxaa ku xiran \_\_\_\_\_  
Jawaabta warq. L. \_\_\_\_\_  
oo \_\_\_\_\_  
Ujeeddo :

رقم \_\_\_\_\_  
الموضوع :

August 1979

Ciribtirka Furuqa

Smallpox Eradication

Waxa yididiilo leh iyadoo dhowaan aynu sax-  
eexi doono 'xaashidii dhimashada' ee Furuqa.

It is a pleasant feeling that we are about  
to sign the 'death certificate of smallpox.

Hadaba halkan waajibkaygu waxa weeye,  
anigoo dawladdayda ka wakiil ah, inaan mahad-  
naq u celiyo dhammaan kuwii ka mas'uul ahaa  
inay Soomaaliya ka ciribtiraan furuqa.

My duty here is, therefore, to thank,  
on behalf of my government, all those who  
were responsible for eradicating smallpox  
from Somalia.

Waxaan jeclahay inaan halkan ku caddeeyo,  
anagoo abaalgudna ugu hayna, kaalmadii aan ka  
helnay Ururka Caafimaa dka Adduunka, hay'adaha  
kale ee Umadaha Midoobay iyo dalal badan oo aan  
saaxiiba nahay.

In this connection I would like to put on  
record, with gratitude, the assistance we  
received from WHO, other agencies of the  
UN system and many friendly countries.

Mahadnaq gaar ah ayaan u soo jeedinayaa  
shaqaalihii (Soomaali iyo ajnebib) sida xilkas-  
nimada leh shaqada miyi iyo magaalaba uga  
waday; iyo madaxda Gobolada iyo Degmooyinka  
oo dowlad weyn ka qaatay ololaha ciribtirka Furuqa.


Special thanks are due to those Smallpox  
field workers, both national and internat-  
ional, for their dedication to their work.  
The Regional and District authorities played  
their full part in this campaign.

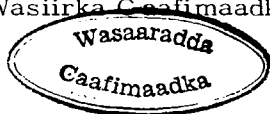
Shaqaalaha Xarunta Mashruuca Ciribtirka Furuqa  
waxay ku ammaananyihiin soo diyaarinta warbixin-  
tan.

The efforts put into preparing this country  
report by the HQ staff of the Smallpox  
Eradication Programme are praiseworthy.

Ugu dambaystii, waxa farxad ii ah inaan war-  
bixintan u gudbiyo Guddiga Caalamiga ah ee Qiim-  
aynta Ciribtirka Furuqa.

Finally, it is my pleasure to submit  
this report to the International Commission  
for the Assessment of Smallpox Eradication.

  
G/Sare Muuse Rabiile Good  
Wasiirka Caafimaadka



  
Col. Muse Rabile God  
Health Minister



## ACKNOWLEDGEMENTS

The eradication of smallpox from the Somali Democratic Republic, where variola virus infected its last victims, signals the success of the global smallpox eradication programme and, thus, a great achievement in the history of public health. Due credit must be given to those who made possible this final victory.

Colonel Musa Rabile God, Minister of Health, was committed to the idea of smallpox eradication from the outset of the programme and was unfailing in his support and encouragement. In this he was fully supported by the Director General of Health Services, Mr Musa Gure Mohamed, who in addition to his enthusiastic assistance removed many administrative obstacles which might otherwise have obstructed the success of the programme. We acknowledge the cooperation received from the Central Committee as well as the Committee for Social Affairs of the SRSP and the Ministries of Local Government and Rural Development, Defence, Education, Livestock, Information and Public Guidance.

One of the most gratifying features of the smallpox eradication programme has been the unified and effective way in which the Government of Somalia and World Health have collaborated. At every level national and WHO staff worked shoulder to shoulder pursuing their goal with technical competence, dedication and enthusiasm. On the side of WHO, continuous encouragement and support was received from the Director-General, Dr H. Mahler and the Assistant Director-General, Dr I. Ladnyi. They committed themselves completely to ensure the success of the programme and at all times gave it priority. In this they were supported by Dr A.H. Taba, Regional Director, EMRO, and his co-workers from WHO Regional Office in Alexandria.

Dr I. Arita, the Chief of the global smallpox eradication programme provided a constant example of dedication and optimism. He never failed in his untiring efforts to assist the programme when experts, finances and transport facilities were desperately and urgently needed, and was ably supported by an efficient staff at Geneva headquarters. The WHO Programme Coordinator in Somalia and the staff members of his office and of other projects always cooperated fully with the programme.

The achievement of the programme is all the more remarkable when it is appreciated that the definitive strategy responsible for eradicating smallpox from the country was first implemented in May 1977. The last known case occurred less than six months later in Merca on 26 October. This Emergency Drive was facilitated by additional funds made available in response to the UNDRO appeal on behalf of Somalia from Canada, the Netherlands, Norway, the League of Red Cross Societies, Sweden and the United Kingdom. France arranged for an airlift of medical personnel who performed valuable field work for two weeks during the height of the epidemic. Iran, the United Kingdom and the League of Arab States assisted the programme with transport facilities when desperately needed. We also appreciate the assistance given in the form of personnel and laboratory support by the Centre for Disease Control, Atlanta, Georgia, USA and in the form of smallpox vaccine supply and laboratory support by the Ministry of Health of the USSR.

Special tribute must be paid to the Resident Representative of the United Nations and its agencies, in particular UNICEF, for their assistance within Somalia.

Locally, assistance was also received from many quarters, particularly from the Somali Red Crescent Society. The political and administrative officials at all levels, members of the police and the army, school teachers, village and locality headmen and social organizations such as the Somali Youth Organization, the Somali Workers' Organization, the Somali Women's Democratic Organization, Victory Pioneer and others too numerous to list, gave help, were valuable informers and played important roles in the publicity of programme activities as well as assisting actively in the all-Somalia active search operations.



The staff at Mogadishu Zeropox headquarters, programme management officers and the national and international staff of the administrative, finance and supply units have also played an essential role in the campaign.

Epidemiologists, both national and international, worked for the programme, living and working sometimes in the most difficult conditions. Their dedication during many hours each day, seven days a week, was far beyond that which could reasonably have been asked of them. They did this cheerfully and without complaint, making an enormous contribution to the enthusiasm and spirit of all members of their teams.

A special mention must be made about regional and district political, administrative and health authorities, too numerous to mention individually. They gave unstintingly of their time and expertise to motivate and direct their staff in their areas of jurisdiction towards achievement of our common goal.

A major tribute must be paid to the grass-roots level programme staff who did the walking from house to house and from hut to hut in endless bush and desert areas, who conducted the never ending questioning and spreading of information about programme activities, who performed the vaccinations and who lived in affected villages or nomadic camps giving up the comfort of their own houses to live with smallpox patients so as to isolate them effectively. They did a magnificent job and our thanks go to them all.

Finally we wish to thank the thousands of smallpox patients themselves for their understanding and full cooperation with the local programme staff as well as the tens of thousands of voluntary informers who did not hesitate to walk many hours to report suspected cases.

In preparing this document itself, we wish to acknowledge the tremendous help we have received from many people. Much information has been drawn from papers and programme documents written by others; they are mentioned in the list of references. The papers prepared by Dr Oles, Dr Samostrel'skij, Dr Mahfuz Ali, Dr I. Arita, Dr Zikmund and Dr Slepishkin in earlier stages of the programme have been particularly appreciated. Dr S. Foster and Mr El Sid observed and documented a spread of smallpox among nomadic groups in Bakool Region and Dr W. Hardjotanojo carefully documented smallpox eradication activities in Mogadishu and assisted very effectively with various studies. Dr B. Kriz's studies on camel-pox and measles were much appreciated. Dr K. Markvart, Dr J. Weisfeld, Mr P. Carrasco and Mr Bashir reported and documented the last smallpox outbreak and its containment in Somalia. Dr V. Rotbauer and Dr V. Madr, epizootologist and virologist, respectively, from the Serum and Vaccine Institute in Mogadishu, assisted in field investigation and documentation on animalpox diseases and provided laboratory support.

We would also like to thank Miss M. Ali Jamma for the time, energy and patience she has devoted to the typing of the report. Mr Imrahim Obsiye Warsame and Mrs Zeinab Ali Henry assisted in collection of the data and in their comprehensive tabular presentation. Those at WHO Headquarters Geneva who finally prepared and printed the report are also thanked.

In the hope that the principles and techniques described and so successfully employed during the smallpox eradication programme will be found useful by health workers not only in the Somali Democratic Republic but also in many other countries, it has been our pleasant duty to prepare this document.

Dr A Deria  
Director of Public Health  
(Programme Manager)

Dr Z. Jezek  
SME Programme Coordinator

Mogadishu  
July 1979

## PREFACE

There are two important considerations concerning the smallpox eradication programme in Somalia.

The first is that this special country programme successfully brought to an end the chains of transmission of smallpox which had continued over the past 3 000 years throughout the world. The programme recorded the last case of smallpox in Merca, a small port in southern Somalia. The date of rash onset was 26 October 1977, since then to date no additional endemic smallpox has occurred in Somalia or elsewhere in the world.

The second consideration is that this special programme employed all the available strategy acquired during the execution of the global smallpox eradication programme. There was strong national commitment to accomplishing the task, which was supported by mobilization of international resources. There was devotion of national and international programme staff to the performance of the operation in difficult and isolated desert areas. There was rapid and excellent development of epidemiological surveillance to expedite the elimination of smallpox, the programme being successful in terminating transmission within a six month period - perhaps the most rapid achievement of a national eradication campaign in a tropical zone in the history of smallpox eradication. To the end there was incredible thoroughness in verifying whether smallpox transmission had in fact been stopped.

This report describes in detail and with precision what has happened in Somalia to achieve the eradication of smallpox. It appears to me that the essential element for success was that the programme was able to set forth a very clear objective, namely, zero incidence - elimination of the world's last focus of smallpox. All decisions for action were coordinated to achieve this simple target. Needless to say, the report also contains many other lessons, both technical and political, which have been learned from this programme, but I suggest you find them for yourself when you read this report.

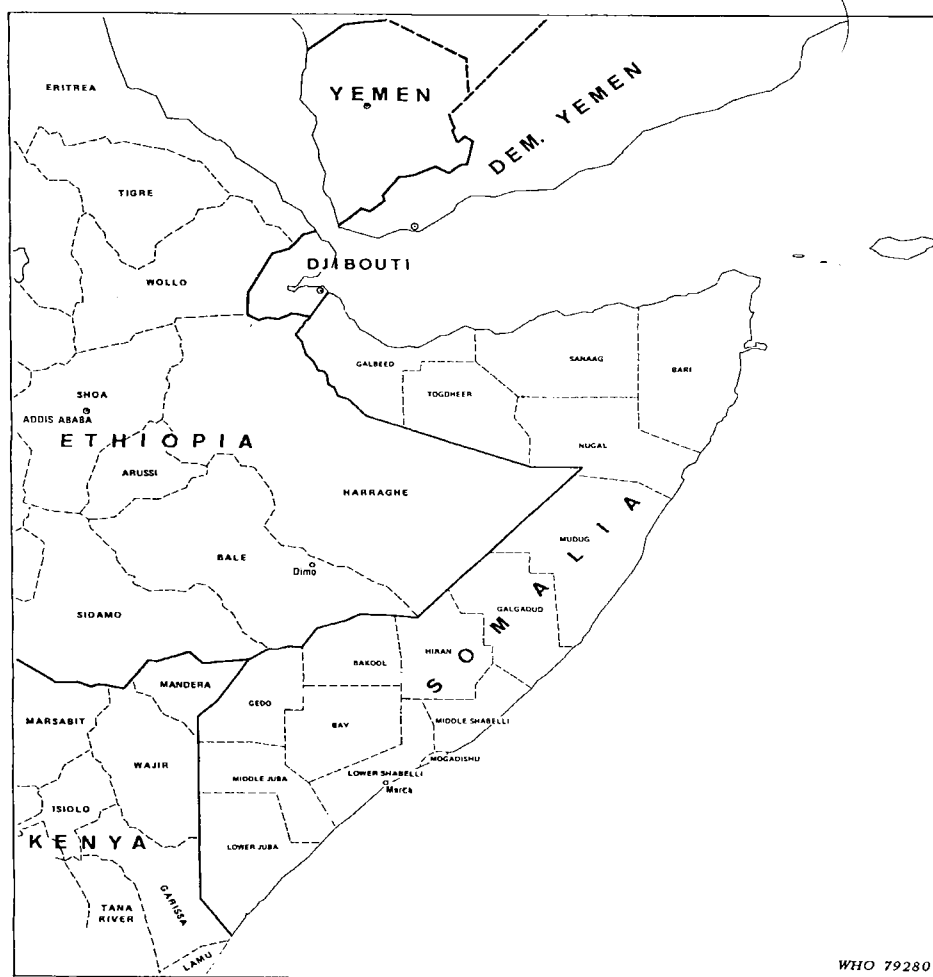
Dr I. Arita  
Chief, Smallpox Eradication Unit  
World Health Organization

## I BACKGROUND INFORMATION

The Somali Democratic Republic occupies 637 657 square kilometres of north-eastern Africa, between latitudes 12°N and 1°30'S and longitudes 41°E to 51°E and forms the "Horn of Africa". The country is bordered by Ethiopia on the west, Kenya on the south-west and the Djibouti Republic on the north-west. The Gulf of Aden meets its northern coastline and the Indian Ocean lies to the east. Its 3 300 km coastline is one of the longest of the countries on the African continent.

FIG. 1.1

SOMALIA AND ITS LOCATION IN THE HORN OF AFRICA  
THE WORLD'S LAST KNOWN FOCUS OF ENDEMIC SMALLPOX



## 1. Topography, Climate and Vegetation

### Topography

Along Somalia's northern coastline is a maritime plain that varies in width from 110 km in the west to as little as 2 to 3 km in the east. This plain, or "Guban", is scrub-covered, semi-arid, extremely hot and crossed by watercourses that are beds of dry sand except during the rainy season. When rains arrive the vegetation is quickly renewed providing grazing for livestock.

South of the maritime plain are north-facing mountain ranges that extend from the north-west border with Ethiopia to the very tip of Cape Guardafui. The elevation of these mountains averages about 2 000 m with the highest point, Surad Ab, reaching 2 400 m. Further south the mountains descend to the elevated, tree dotted Ogo plateau, the western part of which has shallow valleys and dry watercourses. Here, the annual rainfall is comparatively high and especially in the west there are areas of arable land used for dryland farming. There are permanent wells to which the nomadic population returns during the dry season. To the west, the plateau merges into the "Haud", an area which provides the best grazing for the herds of the nomads. There are natural depressions in the "Haud" that flood during the rains to become temporary lakes and ponds. The eastern part of the Ogo plateau is interspersed with a number of isolated mountain ranges and gradually slopes towards the Indian Ocean. A dominant feature is the Nugal Valley with an extensive network of intermittent seasonal watercourses. The Mudug plain, a barren plateau rising 200 to 600 metres above sea-level, constitutes central Somalia.

Most of the country is intersected by watercourses ("doho"), which flow briefly during the rains, only occasionally reaching the sea. The two perennial rivers arise in the Ogaden highlands, flow generally southward and serve only the southern region of the country. The Juba River meanders its way into the sea near Kismayo, while the Shabelli River flows parallel to and east of the Juba to Balad where it turns south-west and runs parallel to the coast for about 200 km to complete its 2 000 km course. Normally it does not reach the sea, losing itself in marshes and sand dunes a few miles north of Gelib. Favourable rainfall and soil conditions make this entire riverine region a fertile agricultural area and the centre of the country's largest sedentary rural population. South of the Juba River, the land is covered with thick bush. In the north the largest seasonal streams are the Daror and the Nugal Rivers which flow only after heavy rains but contain permanent water in their lower reaches. Elsewhere water accumulates temporarily in land depressions ("wars"). A few natural springs and many artificial wells are additional sources of water.

### Climate

Climate, determined by the prevailing winds, has an important influence on Somali life and population movement and thus, indirectly, on the spread of disease. Both the rainfall and the temperature vary considerably from one region to another and from season to season (figure 1.2). There are basically four seasons, two wet and two dry, determined by the north-east and south-west monsoons:

Jilal - From late December or early January until about March hot dry and dusty winds are prevalent and droughts often occur. This is the harvest time for nomadic groups.

Gu or Tangambile - In early March and extending into May or even June, the monsoon winds change direction and bring the country its heaviest rains.

Hagaa - This, the longest season, starts in June and by July the pastures and vegetation begin to dry up and dust is blown by the strong winds. This season continues through August and is the hottest period in the north. Showers occur in the coastal areas.

Dayr - The second wet season occurs in the lull between the south-west and north-east monsoons, usually in October and November and in some areas accounts for 30% of the annual rainfall.

FIG.1.2 AVERAGE MONTHLY RAINFALLS AND TEMPERATURES, SOMALIA

LOCALITY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
BERBERA	31 17	31 18	32 21	34 22	42 24	44 27	44 28	43 27	43 25	37 21	33 19	32 18
BOSASO	30 21	30 21	31 22	34 24	37 26	40 31	39 32	40 30	38 28	32 23	31 20	30 21
BURAO	29 9	31 11	32 12	33 14	35 16	34 16	33 17	34 17	34 17	33 12	30 11	29 9
LAS ANOD	31 11	33 13	33 12	34 16	35 18	34 18	33 17	32 18	35 16	34 14	32 14	31 12
MOGADISHU	30 22	30 23	31 24	32 25	31 24	29 23	28 22	28 23	29 23	29 24	30 23	30 23
HOBYO	31 19	32 20	35 22	36 23	35 23	31 22	30 21	30 21	30 21	32 21	33 21	35 19

Average monthly rainfall



0-49 mm



50-99 mm

Average monthly temperature



maximum

°C

minimum

Rainfall: Precipitation fluctuates from year to year and from area to area. Most of the country receives less than 500 mm of rain annually. Rainfall is largely in the form of localized downpours and is characterized only by an extreme degree of variability. The entire eastern area is in a zone of low rainfall.

Temperature: Mean daily maximum temperatures range from 30°C to 40°C, although they are lower at the higher elevations and along the Indian Ocean coast. Mean daily minimum temperatures usually vary from 18°C to 30°C. From June to September, the northern coast is extremely hot and dry; Berbera and Bosaso have average maximum temperatures of 42°C. The main wet season here is in the cooler months between November and March. In the Mogadishu area, the low wind velocity and high humidity produce uncomfortable conditions during two periods, mid April to mid May and October to early December. Daylight normally lasts from around 6 a.m. to 6 p.m. with little variation throughout the year.

#### Vegetation

Most of the country is covered by scrub, in many places almost impenetrably dense, intersected by wide grassy plains. The vegetation pattern corresponds generally to the distribution of saline and non-saline soils. In the non-saline areas there is a wide range of acacias, "Galol" (*Acacia bussei*) being the most important. Its long roots are used for the framework of nomadic huts, mats and ropes are made from its bark, the ripe fruit is eaten, and leaves and young branches provide fodder for livestock on the high

plateau. It is also used for firewood and burnt to produce charcoal. In the north-east, *Boswellia* and *Commiphora* trees are sources of frankincense and myrrh, respectively, for which Somalia has been known since ancient times.

Somalia has a large variety of big game and smaller wild animals. For reasons of natural habitat the range of some animals is restricted to certain parts of the country. Elephant, black rhinoceros and wild buffaloes live in the south-west, as well as such large predators as lions, leopards, servals, cheetahs and lynx. These animals sometimes limit the movement of health workers in bush areas. Snakes, including puff adders, spitting cobras, mambas and pythons, also present a potential hazard. Tse-tse flies and mosquitoes, particularly after rainy periods, together with ants, scorpions, ticks and sandflies, can make overnight halts uncomfortable.

## 2. Demography and Socio-Economic Considerations

### Population Estimates and Distribution

The Somali are Hamitic people, related to the Galla, Danakil and Affar groups of Ethiopia in the north and influenced by the Bantu in the riverine areas of the south. They are an homogenous race with a strong national unity based on linguistic, cultural and religious backgrounds. Their physical characteristics and features distinguish them clearly from most other races.

In 1963, the population was estimated to be 2.3 million (ILO), in mid 1974, 3.09 million (UN) and in mid-1975, 3.16 million (US Bureau of Census). The first nation-wide census was concluded in February 1975 and Somali estimates at that time reached 3.8 million. The current estimated 3.8 - 4 million population is divided into three major sectors: urban (35%), settled rural (10-15%) and nomadic or semi-nomadic (50-55%). The urban population lives in towns along the coast such as Mogadishu (450 000), Kismayo (60 000), Berbera (50 000), Merca (30 000), Brava (12 000) and in the inland centres of Hargeisa (60 000), Baidoa (30 000), Afgoi (22 000), Burao (30 000), Galkayo (15 000), Jamame (15 000), Genale (10 000) and Jowhar (20 000). In the mid-sixties, some 60 towns and cities were designated as municipal centres but fewer than 25 had 5 000 or more inhabitants. The rest of the non-nomadic population is concentrated principally in the region between the Juba and Shabelli Rivers, where they are engaged in agriculture. The pattern of sedentary agricultural occupation has been reinforced during the last decade, especially from 1975 when over 100 000 nomads from the drought-stricken north were resettled in agricultural occupations in the south-west.

About half of the population are pastoralists. There are many indications that the mode of living of these people is changing and that the term "nomads" is incorrectly applied to them all. Three sub-categories may be distinguished:

"Semi-settled" pastoralists who both farm and herd cattle. They have permanent huts in villages, occupied by the family head and older family members. The younger people move with the livestock during the wet season to pastures away from the cultivated areas.

"Semi-nomadic" pastoralists who carry on some cultivation in addition to their pastoral activities, but who seldom have a base to which they constantly return. They cultivate only fast-maturing crops that require them to remain settled for only a short time.

"Nomadic" pastoralists who never farm and whose movements depend only on the needs of their livestock for water and pasture. These true nomads are estimated to constitute one to two fifths of the total population. They migrate in a cyclic pattern regulated by the alternation of wet and dry seasons (see section 4).

modern educational facilities are still in shortage, and Koranic schools continue to be an important source of formal schooling. The Latin script was adopted in October 1972, and is used throughout Somalia. Prior to this the diverse use of Arabic, English and Italian was a factor contributing to the low literacy rate. In March 1973 a massive campaign was launched to make the entire population literate in Somali. In mid-1976 it was estimated that as many as 60-70 per cent of the overall population had attained some degree of literacy.

### Agriculture

Of the total area of 64 million hectares, about 8 million hectares are potentially arable; most of the rest is used for raising of livestock. The main agricultural areas are in the south, along the Juba and Shabelli river-valleys where sugar cane, cotton, maize, bananas and grapefruit are grown. To provide greater self-sufficiency, further crops have been introduced, including sorghum, rice, beans, sesame, ground-nuts, berseem, tobacco, onions, peppers and tomatoes.

### Livestock

The nation's livestock is its principal store of wealth. Somalia has one of the highest livestock to man ratios in the world with 75 per cent of the population dependent on livestock for their livelihood.

The camel is the most important domestic animal in the country. The total number of camels is estimated to be over 3.5 million. Apart from their special need for salt, camels live entirely off the trees, shrubs and grasses. In the dry season camels can go 10 to 30 days without water. Adult camels are grazed by young unmarried men ("gel jirreh") usually many days' or even weeks' march from their encampment. The herds move between 4 and 8 or 9 o'clock in the mornings and between the same hours of the afternoon and evening. Moving at 4-5 km an hour, they generally cover 25-35 km in a day. Between the morning and afternoon movements the herds graze. The milking camels, needed to supply the women and children, may graze up to a day's march from the camp. A few working camels stay close to the nomadic huts to fetch water and carry goods, but camels are not usually used for riding. Female camels may live 20 years and produce eight calves. When camels are considered too old they are killed for meat.

There are an estimated 9 million goats and 6 million sheep in Somalia. Sheep herding is done either by the women or by girls and boys from 5 to 15 years old. The lambs and kids are grazed near the camps by the youngest children. The sheep live only on grass and its roots, whereas the goats browse on all available vegetation. Goats can survive longer without water than sheep, often up to one week, and when the grass is green water is not needed.

The total number of cattle is estimated to be above 4.5 million, predominantly of the Zebu type and variable in size and colour. They have to be watered every second day irrespective of season. The calves are grazed by the youngest children and the adult herd by older girls, youths or older men.

### Fishing

Fishing has been conducted traditionally on a small scale by the people living along the shore. The government has recently set up more than 20 fishing cooperatives and provided assistance with boat-building.

### Industry

The largest industrial establishments in Somalia are the sugar factory in Jowhar, the meat canning factory in Kismayo, the milk factory in Mogadishu, the fishing and fish-

canning factory in Las Corey and the textile factory in Balad. There are also a number of small manufacturing and service industries, the majority of them in the Benadir Region where the capital is situated.

### 3. Transport and Communication

#### Roads

The country's road network consists at present of about 2 000 km of asphalt-surfaced roads, 4 000 km of built-up gravel and earth roads and many thousands of kilometres of earth trails and tracks that are unmaintained. The main developments have been to link Hargeisa with the port of Berbera and the completion of a highway from Beletweine to Burao, assisted by Chinese technicians. In addition, a new highway connects Kismayo with Gelib in the south. New asphalt-surfaced roads connecting Berbera with Burao, Mogadishu with Kismayo and Hargeisa with Borama are under construction.

#### Sea-ports

Mogadishu is the main port and handles two-thirds of all imports and about 25 per cent of exports. Berbera is the largest port in the northern part with first-class modern sea-port facilities, and Kismayo is the country's third major port. Emphasis has been placed on increased development of port facilities and a new deep-water harbour at Ras Shif in Mogadishu was opened in 1977. There are other minor ports where all loading and unloading is done by lighters while ships anchor in the open sea, as there are no mooring facilities for ocean-going vessels.

#### Airports

The main airports of international standard are at Mogadishu, Hargeisa and Kismayo. They handle approximately 50 000 passengers and a thousand tons of freight yearly. Other main airports are in Berbera, Burao and Erigavo. Many of the regional capitals have airstrips suitable for light aircraft.

#### Telephone

Somalia has approximately 10 000 telephones in use with a newly installed automatic telephone system in Mogadishu, Kismayo and Hargeisa. There are 58 post offices in the country having telegraphic communication with the capital.

#### Information Media

Newspapers written in Somali, English, Italian and Arabic are published both daily and weekly. The Somali National News Agency (SONNA) is responsible for reporting both international and local news. The Film and Visual Service produce films, photos and display posters and placards. Somalia has two radio stations, in Mogadishu and Hargeisa. The number of radio sets is estimated at 150 000. There is no TV in Somalia at present.

### 4. Population Movement

The various patterns of population movement are among the most important demographic features and present serious difficulties to public health programmes. The volume of population movement in Somalia has proved to be important in the spreading of infectious diseases and, in particular, smallpox. As these movements cannot be stopped or even substantially limited, they must be taken into account during public health surveillance and control activities, including those of the smallpox eradication programme. A proper understanding of these movements requires a detailed knowledge of many factors including: when, where, and how many, people move, their patterns of contact, the distribution of the population, the patterns of settlement, the social organization and the range of activities. Various distinct types of movement can be identified and are outlined below.



### Nomadic Movement

At least 80 per cent of the population in some regions of Somalia are nomadic pastoralists and although the overall figure falls to about 50% for the southern regions, there are areas, for example Mudug and Nugal Regions, where the percentage of nomadic population reaches 90%. All these nomads depend for a living on their livestock and follow annual and seasonal movement patterns in their search for water and pasture.

In the northern part of Somalia in the dry season the nomadic population is concentrated near deep wells providing permanent water, such as the areas located in the vicinity of Borama, Tugwajale, Hargeisa, Odweine, Bohodle, Burao, Aynabo and Las Anod. With the rains they move southward and scatter their herds throughout the Haud, where they form a pattern of dispersed small encampments during the whole wet season or as long as grass and water are available. As the dry season progresses nomadic groups leave the grazing land in the Haud and return to home-wells or other sources of water where they concentrate in larger encampments. To the Somali nomad the existing international boundaries are in all respects unnecessary and are irrelevant to their way of life; they cross them freely and repeatedly in the course of their seasonal movements.

In the southern part of Somalia, the nomads are concentrated, with their animals, in the basins of the Shabelli and Juba Rivers in the dry periods of the year and are more widely dispersed in the inter-riverine bush areas, with their greater availability of pasture and water, during the wet season. Nomads living in this area are also engaged part-time in farming (figure 1.3).

Within the basic annual cyclic patterns of movement, there are more limited and more complex seasonal movements of people and their animals. These occur especially in the wet season in response to immediate availability of water and grass due to the sporadic occurrence of localized downpours of limited duration affecting areas of only a few square kilometres. To best cope with these circumstances, each nomadic group sends out its own searchers to find out where rain has fallen and if grazing and water are available. Different groups compete with one another for these scarce commodities. On the basis of information obtained by their searchers, a decision is immediately taken involving rapid movement of a considerable number of people for distances of sometimes more than 150 km in 3-4 days. The moving groups change frequently in size and composition. To increase mobility they divide, so that the young men with the camels (which usually constitute the main livestock) may range over much greater distances, followed by older people with children who tend the sheep and goats and move rather more slowly.

It is impossible to forecast with precision where the people will move; a high degree of variation is found in movements from year to year and from season to season.

In addition to these movements conditioned by environmental factors, there are a further two elements encouraging constant mobility. The first is of a social nature. The basic social unit among nomads is a "reer" consisting of three or four families. There is continual fission and fusion of "reers" as families break off from one "reer" to join another. The second factor is the easy transportability of nomadic huts ("aqal") which can be dismantled and packed for transport within an hour and re-erected in about two hours. They are hemispherical in shape, constructed of a framework of curved poles covered with grass mats. Each house is occupied by a man, his wife and the younger children. The house is surrounded by a fence of cut thorn branches and several houses in a ring are enclosed inside a thick thorn fence. Within the ring of houses is a central pen for sheep and goats. This pen is partitioned so that the stock of each family is kept separate at night. A few working camels sleep by the house, but the main camel herd has a separate thorn enclosure nearby. When conditions make a move imperative, the women of the "reer" take down the huts, and load them on to the working camels. The average household usually comprises enough to load three camels. On reaching the new grazing ground the women put up the houses while the men cut and place a new fence.

In recent years, water reservoirs and deep wells have been built in many waterless areas all over the country to trap rain for conservation and use during dry seasons. This has naturally led to the development of semi-permanent settlements and a change in the movement patterns of nomadic populations from migration (involving change of residence) to circulation (mobility around one place of residence but with eventual return to it).

#### Seasonal movement of agricultural labour

There is seasonal movement of labourers to the banana and sugar-cane growing areas in the Juba and Shabelli basins at the peak of planting and harvesting times. The number of labourers is supplemented by an influx of nomads who move in ostensibly to work in fields but are probably even more attracted by available water and pasture in the form of crop stubble.

#### Urban migration

The migration of population from rural to urban areas has increased in recent years as a result of increased economic activity, improved transport and communications and the extension of education and employment opportunities.

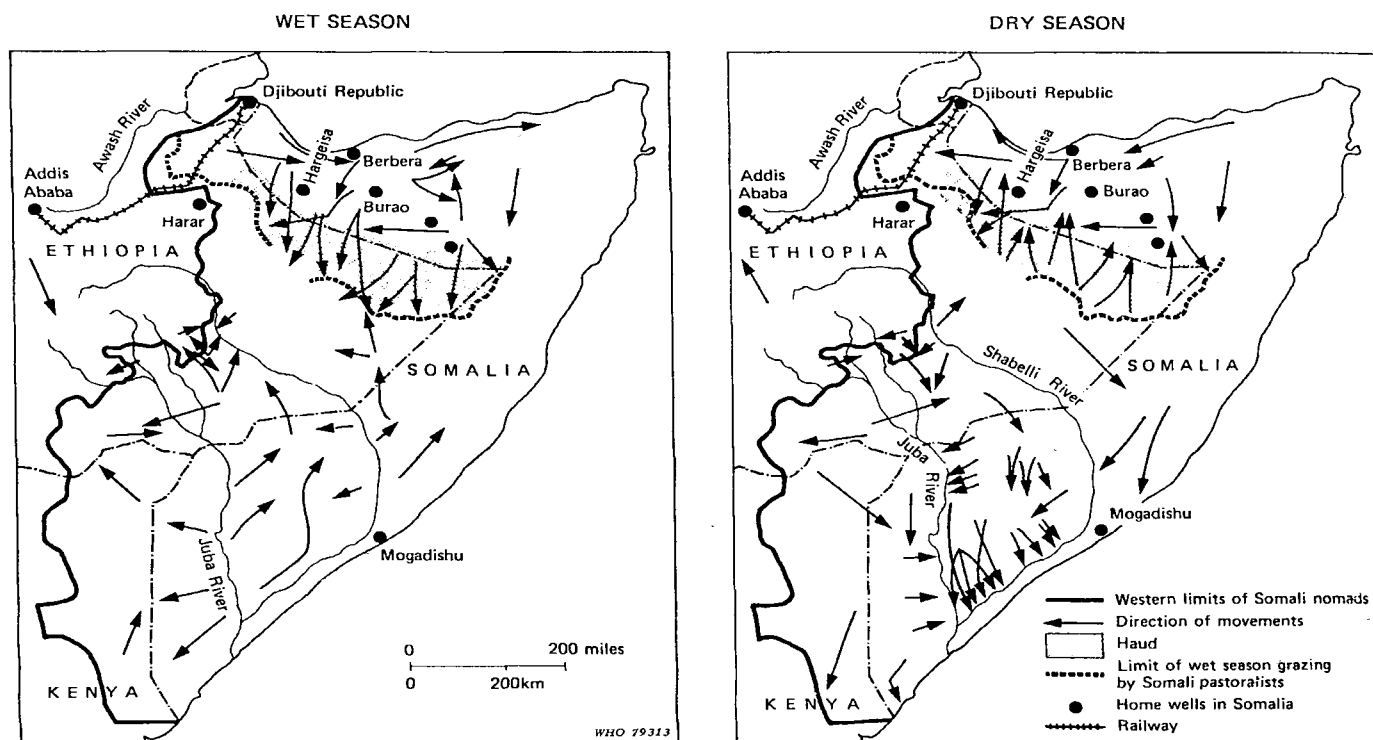
#### Hardship migration

Migration occurs at times of extreme hardship caused by local occurrences. For example, following the loss of their herds in 1974-1975, the nomadic population of the drought-stricken north were resettled in the south-west in sedentary agricultural occupations.

Movements of population made for religious reasons are relatively unimportant in Somalia as compared with those observed in other parts of the world (e.g. India, Bangladesh). The only one of any real significance is the annual pilgrimage to Mecca and Medina.

Of significance in recent times was the large-scale arrival of some 220 000 refugees from the Ogaden Desert area of Ethiopia into border districts of Somalia. Special public health surveillance and prevention measures were instituted in temporary refugee camps. In particular, no cases of smallpox were detected.

FIG. 1.3  
MOVEMENT OF SOMALI PASTORALISTS HORN OF AFRICA



## 2 GENERAL AND HEALTH ADMINISTRATION

### 1. History

On 1 July 1960, the former Somaliland Protectorate, which had become independent on 26 June 1960, and the UN Trust Territory of Somalia united to form the independent Somali Democratic Republic.

The military successfully staged a bloodless coup d'état on 21 October 1969. Legislative and executive powers were vested in the Supreme Revolutionary Council (SRC) led by Major General Mohamed Siyad Barre and committed to leading the country along the path of scientific socialism.

On 1 July 1976, the Somali Revolutionary Socialist Party (SRSP) was founded and its Central Committee took over the authority of the SRC, which was disbanded.

### 2. General Administration

There is close interrelationship between the party and the general administration (figure 2.1). Legislative, judicial and executive powers are vested in the Central Committee of the SRSP, which is headed by the President of the Republic. The President, the three Vice Presidents and the Chief of the National Security Services form the Politbureau. The President of the State is also the Secretary General of the Party.

The Central Committee of the Party has a number of permanent committees (composed of Central Committee members) which have no counterparts at the Regional or District levels. Each of these Committees oversees certain numbers of Ministries, e.g. the Committee for Social Affairs deals with, inter alia, the Ministry of Health. They act as a liaison between the Central Committee of the SRSP and the Ministries, playing an advisory role in political matters. All Ministers are members of the Central Committee.

Administratively, the Republic is currently divided into sixteen regions that are composed of 83 districts (figure 2.2). The Municipality of Mogadishu is one of the regions and itself has 13 districts.

At the regional level, the Secretary of the Party Regional Committee is appointed by the SRSP Central Committee to which he is directly responsible. He is also responsible to the Ministry of Local Governments and Rural Development. These Regional Committees of the SRSP run the respective regions politically and administratively. All Secretaries of the Regional Committees are members of the SRSP. The Regional Head of the Armed Forces is second in the line of command to the Secretary of the Regional Committee. All the chief representatives at regional level of the various ministries (e.g. the Regional Health Coordinator) are members of the Regional Committee which they consult on all non-technical matters.

This administrative structure is replicated at the district level, except that the District Committee reports to its Regional Counterpart. All the Secretaries of the District Committees are members of the Regional Committee in their respective region and attend all the regular meetings.

FIG. 2.1: RELATIONSHIP BETWEEN PARTY STRUCTURE AND THE  
GENERAL ADMINISTRATION STRUCTURE

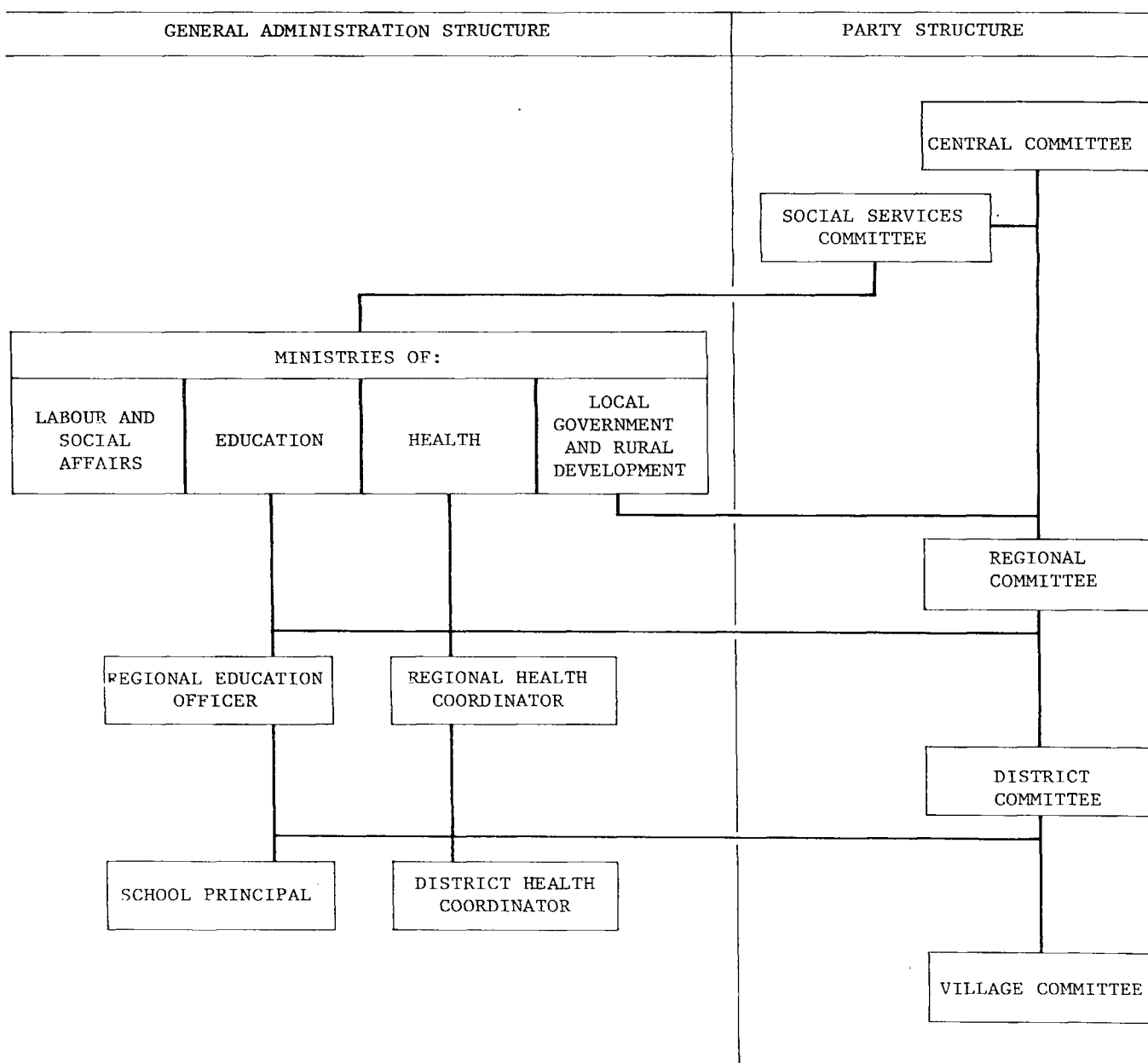
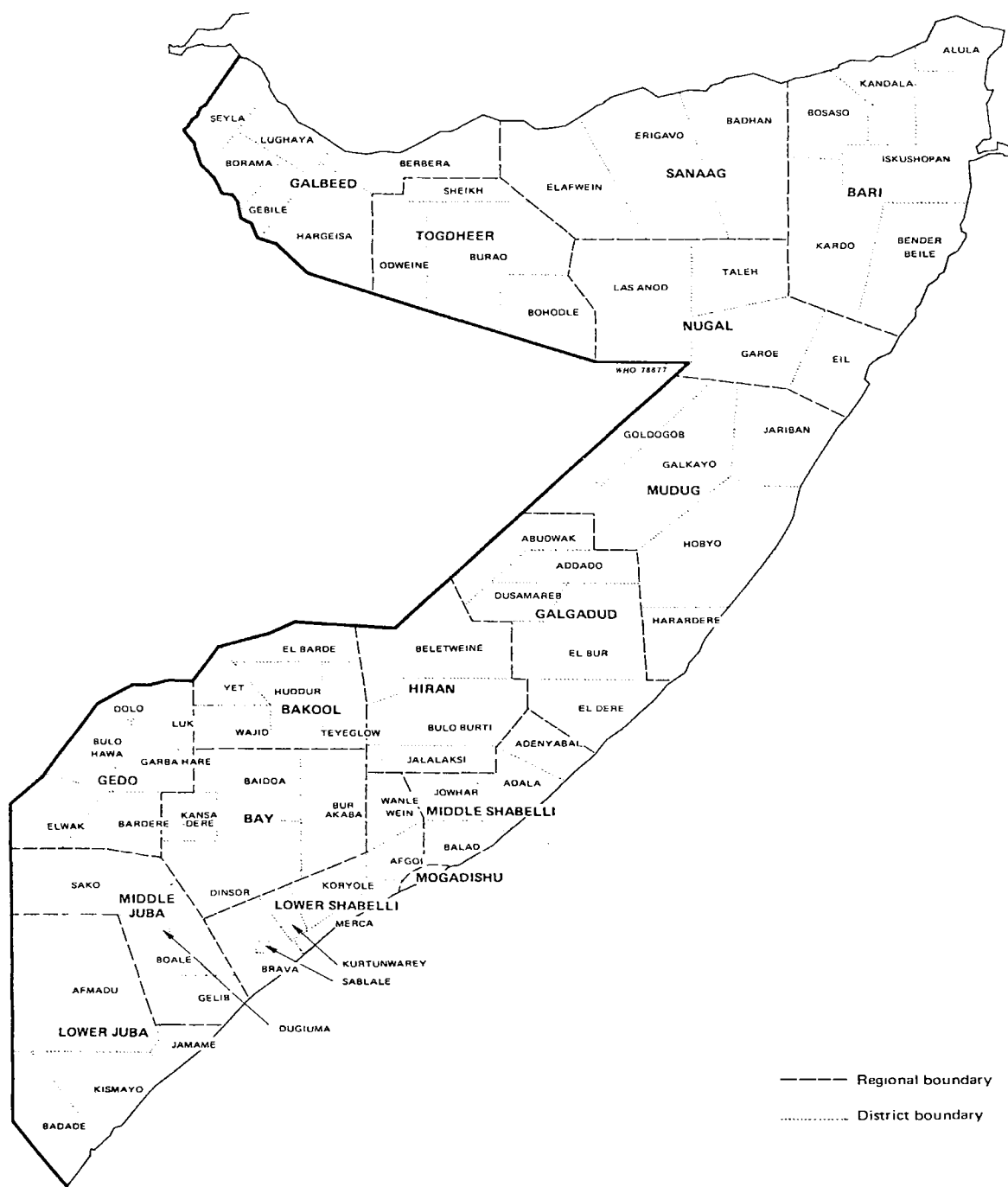


FIG. 2.2  
ADMINISTRATIVE DIVISIONS OF SOMALIA

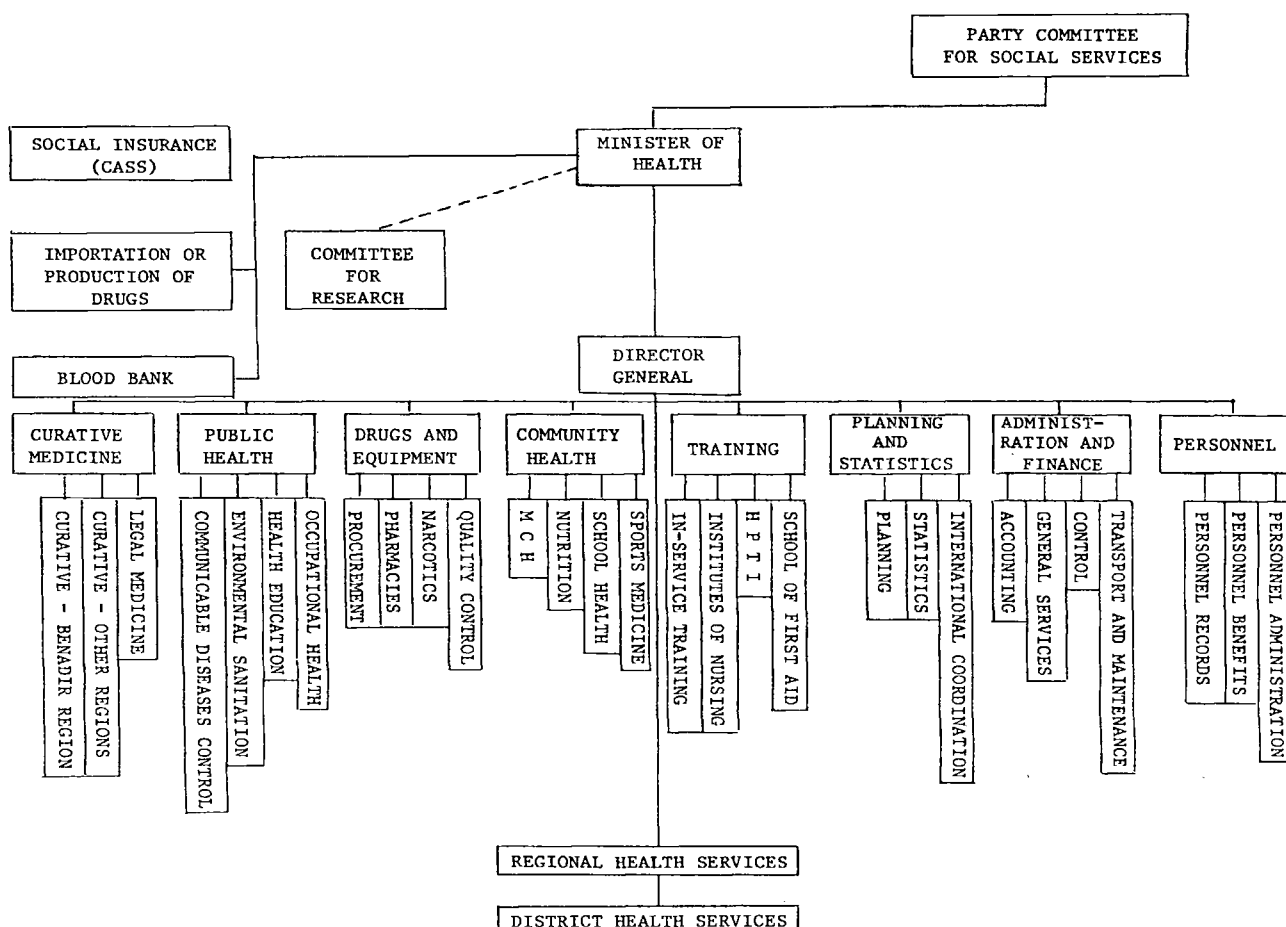


The districts are usually composed of village units (zones). The "beel" (big village) has a population that varies in excess of 4 000 and includes four or five "tuulos" (small villages). The "beel" is headed by a "nabadon" (village chief) and the "tuulo" is headed by a "samadon". The "nabadon" is also the secretary of the village Party Committee and he attends the District Committee's meetings. He is an influential and a well respected figure in his "beel". Apart from the "samadon", the traditional midwife and the village koranic teacher are the opinion leaders in their community with the potential to mould their fellow villagers' attitudes.

### 3. Health Administration

The health service organization can be clearly understood from the organization chart of the Ministry of Health (figure 2.3). At the central level, the link between the Minister of Health and the Party Central Committee is through the Party's Committee for Social Affairs.

FIG. 2.3: ORGANIZATION CHART OF MINISTRY OF HEALTH



At the regional level (figure 2.4), the Regional Health Coordinator (RHC) is a member of the Regional Committee and, therefore, participates in policy making at the regional level. An ad hoc Health Committee of which the RHC is a member is formed out of the Regional Committee. For technical matters, the RHC reports to both the Secretary of Regional Committee and the Ministry of Health (Department of Curative Medicine).

At the district level (figure 2.5), the District Health Officer (DHO) is a member of the District Committee and he heads similar units as those headed by the RHC.

In some districts, as also in some regions, the units listed are not yet staffed and are not yet operational.

FIG. 2.4: ORGANIZATION CHART OF REGIONAL HEALTH SERVICE

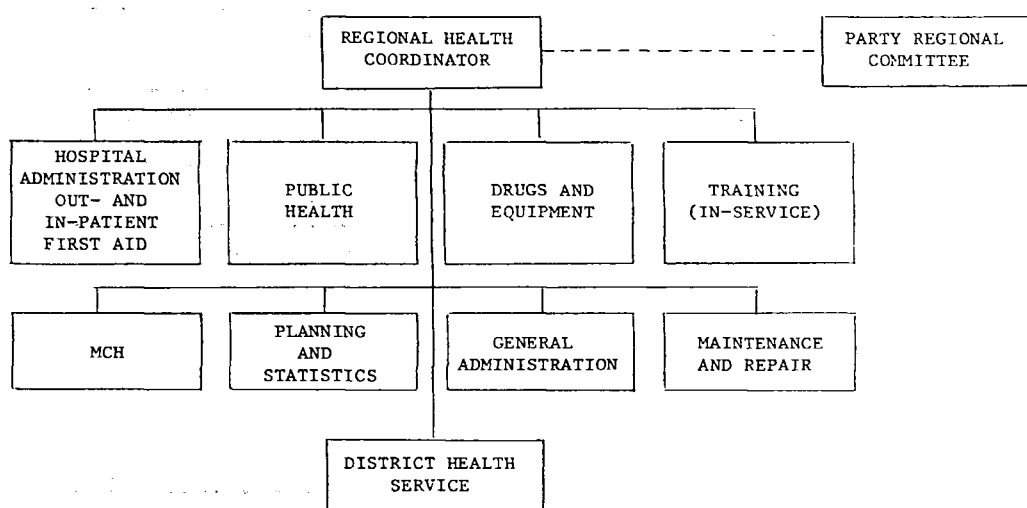
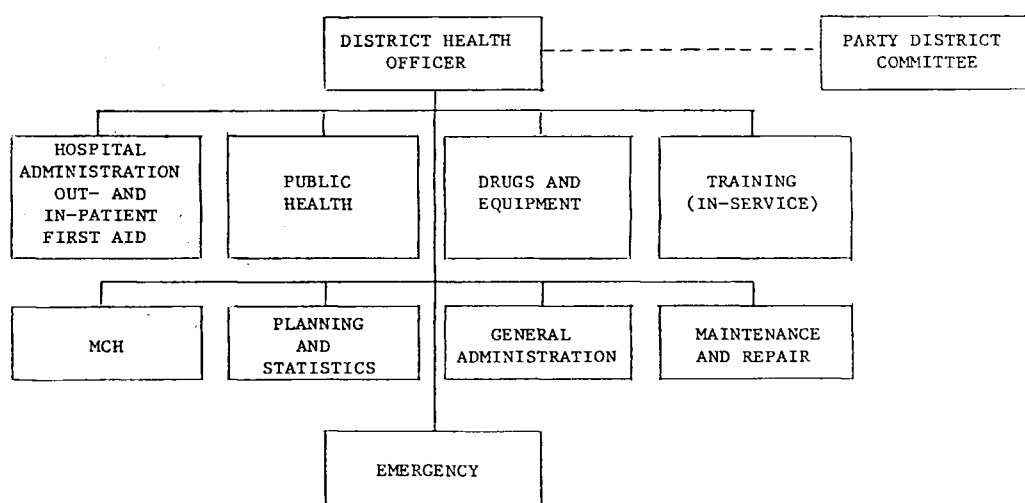


FIG. 2.5: ORGANIZATION CHART OF DISTRICT HEALTH SERVICE





#### 4. Medical Care

The state provides medical care to the public free of charge, but ambulatory patients have to buy drugs prescribed for them, except tuberculosis, malaria and schistosomiasis patients who can receive free medication if they attend the appropriate clinics. Private medical practice is prohibited by law and there are no national philanthropic organizations providing medical care in the country.

The health facilities and health manpower are summarized in tables 2.1 and 2.2 and figure 2.6.

TABLE 2.1  
HEALTH FACILITIES (1979)

Type of facility	Number	Population per facility
Hospitals <sup>a</sup>	66	53 030
Health posts	215	16 279
MCH clinic	77	45 454
Beds <sup>b</sup>	5 381	650

Source: Health Statistics Section, Ministry of Health

<sup>a</sup> Armed forces hospitals excluded.

<sup>b</sup> Beds in armed forces hospitals excluded.

TABLE 2.2  
HEALTH PERSONNEL (1979)

Category	Number	Population per health worker
Doctors <sup>a</sup>	231	15 151
Medical Assistants	24	145 833
Nurses	611	5 728
Midwives	352	9 943
Pharmacists	17	205 882
Assistant Pharmacists	64	54 687
Sanitarians	101	34 653
Laboratory Technicians <sup>b</sup>	122	28 688
Assistant Radiographers	34	102 941
Auxiliaries	633	5 529
Dentists	3	1 166 667

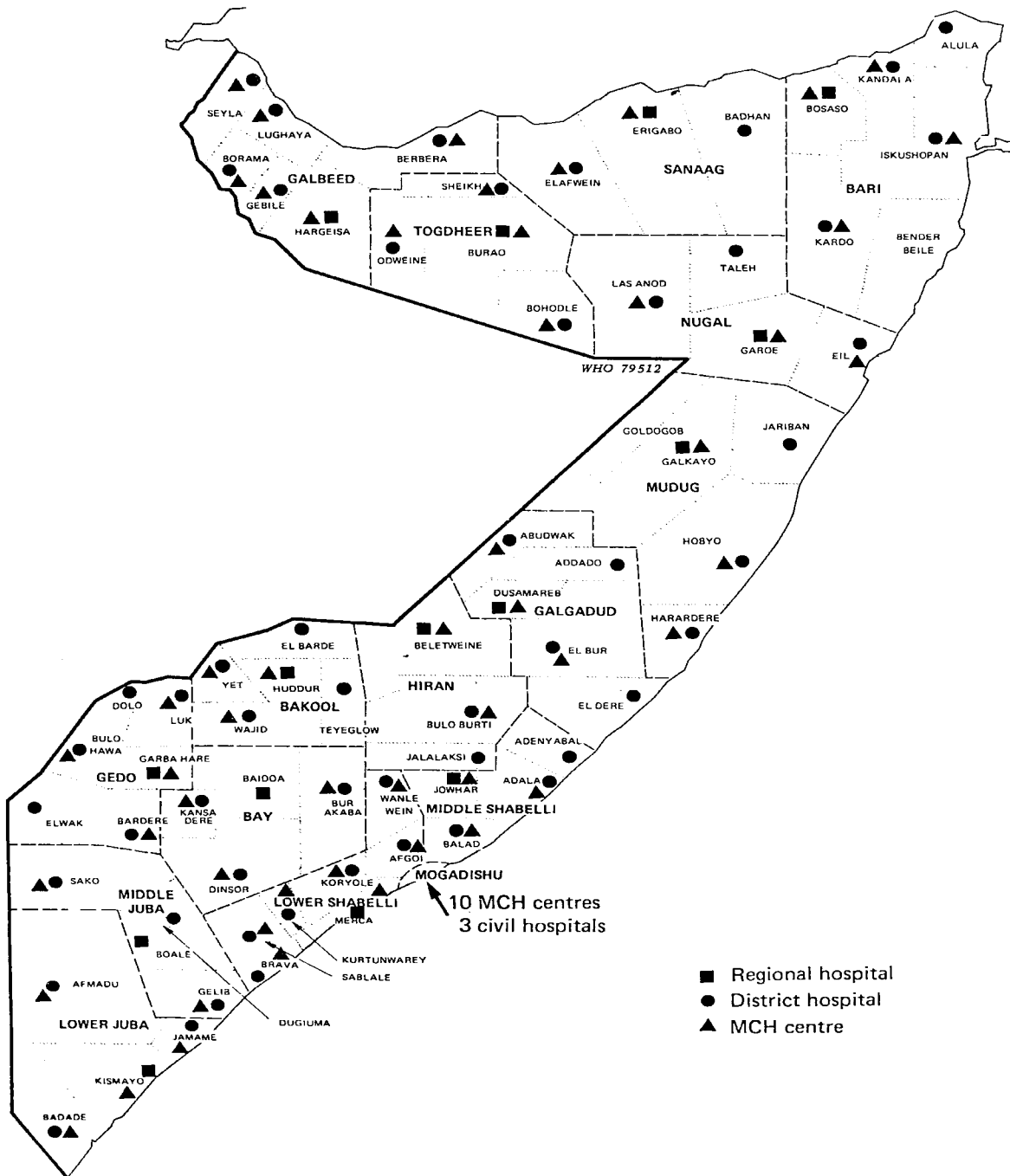
Source: Department of Personnel, Ministry of Health

<sup>a</sup> Armed forces doctors excluded. There are also about 60 expatriate doctors working in the country.

<sup>b</sup> Number includes some auxiliaries who can only do microscopic examination for malaria, schistosomiasis or tuberculosis.

FIG. 2. 6

### THE DISTRIBUTION OF SOME HEALTH FACILITIES IN THE COUNTRY (1979)



Indigenous medicine is widely practised in Somalia. Although there is no documented information available, it is known that a large section of the community - especially the nomads - depend, to a large extent, on traditional healers for their medical care. It is not uncommon for a patient who does not improve on orthodox medicine to resort to indigenous therapy. The Ministry of Health is in the process of evaluating the efficacy of certain aspects of indigenous medicine as well as retraining a number of traditional healers.

#### 5. Administration of other health-related services

Quite apart from the Ministry of Health, other agencies provide a variety of health-related services, for example:

- medical education and research are controlled by the Ministry of Higher Education, although the teaching hospitals are under the Ministry of Health;
- the armed forces have their own health services and institutions;
- first-aid is available at schools, but all other services for school children are provided by the Ministry of Health;
- civil registrations are the responsibility of the Ministry of Local Governments and Rural Development;
- water supply and environmental sanitation, in their various components, are the responsibilities of a number of Ministries including those for Mineral Resources, Public Works, Local Governments and Rural Development, and the Ministry of Health;
- food hygiene control for the export of meat and other animal products is the responsibility of Veterinary Health Services, under the Ministry of Livestock, Forestry and Game. For all imports, food hygiene is controlled by the Ministry of Health;
- a few semi-autonomous bodies have health posts for their staff, e.g. the meat factory in Kismayo, "Somaltex" in Balad and the sugar factory in Jowhar;
- all pharmacies are organized on a cooperative basis and they are under the technical control of the Ministry of Health. The prices of the individual drugs are controlled.

#### 6. Communicable Disease Control

In common with other countries at a similar socio-economic stage of development, Somalia experiences the ravages of preventable communicable diseases. The Ministry of Health, mainly in collaboration with WHO, runs several programmes for the control of some of the major communicable diseases. UNICEF also assists in a number of health programmes (e.g. MCH, EPI and tuberculosis control). Control programmes are now being developed for leprosy and venereal diseases. Malnutrition is also prevalent. Several specific programmes are mentioned below:

Malaria: A control programme for malaria has been in operation for many years now. The work involves active and passive case finding and periodic spraying. Experience with larvivorous fish is encouraging and the Ministry is in the process of initiating a pilot study in this aspect of biological vector control.

Schistosomiasis: An active survey programme, conducted by mobile teams, to detect both the snail and infected persons is under way. This disease is confined, as far as is known, to the riverine areas.

Tuberculosis: A control programme exists for this disease. The strategy for the control of TB is to treat the 'open' case on an ambulatory basis and BCG vaccination (without prior Mantoux test) for children under 15 years. At the present time limited resources preclude an effective nation-wide control programme.

Expanded Programme of Immunization (EPI): This programme started functioning in March 1978. It includes mobile teams using vehicles with special fittings including refrigerators.

Once the eligible children in a given area are given all the appropriate vaccination doses for the six diseases covered by this programme (poliomyelitis, tuberculosis, diphtheria, pertussis, tetanus and measles), the mobile teams move on to a new area, leaving the MCH Centres to carry on the maintenance phase of the programme. The Benadir (Mogadishu) Region has already been completed and another four regions (Lower Shabelli, Middle Shabelli, Lower Juba and North West) are currently being covered.

It is assumed, according to the EPI Plan of Operation, that 50% of the eligible children live in the main urban centres and it is aimed to vaccinate this number within five years.

#### 7. Smallpox Eradication Programme (SEP)

In 1969 a programme commenced, the objective of which was to eradicate smallpox from the Somali Republic by vaccinating the entire population within a period of three years. To achieve this, it was anticipated that the basic health services would be strengthened by creating an appropriate cadre of basic health workers and training them in smallpox eradication activities. It was later realized that the objectives set were unattainable within the specified period and the programme was subsequently modified.

In March 1977, when the present programme was introduced, the staff of the previous programme consisted of 1 WHO epidemiologist, 1 national director, 24 sanitarians, 1 administrator, 1 clerk, 5 peons and 9 drivers, making a total of 42 persons. There were 9 vehicles for the programme.

Following the smallpox outbreak in Somalia in 1976, the Government, in collaboration with WHO, decided not only to augment the existing programme but also to incorporate recent advances in smallpox eradication strategy. It was then realized that the basic health services were not strong enough to support the eradication programme. Accordingly a special programme was jointly formulated by the Ministry of Health and WHO, and became operational in March 1977.

As it was assumed that there was no transmission of smallpox in the country at that time, it was envisaged that the programme would conduct nation-wide active surveillance for smallpox for six months and, if no smallpox was detected, the Expanded Programme on Immunization would be introduced, utilizing the facilities assembled for the smallpox programme. However, this was not to be. The first smallpox outbreak was detected in mid-March 1977 and, soon after, many more outbreaks were discovered. The programme was quickly modified in the light of the new situation. In May 1977, the Government declared an 'emergency situation' in the country and appealed for international assistance through WHO. The programme quickly gathered momentum and grew in both size and quality. At one time, the number of smallpox workers exceeded 3 000, including 25 WHO field epidemiologists and support staff.

The programme organization, as shown also in figure 2.7, has three tiers:

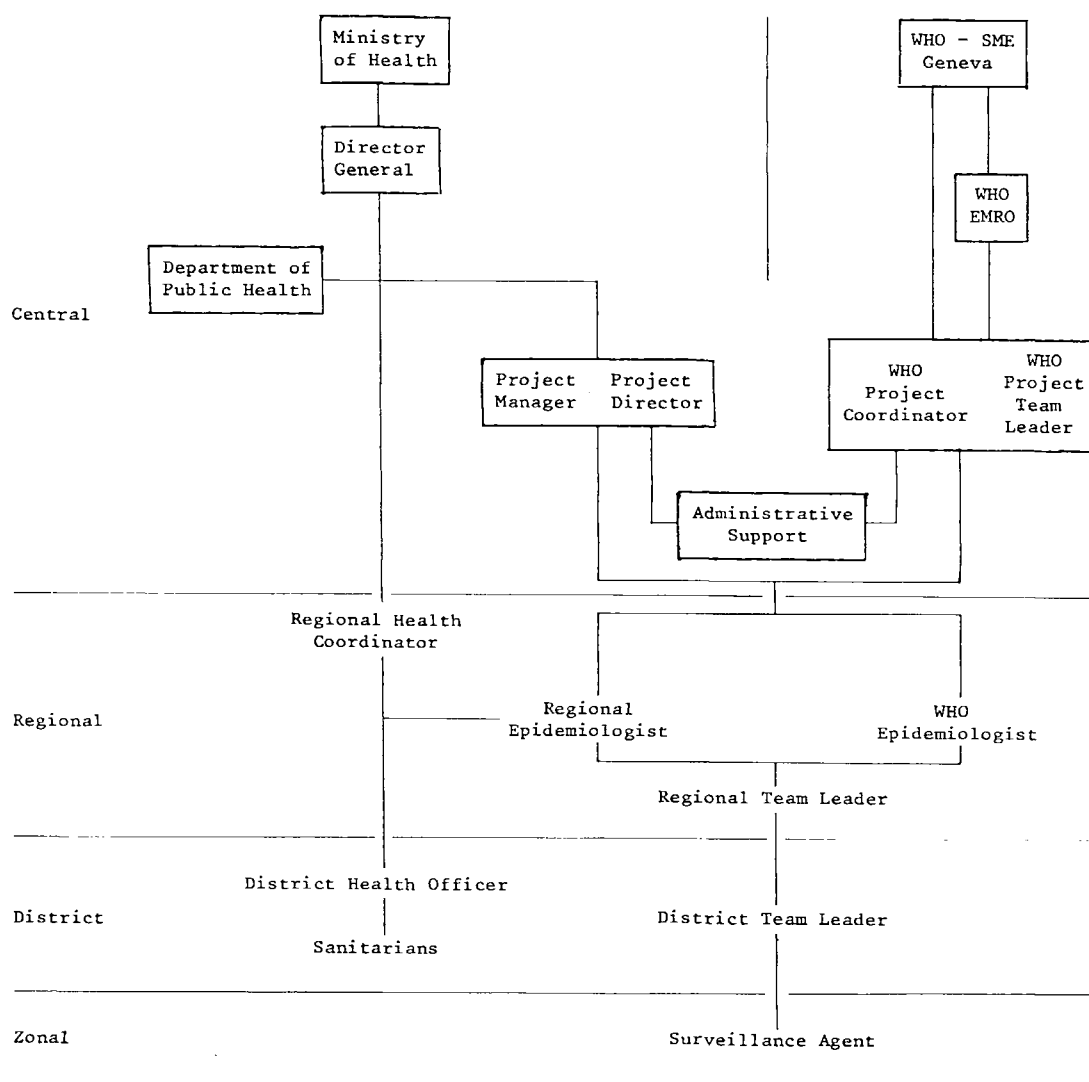
At central level the headquarters staff consists of the National Programme Manager, WHO Team Leader and WHO Programme Coordinator with administrative support provided by both national and international staff.

At regional level the staff consists of the Regional Epidemiologist, the Regional Team Leader (in some regions) and a WHO Epidemiologist (who may supervise more than one region).

At district level there is a District Team Leader in all but four districts and there are as many Surveillance Agents as there are zones in each district. The "Zeropox" office in the district is the reporting unit.

The roles of the various staff are more fully outlined in a later section of programme personnel.

FIG. 2.7  
ORGANIZATION CHART OF SMALLPOX ERADICATION PROGRAMME, SOMALIA 1978-79



### 3 HISTORY OF THE SMALLPOX ERADICATION PROGRAMME

#### 1. Chronology of Events

##### 1960

Following the resolution of the Thirteenth World Health Assembly on the eradication of smallpox, the Government of Somalia contacted WHO on the matter of smallpox control.

##### 1961

In February, the Government of Somalia informed WHO of its objective to intensify prophylactic measures against smallpox by carrying out vaccination in all main centres and, if possible, in the larger nomadic groups.

##### 1962

The national anti-smallpox campaign faced difficulties due to the vastness of the area, the lack of communications and the large nomadic population. The Ministry of Health requested assistance from WHO and a WHO advisor was instructed to assist in implementing the control activities with a view to future eradication.

##### 1966

Production on calves of lymph vaccine, which had begun in the early 1920s in the Institute of Vaccine and Sera at Merca, was stopped. Liquid vaccine from Kenya and freeze-dried vaccine from Italy were thereafter imported.

##### 1967

The World Health Assembly decided to intensify the Global Smallpox Eradication Programme. A total of 44 countries were reporting cases of smallpox and in 33 of these the disease was endemic. No smallpox case was reported from Somalia during this year. In November, smallpox eradication activities assisted by WHO were started in Somalia by the Tuberculosis Control Project. A combined BCG/smallpox vaccination campaign was started by Somali sanitarians, with assistance from American Peace Corps volunteers, organized into 9-man teams. Freeze-dried vaccine was used and administered by the simple scratch method until the newly developed bifurcated needle was gradually introduced.

##### 1968

In January, a WHO short-term consultant visited Somalia to evaluate the possibility of beginning a smallpox eradication campaign later in 1968. In September, the WHO assisted Smallpox Eradication Project was created and a total of 9 persons appointed as project staff began their training in December.

##### 1969

In May, the combined BCG/smallpox vaccination campaign was discontinued. The plan of operation for the Smallpox Eradication Project was signed by WHO on 17 April and by the Somali Government on 1 June. The fundamental aim of this plan was to eradicate

smallpox from the Somali Republic by vaccinating the entire population within a period of three years. At the end of August, the attack phase of the mass vaccination campaign was launched. A total of 33 workers divided into six teams and supported by three vehicles started vaccination of school children, students, police and medical personnel.

#### 1970

The mass vaccination campaign in Mogadishu was considered completed at the beginning of February although among recorded vaccinees the proportion of females and children below 4 years was surprisingly low. Routine vaccination in the capital was then made the responsibility of the existing general health services. Vaccination, carried out by 31 project staff members, continued in the districts of Afgoi, Balad, Jowhar, Adenyabal, Adala, Merca, Brava and Koryole, and commenced in Hargeisa in May. In spite of extensive propaganda the public response was indifferent and even point blank refusal to be vaccinated was not uncommon.

The mass vaccination campaign was gradually reduced and eventually suspended in November as the whole project's activities were diverted towards the mass anti-cholera vaccination campaign.

#### 1971

Smallpox transmission reappeared on the Kenyan side of the Somali/Kenya border in March. Cholera vaccination work which had been absorbing smallpox staff was dropped and smallpox vaccination promptly started in Luk District, adjacent to the reported outbreak. Programme activities returned to mass vaccination in the second half of the year. Nine vaccination teams allotted to the south completed vaccination in Hiran and four teams continued vaccination in the north-west and north-east regions.

In view of the smallpox outbreak in Djibouti, check posts along the border with what was then the French Territory of the Afars and Issa's were established and mass vaccination was conducted in Seyla, the most western district of Somalia, bordering the affected territory.

#### 1972

One complete national round of mass vaccination was accomplished in the northern regions by February and in the southern regions by April. Assessment revealed that Hiran and Upper Juba Regions (comprising at that time the present regions of Bakool, Bay and Gedo) had the lowest coverage.

In view of reported smallpox cases on the Ethiopian side of the border in the Tugwajale area in Galbeed Region, a special vaccination drive was organized on the Somali side of the border. Nevertheless, five imported smallpox cases were reported from the northern part of the country during October-November and all were confirmed as importations from around Jijiga in Ethiopia. 24 special teams were created to conduct surveillance-containment measures.

#### 1973

The second round of mass vaccination started in Benadir and Lower Juba Regions in the south and in the North East and North West Regions at the beginning of the year. During the year only seven smallpox cases were recorded, all importations from Ethiopia.

#### 1974

Somalia continued to experience importations of smallpox cases from endemic neighbouring areas of Ethiopia, particularly from Hararghe and Bale provinces. In all, 11 cases were reported between January and November from four southern and two northern

districts. Check posts at Loyado, Tugwajale, Allaibaday and Ferfer were maintained. Surveillance teams continued their activities along the international border in Mudug, Hiran and Bakool Regions. Project staff also participated in the national multi-purpose literacy campaign launched by the Government.

#### 1975

A vast area of the Ogaden desert and much of Somalia was struck by the severest drought in living memory. Border areas saw large movements of nomads who had lost their livestock and who had moved to Somalia in search of food and water. Two separate smallpox importations occurred in January, one in Burao and the other in Yet. With the population movement from Ethiopia continuing there was justified fear of further importation of cases, and to discuss this problem a border meeting between Somali and Ethiopian smallpox staff was held at Tugwajale in April.

The establishment of drought-relief camps attracted nomads, including those from across the border. A total of 12 imported smallpox cases were detected either in, or on their way to, these camps. All camps in drought-stricken areas were under permanent surveillance and smallpox and BCG vaccinations were routinely given. Two 4-man surveillance teams were formed in the first half of the year and assigned to the southern and northern border areas respectively for continuous surveillance and investigation of all rumours. Project staff were again involved in the national literacy campaign and assisted in cholera surveillance in Mogadishu and along the Kenyan border.

#### 1976

January: Three separate importations from Warder, El Kere and Kelafo in Ethiopia resulted in five smallpox cases in Wajid and Huddur in Bakool Region and in Burao District in the north.

August: The last of 915 smallpox cases reported in Ethiopia in 1976 occurred on 9 August in Dimo, a small nomadic village in Bale Region of the Ogaden desert. Due to the lack of rains in this area many nomadic groups had migrated into Somalia. It is probable, although not confirmed, that infection persisted in one or more of these groups.

September: Five smallpox cases with dates of onset ranging from 30 August to 23 September were detected in Mogadishu on 27 September. Despite intensive searches along the border with the Ogaden, the exact link in the chain of transmission was never identified.

October: Smallpox infection spread slowly amongst the comparatively well vaccinated population of Mogadishu, resulting in another 13 cases. On 13 October and again on 24 October, 2 000 workers were mobilized for a city-wide house to house search and vaccination programme.

November: A training course for surveillance staff was organized by WHO epidemiologists on 20 and 21 November. A further 10 smallpox cases were detected in Mogadishu. No reports of any suspected cases were received from outside the capital.

December: A further 6 smallpox cases were detected in the capital in December. Two surveillance teams left Mogadishu, the first to conduct a search in Middle Shabelli, Hiran and Bakool Regions, the second in Lower Shabelli, Lower and Middle Juba and Bay Regions.

#### 1977

January: Despite intensive night-searches and mass vaccination, transmission continued at a low level in Mogadishu until 17 January, by which time a total of 39 smallpox cases had been reported since 30 August 1976. Five cases of smallpox were detected in Ledhi,



a small waterpoint in Mandera district of Kenya, the alleged source of infection being a Kenyan returning from Mogadishu in December 1976. No further cases were detected there after 5 February.

February: Except for the cases in Kenya, it was believed that the outbreak had been confined to Mogadishu town and a month after the last case was recorded in Mogadishu, an intensive house to house search failed to detect additional cases. A plan of action was prepared with the main objectives being a thorough nation-wide search and full documentation of surveillance activities. A reward of 200 Somali shillings for reporting a previously unknown smallpox foci was introduced.

March: The first Coordination Meeting convened by WHO in Nairobi, Kenya from 14 to 16 March was attended by national and WHO epidemiologists from Somalia, Ethiopia, Kenya and the Sudan to formulate and coordinate detailed plans for intensified surveillance activities in their respective countries. A special search operation initiated in Somalia in mid-March by joint WHO/national teams soon detected smallpox foci in Bakool and Bay Regions.

April: Many localities affected by smallpox were discovered situated along three major roads: Mogadishu - Beletweine, Mogadishu - Baidoa - Luk, Mogadishu - Merca - Gelib - Kismayo. With this discovery came the mutual decision of WHO and the Somali Government to institute a full-scale eradication campaign to interrupt smallpox transmission as soon as possible.

May: By the middle of May it was found that smallpox had affected a total of 9 southern regions: Bay, Bakool, Galgadud, Hiran, Middle and Lower Shabelli, Middle and Lower Juba and Benadir. A group of WHO epidemiologists arrived in Somalia and started both search activities and outbreak containment on a large scale. Local workers were hired and trained directly. On 18 May, the Ministry of Health declared the smallpox situation an emergency and issued a formal appeal through WHO to the United Nations Disaster Relief Office (UNDRO) for emergency assistance. On 23 May, a detailed list of urgently needed supplies, including 16 four-wheel-drive vehicles, spare parts and radios, was forwarded to WHO and UNDRO. On 27 May, UNDRO accepted the appeal for emergency assistance and in turn issued an appeal to international donors for support. By the end of May, when search operations had become fully effective, ten regions in the southern part of the country were found to be affected by continuous transmission. A sharp increase in the numbers of reported cases occurred in May.

June: By 3 June, the UNDRO appeal for international assistance had been successful and by 14 June 16 vehicles and many tons of supplies had been airfreighted from Europe. A team of French physicians and technicians were flown from Djibouti to assist for two weeks in vaccination and containment operation. By the end of June, smallpox eradication activities were fully operational with 23 WHO epidemiologists, 3 000 national workers, 50 vehicles and tons of essential supplies distributed throughout the country. The Government issued a directive urging the assistance and cooperation of political bodies, military, police, teachers and general health staff. The reward of 200 Somali shillings for detection of hidden smallpox foci was widely publicized. Coincident with this newly intensified effort and technically sound approach to containment activities, the number of newly detected outbreaks showed a declining trend despite the continuous intensive search.

July: Smallpox incidence having sharply declined, major outbreaks were restricted to only four southern regions: Bay, Bakool, Gedo and Lower Shabelli. The incidence in the other regions, including the previously heavily affected Hiran, Middle Juba and Middle Shabelli, appeared to be rapidly approaching zero. The first active search round in northern Somalia had failed to detect any smallpox with the exception of a single case detected in July in Burao which was confirmed to be an importation from Jowhar District, Middle Shabelli Region.

August: The sharp decline in the reported smallpox incidence was slowed by the discoveries of persistent transmission in small nomadic groups in the more remote bush areas. Investigation revealed that smallpox transmission had often persisted among such groups for from four to six months. To combat this set-back, large numbers of locally hired temporary searchers were sent on foot through the most remote bush and desert areas to search for smallpox cases and perform routine vaccination of the population.

September: A second coordination meeting was convened in Nairobi, Kenya from 26 to 28 September and was attended by epidemiologists from Somalia, Ethiopia, Kenya, Djibouti and the Sudan. The meeting recommended inter alia: 'Current international cooperation should be sustained for the Somalia eradication campaign so that smallpox transmission can be interrupted in the shortest possible time - the target being the end of 1977'.

October: The last known naturally transmitted outbreak of smallpox in Somalia and in the world occurred in Merca, Lower Shabelli Region, on 26 October. The only patient, Ali Maow Maalin, a 23 years old hospital cook, was recognized as a smallpox case on 31 October. The last smallpox containment activities started in Merca town and the neighbouring districts on the same day.

November: Surveillance was severely hampered and travel by vehicles rendered almost impossible in many parts of the country due to heavy rains and flooding. Field work continued on foot only, prohibiting adequate supervision and thus resulting in incomplete search coverage in some areas. In view of this, personnel were concentrated in those areas considered to be at the highest risk of having undetected foci.

December: A nationwide search operation involving 1 670 local staff supervised by 24 international epidemiologists failed to detect any smallpox cases. A total of 947 smallpox outbreaks resulting in 3 229 cases had been reported in 10 southern and one northern region during 1977. Somalia was proclaimed "smallpox-free" on 31 December 1977.

## 1978

January: A substantial reinforcement of the surveillance and reporting system was started, and in every district a smallpox surveillance office was established, with a District Team Leader and an average of 7 to 10 Surveillance Agents. A new element, fever and rash surveillance, was introduced throughout the country. Operational guidelines for the next two years were finalized.

January - March: Two or three search operations (depending on the assessed risk) were carried out in every region of Somalia during the first quarter of the year to confirm the smallpox-free status of the country. Assisted by temporary hired searchers, surveillance agents searched repeatedly all villages and nomadic encampments and visited schools, markets and waterpoints. The programme utilized up to 1 600 workers during the search period and 790 staff for continuous surveillance activities.

May - June: A special search with emphasis on the nomadic areas was conducted all over the country and 503 000 semi-permanent and nomadic huts were visited by searchers.

July: Another search of the entire country including both urban and rural areas started in July, at the beginning of the dry season, but found no sign of ongoing smallpox transmission.

October: Independent programme assessment was carried out by WHO international epidemiologists outside the areas of their usual responsibilities. Areas where the surveillance system needed further strengthening were pinpointed and defects remedied promptly. An average of 78% of the settled population and 69% of nomads showed a fair knowledge about the programme, including where to report a suspected smallpox case. A special ceremony in Mogadishu commemorated "one year of freedom from smallpox". The occasion was used to boost the morale of the programme staff for the next year of activities.

November: International Commission members, Prof. J. Kostrzewski and Dr P.N. Shrestha, visited Somalia from 16 November to 3 December to review programme activities. 34 localities in 16 districts were visited and field work as well as documentation was assessed.

December: The last all-Somalia search operation in 1978 started in both urban and rural areas. On average, throughout 1978, 780 personnel were engaged full-time in surveillance activities, including 19 National Counterparts, 10 International Epidemiologists, 69 District Team Leaders and over 500 Surveillance Agents. A total of 50 vehicles provided the necessary transport.

## 1979

January - February: The first all-Somalia search operation of 1979 started with 540 searchers visiting, in a two month period, 5 803 settled villages with 341 985 permanent houses and 19 432 nomadic camps with a total of 231 285 nomadic huts. No sign of persisting smallpox transmission was detected.

March: An independent assessment known as the "Internal Technical Audit" was carried out. Regional Assessment Commissions consisting of regional health workers and smallpox programme supervisors visited all regions and scrutinized the main programme activities. No sign of smallpox transmission after the date of onset of the last case in Merca was found. With few exceptions, regions appeared to be adequately prepared to meet the International Commission.

April - May: Inter-search surveillance activities were focused on the nomadic population and the areas most deficient in submitting routine reports or reporting no cases of fever and rash. Areas bordering other districts, regions and neighbouring countries and areas which had shown no improvement in the assessment findings were also given special attention.

June - July: The second 1979 all-Somalia search operation was carried out in which 370 317 households in 4956 settled localities and 196 134 nomadic huts in 16 059 nomadic encampments were carefully searched and public awareness about the programme activities strengthened.

August - September: About 230 surveillance agents were released as the first phase of staff reduction after completion of the second all-Somalia search operation. Altogether 10 WHO advisers, 17 regional epidemiologists, 68 district team leaders and 200 surveillance agents remained with the programme from mid-August. In the majority of regions, the remaining staff was pooled and formed into mobile surveillance teams. The scope of the programme activities was reduced accordingly.

## 2. Evolution of the Eradication Strategy

### Mass Vaccination (1968-1971)

Participating in the global programme to eradicate smallpox, Somalia announced in 1968 that it would aim to eradicate smallpox from the country within three years. The strategy was to be a mass vaccination campaign with three phases: a preparatory phase to commence in September of that year, an attack phase to start in January 1969 and a maintenance phase to follow in due course. Supplies of potent, freeze-dried vaccine were assured by WHO and vaccinators and other personnel were recruited and trained. The target of the attack phase was to vaccinate 100% of the entire population of all age groups within the three years 1969 to 1971. Assuming that this was achieved, the target for the maintenance phase would be to vaccinate all newborns, immigrants and the floating population and to revaccinate the whole population at three to four year intervals.

In spite of extensive propaganda, the response to vaccination varied from full cooperation to point blank refusal. It soon became obvious that achieving 100% vaccination coverage, especially in a country with a high proportion of nomads, was not feasible.

### Beginnings of Surveillance and Containment (1971-1976)

During the years 1972-1976, Somalia continued to experience importations of smallpox from endemic neighbouring areas of Ethiopia, particularly from Hararghe and Bale Provinces. In view of this the Somali smallpox eradication strategy was redirected from one in which mass vaccination was essentially the only activity to an approach in which basic smallpox surveillance, a better understanding of the epidemiology of smallpox and vaccination of the population in areas of risk were regarded as the most important elements.

This new strategy was gradually implemented by developing a system capable of detecting imported smallpox cases, introducing rudimentary epidemiological investigations and by attempting containment of all detected outbreaks. A basic, albeit incomplete, reporting system was gradually established, especially in border districts where information was gathered by contact with local health staff, political and administrative officials and village and nomadic leaders.

The mobile vaccination units were eventually converted into surveillance teams charged with the responsibilities of the new programme. In addition, existing quarantine services were strengthened. In the second half of 1976 a new element of surveillance was introduced into the programme: active searches for smallpox cases in limited areas.

### Intensified search and outbreak containment: Emergency Strategy (May - December 1977)

An emergency strategy, based on a methodology already proved in the field to be highly effective and having access to considerable national and international resources was outlined, in May 1977, for the final battle against the world's last known focus of smallpox.

With the discovery of continuing widespread transmission of the disease in the country, the Somali Government, with assistance from WHO, moved quickly to implement the new campaign. The objective was simply the interruption of smallpox transmission as quickly as possible, using a strategy which essentially consisted of two phases:

#### Phase I - May to August 1977. The objectives were:

- to assess more accurately the extent of the smallpox problem in the country,
- to reduce smallpox transmission in the apparent centre of the existing smallpox epidemic in the area enclosed by the Juba and Shabelli Rivers,
- to interrupt smallpox transmission in low-incidence regions bordering the inter-riverine area, and
- to maintain the smallpox-free status of any unaffected areas of the country.

#### Phase II - September to December 1977. The objectives were:

- to interrupt smallpox transmission in the inter-riverine area,
- to maintain the smallpox-free status of the remaining areas.

The achievement of these objectives was dependent on the coordinated use of the available resources to rapidly develop a highly sensitive surveillance system coupled with reliable, effective containment action.

### Surveillance

The following elements were identified as priorities:

- establishment of weekly reporting of smallpox cases from village or encampment to national level,
- wide publicity of the 200 Somali shillings reward to encourage the public to report all suspected cases of smallpox,
- establishment and implementation of a continuous programme of house to house, locality by locality searches for smallpox cases.

The searches played a major role in achieving effective surveillance. Each searcher was assigned an appropriate number of "fixed search units" (villages, plantations, waterpoints, etc.) and specific areas inhabited by nomads. They were instructed to enquire about the existence of smallpox and chickenpox, show the smallpox recognition card, and inform people about the reward and where to report suspected smallpox cases. In each village, school, market, shop, tea-shop, local public place and health establishment enquiries about smallpox cases were made. Prominent village headmen, teachers and political and administrative officials were contacted and interviewed. The striking increase in reported smallpox incidence during May and June and into July, reflected the impact of this newly established system of case detection. From June onwards it is believed that the reported smallpox incidence very accurately reflected the actual epidemiological situation. With limitations on manpower, transport facilities and funds it was not possible to establish and maintain full-scale surveillance in all areas at once. Therefore, while maintaining basic surveillance throughout the country, the frequency and intensity of activities varied in proportion to the assessed risk. From May to December, active searches were carried out 2 or 3 times monthly in high-incidence regions, monthly in low-incidence regions and once every six to eight weeks in smallpox-free areas. (figure 3.1)

Furthermore, the techniques of search and surveillance had to be adapted to the specific area and character of the population being searched. From previous field experience it was clear that no single technique of surveillance could detect all foci, therefore separate surveillance methods had to be utilized simultaneously. (see Chapter 7 )

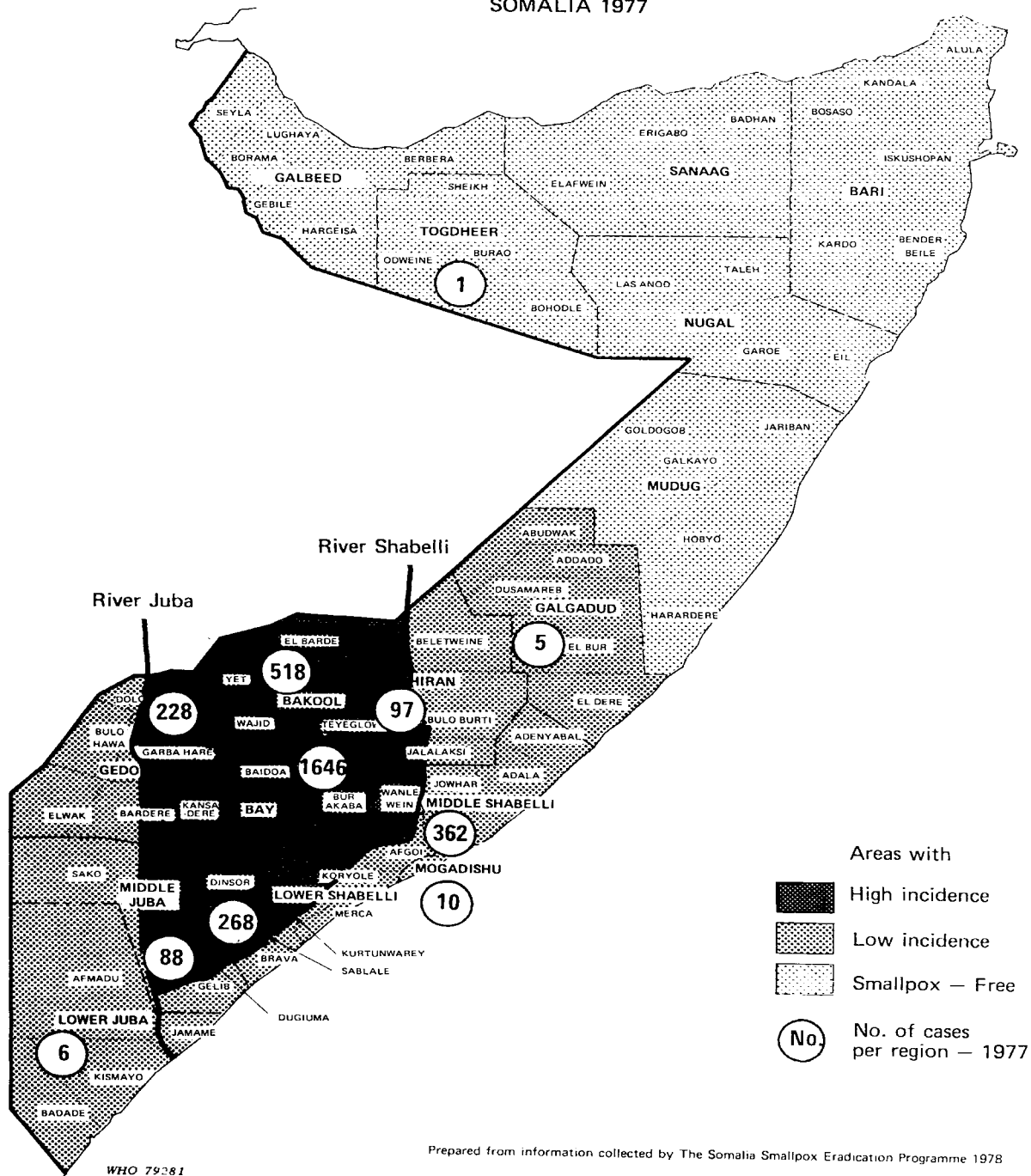
### Containment

Aiming to achieve rapid and rigorous containment of all outbreaks, the following elements were considered as priorities:

- vaccination of all residents and visitors in the immediate vicinity of each affected area within 48 hours, and preferably within a shorter period,
- establishment of a secure "isolation unit" in each affected area,
- provision to isolated patients of adequate shelter, food and water as well as incentives to stay in isolation.

To cope with the prevailing epidemiological situation, 'Zeropox' offices were established in each affected district in high-incidence regions. The district was subdivided into operational areas, such that no area had more than 30 outbreaks, and an epidemiologist or national counterpart was assigned to each such operational area. Further subdivisions defined "team areas" where a team, headed by a supervisor and comprising, as far as possible, all locally hired workers, effected containment. These "team areas" contained no more than 10-15 outbreaks and were small enough to be readily covered on foot. (see Chapter 9 )

FIG. 3.1  
SMALLPOX INCIDENCE  
GEOGRAPHICAL DISTRIBUTION  
SOMALIA 1977



Prepared from information collected by The Somalia Smallpox Eradication Programme 1978

Weekly training and review sessions with epidemiologists, counterparts and team leaders were held in affected districts and regions to discuss the current situation. Monthly progress review meetings, in Mogadishu, attended by all supervisory staff, reviewed the prevailing epidemiological trends, provided refresher training, assessed individual methods and allocated resources according to actual needs.

Understandably, there was an acute shortage of trained staff and, with Government consent, from April the programme hired and trained staff locally. Trainees were warned in advance that their assignment would involve travelling on foot to remote areas, spending nights in affected localities and long hours of work without weekends and holidays. Over 3 000 workers were hired, trained and put into operation within less than 5 weeks.

In autumn 1977 the "public health miracle" happened. With great dedication and in spite of personal suffering, these highly motivated smallpox fighters, of whom only about 1% had any previous health education, interrupted smallpox transmission after less than 6 months. Only 141 days had elapsed from the declaration of the emergency by the Ministry of Health to the onset of disease of the last known case of variola minor, in Merca town, on 26 October 1977.

#### Continued Freedom from Smallpox: Rash with Fever Surveillance (October 1977 - October 1979)

The strategy employed during the two year period after the last known smallpox case has been to consolidate the victory over smallpox while maintaining effective surveillance throughout the country. It includes several important elements which have been gradually adapted and developed according to field experience.

##### Periodic search operations

Active hut to hut searches in rural areas as well as house to house searches in the towns throughout Somalia have continued. During 1978, all regions were thoroughly and repeatedly searched, six times in the south and four times in the north. In 1979, there have been only two all-Somalia active search operations:

- the all-Somalia "Jilal" 1979 search campaign in January and February,
- the all-Somalia "Hagaa" 1979 search campaign in June and July, after the wet season.

Following these searches 'mopping-up' activities were implemented, from March and August respectively.

##### Surveillance during inter-search periods

The majority of regions and districts have geographic areas or groups of population which pose particular surveillance problems due to their relative inaccessibility, the high mobility of the population or the theoretically greater risk of exposure to smallpox infection. Special searches were organized repeatedly in some areas, for example:

- remote areas that may have been missed during regular search operations,
- areas most recently affected by smallpox transmission,
- areas bordering other districts, other regions or neighbouring countries,
- areas to which access was cut off by seasonal climatic changes,

- areas with newly introduced nomadic populations and seasonal workers' or refugee camps,
- areas not reporting rash with fever cases or not showing improvement during search assessments.

#### Continuous routine surveillance by Surveillance Agents

The primary objective for surveillance agents has been to collect information about suspected smallpox cases and other rash with fever cases within their areas of operation (zones). They have continued to motivate and stimulate the general population and the local health and administrative workers to report rash with fever cases. They have carried out surveillance at markets, schools, public offices, health establishments and other places of gathering where the rural population, settled or nomadic, come to exchange views, news and products or to avail of various services. During the dry seasons they have paid special attention to surveillance at watering points.

#### Publicity of the reward for reporting smallpox

The reward for reporting smallpox outbreaks has greatly assisted all forms of surveillance. Its existence and purpose have been widely publicized among all segments of the population by a variety of methods including: reward posters in villages, nomadic encampments, hospitals, schools, public offices, shops and tea-shops; announcements written on walls; reward slogans on programme vehicles, publication in the press, announcement by radio and payment of the reward in public at large gatherings. However, undoubtedly the greatest form of publicity, in keeping with Somali tradition, was by word of mouth of the searchers and the public themselves.

#### Rash with fever surveillance

In January 1978, an additional element of surveillance was introduced, requiring all programme staff and health workers to report all cases of rash with fever. Smallpox rumour registers for recording such cases have been established at every reporting unit in each district and each report obtained is supposed to be investigated promptly by a staff supervisor or regional epidemiologist.

#### Reinforcement of reporting system

The system of routine notification and regular reporting, which forms the base for all surveillance activities, was reinforced in January 1978. The key points in the reporting system are the district and regional "Zeropox" offices. In addition, selected health centres, hospitals and dispensaries function as reporting sub-units. Constant checking and insistence on the receipt of a report each week has greatly improved this system.

#### Secondary surveillance system

The secondary surveillance network utilizes government, political and administrative officials, police, teachers, zonal and village headmen and public institutions such as the Somali Youth Organization, the Somali Women's Democratic Organization and the Red Crescent Organization. All have been asked to report suspected smallpox cases or any cases of rash with fever to the nearest "Zeropox" office.



#### Vaccination

A continuous programme of vaccination has always been included in the programme in an attempt to improve the immunity of those sectors of the population considered at greatest risk. Vaccination has been combined with search operations in remote or vulnerable areas. Mass vaccination has never been conducted during the intensified programme, however, vaccination is available to anyone on request.

## 4 EPIDEMIOLOGY OF SMALLPOX

It is known that smallpox prevailed in the Horn of Africa for centuries as it is mentioned in the chronicles of early western explorers of this part of the world, however, detailed reliable data on its occurrence are not available.

A German traveller, Von der Decken, who in 1865 sailed up the River Juba, referred to a severe epidemic of smallpox amongst Galla people who still occupied a few areas in the southern part of the country at that time. Their defeat, around the same time, was partly attributed to the occurrence of the disease among them.

The son of Boqour Isman, a sultan of a part of southern Somalia, is reported to have died of smallpox in 1927 when an epidemic swept through Mogadishu and neighbouring areas.

Concerning the more recent past in Somalia, it has been stated that: "Smallpox has been reported in epidemic proportions every six to seven years. It usually takes the clinical picture of alastrim with a very low lethality rate. It is suspected that the number of cases normally reported in Somalia is minimal and the population, particularly in the rural areas is to a very large extent not vaccinated..."<sup>a</sup>

### 1. Smallpox Incidence before 1970

No information about the incidence of smallpox in Somalia prior to the late nineteen-twenties is available. The reported annual incidence since 1929 in the Somali territory under British and Italian administration, as well as in the Somali Republic after its independence, is given in Table 4.1. It should be noted that the numbers for some years and areas are only estimates and that notification and registration of cases, particularly in the earlier years, was often very incomplete and inconsistent from year to year and from area to area. Registration of smallpox was compulsory under the British and Italian administrations but no organized reporting structure existed. After independence the pre-existing laws ceased to be valid and smallpox notification was based largely on the good will of the people. Any person who suspected smallpox traditionally had the duty to report the case to the nearest administrative or health authority. No incentive was given to him for such a report and no records of registration, nor of epidemiological and clinical observations were maintained.

From Table 4.1 it can be seen that from reported figures no definite pattern or trend of smallpox incidence can be determined. The last epidemic prior to that of 1976-77 was in 1953-55, during which several thousand cases were reported. However, as no adequate reporting system existed the exact number affected remains unknown. It is estimated that only a small percentage of cases was notified and subsequently entered in official annual records. Various problems in the detection of outbreaks were cited at that time by investigation teams who were often given conflicting information or deliberate misinformation. For example, hoping to get transport to a remote area, a member of the public might volunteer information on non-existent cases. The population feared smallpox especially because of the isolation imposed on affected groups by the rest of the community. This often resulted in concealment of cases as well as false reports by suspicious neighbours. These problems were also observed during the epidemic in 1977.

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<sup>a</sup> Macchiavello, A., Integral Dynamics of Health in Somalia, Ministry of Health, Mogadishu, 1965.

TABLE 4.1  
SOMALIA - ANNUAL SMALLPOX INCIDENCE 1929-1979

Year	Northern Part Cases	Southern Part Cases	Total Cases	Year	Northern Part Cases	Southern Part Cases	Total Cases
1929	121	.	121	1954	818	737	1 555
1930	122	.	122	1955	250*	391	641
1931	13	.	13	1956	0	84	84
1932	14	0	14	1957	3	88	91
1933	38	76	114	1958	0	.	0
1934	91	0	91	1959	94	.	94
1935	243	2	245	1960	2	45	47
1936	152	10	162	1961	0	36	36
1937	1	49	50	1962	0	221	221
1938	2	1	3	1963	0	0	0
1939	7	71	78	1964	0	0	0
1940	2	1	3	1965	0	0	0
1941	.	.	.	1966	2	0	2
1942	.	.	.	1967	0	0	0
1943	634	.	634	1968	0	0	0
1944	13	.	13	1969	0	0	0
1945	1	0	1	1970	0	0	0
1946	0	3	3	1971	0	0	0
1947	0	0	0	1972	5	0	5
1948	0	0	0	1973	1	6	7
1949	0	0	0	1974	2	5	11
1950	250*	0	250	1975	13	1	14
1951	250*	0	250	1976	1	38	39
1952	250*	0	250	1977	1	3 228	3 229
1953	240	0	240	1978	0	0	0
				1979	0	0	0

\* Estimated approximate figures.

. No data available.

Sources: WHO Epidemiological and Vital Statistics Reports.

World Atlas of Epidemic Diseases, Part III, Redenwaldt, E. and Jusatz, H.J., editors, Falk-Verlag, Hamburg, 1961.

In February 1966, of about six persons who were reported to have crossed the border from French Somaliland, two, a man and a woman, developed smallpox shortly after their arrival in the Abdulkader area in northern Somalia. The man died during the first days of illness, and only the woman, who recovered, was originally reported. Around this time a total of 20 suspected smallpox cases were reported in a 4-5 week period: 8 from the Sheikh area, 7 from Burao, two from Erigavo and one each from Fagayob, Mogadishu and Abdulkader. All but the last were diagnosed as chickenpox by paramedical staff although the differentiation from smallpox was made on clinical observations only.

The situation at that time may have been worsened by the differentiation by some paramedical staff between "smallpox" and "alastrim". The underestimation of "milder forms of smallpox" and the view that they did not represent "true smallpox" might have led not only to a substantial under-reporting but to the danger of an unchecked epidemic.

It seems probable that cases of smallpox occurring in more remote areas might have escaped diagnosis and/or not have been reported. There was a strong belief both inside and outside the country that because of the low population density it would be impossible

for the disease to spread and cause an epidemic. This hypothesis was proven incorrect in 1977. Considering these factors, it is difficult to establish when endemic smallpox really ceased in the country, although the year 1963 is usually quoted on the basis of official reports. Following the start of the smallpox eradication project, reporting was becoming more reliable by 1970. However, the programme was still based on mass vaccination and many workers considered the number of vaccinated more worthy of reporting than the number of affected.

## 2. Smallpox Importations 1972-1976

After a lapse of six years, importations of smallpox from Ethiopia started to recur in 1972, affecting densely inhabited border areas of Somalia. In this and subsequent years Ethiopia experienced massive epidemics of smallpox spreading over the majority of its territory and resulting in 26 329 recorded smallpox cases in 1972, 16 999 in 1973, 5 414 in 1974, 3 935 in 1975 and finally 915 smallpox cases in 1976 including the last reported case, in August. During these years smallpox was detected among Somali pastoralists, who migrate regularly between Ethiopia and Somalia across the 1 600 km open border, and among visitors coming to see their relatives living in Somali territory.

### 1972

A total of five smallpox cases were detected in Galbeed Region in October-November, two from Gebile District, two from Hargeisa town and one from Borama District (figure 4.1A and annex 6). Although the first two cases were detected at the border villages of Allaibadi and Tugwajale, both of these persons had visited Hargeisa after crossing the border from Ethiopia, one staying there for about one week after developing a rash. An extensive search was started in the suspected areas of Hargeisa and led to the discovery of two more smallpox cases. The fifth case was suspected by health staff in Borama and later confirmed by a WHO epidemiologist. There were 21 direct contacts of these cases; nine of them were not vaccinated. All of them were kept under observation but none developed smallpox.

### 1973

Seven smallpox cases were detected and reported in Somalia during 1973 (figure 4.1B and annex 6). The first case was detected in Mogadishu on 30 April, a 9 years old girl who had left Mustahil, Ethiopia on 17 April and arrived in Mogadishu on 21 April. She developed a fever on 24 April and a rash on 29 April and on that day the case was detected and isolated. Among 30 direct contacts, six children under 10 were found unvaccinated but no known secondary cases developed.

In June, three imported cases of smallpox in the same family were discovered in Mataban, in Galgadud Region, where they had developed rashes late in May after crossing the border from the Mustahil area, possibly from El Halima.

In the north, one imported case of smallpox was detected in Allaibadi, Gebile District, in mid-August and was probably infected in Faafan, near Jijiga in late July. No secondary cases were detected.

The last two imported cases of smallpox in 1973 were detected in Beletweine area in mid-October. No details are known except that they arrived from Bulo Olow in the Mustahil area in Ethiopia.

These cases confirmed that as long as there was smallpox in neighbouring areas of Ethiopia, Somalia was at extremely high risk of importation through mobile nomadic groups.

FIG. 4.1.A SMALLPOX IMPORTATIONS  
FROM ETHIOPIA INTO SOMALIA - 1972

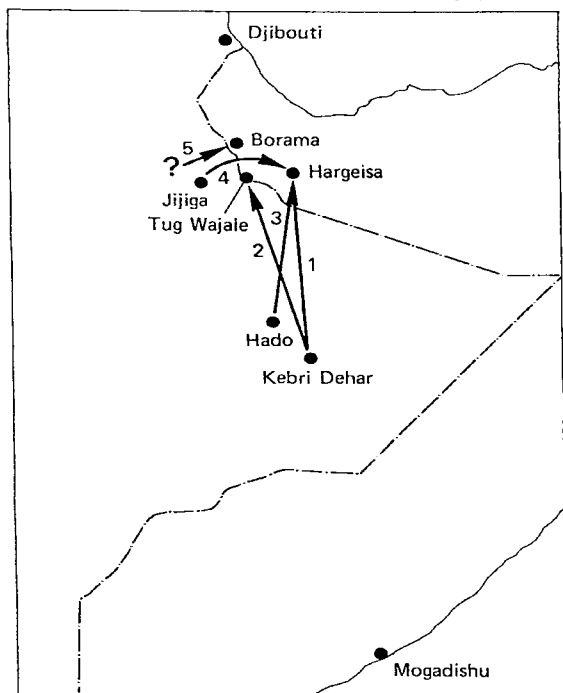


FIG. 4.1.B SMALLPOX IMPORTATIONS  
FROM ETHIOPIA INTO SOMALIA - 1973

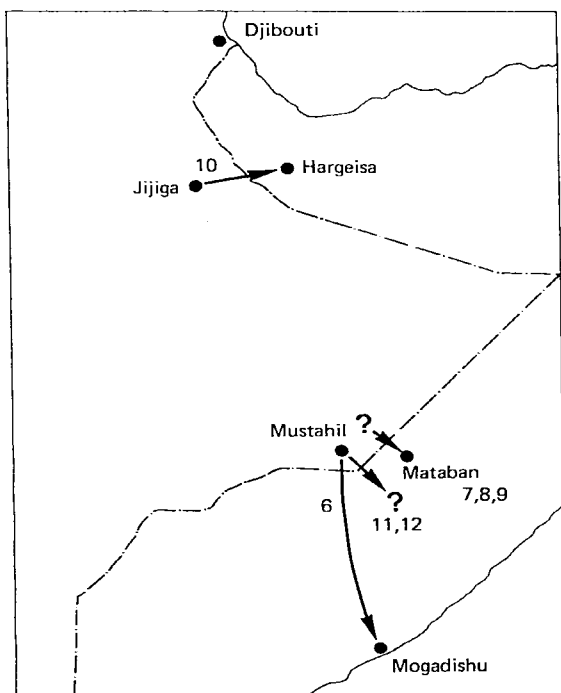
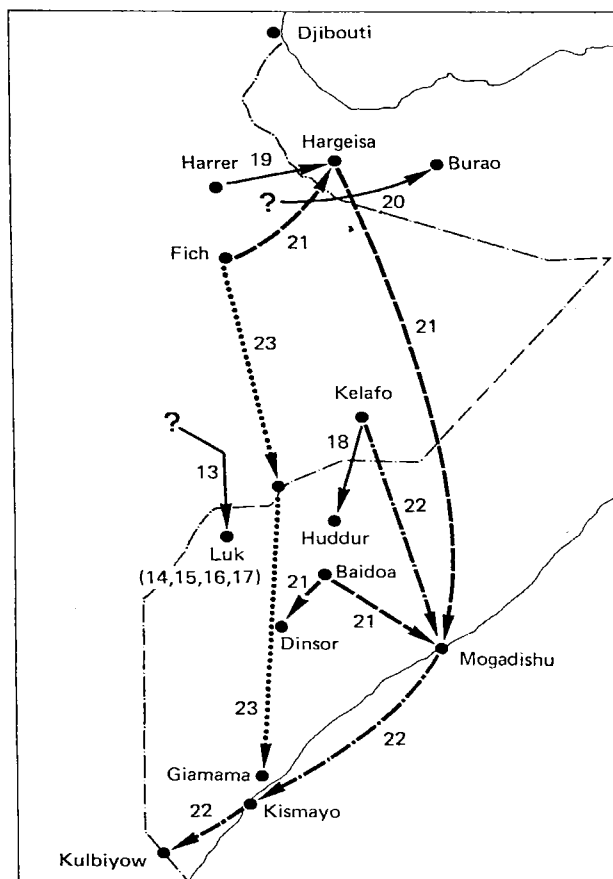


FIG. 4.1.C SMALLPOX IMPORTATIONS  
FROM ETHIOPIA INTO SOMALIA - 1974



WHO 79277

Numbers correspond to reference numbers in Annex 6

1974

Altogether, a total of 11 smallpox cases was detected and reported in Somalia in 1974, of which 7 were confirmed as importations and the remaining four as secondary cases to one imported case (figure 4.1C and annex 6).

On 3 January, information was received of a suspected case in Dolo District of Gedo Region and a further four cases soon followed. The index case, a 30 years old male, resident of Sheedley village in Dolo, crossed to Ethiopia early in December 1973 and visited his relatives in Dir Hara. He returned on 20 December, developed a fever 6 days later followed by rash on 29 December. He confirmed that he had stayed with a family in Ethiopia whose members were suffering from smallpox. Four direct household contacts who were not previously vaccinated acquired the disease, the first on 4 January and the others on 5 January.

A further smallpox case was detected in Abe Saleh in Huddur District, Bakool Region on 20 March, having developed a rash on 14 March on his return from the Kelafo area in Ethiopia, where he had stayed for a few weeks.

In the north, two separate importations occurred, the first being detected in Hargeisa at the end of March, was an adult male who was a voluntary worker in the Group Hospital, Hargeisa and who had recently visited his relatives in the Madar area of Hararghe Region in Ethiopia. Containment vaccination was carried out in the affected sector of Hargeisa and the border areas through which the patient had travelled. The second case was detected in Burao in April. The source of infection was most probably also in Hararghe Region in Ethiopia. No secondary cases were detected from either outbreak.

At the beginning of September, a case of smallpox was detected in Dinsor, Bay Region and the source of infection was traced back to Fich, Ethiopia. The patient had crossed the border at Tugwajale on 29 August and travelled extensively (over 2 000 km) on a route linking Tugwajale, Hargeisa, Mogadishu, Baidoa and Dinsor. He developed a rash on 4 September, while staying in Mogadishu.

At the end of September, a 16 years old male with smallpox was discovered in Kulbiyow, a border town near Kenya in Badade District of Lower Juba Region. The patient arrived from Kelafo, Ethiopia, crossed the border at Ferfer on 11 September and travelled by truck via Beletweine, Mogadishu, Kismayo and Badade. He developed a rash on 23 September after arrival in Kulbiyow.

The last case of 1974 was discovered in Jamame District of Lower Juba Region on 19 November. The source of infection for this case was also traced back to Fich in Ethiopia. He crossed the border at Yet on 25 October and developed a rash on 8 November. The three latter cases had travelled considerable distances in Somalia before reaching their final destinations. Although some of the time they were infectious, no secondary cases related to them were reported.

1975

Fourteen smallpox cases, all allegedly imported into the country, were reported during this year. 13 of them were detected in the north (figure 4.1D and annex 6).

At the beginning of the year a vast area of the Ogaden desert and northern parts of Somalia had been struck by drought, resulting in extensive loss of livestock and migration of nomads in search of food and water. The establishment of drought relief camps attracted nomadic groups into Somalia from across the border, including some from areas in Ethiopia affected by smallpox. Smallpox importations were soon detected in persons living in camps or among those on their way to the camps. The histories of these episodes of importation are outlined below.

On 14 January a family, coming from an area near Warder in Ethiopia, entered Somalia and went to Burao. The mother and two children were in the pustular stage of the smallpox rash and another child was suffering from a fever and developed smallpox on 18 January. No one in the family had been previously vaccinated. Smallpox was diagnosed one day after their arrival in Burao, when the family was referred to a hospital. All contacts were isolated and vaccinated and no known secondary cases occurred.

About the same time, on 23 January, a young male leading a camel herd alone entered Somalia on his way from El Kere to Yet. He had smallpox in the pustular stage which was noticed by the local people who informed a vaccinator. The patient was isolated and no secondary cases appeared in the area.

On 25 February, another young male crossed the Somali border and arrived at Beer relief camp from Garlooghay area near Warder and two days later developed smallpox.

Another patient, an adult female and a resident of Warder in Ethiopia, entered Somalia on 9 March, visiting Odweine and Burao on her way to Gaha Relief Camp where she arrived on 16 March. Four days later a rash was noticed and the same day containment was instituted.

An adult male reported to the Group Hospital, Hargeisa on 27 April and was diagnosed as a case of broncho-pneumonia. A few scabs on the distal parts of the lower extremities and some fresh scars were noticed. He reported that he had had a fever and headache while staying in Garlooghay on 23 March. Two days later a rash had appeared which had confined him to bed for 10 days. In mid-April he had left Garlooghay going to Maholin where he stayed for a week before crossing the Somali border on 24 April.

A medical dresser working at Haji Saleh village, near the border, saw an adult male suffering from a fever and rash all over his body on 27 May. One day later, the Medical Officer from Burao confirmed the diagnosis. The patient had left Garlooghay on 20 May, crossed the border on 25 May and developed rash on 26 May. Five direct contacts were isolated.

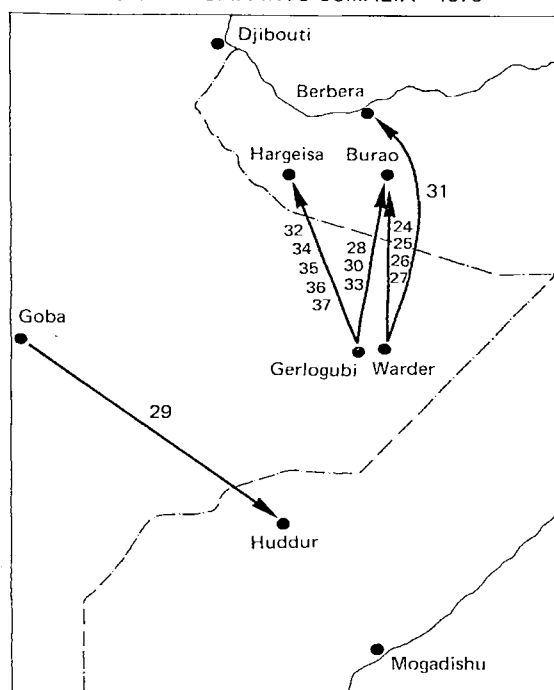
On 26 July, a family of seven, three adults and four children, arrived at Hargeisa, again from Garlooghay. The mother and a child, who were suffering from rashes, were immediately detected by a dresser in the locality. The family and their contacts were isolated the same evening. On 30 July and 5 August, respectively, two other family members developed rashes while in isolation.

#### 1976: The first six months

Five imported smallpox cases were reported in the country during January-February, four in the south and one in the north (figure 4.1E and annex 6). On 20 January an adult female was detected with smallpox in Bohodle District, Togdheer Region, and isolated the same day. It is understood that she left an area 11 km north of Warder on 11 January and reached Bohodle on 15 January where, two days later, a rash appeared. Four direct contacts were isolated but no one developed disease.

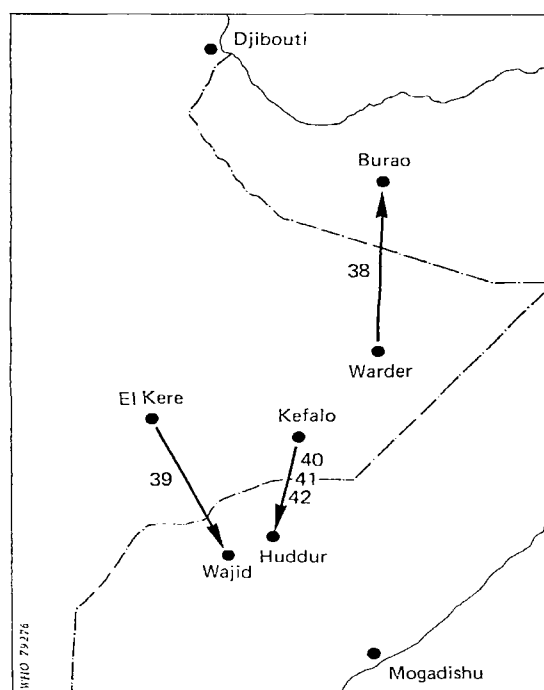
On 14 January, a 40 years old male arrived at the out-patient clinic of Wajid Hospital in Bakool. Pulmonary tuberculosis was suspected and he was treated while staying in the hospital compound. When a high fever developed on 19 January, followed two days later by rash, allergic reaction to streptomycin was initially considered. When the patient admitted that he had arrived from El Kere in Ethiopia, with an overnight stop in Yet, smallpox was suspected. His general condition deteriorated and the patient died on 4 February. About half of his direct contacts, 28 employees and 60 in-patients, were found not to have been previously vaccinated but no secondary cases were detected.

FIG. 4.1.D SMALLPOX IMPORTATIONS  
FROM ETHIOPIA INTO SOMALIA - 1975



Numbers correspond to reference numbers in Annex 6

FIG. 4.1.E SMALLPOX IMPORTATIONS  
FROM ETHIOPIA INTO SOMALIA - 1976



In mid-February two smallpox cases, who had developed rash in Kelafo area during the first days of February, were detected in an area between Yet and El Barde, approximately 50 km north of Huddur, in Bakool Region. Another case, also from the Kelafo area, arrived in Huddur on 19 February and developed a rash the next day.

Summary: 1972 - mid 1976

In all, 42 smallpox cases were detected and reported from Somalia during the period from the beginning of 1972 to mid-1976, of which 38 cases were recorded as importations, 22 into the northern regions of the country (Table 4.2). Only four secondary cases were documented.

TABLE 4.2

SMALLPOX CASES DETECTED IN SOMALIA 1972 - MID 1976

Year	Total smallpox cases	Documented Importations		
		Total number	Northern area	Southern area
1972	5	5	5	-
1973	7	7	1	6
1974	11	7	2	5
1975	14	14	13	1
1976	5	5	1	4
Total	42	38	22	16



The age and sex of 35 of the cases are known: 66 per cent were males and 83 per cent were 15 years of age or older, including 46 per cent in the 15 to 29 years age group and 37 per cent of 30 years or more.

Three main routes of importation were evident: along the Juba River via Dolo District in Gedo Region, along the Shabelli River crossing the border in the Ferfer area of Beletweine District, and through the "Haud" area crossing somewhere on the long border from the Abdulkader - Tugwajale area to Burao. No special seasonal pattern of importation is apparent.

### 3. The Mogadishu Outbreak - 1976

#### UNISANTE 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

HENDERSON CHIEF SMALLPOX ERADICATION GENEVA

This cable of 27 September 1976 confirmed the existence of one of the most important outbreaks in the history of smallpox eradication, the "Mogadishu Outbreak", the first reported case of which had occurred a month earlier, on 30 August. This confirmation ruined the prevailing dreams of veteran smallpox fighters and the plans of the World Health Organization to proclaim the world's freedom from smallpox on 26 October 1976. Coincidentally, it was exactly one year later, on 26 October 1977, that the actual last known case of smallpox developed a rash in Merca town, southern Somalia, and smallpox transmission was finally interrupted.

#### 3.1 Source of Infection

Prior to the discovery of this outbreak, the last known smallpox in the Horn of Africa had been in the Ogaden Desert area (figure 4.2). In the Bale region of Ethiopia, bordering Somalia, numerous outbreaks had occurred among nomads during spring and early summer, however, it was reported that Ethiopian teams had not been able to search extensively nor vaccinate in this area until July. When the search was eventually conducted, they found many nomadic encampments which had been recently affected with smallpox but only in some had smallpox transmission persisted. The outbreak at Dimo, where the last known case occurred on 9 August, was the last of these. It was learned that because of lack of rain in the area, many nomadic groups had migrated into Somalia in search of water and grass for their animals. It is probable that smallpox infection persisted in a few such groups which settled near the Ethiopia-Somali border. The reasonable roads and a frequent bus service for the trip of about 400 km from the border to Mogadishu, a journey often made by nomads visiting relatives, probably provided the route of transmission of the disease to the capital.

The detection of the first 5 cases in Mogadishu with dates of onset of rash from 30 August to 23 September had necessitated a fresh appraisal of the situation. It was calculated that all of these cases must have been exposed to unknown sources of infection between 13 August and 16 September. Epidemiological investigation revealed that the five persons had travelled to Mogadishu separately, having crossed the Ethiopia-Somali border some 8 to 10 days prior to the onsets of their rashes. It was concluded that the source of infection was either in Ethiopia or in Somalia, but very near the border. From the information available, and shown in table 4.3, two foci were suspected (figure 4.3): first, the area between Kelafo, El Abred, Ferfer and El Goran and secondly an area 15 - 50 km south and south-west of El Kere.

FIG. 4.2  
AREA OF LAST KNOWN OUTBREAKS IN OGADEN DESERT

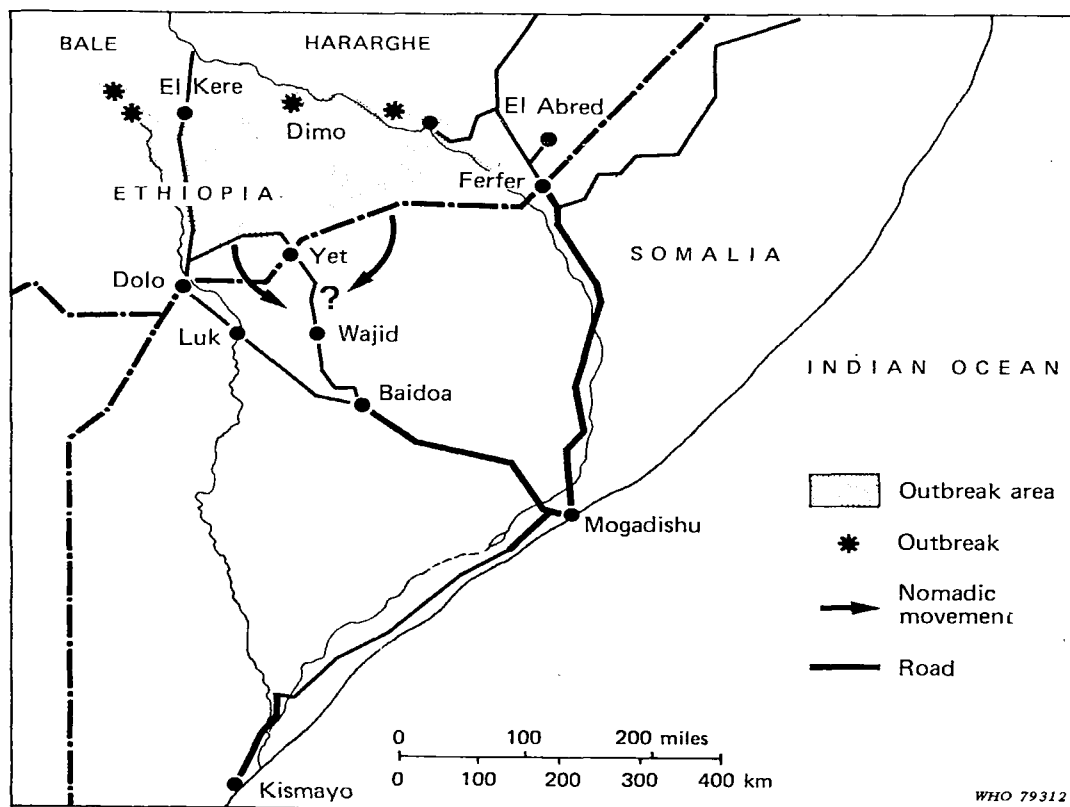
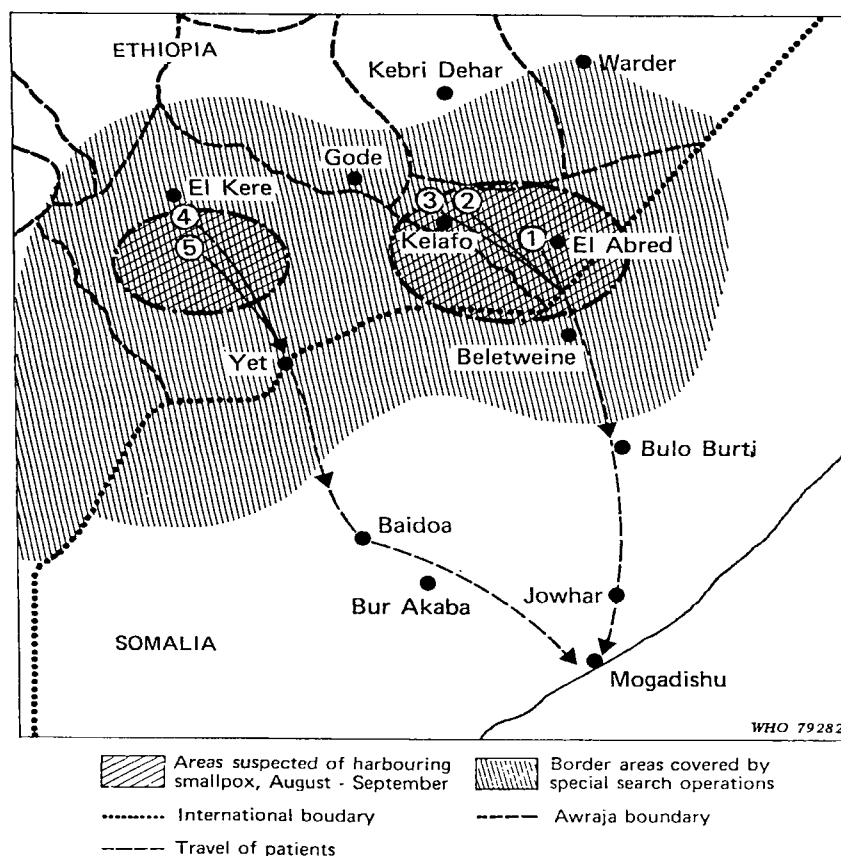


TABLE 4.3  
LINELISTING INCLUDING TRAVEL ITINERARY OF FIRST FIVE DETECTED CASES IN  
MOGADISHU OUTBREAK, AUGUST - SEPTEMBER 1977

Name	Sex	Age	Arrived Mogadishu	Onset rash	Hospitalized	Travelling Itinerary
1 Sadia Hassan Abdulle	F	16	22 Aug.	30 Aug.	1 Sep.	Left encampment between Kelafo and El Abred after mid-August
2 Abshira Hasan Nura	F	18	4 Sep.	12 Sep.	20 Sep.	Left Kelafo 26-28 August; left Ferfer on 2 September
3 Nur Sheikh Yusuf	F	30	15 Sep.	23 Sep.	25 Sep.	Left Kelafo on 6 Sep. and left Ferfer on 13 Sep.
4 Mohamed Jimale Abikar	M	70	31 Aug.	5 Sep.	14 Sep.*	Left encampment 15 km south of El Kere after mid-August
5 Faduma Ali Mohammed	F	30	12 Sep.	17 Sep.	20 Sep.	Left encampment 10 hrs walk south of El Kere on 5 Sep., left Lam. Shillini on 7 Sep., left Yet on 9 Sep.

\* Died 19 September with bronchopneumonia.

FIG. 4.3  
AREAS SUSPECTED OF HARBOURING SMALLPOX,  
AUGUST - SEPTEMBER 1976  
SHOWING TRAVEL OF PATIENTS



One patient (case 3, Table 4.3) reported having seen similar cases in a village near El Goran from whence she travelled on foot to the border and by bus to Mogadishu. Similarly, case 5 reported smallpox cases in a village near El Kere. Cases 4 and 5 both travelled from El Kere to Yet on foot, via Lama Shillindi, and from there to Mogadishu by bus, via Baidoa. This route is some 400 km distant from those taken by cases 1, 2 and 3. All five patients developed illness after arrival at Mogadishu and were without symptoms while travelling.

Extensive searches in both the areas suspected as sources of infection revealed no smallpox cases. Furthermore, border searches organized by Ethiopian, Somali and Kenyan Smallpox Eradication Programmes failed to find any additional cases. An intensive search of the vast Ogaden Desert area, organized at the end of the year, and supported by helicopters on the Ethiopian side, failed to detect any evidence of continuing smallpox transmission. Thus, despite concerted efforts, the missing link between the outbreaks in Dima and the Mogadishu outbreak could not be identified, neither in the border areas nor in Mogadishu itself. Once again the difficulties of identifying the source of infection of smallpox in a floating nomadic population were made apparent.

### 3.2 Spread of Smallpox in the Capital

Infection in Mogadishu spread slowly among the relatively well-vaccinated population, resulting in the eventual occurrence of 39 reported cases, the first of which occurred on 30 August 1976 and the last on 17 January 1977. Secondary and subsequent cases were either relatives or unvaccinated contacts living in the 100, or so, houses surrounding that of the first case (index case). Generally, the disease was not severe and there was only one death, as mentioned in Table 4.3. The age and sex distribution of the 39 cases is shown in Table 4.4 and they are listed in Annex 7.

TABLE 4.4  
DISTRIBUTION OF SMALLPOX CASES BY AGE AND SEX - MOGADISHU OUTBREAK

Age group	Males	Females	Total	
			Number	Percentage
0 - 4	3	0	3	7.7
5 - 9	3	2	5	12.8
10 - 14	1	3	4	10.3
15 - 19	1	5	6	15.4
20 - 29	8	4	12	30.8
30 - 39	0	6	6	15.4
40 - +	3	0	3	7.6
Total %	19 48.7	20 51.3	39	100.0

There is no significant predominance of infection in either sex but the age distribution is notable, 69 per cent of the cases occurring in persons 15 years or older. The reason for this disproportionately large number of cases among adults is obscure, however, their higher mobility and hence greater risk of exposure may be a more valid explanation than any supposed difference in vaccination status.

The distribution of the reported cases by week of onset of rash is shown in figure 4.4 and the chain of transmission detected during investigations is shown in figure 4.5. As is shown, the source of infection remains unknown for 13, or one third, of the 39 cases. These include the five cases initially detected in September, one case whose house was not located, one case detected in a market, another who developed smallpox while in hospital, two cases living within 300 metres of a known case but with no known contact and three other solitary cases for which no source information could be obtained (cases 1-5, 6, 12, 14, 20, 22, 26, 36 and 39 respectively). This unusually high proportion of cases for which the source of infection remains unknown has led to postulation of other undetected importations of smallpox into Mogadishu. One rural locality in Lower Shabelli, 150 km from Mogadishu, was also strongly suspected but this possibility remained unconfirmed as the cases there had been diagnosed as chickenpox.

Figure 4.6 shows the geographical distribution of the 39 cases in the capital; the majority were within 5 km radius of the north-western edge of the city, in Yaaqshiid, Wardhigley, Holwaday, Hodon, Bondheere and Shibes Districts. The majority of other cases could also be traced to having had contact with patients living in this area or working there.

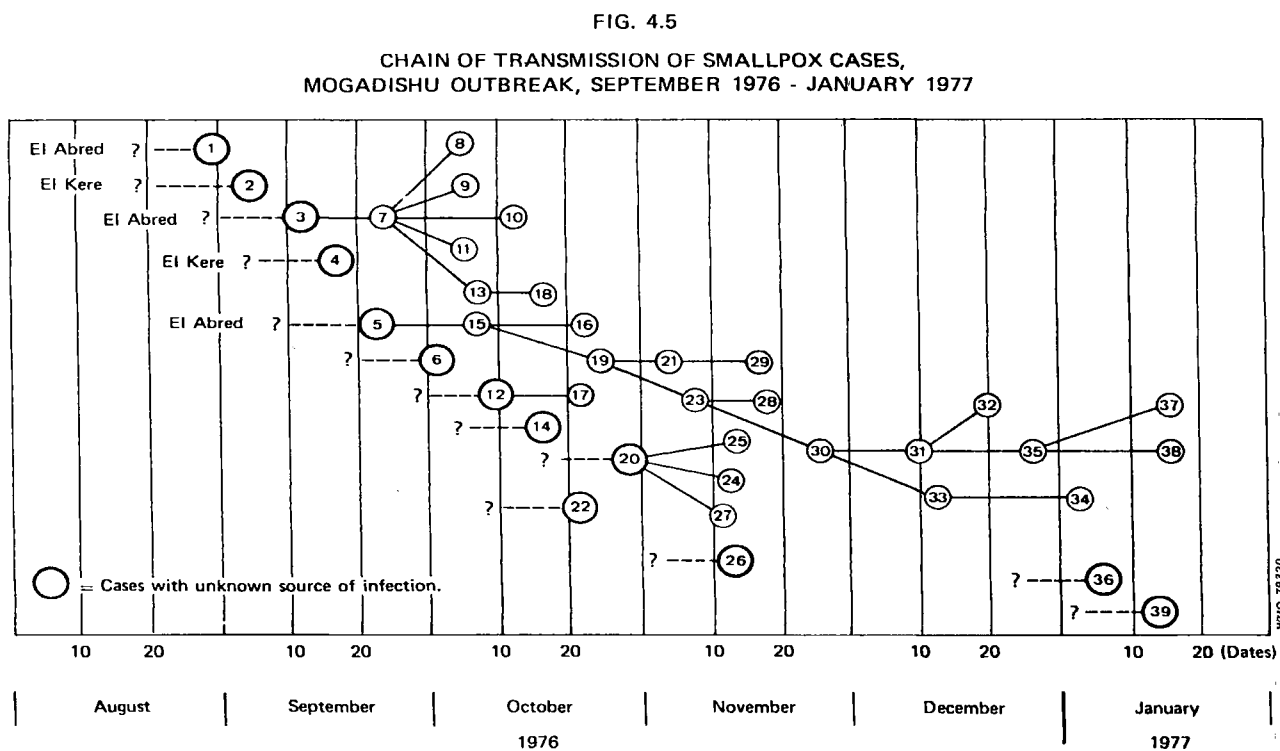
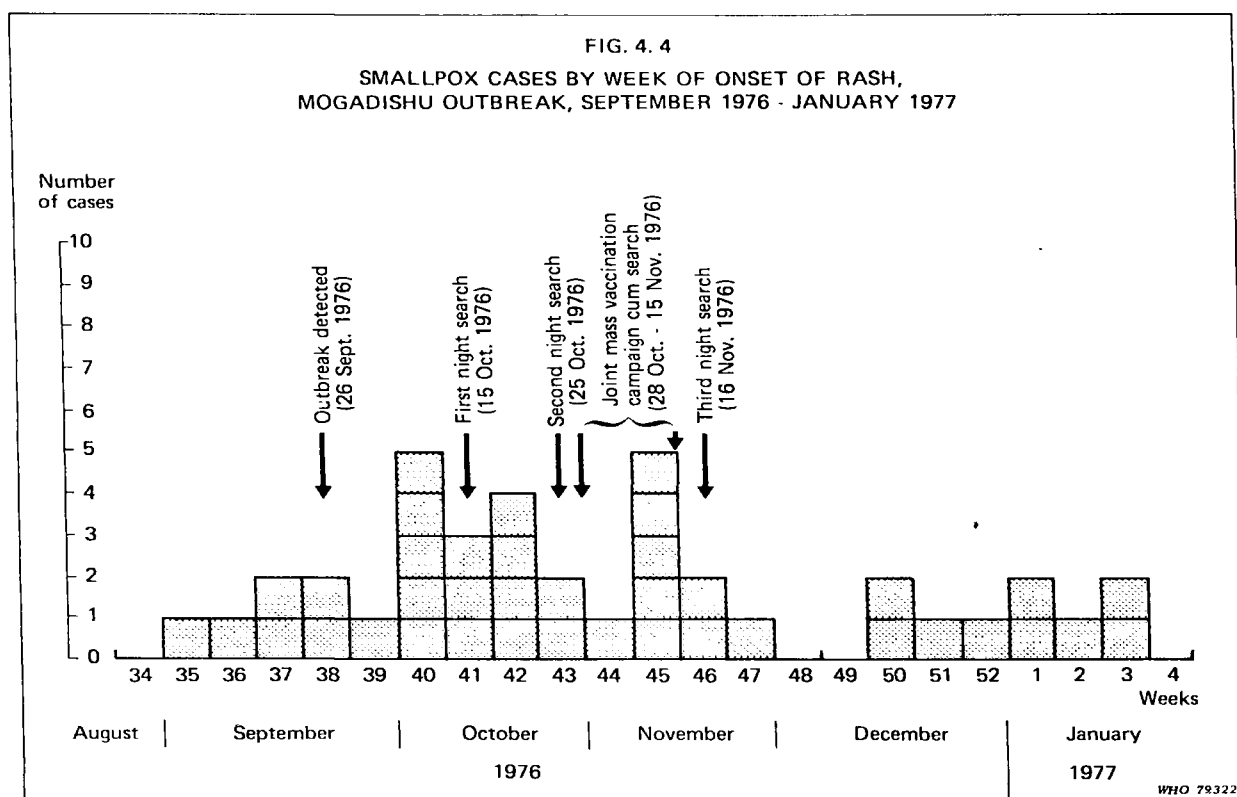
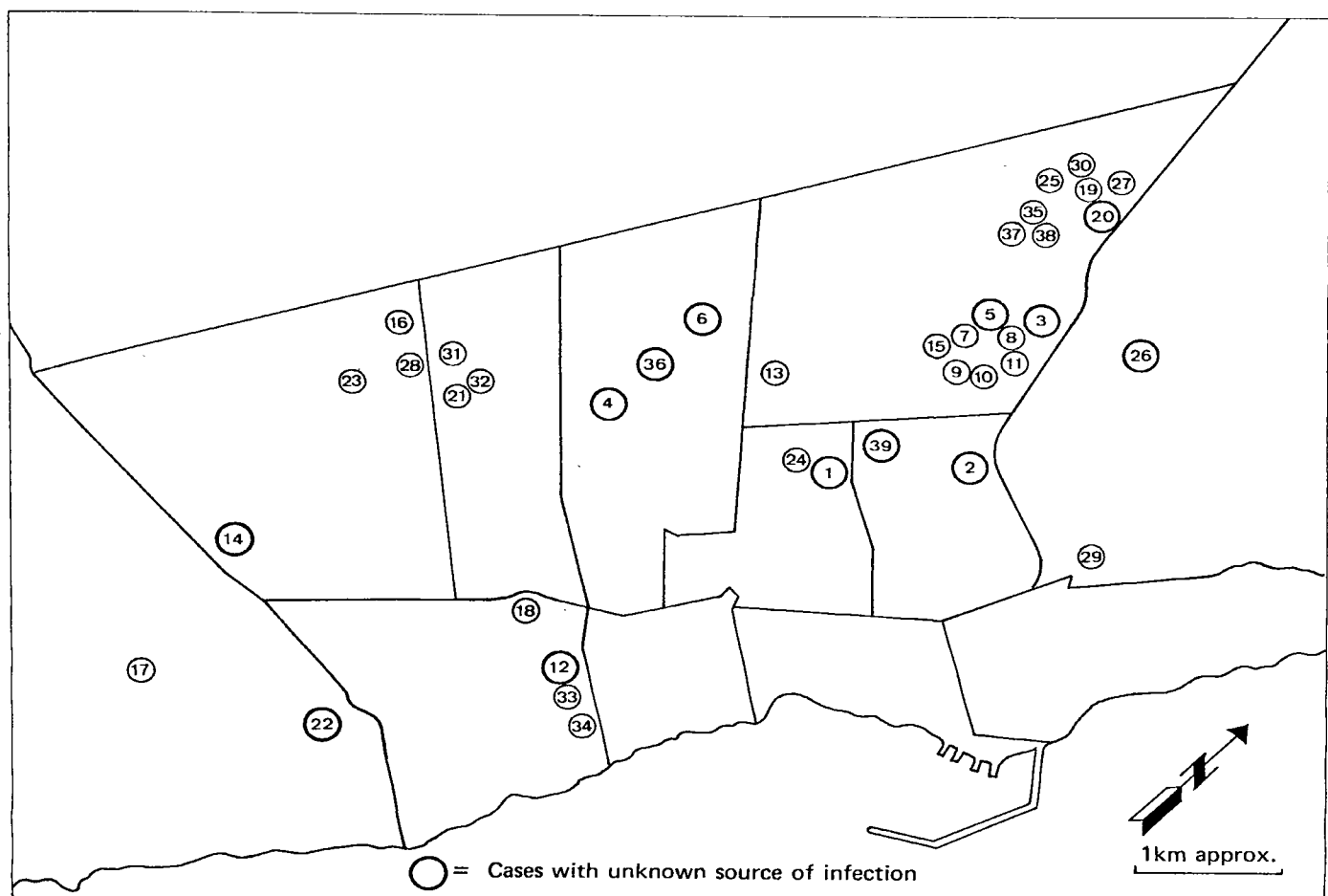


FIG. 4. 6  
GEOGRAPHICAL DISTRIBUTION OF SMALLPOX CASES,  
MOGADISHU OUTBREAK, SEPTEMBER 1976 - JANUARY 1977



### 3.3 Search and Containment Activities

Simultaneously with the discovery of the smallpox outbreak, public health authorities in Mogadishu implemented a mass search and vaccination campaign. Instructions were also given to regional health services to reinforce surveillance and vaccination activities. From October, WHO provided three epidemiologists to assist the programme.

Searches: On 15 October and again on 25 October, city-wide house-to-house searches for smallpox cases were conducted at night, employing approximately 2 000 searchers, including health services personnel, students, volunteers and police. Seven previously unknown smallpox cases were detected during the first of these night searches and a further 4 during the second. From 28 October to 15 November a joint search and mass vaccination campaign, employing approximately 900 personnel, was carried out. A third night search, organized with the help of the army and police, started on 16 November and detected two further smallpox cases and one suspected case.

In addition to these searches, about 60 smallpox project staff were engaged in surveillance activities and maintained 3 checkpoints on the major roads on the outskirts of the capital. Overall, 53% of smallpox cases were detected by night searches, 34% by surveillance activities of smallpox staff, and the remaining 13% by other health staff during their routine activities.

Containment: Smallpox patients were removed from their houses immediately after their detection and this substantially limited spread of the disease in the town. They were placed in Forlanini Hospital, the isolation hospital for Mogadishu. At the end of October, the isolation tents at Forlanini Hospital were exchanged for shelters placed in a separate isolation enclosure outside of, but very near to, the hospital compound.

The failure to quickly contain the outbreak was discouraging. Undoubtedly its persistence for a full 21 weeks was the result of the inadequacy of initial containment measures. The Somali SEP staff, although thorough in search and vaccination activities, were inexperienced in containment. It took time for the staff to be reorganized from following simple vaccination routines to ensuring planned and effective containment. From figure 4.5 it is seen that patient No. 5 had already resulted in the occurrence of 15 cases, the last, No. 38, occurring after 7 or 8 generations of transmission. A substantial number of close contacts, including relatives and neighbours of patient No. 5, or people sharing the same working place, obviously remained unvaccinated for a long period. Simple revision of working hours for containment teams, to early morning and evening, considerably improved vaccination coverage among contacts, however, epidemiological investigation often remained incomplete, delayed and not well documented enabling many close contacts to escape the attention of the containment teams. Even in December, a chain of transmission continued in Mogadishu and was finally broken only in the second half of January 1977. A mid-February house-to-house search failed to discover any new cases and so confirmed the smallpox-free status of the capital.

#### 4. Extensive Smallpox Transmission - 1977

Transmission of smallpox had persisted at a low level in Mogadishu for six months but was reported to be interrupted in January 1977; several night searches detected no further cases related to this outbreak after 17 January. At that time limited resources precluded a thorough active search of the whole country. WHO epidemiologists accompanied by national staff visited some of the most vulnerable districts outside the capital but were unable to detect any recent outbreaks.

##### 4.1 Importation to Kenya

The first strong warning of possible smallpox transmission outside the Somali capital came from neighbouring Kenya. Here a single smallpox outbreak was detected in January 1977 in Ledhi, a small watering point in Mandera District, a semi-desert area the majority of the population of which is nomadic. There are frequent population movements between this area and neighbouring areas of Somalia.

The index case of this outbreak was a Kenyan who had travelled to Mogadishu and adjacent areas and returned to Mandera District on 20 December 1976. After visiting his brother in Kalalio, he returned to his family in Ledhi on 25 December and developed a rash the following day. On 29 December, when the outbreak was reported, it was found that he had already left again for Somalia. From 9 January to 5 February four secondary cases developed in this family.

Investigators were informed that this man may not have been living in Mogadishu but in a village near Jowhar, the capital of Middle Shabelli Region. Jowhar town and six localities of this area had been searched during February with negative results. However, with this new episode, it was considered desirable to extend systematic surveillance activities and to include all regions as soon as possible. Accordingly, in February 1977, a plan for active searches in all parts of the country was prepared and

special surveillance teams started to organize searches in those regions in frequent contact with Mogadishu. These operations, initiated in mid-March, soon detected smallpox outbreaks in Bakool and Bay Regions. In a short time period the situation had, therefore, changed dramatically.

#### 4.2 The First Detected Outbreaks

The first detected outbreak occurred on the outskirts of Huddur town in Bakool Region and was reported on 18 March 1977. The two patients, a man called Mohamed Yarow and a woman, Aisha Adam, both in their forties and unvaccinated, developed rashes on 7 and 12 March respectively. Mohamed Yarow stated that he had visited the Ethiopian village of El Dini, 20 km north of the Somali-Ethiopian border two weeks previously. An Ethiopian smallpox team subsequently visited this village, but no evidence of recent smallpox was found. It became clear that a source of infection had to be sought inside Somalia. A few days later Mohamed Sheikh Hassan, a 20 year old male, who had developed a smallpox rash on 14 March, was detected in Tawsly village in the Gofgodud area of Baidoa District, Bay Region. On 24 March, in Mogadishu, Faduma Ibrahim Hussein developed a rash which was detected there five days later. Before coming to Mogadishu this woman had visited an area called Debagas, near Baidoa in Bay Region.

All these first outbreaks and cases were detected late in March but it was logical to assume that smallpox transmission had been continuing undetected outside of Mogadishu probably having originated there 4-5 months earlier. Further foci of smallpox were subsequently discovered and another six regions were reported to be affected by smallpox transmission during April: Galgadud, Hiran, Middle and Lower Shabelli, and Middle and Lower Juba.

The discovery of this widespread smallpox transmission in Somalia was an unexpected and serious setback at a time when success in the global smallpox eradication programme seemed imminent, however, the global programme had faced similar crises in the past, for example in Bihar State in India and in Bangladesh. The new crisis had to be rapidly tackled with all the experience gained in these previous epidemics.

By the end of May, when smallpox search operations had become fully effective, ten regions in the southern part of the country had been found to be affected. Many of these outbreaks were located along the three major roads (Mogadishu-Jowhar-Beletweine, Mogadishu-Baidoa-Luk and Mogadishu-Merca-Gelib-Kismayo) suggesting Mogadishu was the source of infection.

It seemed that the frequency of smallpox transmission increased in mid-March and again in May 1977. The reason for these explosive epidemics, especially for those in the area enclosed by Juba and Shabelli rivers, is not readily apparent as they relate to a wide variety of factors including the rapidity of population movement, the immunity level of the inhabitants and the degree of exposure in a particular season. In high-incidence areas, continuing low-level transmission in February and March might have been speeded up by intensive nomadic movement coinciding with the beginning of rains in April-May. The extremely low level of vaccination status in these areas augmented significantly the speed of transmission.

#### 4.3 The Emergency Operation

A total of 140 smallpox outbreaks resulting in 470 cases had been reported by mid-May in 16 of the 41 districts in the 10 affected southern regions. Emergency measures were indicated and on 27 May at the request of the Somali Government, the United Nations Disaster Relief Office in Geneva appealed for urgent assistance to cope with the smallpox situation. Five countries and one international agency promptly responded to the appeal and within three weeks supplies and equipment including 16 vehicles were airlifted to Mogadishu. An effective countrywide programme rapidly became operational with WHO assistance which included 24 WHO epidemiologists and operations officers and financing of local costs. More than 1700 national personnel and 50 vehicles were engaged in



surveillance and containment measures throughout the country. The Government issued a directive urging the assistance and cooperation of political and administrative bodies, police, teachers, general health staff and mass organizations such as the Somali Women's Organization, the Somali Youth Organization, the Somali Workers' Organization and the Red Crescent Organization.

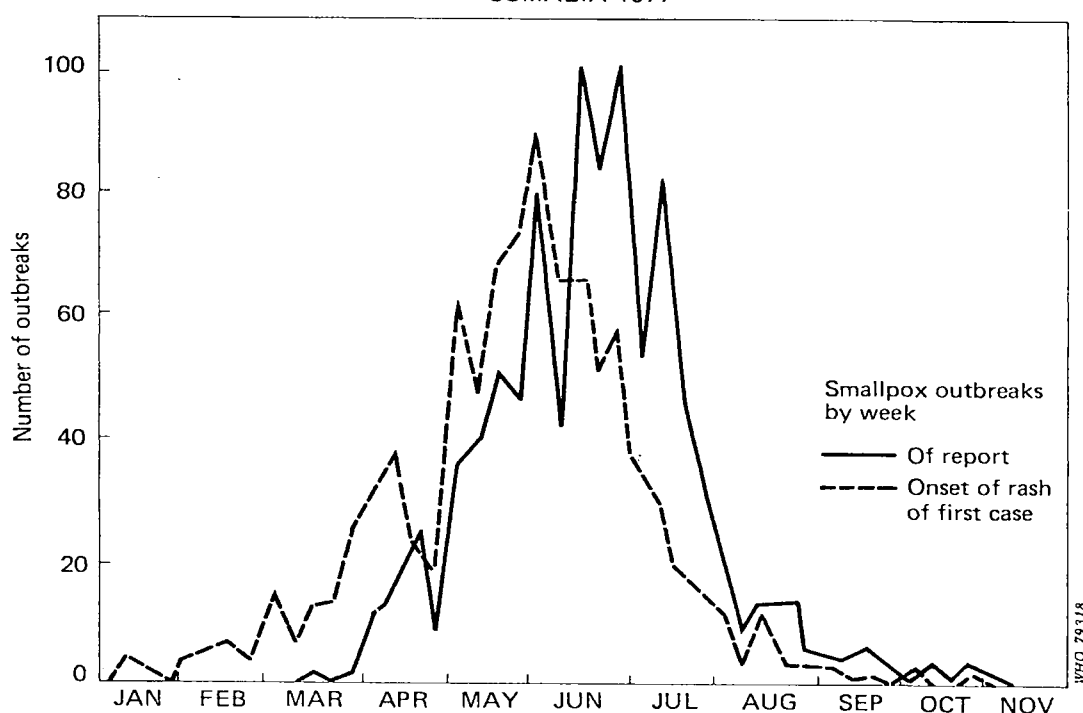
Search activities revealed that the spread of smallpox in the southern part of the country was considerably more extensive than earlier field-surveys and experience had suggested. On the other hand, the search operation revealed no evidence of smallpox transmission in Galbeed, Togdheer, Sanaag, Bari and Nugal Regions of northern Somalia nor in the central Mudug Region. Later, one case was imported to Burao District of Togdheer Region from Jowhar District, Middle Shabelli Region. It was reported four days after onset of rash on 27 July and was quickly contained and no secondary cases occurred.

#### 4.4 The Course of the Epidemic: Outbreaks Recorded

A total of 947 smallpox outbreaks resulting in 3229 cases and 12 deaths were reported from towns, villages and nomadic encampments during the year 1977 in ten southern and one northern region from the total of 16 regions of the country. (Annexes 8 and 9)

The occurrence of the outbreaks by week of onset of the first case in the outbreak and the week of report is shown in figure 4.7. The limited retrospective analysis of the epidemic which was possible indicates that the rate of transmission increased in March-April and again in May. The peaks of incidence, therefore, occurred at the end of May and beginning of June, around week 22. The sharp increase in the number of reported outbreaks in June coincided, however, with a substantial increase in the number of field staff engaged and with a wide publicity campaign for the reward of 200 Somali shillings for any report leading to the discovery of an unknown smallpox outbreak. Figure 4.7 also indicates that the intensified search operations from the end of May onwards were able to detect relatively quickly any newly appearing smallpox foci.

FIG. 4. 7  
NEWLY DETECTED SMALLPOX OUTBREAKS, BY WEEK  
SOMALIA 1977

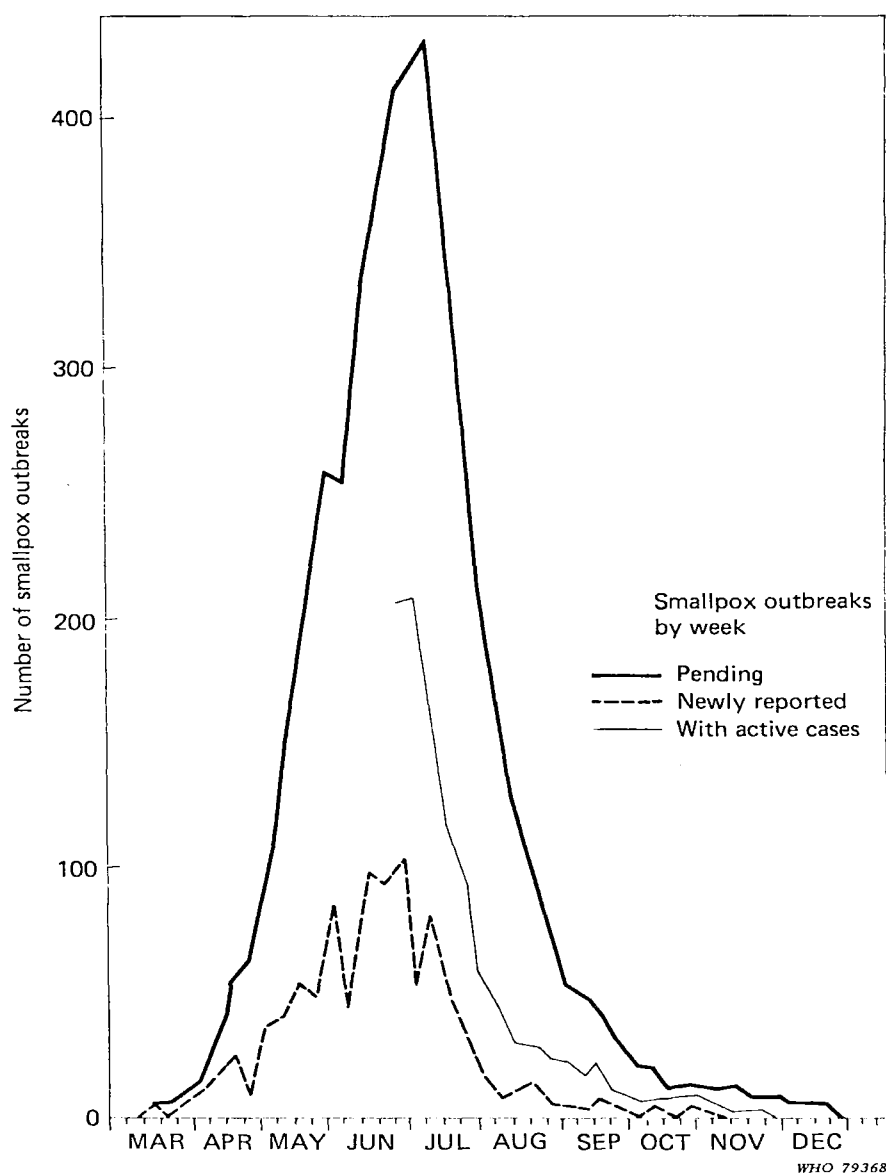


The development of the epidemic as well as the progress of smallpox eradication activities was monitored in terms of three parameters, the numbers of:

- newly reported outbreaks
- outbreaks with active cases
- pending outbreaks.

An outbreak with active cases was defined as any outbreak having a patient or patients with skin lesions or scabs on his body. A pending outbreak was defined as any locality in which one or more cases of smallpox had occurred during the preceding six weeks, during which close "follow-up" surveillance was maintained in order to ensure that the transmission of infection had been interrupted.

FIG. 4. 8  
SMALLPOX OUTBREAKS — SOMALIA 1977



The distribution of newly reported smallpox outbreaks, outbreaks with active cases and pending outbreaks by week for the period March–December is shown in figure 4.8. It can be seen that as search activities improved the number of pending outbreaks increased from three in March to 63 at the end of April and to 219 at the end of May and reached a peak in week 28 at the beginning of July when field staff were working on containment and follow-up of smallpox foci in 425 villages or nomadic encampments. The number fell abruptly to 301 at the end of July and further to only 70 at the end of August. Similarly, from the end of June there was a steady decrease in the number of outbreaks with active cases, from 95 at the end of July to 24 in August and further to only 10 at the end of September. The number of newly reported outbreaks reached its peak in the second half of June following the intensification of search activities in May and early June when for three consecutive weeks (25, 26 and 27) about 100 outbreaks were detected and reported weekly. A total of 416 new outbreaks was detected in June. From July onwards the number of newly reported outbreaks shows a steady decline despite continuing active searches in all affected areas.

The persistence of outbreaks after mid-August as shown in figure 4.8 may be partly explained by continuing smallpox transmission in small nomadic groups in the more remote bush areas that were only just being reached by the expanded search activities.

The trend of the epidemic is also reflected in the number of districts reporting smallpox cases, by week, as shown in figure 4.9. Figure 4.10 shows the location in Somalia of these affected districts with the number of known smallpox foci detected in each of the 70 administrative districts. 33 (47%) were affected by smallpox transmission during 1977, 32 in the south and one in the north. It is apparent from figure 4.10 that the epicentre of smallpox transmission and, therefore, the majority of smallpox foci were situated in the area between Juba and Shabelli Rivers. Annex 8 details the regional distribution of smallpox reported monthly during 1977 and figure 4.11 maps this distribution by month and area for the crucial period from the detection of the first few outbreaks in March until October. Both the annex and the figure, as well as figure 4.12 showing the distribution of outbreaks by onset of the first case and by region, further localize the centre of the epidemic to Bay and Bakool Regions which recorded 545 outbreaks resulting in 1646 cases and 155 outbreaks with 518 cases respectively. Of all outbreaks reported in Somalia in 1977, 74%, accounting for 67% of all cases, were detected in these two regions alone. In particular, Baidoa District of Bay Region experienced an enormous number of outbreaks. In an estimated population of 150 000 a total of 322 smallpox outbreaks resulting in approximately 900 cases were detected. This represents a morbidity rate of six cases per 1000 population, one of the highest observed anywhere in the world.

FIG. 4.9

NUMBER OF DISTRICTS REPORTING CASES BY WEEK  
SOMALIA – MARCH - NOVEMBER 1977

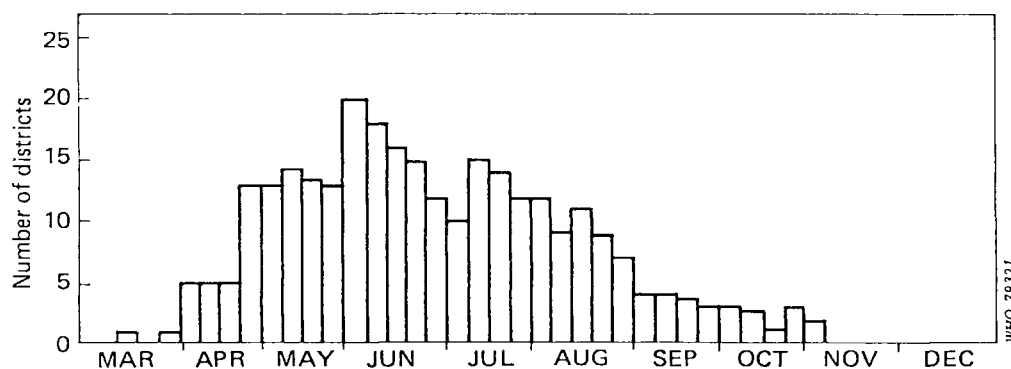


FIG. 4.10

DISTRICTS AFFECTED BY VARIOLA MINOR, SOMALIA 1977

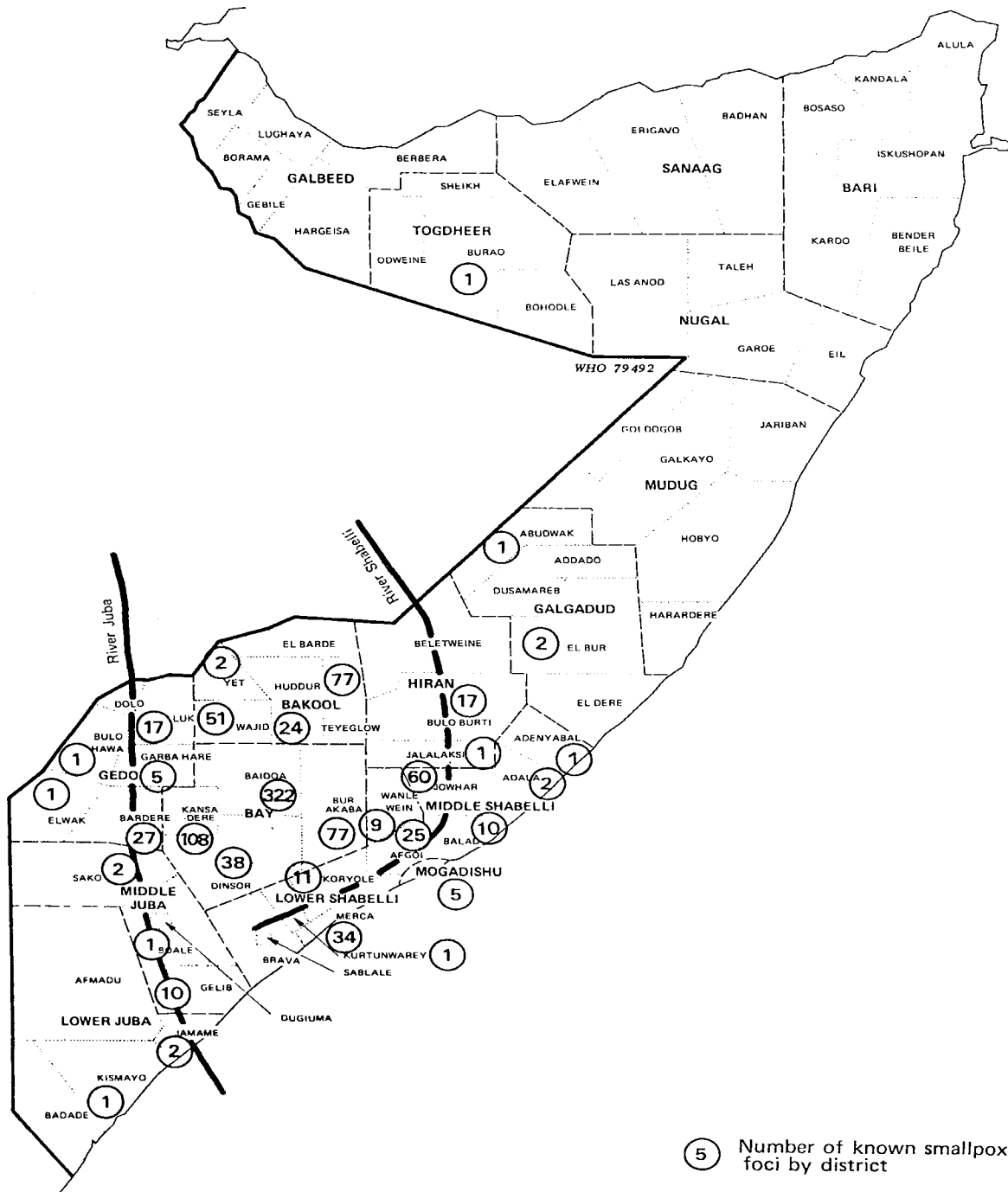
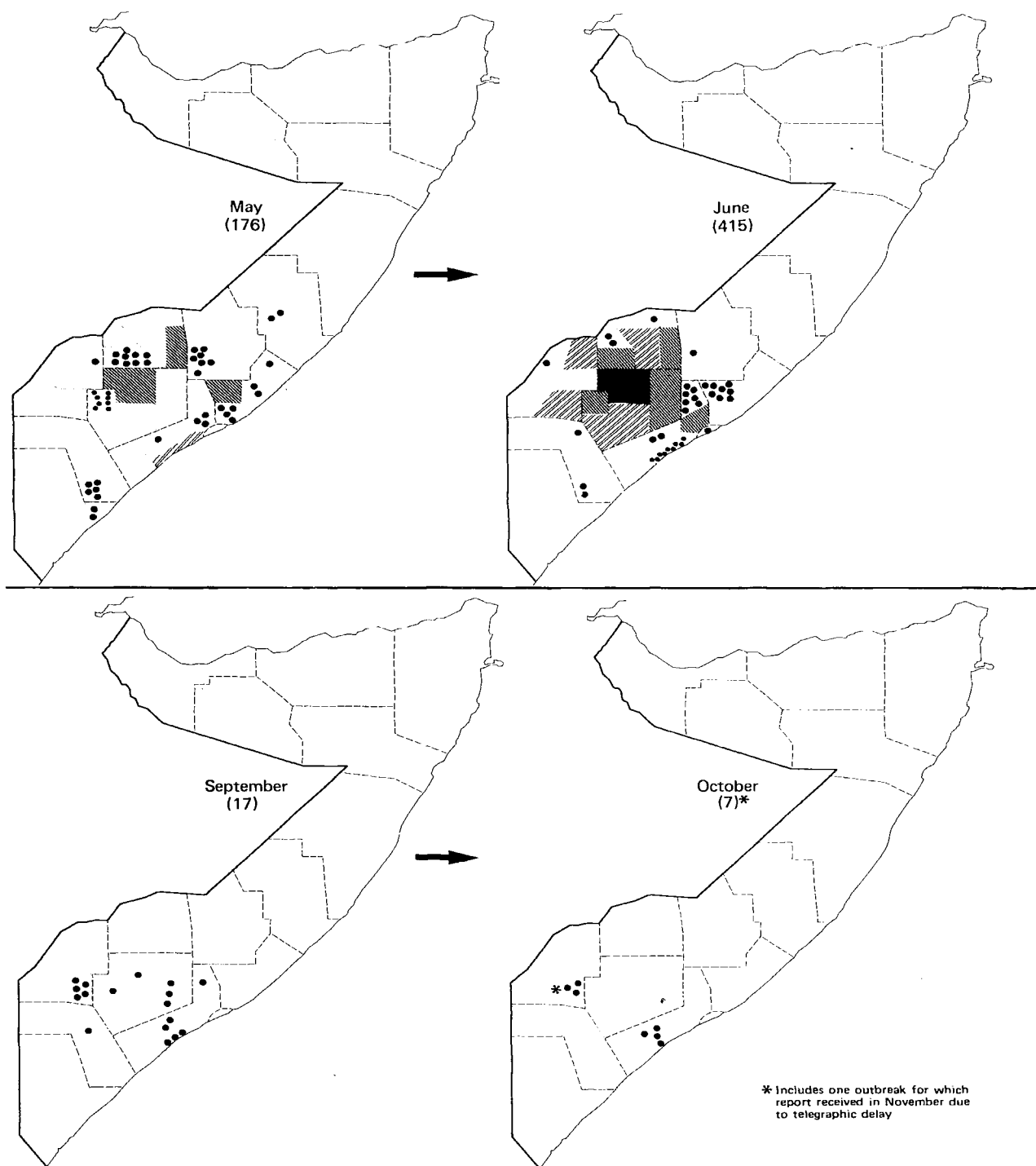


FIG. 4. 11  
SMALLPOX OUTBREAKS DETECTED DURING EACH MONTH  
SOMALIA MARCH – OCTOBER 1977



FIG. 4.11 ( contd.)



As shown in figure 4.12 the number of outbreaks in the five regions surrounding Bay and Bakool Regions was substantially lower: Hiran (18), Middle Shabelli (73), Lower Shabelli (80), Middle Juba (13) and Gedo (51). Nonetheless, smallpox outbreaks persisted there for many months. Only isolated smallpox outbreaks, scattered both in time and place, occurred in Galgadud (3), Lower Juba (3), Mogadishu (5) and Togdheer (1) Regions as the results of importations from neighbouring affected areas. It is illustrated, once again, in this figure that undetected smallpox transmission continued in Bay, Bakool, Middle and Lower Shabelli Regions from Janaury onwards.

During the second coordination meeting held in Nairobi on 26 September 1977, the following resolution was adopted:

"Current international cooperation should be sustained for the Somalia eradication campaign so that smallpox transmission can be interrupted in the shortest possible time - the target being the end of 1977."

The final battle in the long war against smallpox started.

At the end of September there were 29 pending outbreaks (figure 4.13) where follow-up and containment continued but only 21 of them had active smallpox cases. As of the end of October the number of affected localities with active cases had further declined to only six, but strict follow-up continued in 12 pending outbreaks. During this month travel by vehicle was severely restricted by very heavy rains. As work had to be continued on foot, there were delays in reporting and incomplete search coverage in certain areas. Personnel were concentrated in those areas considered to be at highest risk of having undetected foci, or where information was most limited. Containment, search, supervision and assessment continued on foot with supplies and equipment carried by camels and donkeys.

By that time smallpox transmission was restricted to only two southern regions, Gedo and Lower Shabelli. The incidence in the previously heavily affected Bay Region, where maximum staff had been concentrated was rapidly approaching zero as only the last links in the chains of transmission were pending and there were no active cases that might function as a source of infection for others. In Middle Juba Region, only one outbreak in Boale District was pending in a nomadic group following its importation from the Baidoa area of Bay Region.

In Gedo, smallpox transmission peaked in early July, but a small second peak occurred in September and October following the importation of a single case from Kasali village to El Bet area of the eastern part of Bardere District in late July. Seven villages were affected in this second wave. Understandably almost all activities in this area were geared towards containment of known foci and search operations concentrated on Bardere. It seemed that the last smallpox outbreak detected in Somalia might occur here in the Juba valley, not far from the Kenyan border.

At the same time, low-level transmission of variola virus was continuing in three districts of Lower Shabelli Region: Merca, Koryole and Wanlewein.

The last 20 smallpox outbreaks in Somalia are listed in Table 4.5 and the dates and details of the last outbreak in each district affected in 1977 are shown in figure 4.14, Table 4.6 and Annex 10.

In week 40, no new smallpox outbreak was reported in Somalia and, thus, in the whole world: the first "zero-incidence" week was recorded, followed by a second in week 42. The third week without newly detected cases came in week 45 at the beginning of November and was to start the period of permanent freedom from endemic smallpox throughout the world. At the end of November, there were only six pending outbreaks in the country, five in Bardere District, and one in Merca town. The single case in this last outbreak was no longer active. These last pending outbreaks were followed up for more than two months until "closed" on 29 December when thorough searches around recent foci as well as search operations all over Somalia failed to find further cases. The target had been achieved.

FIG. 4. 12  
SMALLPOX OUTBREAKS BY REGION AND BY ONSET  
OF FIRST CASE – SOMALIA 1977

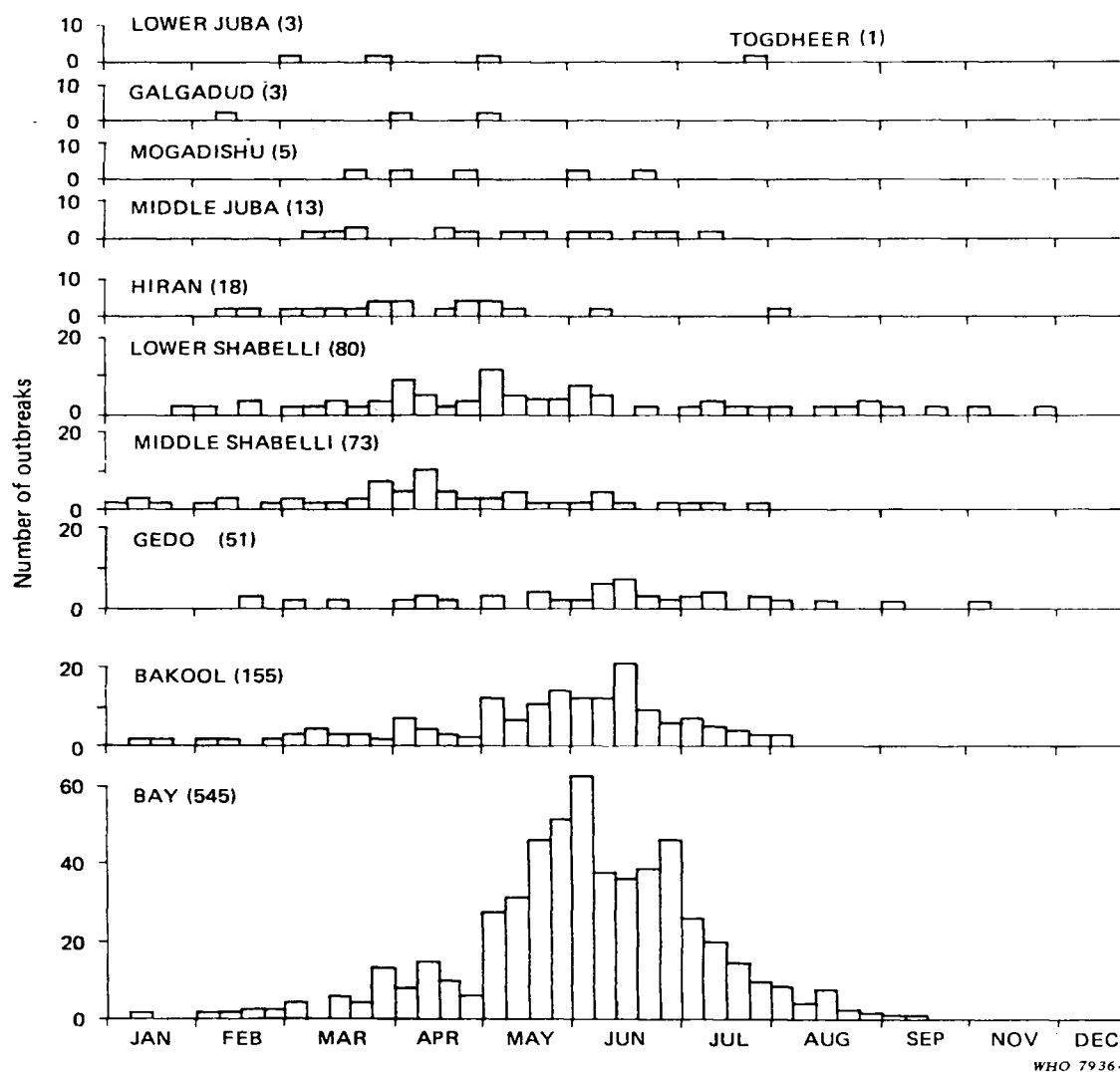




FIG. 4. 13  
SMALLPOX OUTBREAKS PENDING AT THE END OF EACH MONTH  
SOMALIA SEPTEMBER – DECEMBER 1977

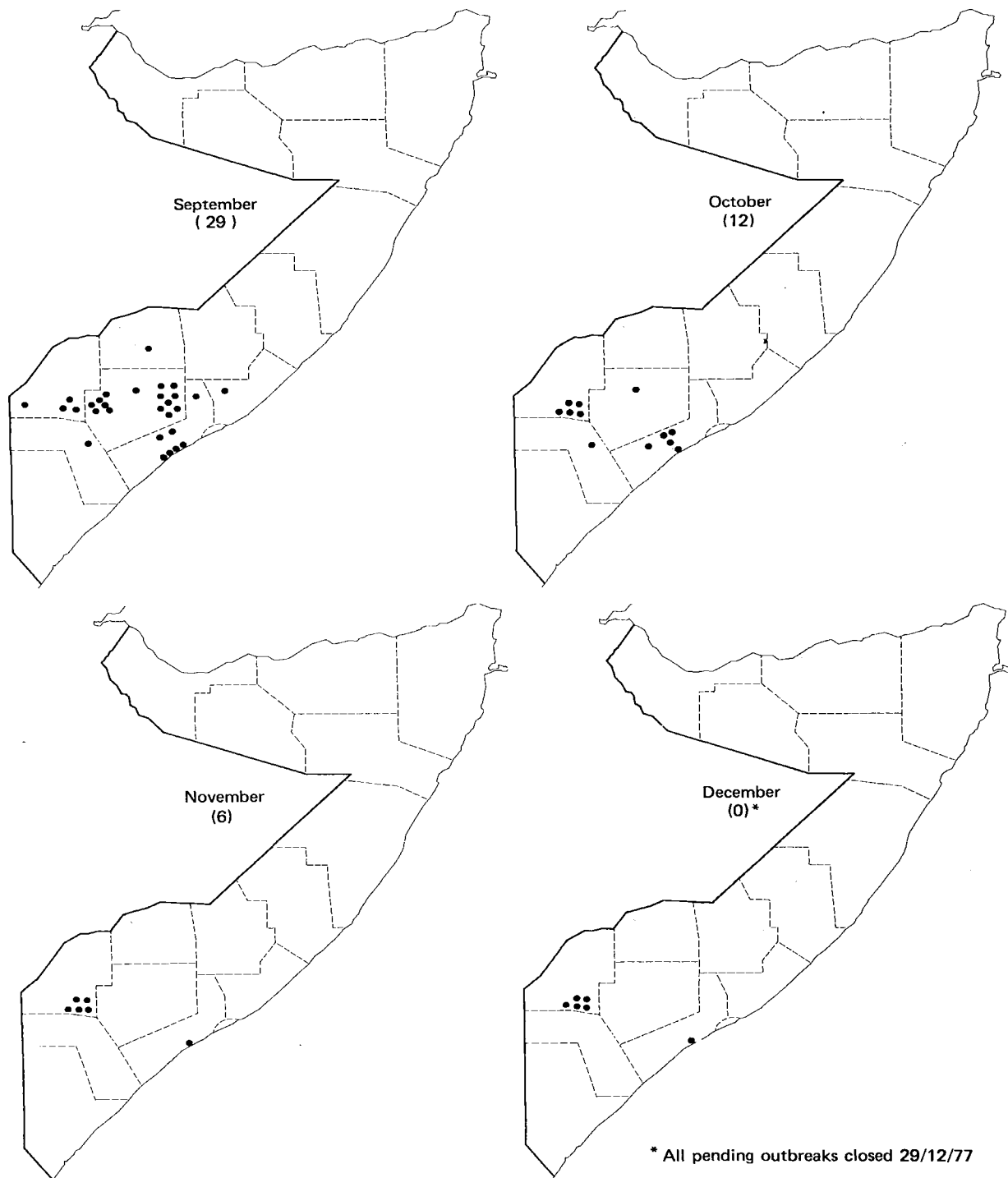


FIG. 4. 14

MONTHS OF LAST KNOWN CASE BY DISTRICT  
SOMALIA 1977

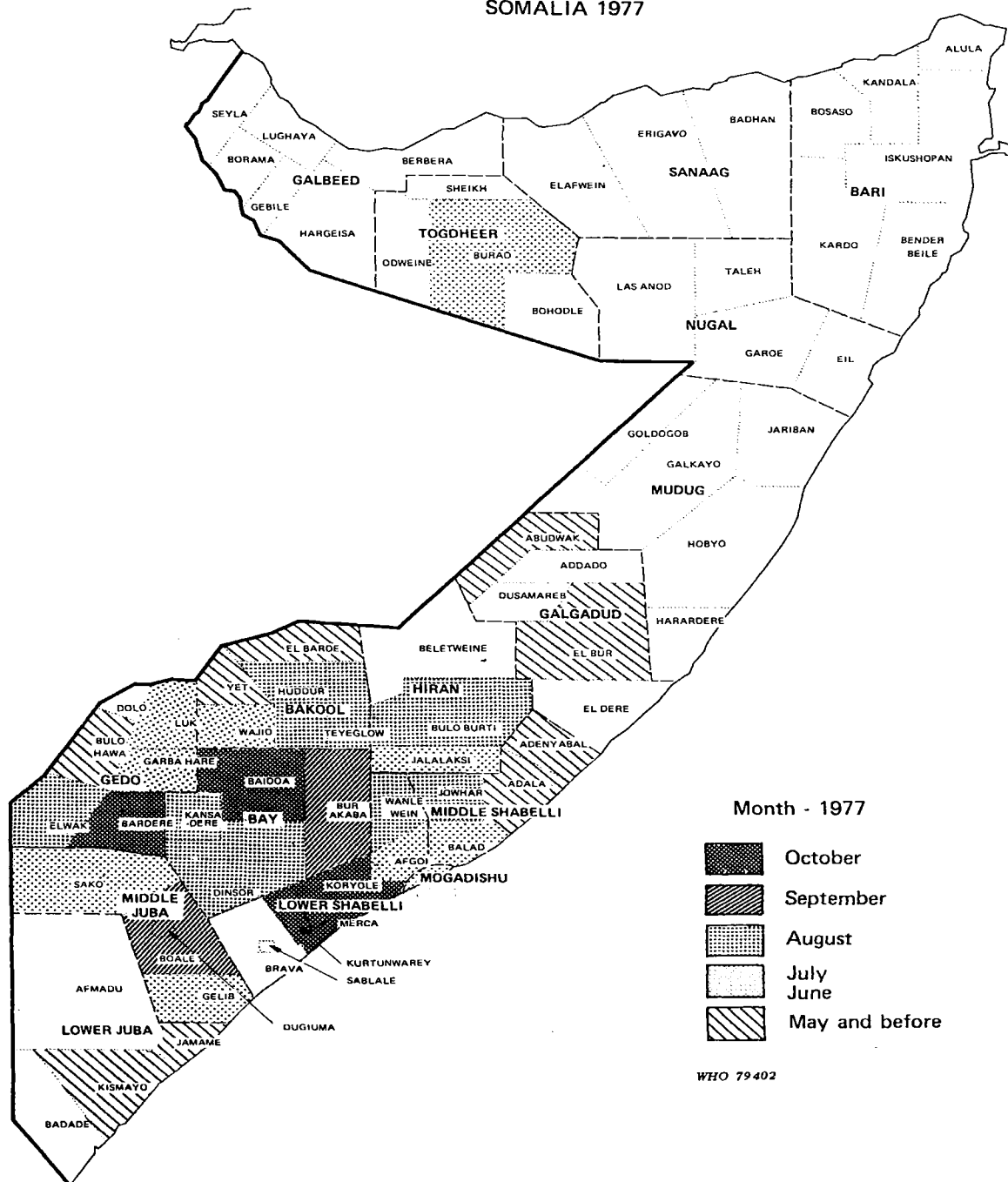


TABLE 4.5  
THE LAST 20 PENDING SMALLPOX OUTBREAKS IN SOMALIA

National Number	Region	District	Locality	Population	Cases	Onset of Rash		Detected	Source of Infection	Date closed
						First Case	Last Case			
908	L. Shabelli	Merca	Gadcode	220	18	15.7	4.9	27.9	Cel Warego	21.10
914	Bay	Burakaba	Asalm 2	62	12	10.7	8.9	25.8	Daydonay	21.10
923	Bay	Kansadere	Bullolosi	45	2	26.8	7.9	26.9	B.Gomer	21.10
925	L. Shabelli	Merca	B. Moday	100	7	8.8	4.9	7.9	Gasade	21.10
928	Bay	Kansadere	Hawl Barbar	65	4	21.8	21.8	4.9	Shawa	21.10
929	L. Shabelli	Wanlewein	Hawl Share	20	3	28.8	30.8	9.9	NR	21.10
931	Bay	Burakaba	Dundufay	75	36	20.8	9.9	9.9	Jmacada	21.10
932	Bay	Burakaba	Ray Bado	11	4	8.9	8.9	13.9	Asalama	21.10
941	L. Shabelli	Koryole	Agalsar	100	11	28.8	27.9	28.9	NR	13.11
930	M. Juba	Boale	Aden Gurcad	38	25	16.7	23.9	12.9	Kago	25.11
939	Bay	Baidoa	Erinta	120	10	13.9	18.10	10.9	Koryole	25.11
942	L. Shabelli	Kurtunwarey	Kurtunwarey	60	5	15.8	18.10	13.10		25.10
943	L. Shabelli	Koryole	Buka Gedlay	17	1	4.10	4.10	11.10	Agalsar	25.11
946	L. Shabelli	Koryole	Dugulle	80	3	20.9	18.10	23.10	Kurtunwarey	31.11
933	Gedo	Bardere	Geser B/aka	280	4	10.9	29.9	20.9	Wansarey	29.12
935	Gedo	Bardere	Kurtunwarey	350	11	5.8	25.9	20.9	Wansarey	29.12
936	Gedo	Bardere	Galacasis	30	1	15.8	15.8	22.9	Bakal	29.12
944	Gedo	Bardere	Galangash	200	1	4.10	4.10	5.10	Gesereb	29.12
945	Gedo	Bardere	Gumurta	40	1	8.10	8.10	18.10	Dinsor	29.12
947	L. Shabelli	Merca	Merca town	26 000	1	26.10	26.10	31.10	Kurtunwarey	29.12

TABLE 4.6

LAST KNOWN AFFECTED AREAS BY DISTRICT, SOMALIA 1977

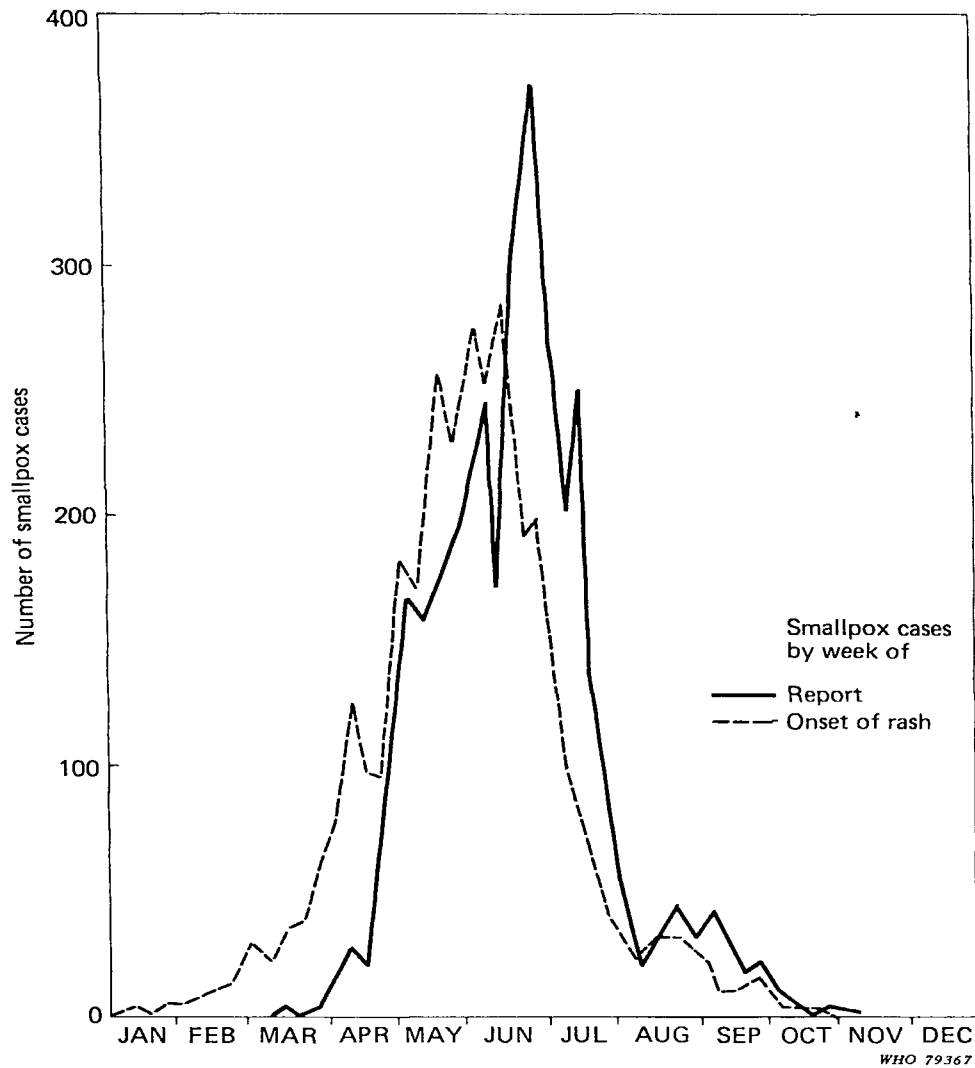
District	Total No. of affected localities	Last affected locality	Last known case	
			Date of onset Month	Day
Merca	34	Merca town	October	26
Koryole	11	Dugulle	October	18
Kurtunwarey	1	Kurtunwarey	October	10
Bardere	27	Gumurta	October	8
Baidoa	322	Erinta	October	5
Boale	2	Aden Gureed	September	23
Burakaba	77	Dundufay	September	9
Wanlewein	9	Hawl Share	August	30
Kansadere	108	Bullolosi	August	29
Huddur	24	Beer Guday	August	25
El Wak	1	Bamiba Halima	August	25
Jowhar	60	Aros Benat	August	22
Teyeglow	77	Fayfay	August	22
Dinsor	38	Warilow	August	15
Buloburti	17	Dabadere	August	6
Luk	17	El Waran	July	31
Burao	1	Burao (camp)	July	26
Garbahare	5	Korfadud	July	24
Wajid	51	Berbar	July	20
Balad	10	Damaly	July	18
Gelib	11	Bula Nasib	June	23
Jalalaksi	1	Jalalaksi	June	20
Afgoi	24	Galalay	June	7
Sako	1	Bula Sablow	June	3
Mogadishu	5	Yassin	June	1
Jamame	2	Kyambulu	May	31
Bulohawa	1	Bulohawa town	May	17
Yet	2	Farbnraley	May	16
El Berde	1	Abe Saleh	May	14
Adenyabal	1	Adenyabal	May	6
Adala	2	Godwher	May	4
El Bur	2	Galhareri	May	1
Kismayo	1	Kismayo town	April	1
Abudwak	1	Bele Belle	March	28

#### 4.5 Smallpox Incidence: Cases Recorded

From January 1977 a total of 3229 smallpox cases were reported from the 11 affected regions. Figure 4.15 shows the distribution of these cases by week of report as well as by week of the onset of rash. Table 4.7 shows regional distribution of reported cases by month.

The number of reported cases rose steadily from 157 in April to 636 in May. As surveillance and field activities substantially improved, a further 1388 cases were detected and reported during June. From July the number decreased gradually, despite continuing intensive search, reaching the awaited "zero-incidence" in week 45, at the beginning of November. The peak in reported cases was observed around mid-June, when in week 25 more than 370 smallpox cases were reported, however, the curve showing distribution of cases by week of onset of rash reached its peak earlier, at the end of May and beginning of June.

FIG. 4. 15  
SMALLPOX CASES BY WEEK – SOMALIA 1977



In addition to the parameters relating to numbers of outbreaks, as detailed above, the progress towards eradication was also monitored in terms of the total number of active cases (the number of patients with lesions or scabs still on their bodies). This type of monitoring started at the end of June, when 475 active cases were recorded. Thereafter there was a steady decrease in the number to 149 at the end of July, 56 for August, 42 for September, 13 for October and finally 0 at the end of November. The last scabs of the smallpox rash of the last known case separated in week 47, in mid-November 1977.

**TABLE 4.7**  
REGIONAL DISTRIBUTION OF SMALLPOX CASES BY MONTH, SOMALIA 1977

Region*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	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	1646
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
L. Juba	0	0	0	1	2	3	0	0	0	0	0	0	6
M. 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
L. Shabelli	0	0	0	15	62	92	1	37	49	11	1	0	268
M. 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
Somalia	5	0	3	157	636	1388	672	220	118	27	3	0	3229

\*Bari, Galbeed, Mudug, Nugal, Sanaag Regions - no smallpox cases reported during 1977.

In Somalia, the disease affected all age groups, the youngest case being a few days old, the oldest over 90 years of age. Table 4.8 shows the distribution by age and sex of 3022 smallpox cases for whom data are available.

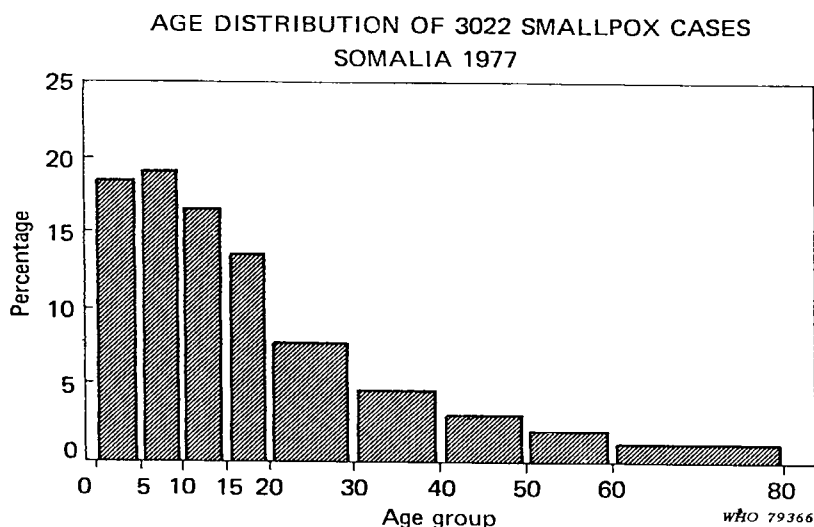
The distribution of cases between males (51%) and females (49%) corresponds to the sex distribution of the general population.

**TABLE 4.8**  
DISTRIBUTION OF 3022 SMALLPOX CASES BY SEX AND AGE GROUP, SOMALIA 1977

Age Groups	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
0	20	1.3	27	1.8	47	1.6
1-4	253	16.3	253	17.1	506	16.7
5-9	288	18.6	272	18.4	560	18.5
10-14	313	20.2	188	12.7	501	16.6
15-19	190	12.3	216	14.6	406	13.4
20-29	217	14.0	231	15.6	448	14.8
30-39	132	8.5	127	8.6	259	8.6
40-49	72	4.6	76	5.2	148	4.9
50-59	33	2.1	45	3.1	78	2.6
60+	29	1.9	40	2.7	69	2.3
Totals	1547	(100)	1475	(100)	3022	(100)

From this table and figure 4.16 it is apparent that the incidence is high not only in infancy and childhood but even among young adults up to 30 years of age. Thereafter incidence gradually diminishes with advancing age. About 18% of all cases occurred in children below 5 years of age and 35% in children between 5 and 14 years. The 47% of cases occurring among adults and the low incidence of cases in infants below one year of age (1.6% of total) are surprising.

FIG. 4. 16



The collected data as displayed in Table 4.9 shows a gradual increase in the proportion of children aged 0-4 years who contracted smallpox as the epidemic developed as well as a gradual decrease in the age group of 15 years and over. Reasons for this are not immediately apparent but probably relate to a variety of different factors affecting immunity and exposure.

TABLE 4.9  
FREQUENCY OF SMALLPOX CASES BY AGE GROUP AND TIME PERIOD

Year 1977 period of	Percentage of smallpox cases in age groups		
	0-4	5-14	15-over
Jan-Mar	12.7	33.9	53.4
Apr-May	17.8	30.1	52.1
Jun-Jul	19.0	39.2	41.7
Aug-Sep	21.4	37.7	40.8
Oct	27.3	36.4	36.4

#### 4.6 Smallpox Deaths

As would be expected in outbreaks of variola minor smallpox, a low number of deaths and very low case fatality rate were observed. Altogether 13 deaths were reported to have occurred among 3229 smallpox patients, that is, one death among every 248 cases or a case fatality of about 0.4%. Table 4.10 provides pertinent information about 12 of the deaths. The other death reported in Huddur District, Bakool Region, was subsequently concluded to be due to foetal vaccinia.

Almost all deaths (85%) occurred among those one year old or less and those of 45 years and over. Deaths occurred exclusively among unvaccinated persons and 42% of them succumbed within the first week, and all but two within the first 14 days, after onset of the rash. Deaths occurred sporadically and no clustering was observed; no outbreak had more than one death.

TABLE 4.10  
REPORTED SMALLPOX DEATHS, SOMALIA 1977

Ser. No.	Week of notification	Region	Outbreak number	Initials of case	Sex	Age	Vaccination scar	Date of:		
								Onset rash	Detection	Death
1	18	Hiran	56	H.A.M.	M	49	No	18.4	24.4	29.4
2	19	M.Shabelli	156	R.H.M.	F	1	No	30.4	8.5	7.5
3	22	Bakool	318	A.A.G.	F	3	No	1.5	15.5	18.5
4	24	Bay - (B)*	277	M.A.M.	M	17 days	No	6.6	7.6	12.6
5	24	Bay - (B)*	492	H.I.A.	F	90	No	13.5	11.6	16.6
6	25	Bay - (H)*	322	A.U.Y.	F	1 ms.	No	16.6	19.6	19.6
7	26	M.Shabelli	86	M.A.A.	M	7 days	No	18.6	22.6	24.6
8	27	Bay - (D)*	517	-	F	6 days	No	15.6	16.6	17.6
9	27	Bay - (D)*	565	M.A.E.	F	2	No	1.6	23.6	4.6
10	31	Bay - (B)*	813	A.I.I.	M	15 days	No	21.7	21.7	29.7
11	35	Gedo	720	M.M.A.	M	1 ms.	No	15.8	17.8	25.8
12	41	L.Shabelli	942	H.N.A.	F	6	No	3.10	13.10	14.10

\*Districts: B = Baidoa, D = Dinsor, H = Burakaba

Habiba Nur Ali, a 6 year old girl who died with severe smallpox on 14 October 1977, was the last known fatality of endemic smallpox in the world. She and her 1½ year old brother were responsible for the infection of the last known case of endemic smallpox which occurred 12 days after her death.

## 5. The Last Known Smallpox Outbreak

On 31 October 1977, an urgent "trunk call" from the WHO epidemiologist in Lower Shabelli Region informed the "Zeropox office" in Mogadishu of a new outbreak of smallpox in Merca Town. His clinical examination confirmed the diagnosis and the preliminary epidemiological investigation revealed the possibility of tens or perhaps hundreds of direct face-to-face contacts with the patient, both in Merca Town and in the neighbouring three districts. The same day a group of epidemiologists left Mogadishu for Merca to assist with containment of what is believed to be the last outbreak of naturally occurring smallpox in the world.

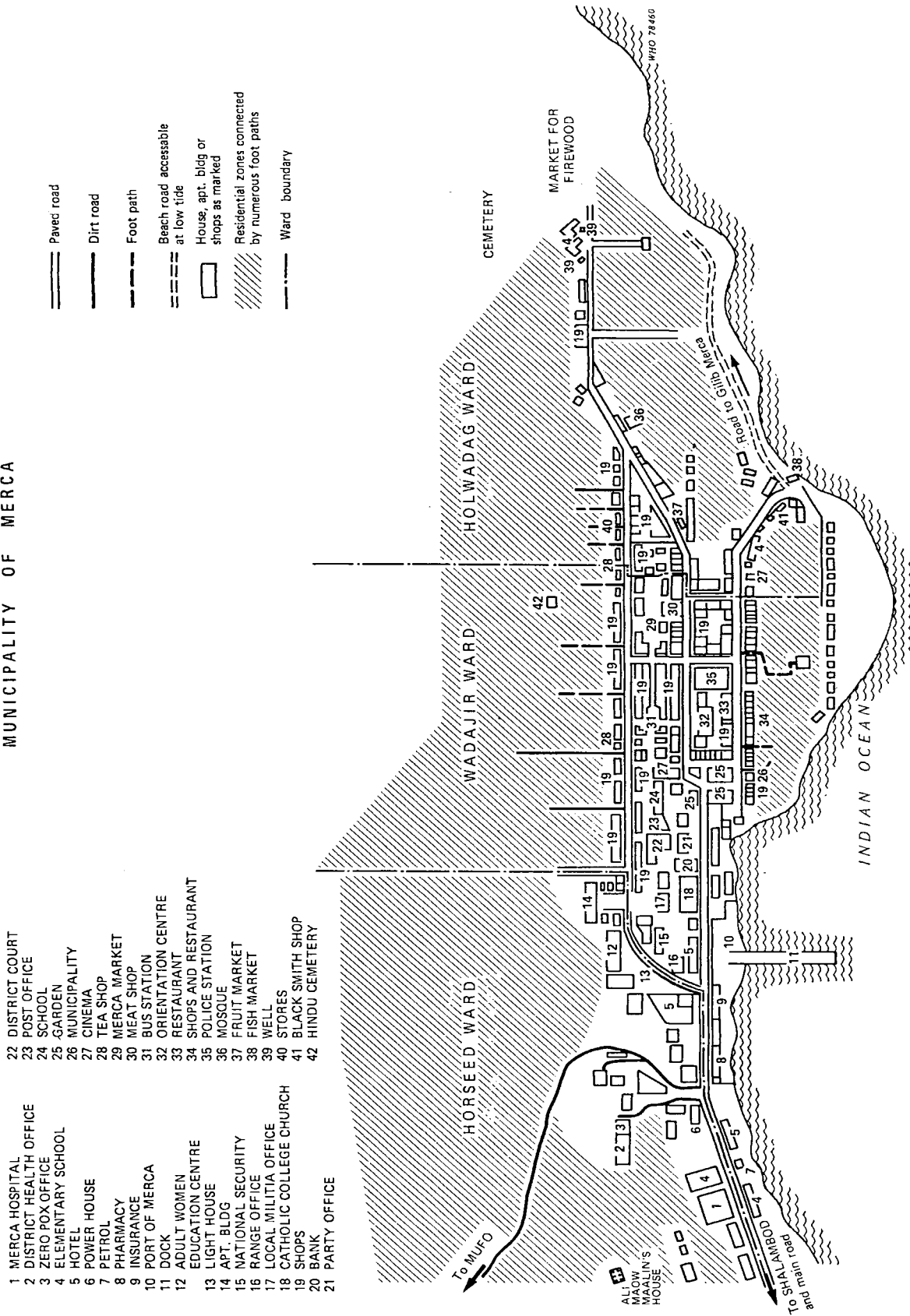
Merca is a busy regional centre and international port with an estimated population of 26 000. It is only two hours drive by surfaced road from Mogadishu and is connected by bus services with the six outer district towns in the region. Most of its inhabitants are employed in local light industry or the port, or conduct various small businesses. Administratively the town is divided into three wards, each having four branches with 200-400 houses. The outbreak was detected in the Horseed ward which forms the south-western sector of the town (figure 4.17).

### 5.1 Initial Investigation and Diagnosis

The patient, Mr Ali Maow Maalin, was 23 years old and was employed as the cook in the Merca hospital. He had been unsuccessfully vaccinated against smallpox in the past and when discovered was suffering from a severe attack of the disease. Clinically there was no doubt about the diagnosis but specimens for laboratory confirmation were taken.



FIG. 4.17  
MUNICIPALITY OF MERCA



On questioning the patient revealed the following sequence of events:

- 22 October: The patient developed a fever while at work and went home.
- 23-24 October: He stayed at home and was visited by many friends including neighbours and hospital employees.
- 25 October: Admitted to the medical ward of Merca hospital with a diagnosis of malaria, he was treated accordingly. He was visited by many friends and hospital employees and walked freely through the hospital and outside the compound to receive his salary and to visit a friend.
- 26 October: He developed a rash in the evening.
- 27 October: The patient was discharged after a provisional diagnosis of chickenpox was made by the attending physician.
- 28 October: He remained in his home compound, very ill, and was visited by friends and relatives.
- 29 October: The patient himself suspected smallpox but through fear of being sent to the isolation camp did not inform the authorities.
- 30 October: A male nurse from the hospital reported the case to the Regional Health Superintendent.
- 31 October: The Smallpox Eradication Programme epidemiologist was informed, investigated the case and diagnosed his illness to be smallpox.

The patient experienced moderately severe smallpox with a discrete rash. On 31 October, when he was first examined, the rash was at the pustular stage with maximum lesions on the extremities, including the palms and soles. By 15 November the rash had reached the scab stage. The patient subsequently recovered without complications. He was discharged from the isolation centre at the end of November.

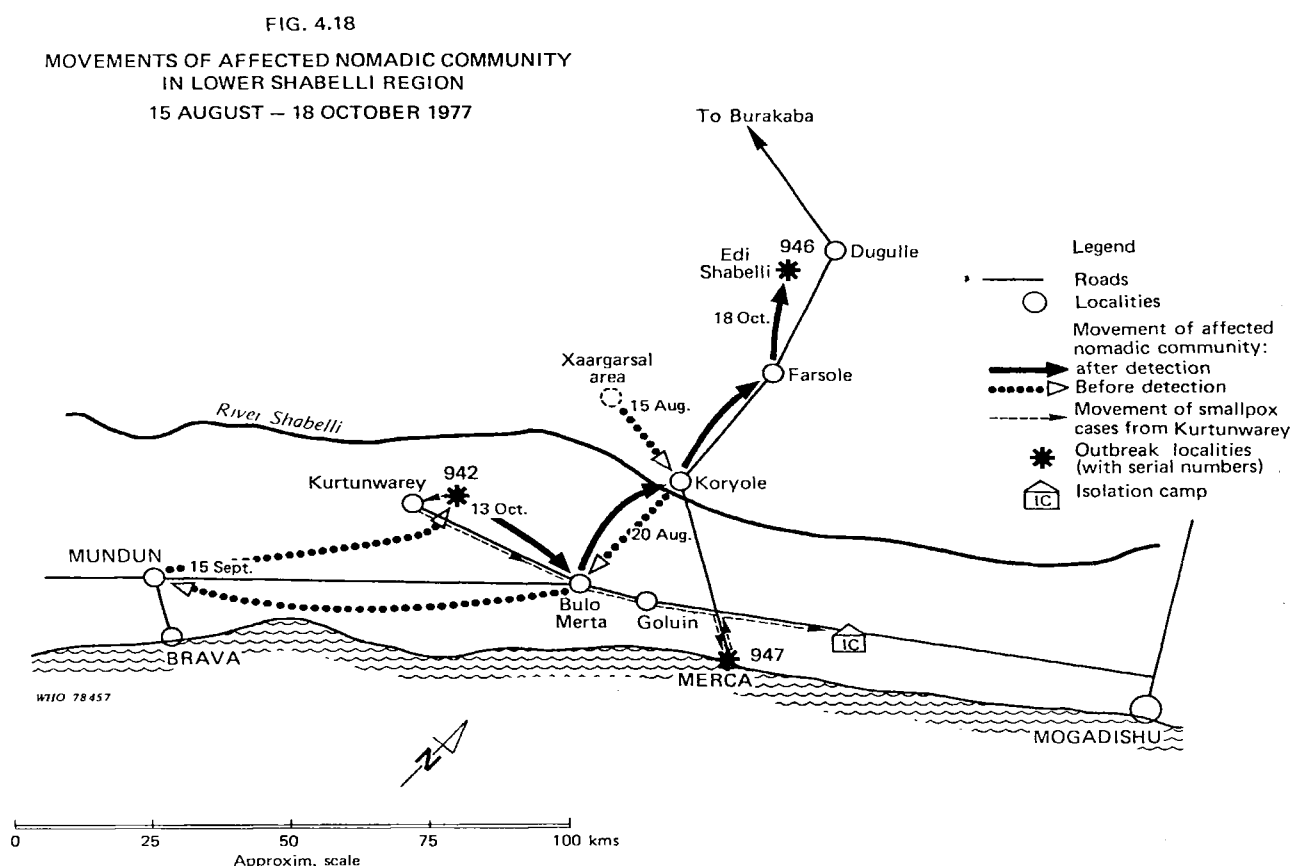
Specimens for laboratory diagnosis were collected on 31 October and forwarded via Geneva to the WHO Collaborating Centre, Viral Exanthems Branch, Virology Division, Center for Disease Control, Atlanta, USA. The diagnosis of smallpox was subsequently confirmed when variola minor virus was isolated.

## 5.2 Source of Infection

The probable source of infection was ascertained without difficulty during the interview of the patient.

On the evening of 12 October, two smallpox cases, detected about 17 km north of Kurtunwarey settlement, were sent in a vehicle to an isolation camp near Merca Town. The vehicle had stopped at Merca hospital to seek directions. Mr Ali Maow Maalin, the hospital cook, travelled in the vehicle to direct it to the Merca Smallpox Eradication Office. His contact with the patients, a 6 year old girl, Habiba Nur Ali, with severe smallpox and her 1½ year old brother in the papular stage of the rash, lasted for a few minutes only but was sufficient to infect this unprotected person. The patients from Kurtunwarey were isolated as planned but follow-up investigation at the time failed to identify Mr Ali Maow Maalin as a contact.

The chain of transmission, resulting in this last smallpox outbreak in Merca, was traced back to mid-August, when the first smallpox case had occurred among a nomadic community of 20 families with a total of 109 persons, staying in Xaargarsal area in Koryole District. In all, eight smallpox cases including the two mentioned above, occurred among these nomads during their two months' movement through Koryole, Brava and Kurtunwarey Districts (fig. 4.18), the last one occurring on 18 October at Edi Shabelli, where the chain of transmission was finally interrupted.



### 5.3 Containment Measures

Additional national and WHO epidemiologists were immediately transferred to Merca from other posts and a detailed plan of action formulated.

**Isolation of the Patient:** Initially the patient was isolated at his home, a room which he rented approximately 200 metres from Merca hospital, and a 24-hour guard was posted, however, as this was located in a densely populated urban area, it was decided to relocate the patient in an isolation camp at El Warego, about 10 km from Merca near the Mogadishu road. He was transferred there on 2 November. One police guard and one militia guard lived at the isolation centre permanently until the patient was discharged four weeks later.

Contact Tracing: Possible contacts included all hospital staff, medical and surgical ward patients from 21-27 October, visitors to the medical ward on the days of Ali's hospitalization and his family, neighbours and friends who had visited him in the hospital or at home. Also to be considered were others in the town who might have had exposure to Ali during the prodromal period. A total of 161 possible contacts was identified, located and interviewed, in some cases necessitating visits to places more than 120 km north and south-west of Merca. They were classified according to the intensity of their exposure (that is, whether or not face-to-face contact could be remembered by either party) and the presence or absence of a vaccination scar said to have resulted from vaccination within the previous three years. Possible contacts without evidence of successful vaccination within the preceding three years were considered "unprotected". "Incidental contacts" were considered to be those individuals who had been in the same place with Ali at some time since the day before the onset of fever but who had not had close exposure. Table 4.11 shows the distribution of possible contacts by degree of exposure and vaccination status prior to exposure.

TABLE 4.11  
CLASSIFICATION OF POSSIBLE CONTACTS  
BY DEGREE OF EXPOSURE AND VACCINATION STATUS

Vaccination status prior to exposure	Degree of exposure		Total
	Face-to-face	Incidental	
Vaccinated within past 3 years <u>a</u>	58	62	120
Vaccinated more than 3 years previously <u>a</u>	21	) ) ) 8	) ) ) 29
Unvaccinated <u>b</u>	12	) 0	) 12
Total	91	70	161

a Refers to presence of a vaccination scar said to have resulted from vaccination within 3 years, or more than 3 years previously.

b Refers to the absence of a vaccination scar, i.e. persons never vaccinated or unsuccessfully vaccinated.

Of 33 face-to-face contacts who had no evidence of successful vaccination within the previous three years, 12 had no vaccination scar whatsoever and therefore were considered to be at maximum risk. Six of these were hospital employees, two were medical ward patients and three were visitors to that ward. Only two of these contacts were children, one an infant. All known and possible contacts and members of their families were vaccinated. Incidental contacts were visited at least twice; "protected" face-to-face contacts were visited an average of four times each; and those classified as "unprotected" six times each during the potential incubation period. All face-to-face contacts were under surveillance for at least 18 days after their exposure to the patient. During this surveillance period, two hospital employees and three neighbourhood contacts developed fevers and were placed in isolation in their homes; none developed a rash. No secondary cases occurred among the 161 contacts.

5.4 Special Measures at Merca Hospital: Due to the numerous contacts with the patient while at the hospital the following measures were taken:

- all in-patient discharges were postponed and admissions were restricted to emergencies only;
- all out-patients were referred to alternative health facilities;
- all hospital patients were immediately vaccinated;
- all health staff in Merca town, as well as their households, were vaccinated;
- all surgical and medical patients were quarantined;
- all hospital staff and patients were checked daily for fever;
- warning signs were posted and a 24-hour police guard was posted at the hospital entrance.

Patients due for discharge were allowed to leave the surgical ward on 13 November and the medical ward on 17 November. The hospital was re-opened to the public one week later.

5.5 Vaccination and Search for Further Cases

Of highest priority was Horseed ward, where the patient's house and Merca hospital were located (figure 4.19).

The patient's house and the 50 closest neighbouring houses were visited by a two-man team of local residents who listed and vaccinated all inhabitants and visitors. Teams, each comprised of two smallpox programme staff, one local party leader and one policeman visited the remaining houses of Horseed ward. The teams worked at night to achieve the maximum possible vaccination coverage of the population. A first round of vaccination was completed in three nights, that is by the night of 2 November.

Thereafter, a team of ten persons was assigned to revisit all households in Horseed ward searching for smallpox cases, vaccinating newly-returned residents or visitors and revaccinating those whose first vaccination was unsuccessful. In the remaining two wards, Wadajir and Hawl Wadag, the teams visited all houses listing and vaccinating all residents during the following seven days. Thus, by 10 November, the whole town of Merca had been covered by one search and vaccination round.

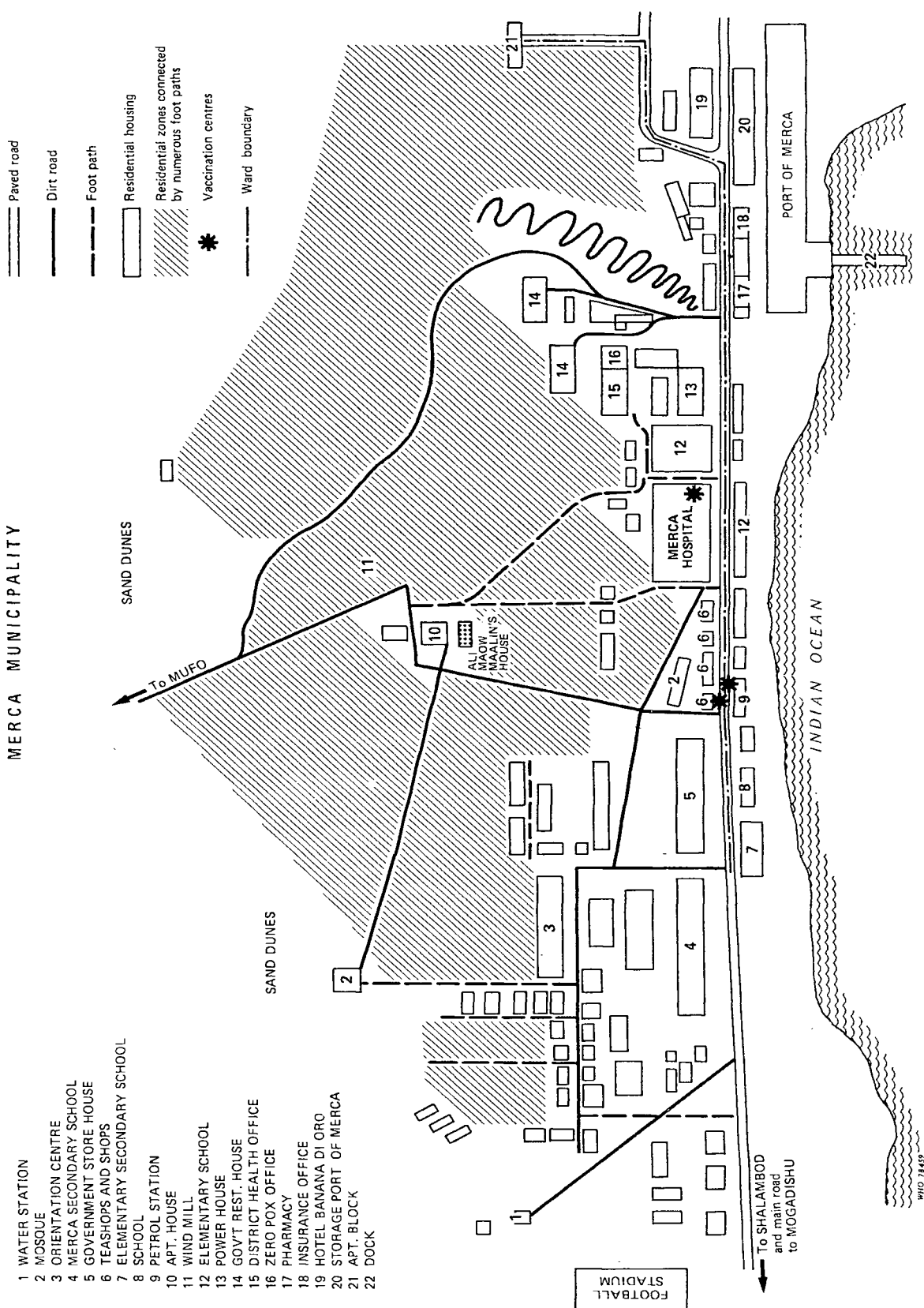
This intensive activity was followed by repeated three-day searches of the whole town during each of the six weeks of the observation period. The scope and findings of these activities are shown in Table 4.12.

TABLE 4.12  
RESULTS OF CONTAINMENT VACCINATION AND SEARCH OPERATION  
MERCA TOWN - NOVEMBER 1977

Area	Period	Number of houses <sup>a</sup>	Population <sup>a</sup>	Number of persons vaccinated	Number of rash cases detected		
					Smallpox	Chickenpox	Others
Horseed	31.10-2.11	792	5 000	3 558	0	1	4
Wadajir	3.11-6.11	738	4 300	2 873	0	1	1
Hawl Wadag	7.11-13.11	1 007	10 502	8 092	0	1	6
Checkposts	31.10-14.11	-	-	40 254	0	0	0

<sup>a</sup> - Estimated.

FIG. 4. 19  
HORSEED WARD  
MERCA MUNICIPALITY



With police assistance, a checkpoint was quickly established on the road into Merca to stop all traffic entering or leaving, and to vaccinate all passengers. Those on foot were also vaccinated and three additional checkpoints covered the three footpaths into Merca. These fixed vaccination/surveillance posts were maintained for six weeks.

Public meetings were held in the orientation centres of all wards to educate the public with respect to smallpox vaccination and the need to report illnesses with rash to the health authorities. A reward of two hundred Somali Shillings for reporting a smallpox case was widely publicized, as was the location of vaccination centres.

#### 5.6 Follow-up Surveillance

During the period when secondary outbreaks were expected and in the four subsequent months (November 1977-March 1978) five active search operations were conducted in the affected district and throughout Lower Shabelli Region. The results of these search operations are summarized in Table 4.13.

No further smallpox cases were found in Merca district or in the entire region during the six-week follow-up period in November and December 1977, providing good evidence that the chain of smallpox transmission had been interrupted. The described outbreak remains the last in the region and the last known smallpox outbreak in the whole of Somalia. In retrospect, it might be concluded that it was the result of a combination of errors and omissions, however, prompt and comprehensive containment confined it to a single case. Despite rigorous surveillance operations in the affected and neighbouring districts and throughout the whole of Somalia, no further cases were identified.

Therefore, the Merca smallpox outbreak became the last known naturally occurring outbreak of smallpox in Somalia and, thus, in the world.

**TABLE 4.13**  
**SUMMARY OF SEARCH ACTIVITIES IN MERCA DISTRICT AND LOWER SHABELLI REGION**  
**NOVEMBER 1977-MARCH 1978**

Period	Area	Number of visited and searched				Number of rash cases detected		
		Villages	Nomadic camps	Houses	Schools	Smallpox	Chickenpox	Others
November 1977	Merca District L. Shabelli	157	NR	24 283	167	0	2	47
		786	239	62 676	598	0	9	362
December 1977	Merca District L. Shabelli	202	NR	27 895	195	0	0	57
		1 328	341	102 898	900	0	16	454
January 1978	Merca District L. Shabelli	169	NR	29 808	329	0	2	25
		1 576	550	104 818	1 000	0	11	204
February 1978	Merca District L. Shabelli	195	90	22 071	269	0	2	4
		1 064	240	79 843	1 053	0	11	70
March 1978	Merca District L. Shabelli	204	120	26 089	305	0	5	7
		1 230	586	77 287	948	0	13	27

NR = Not reported



Ali Maow Maalin the last known case of naturally occurring smallpox in Somalia, and in the world. His smallpox rash appeared on 26 October 1977 while he was at home in Merca town, in Southern Somalia.



## 6. Some Features of the 1977 Smallpox Outbreaks

Analysis of the records of the 1977 smallpox epidemic in Somalia identified some specific characteristics. These are described and commented upon in the following text.

### Size of Affected Localities

From an analysis of 790 smallpox outbreaks (from the total of 947) which occurred in Somalia in 1977, it was found that more than one quarter of the affected localities had a population of less than 50 and almost one half a population of less than 100 persons. Table 4.14 shows the size of affected localities, by month. Only 5% of outbreaks occurred in centres with over 1000 population.

The small size of affected localities influenced considerably the scope of containment activities and, in particular, facilitated containment vaccination.

At the beginning of the intensified surveillance activities a greater proportion of larger villages or towns were found to be affected than in subsequent months. The proportion of outbreaks found in smaller settlements or encampments, especially those having less than 50 inhabitants, gradually rose from 7% in April to 46% in July. It is noted that the trend illustrates more the extension of the effective surveillance activities than any peculiarities of the epidemiological situation.

TABLE 4.14

SIZE OF SMALLPOX AFFECTED LOCALITIES BY MONTH, SOMALIA 1977

Month*	Population										Total No.    %	
	50		50-99		100-499		500-999		1000+			
	No.	%	No.	%	No.	%	No.	%	No.	%		
Jan.-March	6	8.2	3	4.1	41	54.6	15	20.0	10	13.1	75	100
April	7	7.2	16	16.4	49	50.5	9	9.3	16	16.6	97	100
May	50	21.7	51	22.2	113	49.2	9	3.9	7	3.0	230	100
June	82	36.7	55	24.6	77	34.8	5	2.3	4	1.8	223	100
July	57	46.3	30	24.4	32	36.1	2	1.6	2	1.6	123	100
August	9)		15)		8)		0)		0)		32)	
September	2)	(31.1)	2)	(43.0)	2)	(23.7)	0)	(0.0)	0)	(2.2)	6)	(100)
October	2)		1)		0)		0)		1)		4)	
Total	215	27.2	173	21.8	322	40.8	40	4.1	40	5.1	790	100

\*When locality was first affected

### Population Groups Affected

Early experience had shown that urban areas were frequent recipients and important disseminators of smallpox and urban outbreaks always presented a significant threat to the programme. During 1977 in Somalia, 19 outbreaks, or 2% of the total, occurred in urban areas, that is, the capital and the regional or district administrative centres. Even these larger towns rarely have a population of more than 10 000 and vaccination coverage was undoubtedly better than in the rural areas.

The remaining 928 outbreaks occurred in the rural areas of the country, their widespread occurrence being attributed to the high degree of mobility and frequent intermixing and regrouping of the rural population. The consequent numerous contacts resulted in much wider transmission of the disease than might otherwise have been expected amongst such a sparse population.

The proportion of outbreaks detected among nomads in comparison with those in the sedentary population increased substantially each month. Figure 4.20 and Table 4.15 show that the percentage of outbreaks found in nomadic encampments rose gradually from around 35% in March to 94% in August. These figures also reflect to some extent the later expansion of programme activities into remote bush areas.

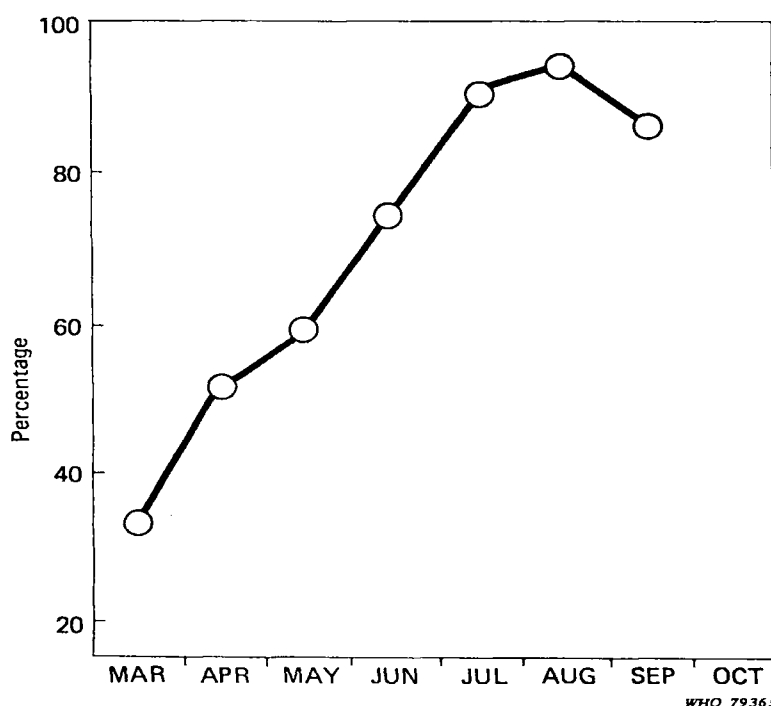
TABLE 4.15

DISTRIBUTION OF SMALLPOX OUTBREAKS BY POPULATION GROUP AND BY MONTH, SOMALIA 1977

Month	Total number of outbreaks with data available	Number among settled population	Among nomadic population	
			Number	Percent
Jan.-March	80	48	32	40.0
April	118	58	60	50.8
May	232	93	139	59.9
June	241	59	182	75.5
July	128	11	117	91.4
August	33	2	31	93.9
September	7	1	6	-
October	4	1	3	-
Total	843	273	570	67.6

FIG. 4. 20

PERCENTAGE OF SMALLPOX OUTBREAKS  
DETECTED AMONG NOMADIC POPULATION  
BY MONTH SOMALIA - 1977



From the 843 outbreaks occurring in rural areas and from which relevant data are available, 273 (32%) occurred in settled villages with a sedentary population and 570 (68%) in nomadic encampments or among travelling nomadic groups. The latter proportion varied from zero per cent in Lower Juba Region to around 74% in Bay and Bakool Regions, as shown in Table 4.16.

TABLE 4.16

URBAN-RURAL DISTRIBUTION OF SMALLPOX OUTBREAKS BY REGION, SOMALIA 1977

Regions	Total number of outbreaks with data available	Number among settled population	Among nomadic population	
			Number	Percent
Bay	447	112	335	74.9
Bakool	155	41	114	73.5
Gedo	51	16	35	68.6
M. Shabelli	73	28	45	61.6
Hiran	18	9	9	50.0
L. Shabelli	80	52	28	35.0
Galgadud	3	2	1	33.3
M. Juba	13	10	3	23.1
L. Juba	3	3	0	0.0
Somalia	843	273	570	67.6

#### Smallpox Transmission in Isolated Rural Population Groups

The continued spread of smallpox for long periods in rural areas or isolated communities was never a major problem during eradication activities in the densely populated areas of India and Bangladesh and other countries of Asia. There, the smallpox outbreaks were usually quickly detected in larger market centres or were reported by travellers from the affected area.

In Somalia, investigations revealed that the transmission of smallpox had often persisted for up to six months among small groups living in small rural settlements and particularly in small nomadic groups isolated in remote bush areas.

Examples of prolonged smallpox transmission in small population groups are shown in Table 4.17 and figure 4.21. The majority of these outbreaks started during the January-March period but were detected and investigated in May and June. The reported dates are, of course, approximate and undoubtedly some missing links, and perhaps intermixing, in the chains of transmission can be assumed.

In seeking explanation of the slow transmission observed among the Somali nomads it should be considered that:

- the strain of smallpox prevalent in Somalia, variola minor, is itself of low virulence, with a case-fatality rate of less than one per cent;
- most activities of the nomads occur in the open and opportunities for concentrated aerosol exposure within closed spaces are less common than in a settled population;
- the nomadic pattern of life, particularly the herding of various kinds of animals, substantially limits contact even between members of the same groups; and

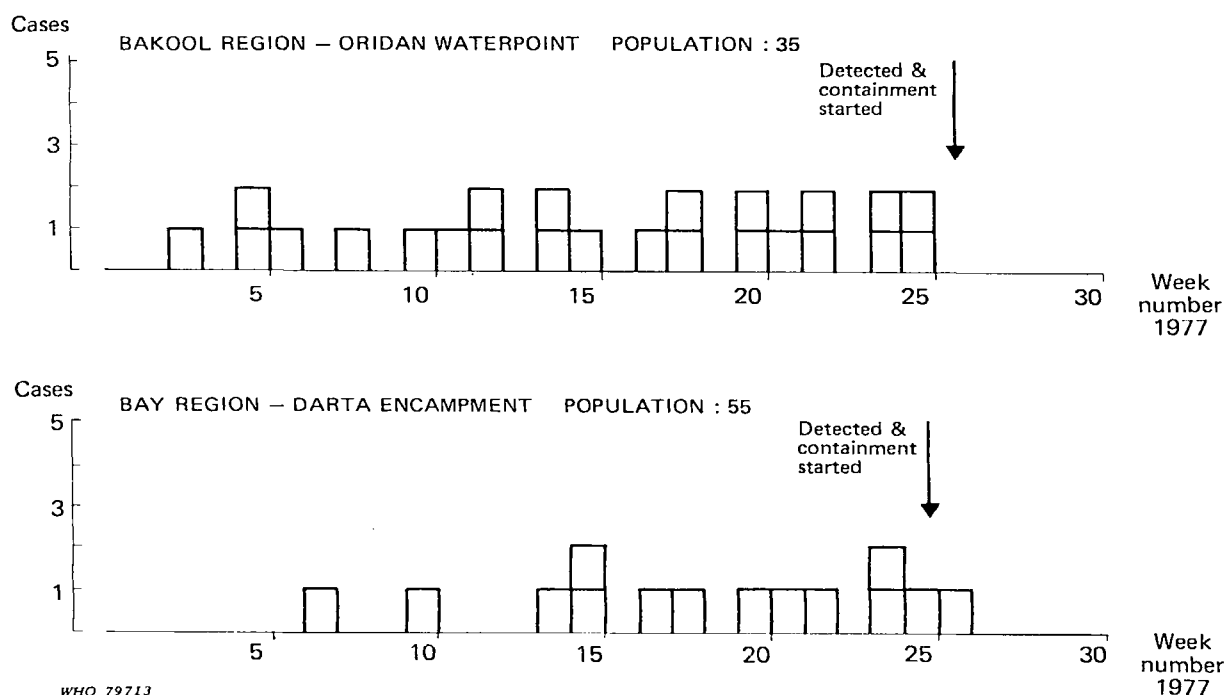
- often patients were not seriously ill and remained mobile even during the acute phase of illness; often patients in the prodromal period of the disease left their encampments to herd their animals and so spread the disease more widely outside than within their own group.

TABLE 4.17  
PROLONGED SMALLPOX TRANSMISSION IN NOMADIC ENCAMPMENTS, SOMALIA 1977  
10 SELECTED OUTBREAKS

Outbreak number	Locality	Population	Number of cases	Number of days from first to last case	Date of		
					First case	Last case	Detection
911	Darta	55	14	163	17.2	1.8	20.8
665	Oridan	35	24	152	21.1	23.6	28.6
462	Loala	98	20	106	22.3	6.7	22.6
547	Bilahey	75	23	95	14.3	8.6	19.6
223	Madhare	35	9	80	6.3	24.5	18.5
687	Berdebirole	65	9	74	20.4	4.7	5.7
186	Boldwene	50	6	73	26.3	8.6	17.5
65	Abdijelib	11	6	70	25.2	7.5	24.4
539	Mandeelo	46	21	68	23.4	1.7	23.6
904	Shafa	60	12	65	28.6	1.9	12.8

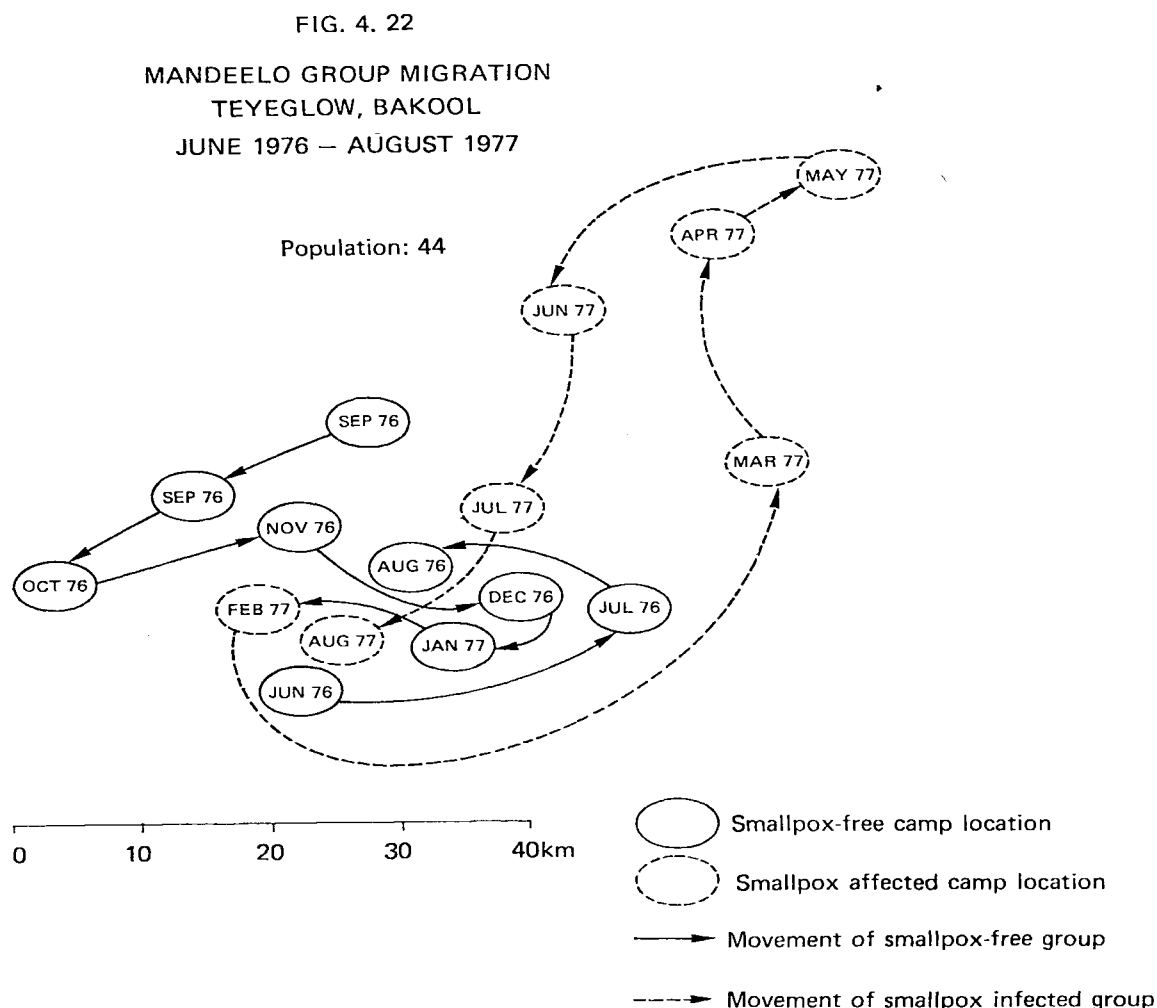
FIG. 4.21

PROLONGED SMALLPOX TRANSMISSION IN NOMADIC OUTBREAKS,  
SMALLPOX CASES BY WEEK OF ATTACK

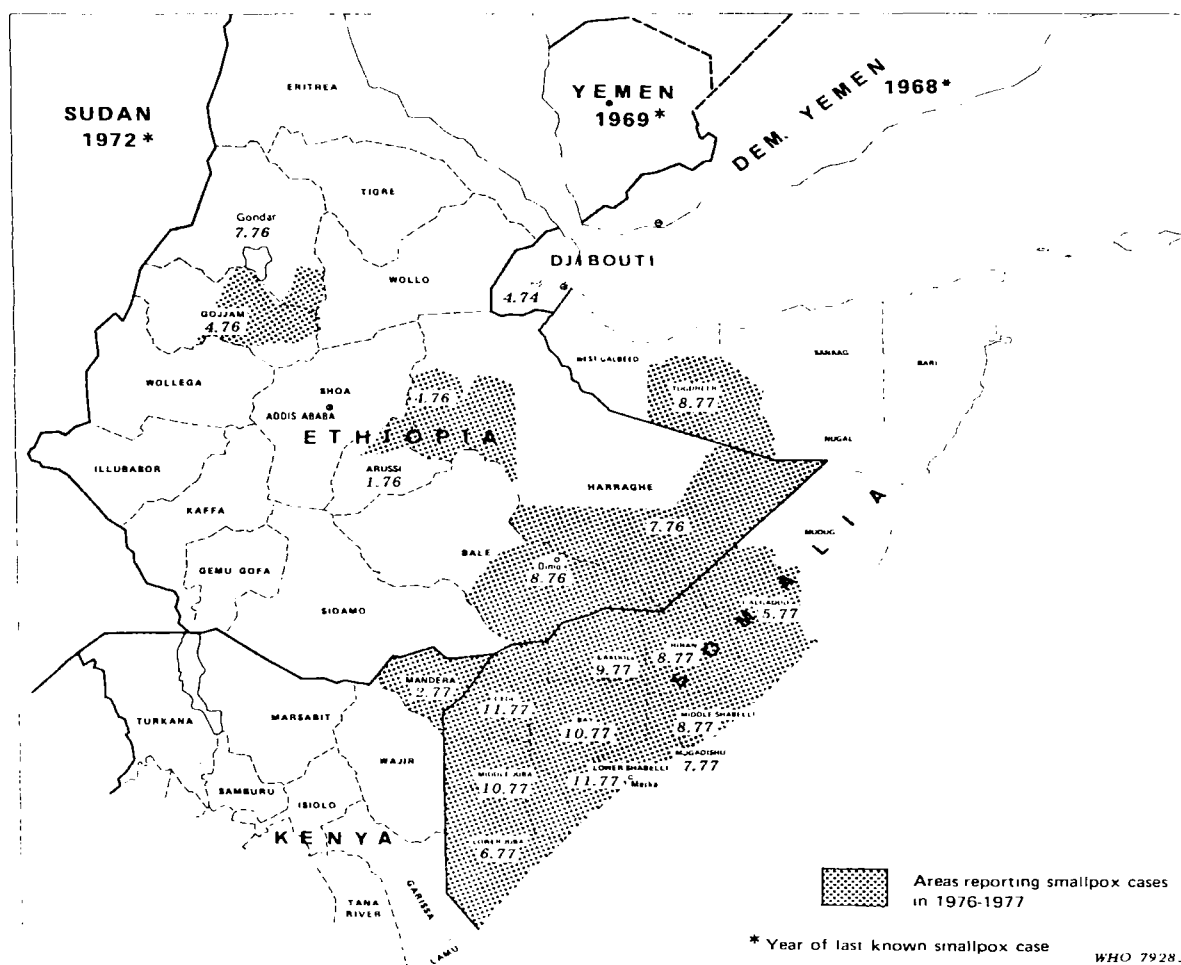


An excellent example of prolonged transmission among a group of nomads has been documented by Foster et al.\* A group of 46 people camped at the time of detection at Mandeelo, in Teyeglow District of Bakool Region, had harboured smallpox for six months. During this time the group had made four major movements over a wide area. These and the movements made in the preceding nine months are shown in figure 4.22. When smallpox was introduced into the group, 84% of its members were unvaccinated, however, five months and an estimated 10 generations of transmission were required to infect 19 persons.

The implication of this and similar discoveries is clear: it was necessary to recognize that smallpox transmission could be maintained even among sparse nomadic populations for considerable periods. Surveillance amongst such groups became a priority of the Somalia Smallpox Eradication Programme



THE WORLD'S LAST KNOWN SMALLPOX FOCI BY AREA  
AND DATES OF LAST KNOWN CASES.  
HORN OF AFRICA



## Smallpox Incidence and Surveillance in Neighbouring Countries

The numbers of smallpox cases reported in the countries neighbouring Somalia during the decade prior to 1977 are shown in Table 4.18. The month and year of occurrence of the last known outbreaks in the Horn of Africa are shown in figure 4.23.

Comments follow on the smallpox situation in each of the countries bordering, or in close contact with, Somalia.

Ethiopia: Last known case - 9 August 1976

In the past smallpox was endemic throughout Ethiopia. An intensified eradication programme greatly improved surveillance effectiveness and in early 1975, as previously inaccessible areas came under surveillance, the number of smallpox outbreaks detected progressively increased. A peak of 150 infected localities was reached in July 1975 and thereafter there was a steady, if irregular, decline.

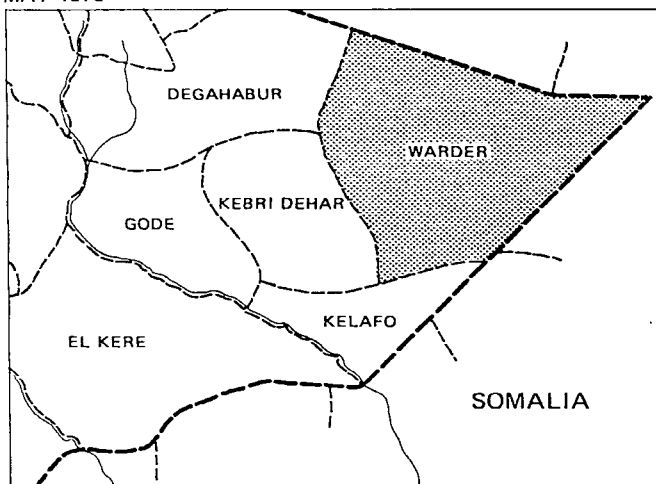
By May 1975 only 20 localities remained affected including five among the nomadic population in the Ogaden Desert area. The situation was complicated by heavy flooding and a consequent disruption of nomadic movement patterns in this area at that time. As can be seen from figure 4.24, smallpox persisted in the regions adjacent to Somalia until August 1976, when the last known case of smallpox in Ethiopia occurred in Bale Region.

Surveillance throughout Ethiopia, including surveillance of the Ogaden Desert region, has been maintained since that time and no further smallpox cases have been detected.

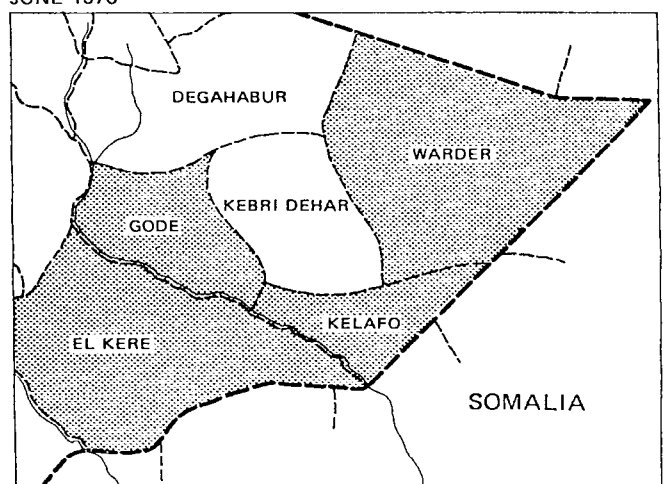
FIG. 4. 24

OGADEN DESERT - AREAS REPORTED AS AFFECTED BY SMALLPOX TRANSMISSION, MAY - AUGUST 1976

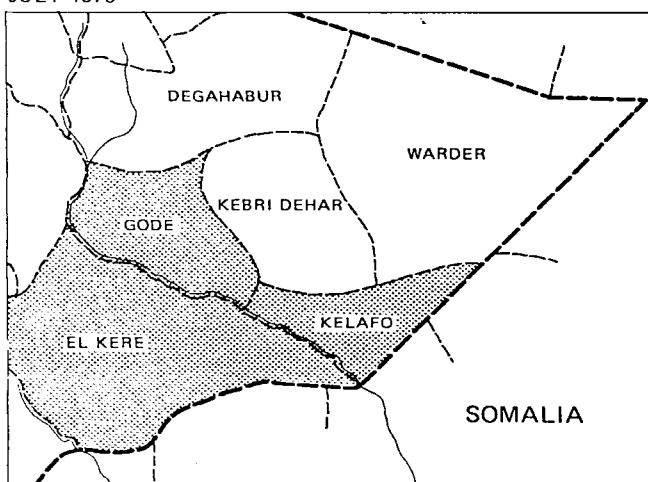
MAY 1976



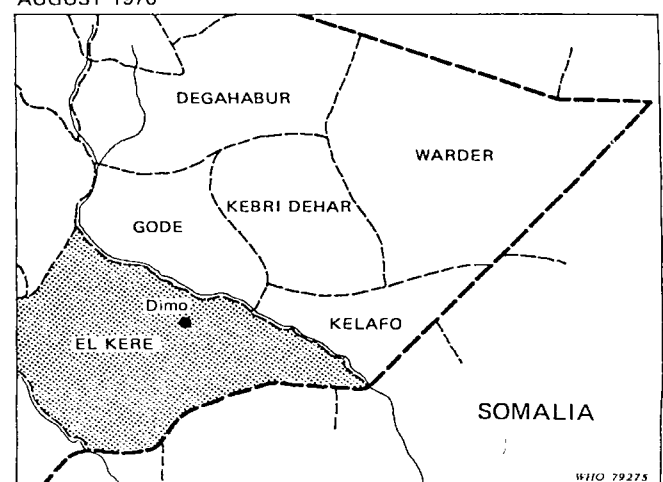
JUNE 1976



JULY 1976



AUGUST 1976



● Last known outbreak in Dimo, 9 August 1976

WHO 79275

TABLE 4.18  
THE HORN OF AFRICA - REPORTED SMALLPOX CASES 1967-1979

Year	Somalia	Kenya	Ethiopia	Djibouti	Horn of Africa Totals
1967	-	153	446	-	599
1968	-	85	426	-	511
1969	-	14	197	-	211
1970	-	0	722	-	722
1971	-	46	26 329	26	26 401
1972	5	-	16 999	93	17 097
1973	7	1	5 414	14	5 436
1974	11	3	4 439	13	4 466
1975	14	-	3 935	-	3 949
1976	39	-	915	-	954
1977	3 229	5	-	-	3 234
1978	-	-	-	-	0
1979	-	-	-	-	0

Kenya: Last known case - 5 February 1977

This country started a WHO collaborated smallpox eradication programme in 1969 and in 1970 no smallpox cases were reported. Importations of the disease from Ethiopia occurred in 1971, 1973 and 1974. In 1977, smallpox was imported from Somalia to the village of Mandera in the north-eastern corner of the country where it caused the last known outbreak, of five cases, in February of that year.

During the smallpox surveillance programme which has continued in Kenya since that time, the north-eastern areas adjacent to Somalia have been given high priority. Four intensive searches, the last involving 300 searchers, have been completed and a 200 Kenyan Shilling reward for reporting smallpox has been widely publicized. No further cases have been detected.

Djibouti: Last known case -

Five major epidemics of smallpox have been reported in Djibouti in the past 25 years with a total number of cases, however, of less than 300. The last occurred in 1974 when 12 cases were recorded in Djibouti town. Nevertheless smallpox surveillance has remained of major importance because of the difficulty of control of immigration across the borders with Somalia and Ethiopia. More than 10 000 displaced persons from the Ogaden area are accommodated in camps in Djibouti. Continuous surveillance among these persons and throughout the country has failed to detect any smallpox case.

Yemen Arab Republic: Last known case - 1969

In the past it was not uncommon for persons from the Horn of Africa on pilgrimage to Mecca in Saudi Arabia to pass through this country. In view of this a large smallpox vaccination effort was organized, mainly in the coastal areas, in 1977, and a countrywide surveillance programme was commenced in 1978. In June 1979 an International Commission certified that smallpox eradication could be considered to have been achieved in Yemen.



People's Democratic Republic of Yemen: Last known case - 1968

The last endemic smallpox occurred in this country in 1960 with single case importations reported in 1961 and 1968. Nevertheless a smallpox eradication programme was started in 1970 based largely on mass vaccination.

In view of the intensified smallpox situation in the Horn of Africa, WHO assisted surveillance activities were commenced in February 1978. During the following 16 months a smallpox search and pockmark survey was conducted throughout the country and in June 1979 an International Commission certified that smallpox had been eradicated in PDRY.

Saudi Arabia: Last known case - 1970

In 1970 smallpox was imported to Jeddah, on board a ship, at the time of the pilgrimage. Ten cases occurred, all within the Jeddah Quarantine Centre. Again in 1973 a smallpox case occurred on board a pilgrim ship in Jeddah harbour; no secondary cases occurred.

Strict surveillance has been undertaken at times of the annual pilgrimages, particularly in November-December 1977 when importation from Somalia was feared. At that time, surveillance teams, including a special team sent from Somalia, working in Mecca, Medina and Jeddah failed to find evidence of smallpox transmission.

Saudi Arabia was certified as smallpox-free in December 1978.

Sudan: Last known case - 1972

Although the last case was recorded in 1972, a smallpox eradication programme continued surveillance and vaccination activities because of the proximity to the Horn of Africa. In 1977-1978, 600 persons were involved in the programme and amongst other activities examined almost 750 000 persons for facial pockmarks. In all, 188 persons were found who had suffered smallpox, all prior to 1972.

The situation in Sudan was assessed by an International Commission in November 1978 and the country declared free of smallpox.

## 5 VACCINATION

### 1. Historical Comment: Variolation

The following account by the Somali folklore authority Musa I. Galal illustrates the traditional attitudes to smallpox and its prevention.

"Somalis also knew for many centuries the ideas of 'tallaal' (variolation) against smallpox, quarantine and immunity. In most parts of the Somali territories a system (of variolation) had always been in practice, in the following way: one or two small incisions were made on the skin over a protruding bone, the one above the wrist usually being selected, although the ankle bone was used by some people. A small amount of pus taken from the lesions of a smallpox victim was then smeared on the bleeding incisions, and the part bandaged. About a week thereafter, the person would get a fever and develop a mild attack of smallpox, 'furuq'. The object was to immunize persons against severe attacks by exposing them to a lesser danger.

"The concept of quarantine is also both old and widely practised in Somalia. Patients suffering from smallpox . . . are isolated in special enclosures with thorny bush ('hero') fences to protect them from wild beasts at night and under a large tree to give shade in the day from the heat of the sun. A number of vessels and utensils are provided for the exclusive use of the patient for food and drink, one article for each kind of food. . . (The patients) are cared for and nursed by previous smallpox victims who are known to have been immunized by their past contraction of the disease."

The practice of performing variolation, as in the Middle East and other neighbouring countries, has certainly been a custom in Somalia for at least 200 years. It was still used on a limited scale in the north during the 1953-1954 smallpox epidemic. The practice prevailed especially among nomadic and semi-settled groups. Those who had not previously suffered from smallpox were variolated with matter from the lesions of the first case to occur in a group. In addition to the method described above, variolation was often performed using a thorn to break the skin and vesicular fluid as the inoculum. Some of those who were variolated subsequently contracted typical smallpox, others had severe local reactions with ulceration.

It is clear that the main reason for variolation was to confer immunity through a milder form of the disease. Another reason existed, however, related to social pressures. Any nomadic group with an infectious case of smallpox would be avoided to the extent of excluding a member of the affected group from wells or markets. This traditional isolation often resulted in extreme hardship for the affected group and led to cases of smallpox being concealed. Therefore, variolation was used to speed up smallpox transmission among group members and thus limit the infectivity of the group to the shortest possible period.

There is no indication that variolation was practised during the last decade. During the programme many Somalis provided information about previous attacks of smallpox or about being vaccinated but not one mentioned recent variolation. In any case, the arms of the nomads are often scarred by injuries caused by fire or juices of cacti and other plants so it is extremely difficult to identify variolation scars. During the National Assessment of the Smallpox Eradication Programme in March 1979, extensive inquiries about variolation were made by Regional Assessment Teams in the majority of districts. No reports of variolation were received, and so it seems that this old tradition was totally replaced during the gradual increase of vaccination activities in the middle of this century.

## 2. Vaccination Activities before 1969

Smallpox vaccination became an important activity of the public health agencies from the first decades of this century. There were no plans for systematic vaccination and in urban areas vaccination was carried out on request while in rural areas it was usually only performed during an epidemic of smallpox.

### Vaccine Production

Prior to 1960 about 100 000 doses of vaccine were produced yearly by the Institute of Vaccine and Sera at Merca which was under the administration of the Livestock Development Agency of the Ministry of Rural Development. Production of vaccine was performed under difficult circumstances as the premises were equipped primarily for animal care and the maintenance of sterile conditions was not easy. The final product was diluted with glycerol, phenol was used as a preservative and penicillin and tetracycline were added. Potency tests were performed on rabbits, and no further controls were made.

After 1960 the production of smallpox vaccine dropped sharply and annual output for the years 1960-1966 averaged only 10 000-20 000 doses in accordance with the needs of the health authorities. Early in 1966, production was again increased following the danger of smallpox importation from French Somaliland, but later in the year production in Merca was stopped indefinitely and no smallpox vaccine has been produced in the country since. The Ministry of Health decided to import liquid vaccine from Kenya and dried vaccine from Italy. From 1969 only freeze-dried smallpox vaccine of certified potency has been used.

Limited refrigeration facilities in the country made vaccine storage difficult. The Mogadishu Municipal Health Authority owned a small refrigeration depot and further doses of vaccine were stored in refrigerators in the Central Medical Store. Within the regions, facilities of limited capacity for the storage of vaccine existed either in the regional medical stores or in regional hospitals.

### Vaccination Technique

Until 1969 all vaccinations were performed by the scratch method, a rather complicated technique involving the disinfection of the skin with alcohol or ether and the subsequent application of smallpox vaccine utilising a "vaccinostyle", sterilized over a flame, with which several scratches were made. The vaccination site was afterwards covered with a simple dressing.

In 1968 this rather time consuming technique was gradually modified and freeze-dried smallpox vaccine was administered by one linear scratch without the previous use of any disinfectant and without subsequent dressing.

### Vaccinations Performed

In the years after 1950, it may be roughly estimated that every year 20 000 to 50 000 persons received smallpox vaccinations. The vaccinations were performed rather sporadically, in both time and place, usually as a reaction of public health authorities to the occurrence of smallpox outbreaks.

During the years 1960-1968, vaccinations against smallpox were mainly performed because of smallpox outbreaks occurring in Upper Juba and Benadir Regions, as they were then called, in 1962, in the northern regions during 1966, and as a routine in the Municipality Health Offices in Mogadishu, Hargeisa, Berbera and a few other larger towns for people travelling abroad. As an example, the data regarding smallpox vaccination performed in the Municipal Health Office, Mogadishu, during the period 1960-1967 are shown in Table 5.1

**TABLE 5.1**  
**SMALLPOX VACCINATIONS PERFORMED MOGADISHU MUNICIPAL HEALTH OFFICE, 1961-1967**

Year	Number of smallpox vaccinations	
	Travellers	Schoolchildren
1961	1 755	1 141
1962	2 939	1 845
1963	2 487	2 657
1964	2 379	3 153
1965	3 593	3 613
1966	3 344	3 165
1967	2 681	3 175

During 1966 more systematic vaccination started in the northern part of the country and in Mogadishu capital and its surrounding area, however, vaccinations were performed only at collection points. As a consequence mainly schoolchildren and the more educated population, especially those in urban areas, were covered. The reports submitted to the health authorities usually stated, "The vaccination is going on satisfactorily," or, "The response of the public to vaccination is extremely good," and the numbers of vaccinations performed were usually not reported.

At the end of 1967, a WHO medical officer undertook a limited vaccination scar survey in a rural area of Balad District and in urban areas of Hargeisa and Berbera. He reported that in the rural area 100% of the 0-7 age group, 54% of the 8-14 age group and 42% among those 15 and over had no vaccination scar. In the urban areas, from the same age groups the proportions were 51%, 48% and 55% respectively. A survey by US Peace Corps Volunteers in Berbera District in 1968 found that 98% of surveyed 0-4 year olds, 63% of the 5-14 age group and 52% of those over 14 had no history or scar of previous vaccination. At that time documentation and assessment of vaccination coverage was inadequate. Notwithstanding the possibility that previous localized emergency campaigns had produced regional differences in immunity levels, it was concluded that during the years 1960-1967 a rather small percentage of the population had been reached by vaccination efforts. The vast majority of the population remained susceptible to smallpox should it have occurred.

### 3. Mass Vaccination Campaign: 1969-1976

In 1969 a plan was formulated for a smallpox eradication programme (SEP) in Somalia. The aim of the Government, with assistance from WHO, was, "to eradicate smallpox from the Somali Republic by vaccinating the entire population within a period of 3 years." Mutual agreement to this plan was followed by the launching of a mass vaccination campaign.

#### Campaign Methodology

It was decided that in view of the lack of established health services the campaign should utilize mobile vaccination teams which could be posted in one area for two to three months. By placing several teams together in one region it was possible to ensure adequate supervision and assessment and, thus, adequate coverage. It was intended that 85-90% coverage would be confirmed before moving to a new area. Ten to twelve vaccinators worked in the north with Hargeisa as their central base and a further 15-25 covered the southern regions from Mogadishu.

In urban and settled rural populations the teams would make house-to-house rounds, each vaccination unit covering one locality. To reach the nomadic population, vaccination teams were stationed at waterpoints to vaccinate all passers-by but also to collect information on the whereabouts of nomad settlements which could then be visited. Efforts were made to gain the full cooperation of all sectors of the administration and public.

Emphasis was placed on the vaccination of newborns, infants, migrants, displaced persons and inhabitants of densely populated areas. All vaccinations were recorded as primary or revaccination, with the age and sex of the recipients.

The multipuncture technique, employing the bifurcated needle was introduced from the early seventies onwards. This technique is a model of simplicity and a vaccinator needed to carry only one plastic container with a sufficient number of bifurcated needles for his day's work and a vial of diluted freeze-dried vaccine.

The campaign was planned to have three phases: preparatory, attack and maintenance. The preparatory phase involved full planning of schedules and personnel deployment, arrangements for transport and equipment and preparation of recording forms. Training sessions were held for vaccinators and supervisory staff.

#### Attack Phase

In August 1969 the mass vaccination campaign's attack phase started in Mogadishu with 33 workers in six teams. They vaccinated schoolchildren, other students, police and medical personnel. At the end of the year the campaign continued among the general public by house-to-house visits.

By February 1970 the capital had been fully covered and responsibility for routine vaccination was handed over to the existing health services. Nine districts in Benadir Region were covered in the second and third quarters of the year, a new branch of the programme which started in May vaccinated Hargeisa town in two months and vaccination in the Kismayo area started in June. The areas covered by the campaign in 1970 and subsequent years are shown in figure 5.1. Towards the end of the year activities gradually reduced and were suspended in November as efforts were diverted to mass anti-cholera vaccination.

Smallpox vaccination was resumed on a large scale in the second half of 1971 with nine teams in the south and four in the north. In early 1972 one complete round of vaccination had been accomplished in the northern regions and the first round finished in the south in April. Thereafter the northern teams concentrated on the area bordering French Somaliland and on nomads while the southern teams worked in Hiran and Upper Juba where assessment had shown poor coverage.

The campaign's three most productive years ended in 1973 with two rounds of mass vaccination having achieved almost countrywide coverage and a rudimentary surveillance system having been started. The total numbers of vaccinations recorded in these years are shown in Table 5.2. They suggest that almost all of the population, whether settled or nomadic, was vaccinated in the attack phase.

FIG. 5. 1

AREAS COVERED BY SMALLPOX MASS VACCINATION CAMPAIGN  
SOMALIA 1970 - 1974

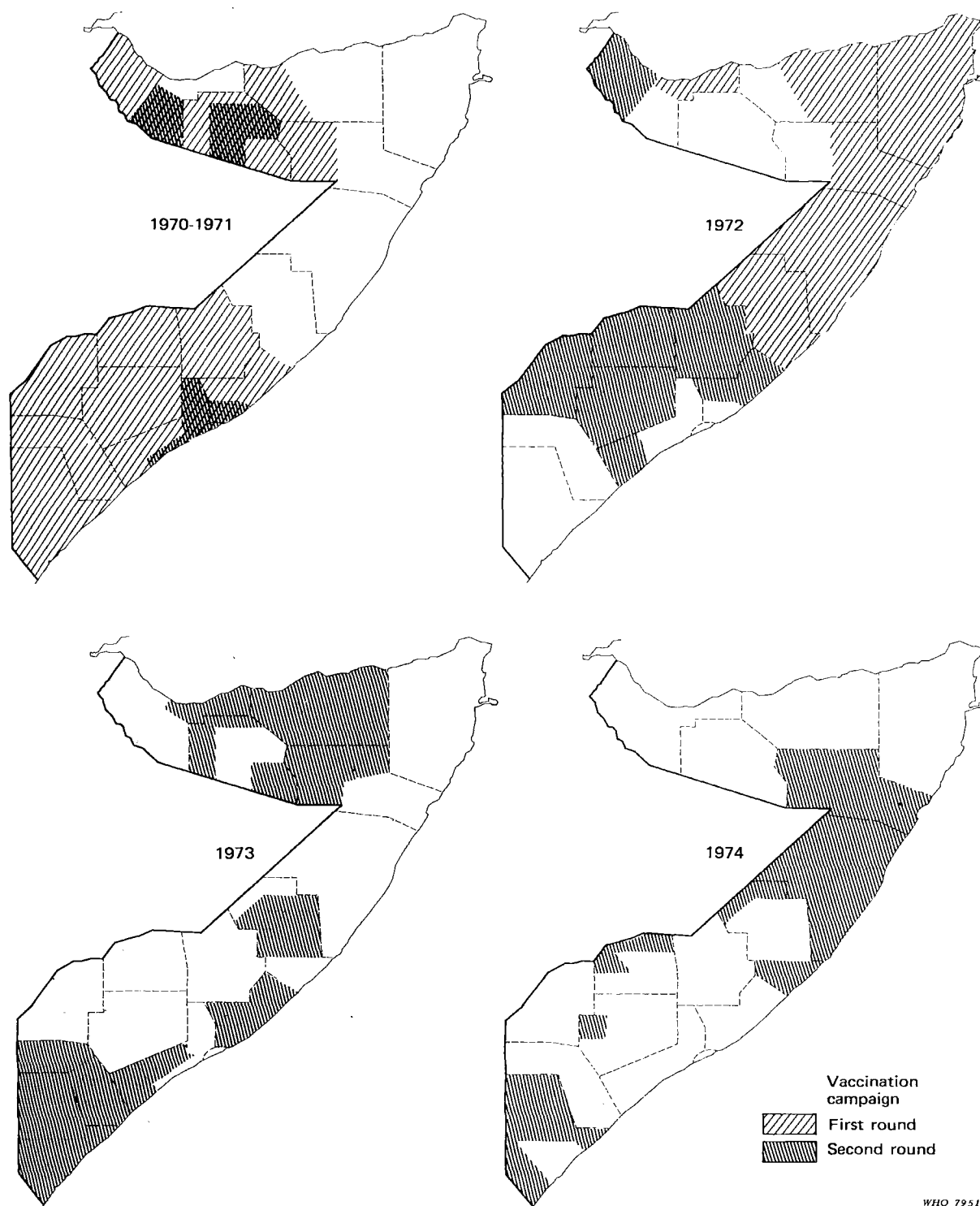


TABLE 5.2  
REPORTED SMALLPOX VACCINATIONS, SOMALIA 1969-1976

Phase	Year	Number of vaccinations performed
Attack	1969	79 974
	1970	645 862
	1971	475 988
	1972	712 045
	1973	850 000*
Maintenance	1974	704 207
	1975	660 000*
	1976	320 000*

\*One or more months estimated because of incomplete data

#### Maintenance Phase

With completion of the second round of vaccination throughout the country the project entered its maintenance phase. The aims of this phase were:

- to vaccinate the newborn, immigrants, "floating" populations and densely populated areas;
- to ensure vaccination of the entire population every three to four years; and
- to establish surveillance and strengthen the quarantine services.

Attempts were made to hand over these responsibilities to the existing health services but problems resulted from both the lack of facilities and from the other diverse duties of the health staff. Work at this time was additionally hampered by drought and economic crisis.

When a national programme for development among the rural and nomadic population was launched, health sector responsibilities included smallpox vaccination. SEP team members were incorporated into the scheme and often provided valuable leadership, however, this resulted in the dissolution of all the experienced teams as their members were distributed throughout the country. Although the teams started to reform in late 1975 the campaign never regained its pre-1974 momentum and the targets of the maintenance phase remained largely unfulfilled.

Vaccinations reported in the years 1974-1976 are shown in Table 5.2 and indicate that over half of the population was reported to be revaccinated during the maintenance phase.

#### Conclusion

Data from the systematic assessment of the mass campaign which was to have been conducted are not available. The only indication as to its effectiveness is a statement made by the assessors that:

"The vaccination campaign achieved reasonable success. In towns and settled population groups, according to assessment carried out immediately after an area was vaccinated, coverage varied between 60 to 80 percent. The assessment of vaccination coverage achieved amongst the nomadic groups was not very reliable. This assessment suffered from the inherent weakness that it was limited to the persons visiting

watering points. In this group a coverage of about 60% was observed. It was observed that the coverage was highest amongst the schoolchildren."

Later experience, following the importation of smallpox into the country in 1976 and its rapid spread among the population casts some doubt on the validity of these statements.

#### 4. Vaccination Activities 1977-1979

In the second half of 1976 and during the emergency campaign of 1977, the main emphasis was given to containment vaccination. In 1977, an average of 890 vaccinations were performed in the vicinity of each smallpox outbreak. Those vaccinated included local inhabitants and visitors as well as persons in neighbouring villages and nomad camps or in places visited by the inhabitants of an affected locality, such as schools, markets and watering points.

In each newly detected outbreak, the first priority was vaccination of all household members and other close contacts of the patients, followed by vaccination of all remaining inhabitants of the affected locality, settled village or nomad encampment. Only after this was completed was vaccination expanded to other neighbouring areas, mainly those situated within a 10 km radius of the affected locality.

In smallpox-free areas and low-incidence areas, an extensive vaccination programme was continued to achieve a high level of immunity which might serve to limit the spread of smallpox if it were reintroduced. Following the occurrence of the last outbreak, more than one quarter of a million vaccinations were performed during October-November 1977 with the aim of consolidating the victory over smallpox transmission.

From January 1978, the programme vaccination policy was modified. Effective surveillance throughout the country was the top priority, however, primary vaccination, particularly of children, remained a programme objective. Vaccination was combined with search operations when they were conducted in remote or vulnerable areas and was always available to any citizen on request.

#### Vaccine Supply and Distribution

The World Health Organization undertook the responsibility of furnishing the programme with adequate supplies of tested, potent, freeze-dried smallpox vaccine. Table 5.3 shows the quantities of freeze-dried vaccine imported to Mogadishu in the years 1975-1979.

TABLE 5.3  
FREEZE-DRIED SMALLPOX VACCINE RECEIVED BY SOMALIA 1975-1979

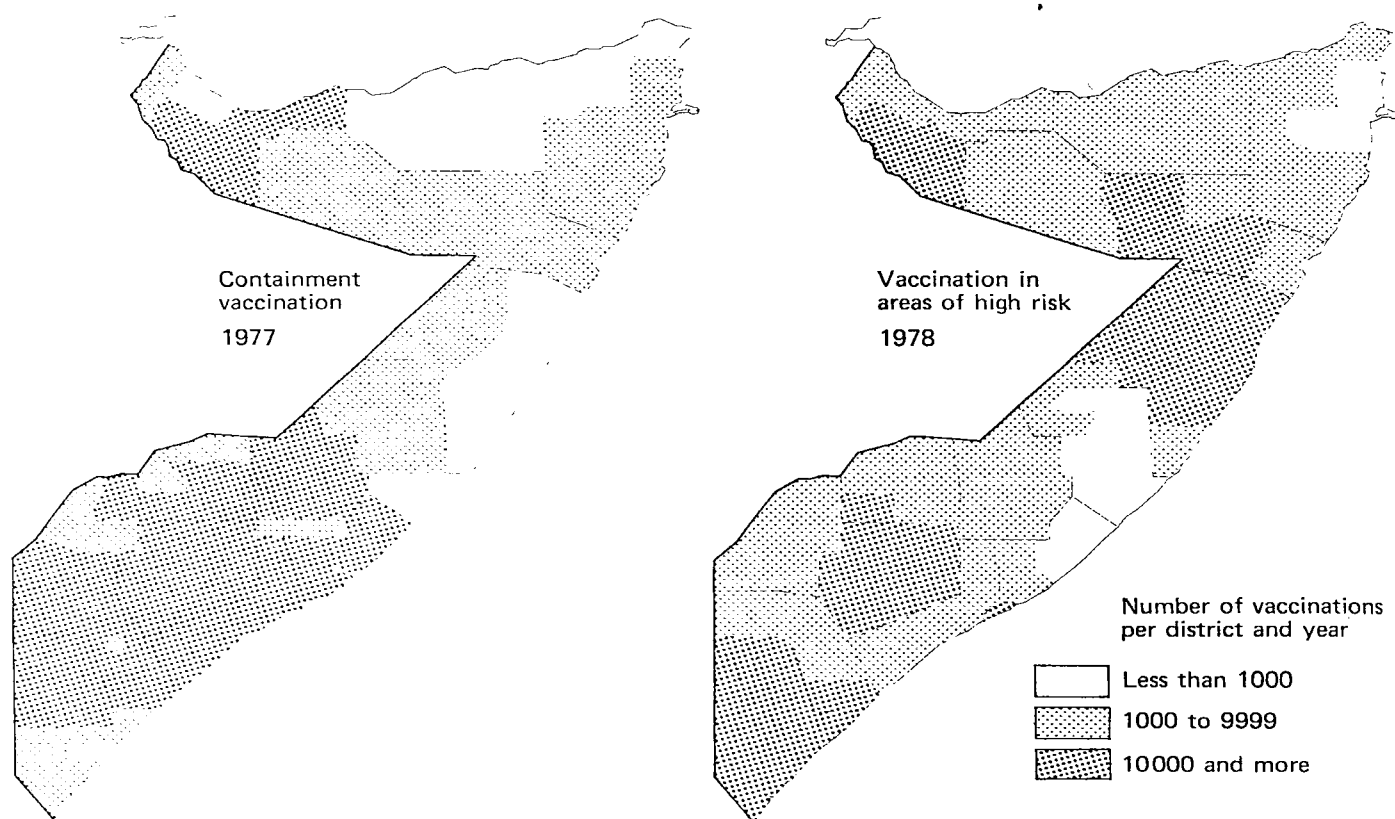
Year	Doses
1975	305 050
1976	511 000
1977	4 392 000
1978	4 474 000
1979	
5 year total	



The "Zeropox" office in Mogadishu maintained an adequate stock of imported freeze-dried vaccine throughout the intensified programme. It was transported to the regional offices monthly by the fastest available means and dispatched similarly to the districts. In the regional centres limited refrigerated storage space was available in hospitals or medical stores. At district level vaccine was stored in hospital refrigerators or in other available facilities, for example, private cold drink shops. Where no refrigeration was available, vaccine was supplied every two weeks and stored in a cool place. Vaccinators carried with them in the field only enough vaccine for their proposed tour.

All staff were frequently reminded of the importance of proper storage of the vaccine and, in particular, district team leaders were instructed to destroy their old vaccine on receipt of new stock. Vaccinators were made aware that, once constituted, vaccine life was limited to 10-12 hours and that it should be protected from sunlight.

FIG. 5. 2  
VACCINATION PERFORMANCE BY DISTRICT  
SOMALIA 1977-1978



WHO 79520

#### Vaccinations Performed

The number of vaccinations carried out by month in Somalia, between 1977 and 1979, is shown in Table 5.4. During the emergency operation in 1977 when the major emphasis was given to containment vaccination, about 1 000 000 persons, or about one third of the Somali population, and especially those living in smallpox affected areas, were vaccinated.

TABLE 5.4  
VACCINATIONS PERFORMED BY MONTH, SOMALIA 1977-1979

Month	Year		
	1977	1978	1979
January	NR	96 549	) 36 725
February	NR	34 675	
March	1 500*	45 979	14 350
April	23 900*	37 021	14 639
May	68 000*	83 146	11 069
June	150 000*	60 580	) 17 965
July	176 866	52 976	
August	140 019	34 453	
September	71 556	29 718	
October	176 944	31 485	
November	89 032	27 014	
December	96 896	32 607	
Total	994 713	566 203	94 748

NR = Not reported      \*Estimated figures

In 1978 a further half million persons were vaccinated especially those living in areas considered to be of high risk from the epidemiological point of view. Preference was given to the nomadic population, displaced persons and the younger age groups. Vaccination continued in similar sectors of the population in 1979, when about 95 000 persons were vaccinated. Table 5.5 shows vaccinations performed in each region during 1977-1979 and figure 5.2 shows the extent of vaccination activity by district. Since self-inflicted upper arm wounds resembling vaccination scars are common among the Somali population positive determination of previous vaccination was difficult. Therefore, differentiation between primary vaccination and revaccination was not recorded.

TABLE 5.5  
SMALLPOX VACCINATIONS PERFORMED BY REGION, SOMALIA 1977-1979

Regions	1977*	1978	1979**
Bakool	85 687	34 559	2 220
Bari	6 721	11 878	0
Bay	327 062	155 815	16 555
Galbeed	50 691	42 976	5 513
Galgadud	7 000	4 912	2 078
Gedo	109 925	16 364	3 117
Hiran	29 614	5 297	3 580
L. Juba	28 033	65 627	6 488
M. Juba	62 524	22 373	2 508
Mogadishu	7 214	70 675	10 426
Mudug	500	40 417	12 953
Nugal	33 637	34 623	3 405
Sanaag	NR	11 639	9
L. Shabelli	164 500	22 223	25 360
M. Shabelli	62 000	6 834	0
Togdheer	19 604	19 991	536
Total	994 713	566 203	94 748

\*Jan-Feb not reported; March-June, estimates only  
\*\*Jan-July only

# Assessment of Vaccination Status - 1978

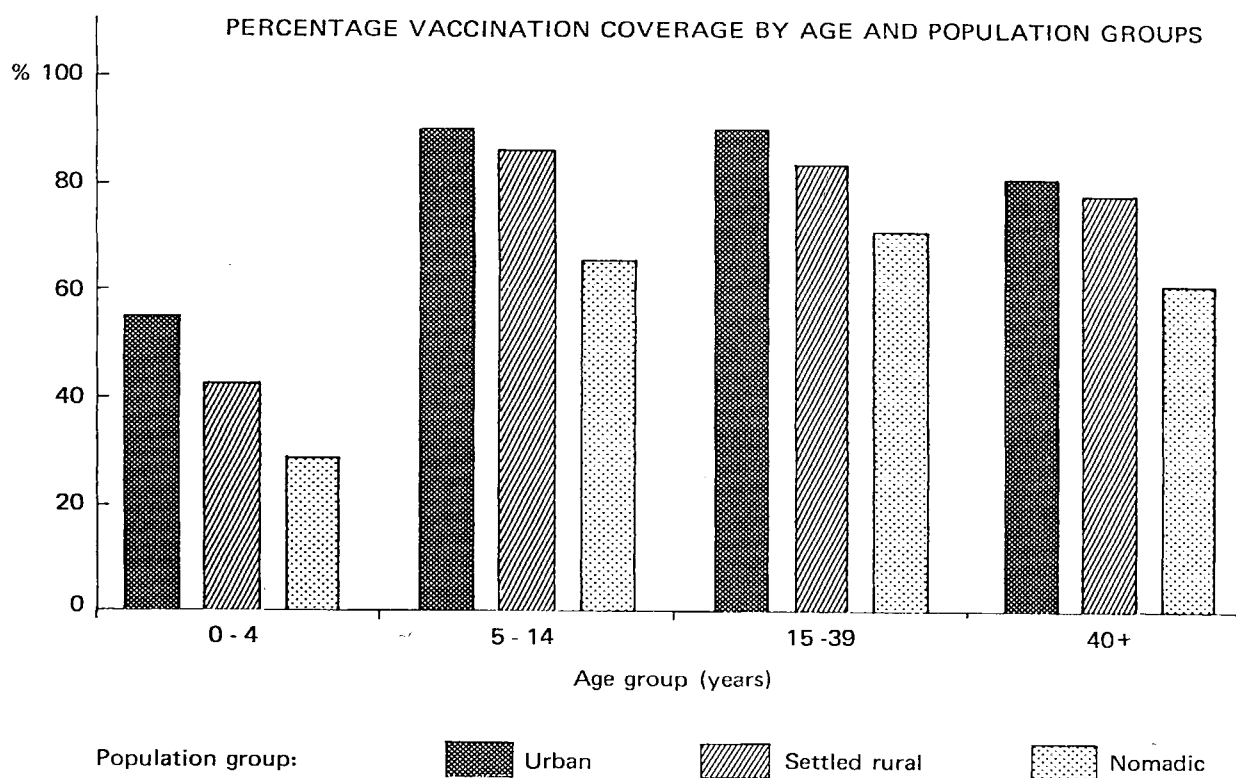
An assessment survey of the vaccination status of the Somali population, based on random sampling, was carried out in October 1978. WHO epidemiologists and programme management officers were used as independent assessors and worked in areas other than those for which they were normally responsible. Approximately 18 000 persons were interviewed and examined including 4500 persons in 1400 urban households and 14 000 persons in 4600 rural households. The survey was conducted in 59 urban sites, in Mogadishu, Hargeisa, Kismayo, Merca and Baidoa and 460 rural localities. Altogether 55 districts evenly distributed throughout the country were represented.

Pertinent epidemiological information, in addition to the results of examination and inquiry concerning vaccination, were entered on a specially designed sheet.

Of 18 148 persons examined, 13 391 (74%) had definite vaccination scars. There were considerable differences in the proportions of different age groups which were vaccinated. For the population as a whole the lowest coverage (40%) was among the 0-4 years age group compared with the highest average (83%) among 5-14 year old children, and a similar coverage among younger adults. Of persons over 39 years of age, 74% were found vaccinated. A slightly greater proportion of females were vaccinated than males.

There were substantial differences in vaccination coverage from one population group to another. An average vaccination coverage of 84% was found among those living in towns compared with 77% among inhabitants of settled villages and 61% among nomads. These differences are shown, by age group, in figure 5.3 in which it can be seen that the lowest vaccination coverage (29%) was found among nomadic children 0-4 years of age compared with 42% among children of the same age group living in settled villages and 56% among those from urban areas.

FIG. 5.3



As expected, a very high vaccination coverage was found in regions with the highest recent smallpox incidence. In these regions hundreds of thousands of persons had been vaccinated, both in settled areas and among the nomadic population, during containment activities in 1977. High, or at least satisfactory, vaccination coverage was observed in those regions with areas of low previous smallpox incidence. However, in all regions rather poor coverage was found among children in the 0-4 years age group. In regions which were classified as smallpox-free during the 1977 epidemic vaccination coverage ranged from satisfactory to poor. The highest average vaccination coverages were found in the regions of Bakool (90%), Bay (82%), Hiran (89%), Mogadishu (86%) and Lower Shabelli (87%). Average vaccination coverages of less than 60% were observed in three regions: Nugal (51%), Middle Juba (51%) and Mudug (55%). Figure 5.4 presents a comparison between the average vaccination status of the settled and nomadic populations of each district.

The summary of interview responses showed that of those persons having vaccination scars, 38% were last vaccinated in 1978, 42% in 1977 and 8% in 1976. Altogether 88% were reported to be vaccinated within the last three years and so could be regarded as protected against smallpox infection. Only 10% of vaccinees claimed that they were last vaccinated in 1975 or earlier and for the remaining vaccinees (2%) the year of their latest vaccination was unknown. Figure 5.5 shows the percentages of those vaccinated in each of the last three years, by region.

In summary, despite the fairly high vaccination figures reported in the past, the assessment revealed some deficiencies in vaccination coverage among certain age groups, localities and population sectors and notably among children of the 0-4 years age group and among nomads. No attempt was made to substantially raise the immunity levels in these groups by subsequent special vaccination efforts as the emphasis of the programme was squarely on achieving effective surveillance.

#### Complications of Vaccination

In Somalia, as in other countries, a small but definite risk of complications followed smallpox vaccination. Information regarding the frequency of those complications is regrettably missing as no survey evaluating the problem was conducted.

Complications observed during fieldwork or supervisory visits included hypersensitive reactions in the form of urticarial, morbiliform and erythema multiforme eruptions. More frequently, autoinoculation from the vaccination site to abraded skin elsewhere and post-vaccinal conjunctivitis have been observed, especially in younger children.

Secondary infection after vaccination was found, particularly in rural areas, in 5-20% of vaccinees. This often reflected the local practice of applying unclean material to the vaccination site or betrayed an unhygienic vaccination technique, perhaps that of using the same bifurcated needle for several vaccinees without proper sterilization. Fever, regional lymphadenitis, deep necrotic lesions or large ulcerations of the skin were not uncommon. Rarely, generalized vaccinia or eczema vaccinatum, especially as a result of pre-existing scabies dermatitis, were noted.

#### The Attitude of the Public towards Vaccination

During the emergency drive and especially in those areas affected by smallpox transmission, enthusiastic acceptance of vaccination was the norm. No cultural or religious resistance to vaccination, sufficiently strong to adversely influence the effective containment of outbreaks, was encountered. In smallpox-free areas and during the surveillance period 1978-1979 the attitude of the public towards smallpox vaccination was also, in general, positive.

FIG. 5. 4

PERCENTAGE VACCINATION COVERAGE BY REGION AND TYPE OF POPULATION  
INDEPENDENT ASSESSMENT - OCTOBER 1978

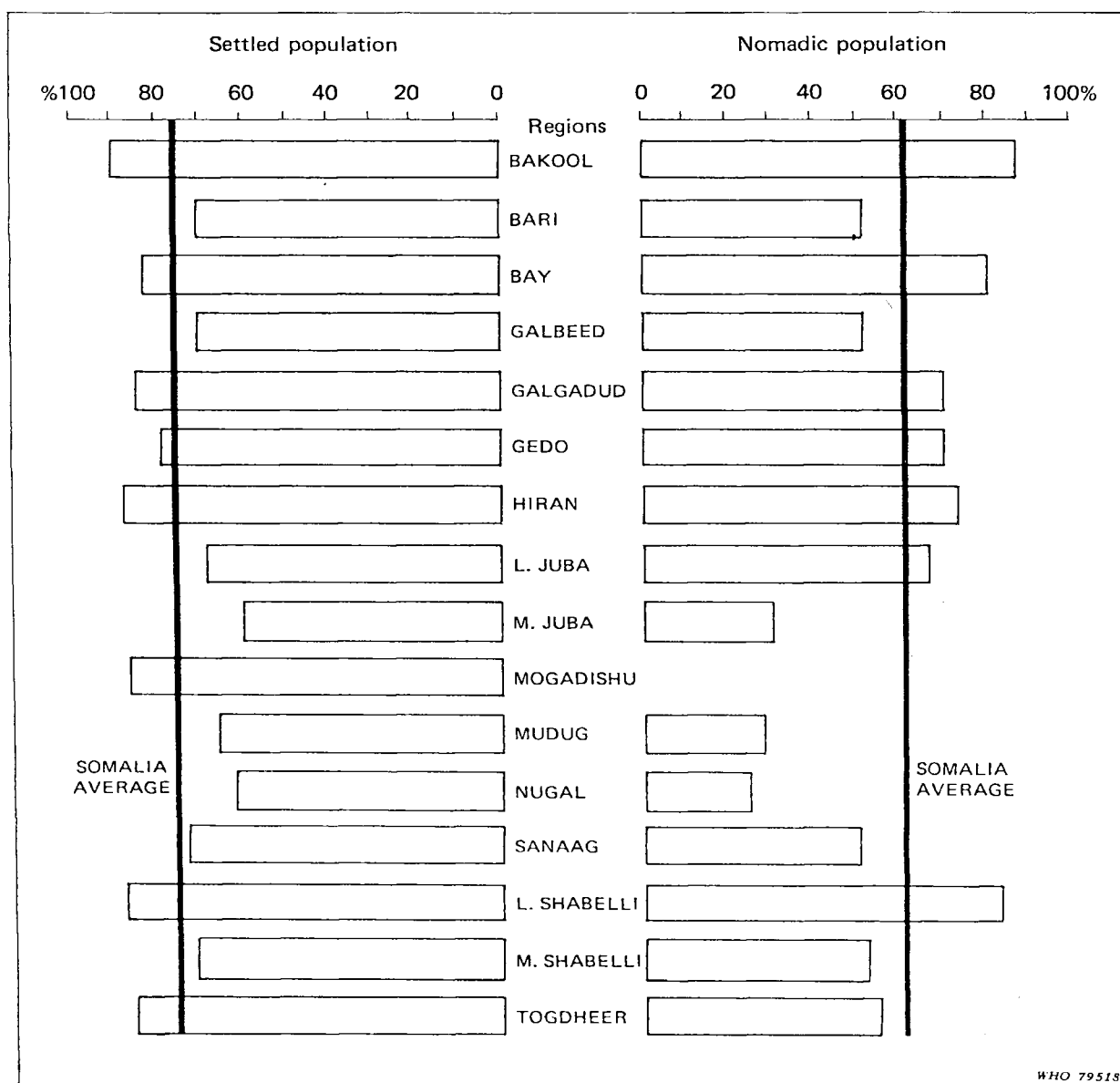
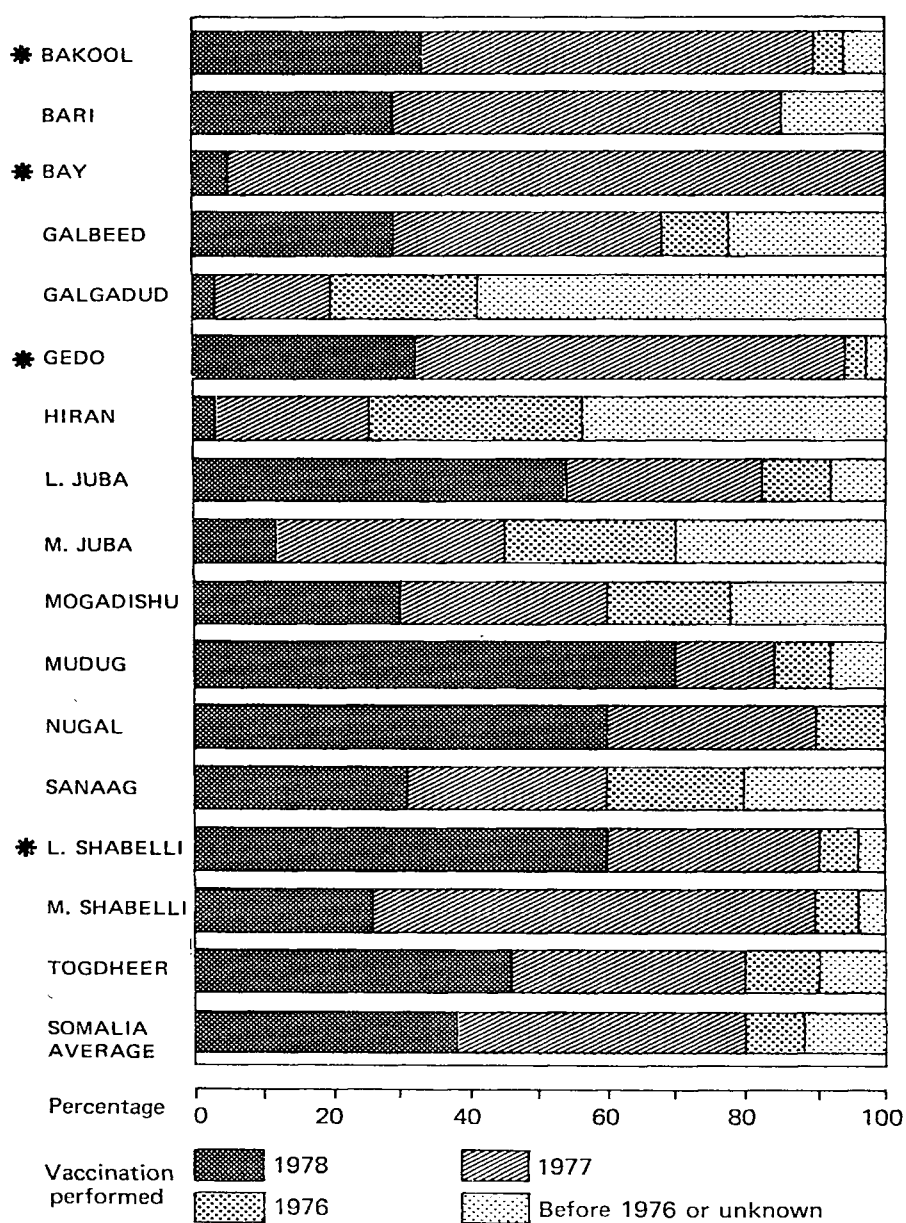


FIG. 5. 5  
PERCENTAGE OF VACCINATED PERSONS BY  
YEAR OF LAST VACCINATION, BY REGION  
SOMALIA 1978



Among nomads indifference was common and refusals to accept vaccination were encountered in some places, mainly among the older generation, who felt there was no need for vaccination or, at least, for revaccination. In most instances lack of cooperation was due to nomads not being convinced of the benefits of vaccination.

Among the settled population only the fear that the reaction to vaccination would affect them economically by rendering them temporarily unfit for work limited their cooperation. A limited resistance was also found among females over 50 years of age and among mothers wishing to protect their infants from subsequent fever and local reactions. It was observed that even among vaccinators there was a feeling that vaccination might be harmful for children under one year of age. Attempts to overcome these feelings were only partially successful.

These problems were generally overcome by patience, careful explanation and consultation with the leaders of the community before vaccination started, and only very exceptionally and as a last resort, by insistence.

In summary, resistance to vaccination in Somalia was localized and limited and no massive resistance, sufficient to have substantially influenced the eradication programme, was encountered.

## 6 PERSONNEL TRAINING AND DUTIES

The programme involved a large number of persons of widely differing backgrounds and training, from Somalia and over 20 other countries, united by a common goal: smallpox eradication.

The backbone of the work force was the Somali nationals who numbered over 3000 regular staff at the height of the programme. Briefing and training, essential for the success of the programme, was required for a broad spectrum of personnel, ranging from national and international epidemiologists through regional and district team leaders to surveillance agents, temporary searchers and workers of voluntary agencies such as the Red Crescent Organization and the general population itself. While imparting the necessary technical knowledge, an effort was made to raise the level of motivation of the staff. Training sessions also provided an opportunity to identify personal skills and individual aptitudes for specific tasks.

### 1. Briefing and Training Activities

The development of briefing and training sessions for epidemiologists and other field workers was an important feature of the programme. Training was facilitated by the printing, in 1977, of the programme's operational guidelines. The activities conducted for training each category of programme staff are outlined in the following sections.

#### Epidemiologists

In May 1977, at the beginning of the emergency drive, there was no systematic training scheme and "ad hoc" arrangements were made for each new epidemiologist. Essential epidemiological and administrative aspects of the programme were explained, however, field orientation was gained simply from several days work with an experienced epidemiologist or by direct assignment to a field post. By mid-June, efforts were being made to coordinate training sessions but often new staff arrived individually rather than in planned groups and usually special arrangements were necessary.

In principle, everyone was to be trained at the beginning of his assignment regardless of his previous experience in the country or in the programme. The briefing of epidemiologists generally involved three days in the national headquarters in Mogadishu and a further two days of field orientation including training in the programme methodology which changed frequently to meet the needs of the prevailing epidemiological situation. Briefing documents were distributed and the sessions covered all operational procedures including principles of containment, methodology of surveillance (especially among the nomadic population), epidemiology and diagnosis of smallpox, laboratory specimen collection, vaccination policy and technique, case notification and reporting and documentation. The administrative structure of the Somali government, the health services and the SEP were reviewed and relevant local traditions discussed. After a detailed appraisal of the latest field information, the training sessions ended by briefing on essential administrative matters including transport, supply and finance. With the relative shortage of government employed programme staff, epidemiologists spent a significant amount of time dealing with such matters, especially at the height of the programme when there were over 3000 staff on the payroll.



### Regional SEP Staff and District Team Leaders

Regional and district level SEP staff were trained separately in each region by WHO epidemiologists and their national counterparts, the regional epidemiologists. Training sessions lasted a few days and mainly involved field training in essential techniques. Staff were then able to work independently and train and motivate searchers, vaccinators and watchguards in their areas of responsibility. Particular instruction was given to vaccination, differential diagnosis of smallpox, specimen collection, indications for and procedures of containment, the organization, supervision and documentation of search activities and administrative functions.

### Basic SEP Field Staff

In other countries smallpox eradication programmes were facilitated by the existence of large numbers of government health workers, in Somalia, however, there was a paucity of experienced health workers in the programme. Those who were initially available served as regional epidemiologists or regional team leaders. Therefore, the SEP relied heavily on hastily trained, temporarily hired villagers or nomads to conduct containment as well as case finding searches. The training sessions, usually of only three to five hours, were hampered by the language barrier, however, these non-governmental field workers usually proved to be honest, sincere and reliable workers. At the height of the epidemic such minimally trained staff formed the bulk of the work force. Their lack of previous health training and future job security made their training and motivation a challenge for international and national supervisory staff. Each daily supervisory visit was used as an opportunity to teach and this continuous in-service training was essential during both the eradication and surveillance phases of the programme. In 1978-79 surveillance agents and temporary searchers usually received regular briefing and instruction at the district level meetings held monthly or before and after each search.

### Other Health or Administrative Staff

Medical officers and senior health staff were informed about the emergency campaign at a meeting held in Mogadishu in May 1977 and at regional meetings held in affected areas in which Government and WHO programme managers, regional health staff, local administrative officials and regional SEP staff participated. Similar meetings were organized in districts affected by smallpox to brief local district staff on the prevailing epidemiological situation. Additional briefing sessions were held for local health and administrative staff whenever particular problems arose.

### Annual Retraining of SEP Staff

Thorough annual retraining sessions for regional, district and basic SEP staff were conducted at regional and district programme offices at the beginning of the rainy seasons in November 1977, April 1978 and April 1979. Their aim was to ensure that the fieldwork was maintained at a high standard and to motivate the staff for future activities.

## 2. Periodic Review Meetings

The emergency plan included the organization of monthly meetings at which progress was reviewed and administrative problems were identified and discussed and their possible solutions considered.

National Meetings: All regional epidemiologists and WHO advisers were called to Mogadishu monthly in 1977 and bimonthly in 1978 and 1979 to meetings at which new ideas in strategy methodology and practical techniques were introduced. These new approaches were then evaluated in the field before the next review meeting.

These monthly progress review meetings consisted of two sessions. The first day was for individual discussion of the epidemiological situation and specific problems on a regional or district basis with the epidemiologists concerned. Overall review of the programme's progress, the future strategy and items such as personnel and transport allotments were discussed during the second day, in the presence of government health officials and WHO representatives from within Somalia, from the regional office or from HQ, Geneva.

Divisional Meetings: These started in 1978 and were held every two months. For operational purposes the country was divided into three divisions and headquarters staff met with local programme management in pre-selected and alternating regional centres. Local SEP staff of the visited region were encouraged to participate. Meeting summaries along with directives or suggestions were mailed to epidemiologists and WHO advisers between meetings and were widely publicized by the "Zeropox" bulletin.

Meetings with District Team Leaders: Regular meetings between regional supervisory staff and district team leaders were organized once or twice a week at their district offices and they all met every month with the regional epidemiologists. Usually district team leaders were called to the regional "Zeropox" office but probably more effective were those meetings held in different districts each month where reports and record-keeping could be compared and mutual or individual problems discussed.

Monthly Meeting with Surveillance Agents: Staff meetings were usually held monthly in all district "Zeropox" offices and attended by regional supervisory staff. During meetings surveillance agents were interviewed separately and their findings evaluated and discussed and plans for the next search were introduced. Continuous briefing and training was an essential part of every such monthly staff meeting.

### 3. Responsibilities of Various Categories of SEP Staff

#### 3.1 Temporary Searchers

At times during 1977 and 1978 more than 500 temporary searchers were hired for short periods to participate in national search operations or special activities such as searches in remote or nomadic areas. They were instructed to:

- visit every house and hut and contact every travelling group encountered in any village, hamlet, nomadic encampment or other locality and in each case to introduce themselves as health workers, show the smallpox recognition card, ask about and examine rash-with-fever cases in the locality, announce the reward of 200 Somali Shillings for reporting smallpox and identify the place at which reports should be made;
- visit each locality headman or other prominent person and obtain his signature on the search report, and sign the locality surveillance record card;
- search every state or Koranic school and talk to the teachers and students of each class;
- search every teashop, market, restaurant, administrative office, orientation centre and health establishment in their allotted area;
- paste placards or paint slogans to attract public attention to the reward on all public buildings visited;
- list the names and addresses of all rash-with-fever cases detected on the back of the search report and discuss these cases with the supervisor and district team leader;
- report all pertinent information on any case of smallpox or suspect smallpox detected, including name, address, age, sex, immunity status and send immediately a special messenger or report in person to the district team leader;
- report all findings to the district team leader at the end of each tour programme and submit a completed search report signed by the village locality leaders.

Searchers were frequently reminded that the 200 shillings reward was payable both to the member of the public who informed of a case of smallpox and to the health worker filing the report.

### 3.2 Surveillance Agents

In every district, there was a team of 5-25 surveillance agents, headed by a district team leader, which worked full-time to ensure a high quality of surveillance in the district. The duties of surveillance agents were identified as follows.

#### In general:

- to assist the district team leader in gathering relevant demographic data including populations of localities and the names of local headmen known to be well informed about the smallpox situation;
- to assist in the preparation of maps of the district, indicating administrative zones, villages, roads, water points and rivers as well as "risk areas" and other special surveillance points;
- to assist in maintaining records of active searches, rash-with-fever notification and investigations of suspect cases.

#### During the pre-search period:

- to assist the district team leader in the planning and organization of the district level pre-search meetings;
- to participate actively in these meetings and to ensure the proper briefing and field-training of the temporary searchers;
- to plan adequate supervision of the temporary searchers and assist in the preparation of their search schedules and search reports;
- to visit and review and treat as top priority remote and "problem" areas.

#### During the search period:

- to be responsible for supervision of the search, making unannounced visits to view the work of each searcher in his place of duty, to observe his search technique and to check his search report forms;
- to resolve problems on the spot by suitable explanation and demonstration;
- to measure the impact of the visit of the searchers, in terms of the population's awareness of the search, of the recognition card, of the reward and of where to report;
- to search immediately areas not covered or considered badly covered during the search period, and urban areas.

#### During the inter-search period:

- to be fully responsible for surveillance work in one or more zones of the district;
- to carry out a programme of special surveillance activities prepared by the district team leader in consultation with the regional epidemiologist (this generally covered villages and nomadic localities omitted during the main search period, other "high risk" areas such as those bordering other districts, water points, farming areas during the harvest and markets, festivals, and other large public gatherings); and
- to ensure the proper functioning of the secondary surveillance system by motivating school teachers, members of the village and zonal committees and local leaders to provide information about rash-with-fever cases.

### 3.3 Office Custodians

In every district and regional programme office there was one person employed to maintain the office and to receive and record any information or messages and pass them to the district team leader. At times these workers were utilized as temporary searchers in some districts.

### 3.4 District Team Leaders

The SEP unit at the district level was the key element in the structure of the programme and the district team leader the main person ensuring the effectiveness of surveillance in each district. They were of lesser importance in some of the northern regions in which there were fewer surveillance agents per region and where their work could be largely covered by the regional epidemiologist. Each district team leader was required to perform the following duties.

#### In general:

- to study thoroughly the operational guidelines and ensure that they were followed by his staff;
- to monitor the epidemiological situation in his district through all surveillance activities and convey relevant details to the regional level;
- to assist in planning, organizing, supervising and assessing all surveillance activities in his area; and
- to maintain an adequate stock of search record forms, recognition cards, reward placards, vaccine, bifurcated needles and other materials required for field work.

#### During the pre-search period:

- to participate in regional level pre-search meetings;
- to maintain and update a list of fixed search units and a map of the district, showing administrative units, villages, roads, water points, rivers, "risk areas" and special surveillance points;
- to prepare search schedules for all temporary searchers and surveillance agents and supply one copy to the regional epidemiologist;
- to conduct a pre-search meeting for all district searchers and supervisors to discuss results and shortcomings of the previous search and techniques for the coming search.

#### During the search period:

- to conduct concurrent supervision and assessment of search activities;
- to collect and file search report forms from all searchers and supervisors and compile them in a district search summary and submit to the regional epidemiologist not later than five days after the last date of the search, one copy being retained;
- to enter "fever with rash" cases found during the search into the smallpox rumour register;
- to investigate personally all rumours and "fever with rash" cases and enter the diagnosis in the smallpox rumour register; and
- to arrange searches of any areas found not searched or poorly searched.

#### During the inter-search period:

- to make contact frequently with local administrative and political organizations to involve them in reporting "fever with rash" cases;
- to plan and organize special searches in remote or previously inaccessible areas, border areas, areas recently affected by smallpox, and areas having transient populations or seasonal workers;

- to initiate water point and market searches according to individual zonal schedules;
- to record rumours and "rash with fever" cases in the rumour register having confirmed all diagnoses and send a weekly epidemic report to the regional level;
- to dispatch immediately, in the event of a definite or suspected case of smallpox or a chickenpox death being suspected, a special messenger to the regional "Zeropox" office and a cable (with a posted copy) to "Zeropox" Mogadishu and to initiate prompt and immediate containment measures;
- to inform the public of the need for prompt notification of smallpox cases, the reward for reporting and where suspect cases are to be reported; and
- to maintain permanently and update the following records: a district map, a list of fixed search units, a smallpox rumour register/weekly epidemic report, smallpox outbreak information sheets for 1977 and suspected smallpox outbreak reports for 1978-1979, schedules, reports, summaries and assessments for each search in the district, a list of surveillance agents and temporary searchers.

### 3.5 Regional Epidemiologists

The regional epidemiologists played an essential role in ensuring overall implementation and supervision of the programme in accordance with the strategy and operational methodology established by programme headquarters in Mogadishu. Their major responsibilities are summarized as follows.

#### In general:

- to ensure the implementation of all aspects of the programme's operational guidelines in his region;
- to ensure that all SEP staff in the region were performing competently;
- to plan, organize, supervise and assess all surveillance activities in his area and to provide a critical analysis of district records and guidance to all staff through meetings, field visits and the supply of briefing materials;
- to ensure timely delivery of all essential supplies and materials;
- to select and train personnel for one or two regional surveillance teams;
- to coordinate activities with the regional WHO adviser; and
- to ensure appropriate use and maintenance of programme vehicles.

#### In connection with active searches:

- to arrange the dates of active search in consultation with all concerned officials;
- to organize pre-search meetings at various levels (region, district, municipalities, etc.) and attend personally all regional and district meetings;
- to assess the search by visiting villages, schools and nomad settlements in priority districts;
- to see that all the search reports are forwarded from district to region, compiled and dispatched to "Zeropox" Mogadishu; and
- to arrange further searches of any area which is found not to be searched or to be poorly searched.

#### During the inter-search period:

- to plan and organize special searches in areas judged as requiring special attention;
- to make periodic approaches to administrative and political officials to inform them about programme activities and to involve them in reporting rash-with-fever cases;
- to inspect the smallpox rumour register maintained at various levels (district, municipality, hospital) and verify information concerning as many rumours as possible;

- to visit immediately any outbreak with a suspected smallpox case and supervise containment if necessary, collect and dispatch a specimen for laboratory testing and inform "Zeropox" Mogadishu of his investigation findings;
- to use all media for publicity of the reward for reporting smallpox;
- to ensure that all weekly epidemic reports are sent promptly from districts on to Mogadishu;
- to prepare and maintain records and wallcharts in regional and district offices; and
- to arrange or recommend on the recruitment of suitable personnel as permanent surveillance agents or temporary searchers.

### 3.6 Regional Surveillance Teams

The main task of these teams was to assist the regional epidemiologist to achieve a high quality of surveillance throughout the region. Their functions are more specifically defined below.

#### In general:

- to coordinate smallpox surveillance activities in the whole region and to monitor the epidemiological situation and determine priorities; and
- to provide technical expertise on epidemiology of smallpox and strategy of smallpox eradication and be acquainted with the duties of all regional staff and plans for surveillance activities especially search supervision and assessment.

#### During the search period:

- to participate actively in regional and district pre-search meetings and assist in producing a complete and unified plan for the entire region for the search and for its supervision and assessment;
- to supervise the distribution of personnel, materials and funds and the completion of search reports;
- to verify the diagnosis, organize containment, collect specimens and initiate epidemiological investigations immediately a suspected smallpox outbreak is discovered;
- to conduct special searches in priority areas;
- to assess independently the effectiveness of the search activities and level of awareness among the public of the reward and reporting of suspected cases;
- to assist in compiling summaries of search and assessment findings thus identifying deficiencies requiring remedial action.

#### During the inter-search period:

- to continue to motivate and stimulate local health and administrative staff to report rash-with-fever cases;
- to organize and carry out special searches in areas of special risk including remote areas or those cut off by seasonal changes, areas inhabited by nomads, border areas, areas recently affected by smallpox, seasonal workers' camps, army barracks and refugee camps;
- to ensure thorough water point surveys and market searches;
- to organize and stimulate both the publicity campaign and the secondary surveillance system throughout the region.

### 3.7 WHO Adviser/International Epidemiologist

Working in close coordination with the regional epidemiologists and the heads of the health services in the area, the WHO epidemiologists shared with them the responsibility for implementing SEP activities. Their tasks included the following aspects.

Administration: The WHO advisers assisted the regional epidemiologists in planning and supervising the work of health personnel. Only the temporary staff (drivers, searchers, supervisors) were under their direct administrative control. They also assisted in control of SEP vehicles and were responsible for all financial matters directly concerning WHO funds. Distribution, explanation and correct use of surveillance materials were also their responsibility.

Training and briefing: The WHO advisers were responsible for training and briefing of regional, district and municipal health staff in methods of smallpox surveillance and outbreak containment. During the course of field visits they constantly trained local staff, corrected any errors of technique or knowledge, and reported all deficiencies to the national counterparts. At pre-search meetings and regular monthly staff meetings all aspects of the programme were analysed and discussed.

Surveillance: In general the WHO advisers worked hand in hand with their counterparts in planning and implementing all aspects of surveillance, reporting, publicity and documentation and in organizing review meetings and other feedbacks of information to the field. Continuous evaluation of all surveillance activities was necessary primarily to ensure that they were sufficiently effective to detect all suspected smallpox outbreaks. In cases of suspected smallpox the WHO advisers were required to investigate and make a diagnosis and were responsible for overall supervision of any containment activities. They also played a role in liaison between regional and central authorities keeping both informed about the current status of the programme.

### 3.8 Central Programme Managers

Simply stated the responsibility of the programme management based in Mogadishu was to develop a strategy which would achieve the eradication of smallpox in Somalia. Coordination with other government agencies was essential to obtain full cooperation for the programme. Repeated review, in consultation with field staff, of the progress made enabled the identification of priorities and the appropriate deployment of manpower and resources. Periodic visits to the regions and districts provided for on the spot assessment of progress in particular areas.

TABLE 6.2  
TECHNICAL KNOWLEDGE REQUIRED OF BASIC NSEP STAFF

Activity		Temporary Searcher	Surveillance Agents	District Team Leader
Surveillance	Search period	Routine search technique for households, schools, markets tea shops, public places and nomadic populations.	Routine search technique. Special techniques for remote areas, nomadic populations' water points.	Planning and organization of search in district and its supervision and assessment.
	Inter-search period	NA	Technique for organization and maintenance of surveillance in zone. Special technique for markets, festivals, harvesting areas, etc.	Planning, organization, supervision and assessment of inter-search activities.
Vaccination		Vaccination technique using bifurcated needle, vaccine handling and reconstitution, sterilization of bifurcated needles.	Vaccination technique, vaccine handling, sterilization of needles, vaccine storage at zonal level.	Vaccination storage at district level, vaccine distribution, vaccine handling, vaccination technique.
Differential diagnosis		Basic distinctions between suspect smallpox cases and other rash-with-fever cases.	Basic diagnosis of rash-with-fever cases, suspect smallpox, chickenpox and skin disease without fever. Method of specimen collection.	Organization of containment, complete differential diagnosis. Methodology of specimen collection and dispatch.
Reporting and recordkeeping		Completion of form SOM 2. Notification of rash-with-fever cases and suspected smallpox.	Completion of form SOM 2. Notification of rash-with-fever cases and suspected smallpox.	Full knowledge of operational guidelines. Regular, weekly reporting. Maintenance of smallpox rumour register, search reports and demographic data files.





Example of poster used to publicize the 200 Somali Shillings reward for reporting a case of smallpox.

## 7 SURVEILLANCE ACTIVITIES

Clearly the main objective of smallpox surveillance systems is the early detection of cases. It is equally apparent that all cases, whether confirmed or suspected smallpox, must be thoroughly investigated and promptly notified.

With the limited manpower and transport available at the beginning of the emergency drive, in May 1977, it was impossible to initiate immediately full scale surveillance in all areas of the country. The development of national, regional and district surveillance systems required time. Planning the most economic use of the available resources for programmes in individual areas required consideration of many factors. Among them were the geographic and demographic conditions, the local traditions and the epidemiological situation, particularly the likelihood of the existence of hidden smallpox foci and the relative risk of importation of the disease. Thus, the methods of surveillance varied according to the assessed risk. As no single method of surveillance was sensitive enough to detect all smallpox foci complementary approaches were employed simultaneously.

The ultimate establishment of a nationwide surveillance network was greatly facilitated by the existing administrative and political structure of Somalia through regional, district and village committees. This structure provided channels for both communication and control of the programme. Its effective utilization and in particular the participation of community leaders was the basis of surveillance activities.

The following surveillance techniques, which were developed and proved successful in 1977, were maintained throughout the country in 1978-1979.

Periodic active searches were conducted in urban areas and in rural areas both amongst the settled population and amongst nomads.

Surveillance in the inter-search periods included continuous activities by regional surveillance teams and surveillance agents, secondary surveillance mechanisms and surveillance at hospitals, markets, fairs and other public gatherings. It also included special efforts in areas of high risk.

Publicity of the reward for reporting smallpox and of where to report played an important role in gaining the cooperation of the public.

Reinforcement of the reporting system was achieved by more clearly defining the system and stressing the importance of regular reporting from district "Zeropox" offices.

### 1. Periodic Active Searches

This important surveillance component was started in the first half of 1977. A standard methodology suitable to the country's conditions was developed and searches were gradually extended throughout the country.

In the later stages of the programme, from May 1977, searches were conducted continuously in regions of high smallpox incidence, monthly in low incidence regions and 6-8 weekly in smallpox-free regions. The frequency of searches from July 1977 to July 1979 is depicted later in figure 7.6 .

### 1.1 Planning and Organization

The first searches, in the second quarter of 1977, were conducted by inexperienced, hastily trained searchers recruited at district or zonal centres. Their search schedules were rapidly prepared with the assistance of local medical officers and party secretaries but without the benefits of maps and accurate demographic data.

It soon became evident that searchers hired from the settled localities and nomadic groups themselves, and who knew the local topography and population movements, were preferable to those hired at district level. The finding of literate persons, sufficiently motivated to walk for many hours to the remotest areas, became a time consuming but essential task for the programme managers.

Frequent changes in searchers and supervisory staff made it necessary to hold new training sessions in preparation for each search. Accordingly pre-search meetings were held at central, regional and district levels, at which the organization and techniques of searches were thoroughly explained. The items covered in these meetings have been detailed in chapter 6, as have the responsibilities of each category of staff during the pre-search and search periods.

Using constantly updated maps and demographic data search plans were made to cover all parts of each district. Each searcher and supervisor's work schedule was recorded on a special form (SOM 1). Some overlap of the sectors to be searched by individual searchers, and into adjacent districts, was recommended. Search plans were checked at regional level to ensure complete coverage.

### 1.2 Personnel and Technique

The actual search operation was conducted by SEP surveillance agents and temporary hired searchers. Each searcher received a search report form (form SOM 2) which listed places to be searched including the dates on which each locality should be visited. In general one or two localities were scheduled for each day. The most experienced searchers were assigned to the areas of highest priority.

In each village or nomad encampment searchers were required to detect all rash-with-fever cases by visiting:

- all houses and huts;
- the headman of the locality (to obtain his signature on the search record and for the searcher to sign the locality surveillance record card) and other prominent persons;
- schools, both state and Koranic;
- tea shops, restaurants and market areas;
- water points;
- other gathering points (e.g. mosques and bus terminals);
- health establishments (e.g. hospitals, dispensaries and pharmacies); and
- orientation centres and other administrative offices.

At each house or group of people the searcher went through a standard procedure which was to:

- introduce himself as a health worker;
- show and explain the smallpox recognition card;
- ask about and, if present, examine rash-with-fever cases;
- inform persons of the 200 Somali shillings reward for reporting an undetected smallpox outbreak; and
- inform them where to report suspected cases.

If a suspected smallpox case was detected the searcher was required to record all pertinent information and send it by the fastest possible means to the district team leader. As messengers could not always be found, the searcher himself often carried the message. In the event of detection of a rash-with-fever case which was clearly not smallpox, full details were recorded on the reverse side of the search report and later discussed with the supervisor and district team leader.

At the end of each search all search reports were submitted to the district team leader who recorded all rash-with-fever cases in the smallpox rumour register. He was required to visit all such cases and verify the diagnosis and other observations. Finally a district search summary (form SQM 3) was completed and handed to the regional office. Examples of search forms are shown in Annexes 11-15.

### 1.3 Search Methods

Various approaches were evolved for achieving effective search coverage in areas of differing physical character and population type.

#### Settled Rural Population Searches

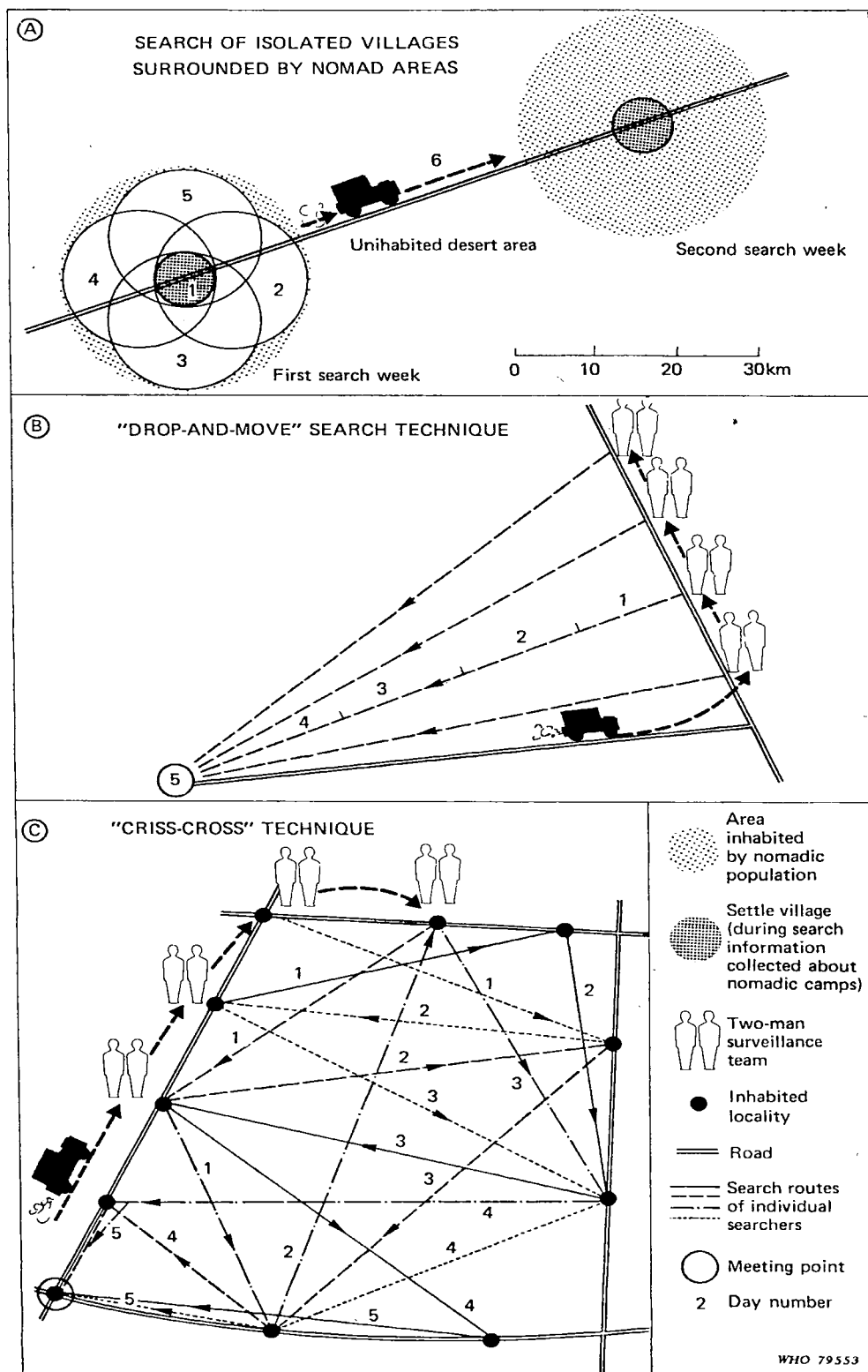
In areas with a large number of settled localities and where a line listing of villages, plantations and permanent inhabitants was available, two-man search teams were utilized. They normally consisted of one literate worker from the district or zonal centre and one local worker. In 1979 when searchers had become fully familiar with their area single workers were used. The searchers moved from locality to locality and house to house staying overnight in larger villages to conduct night searches to cover the 25-45% of people found absent during the day.

In areas where isolated, solitary villages serve a large area, a different search methodology was used (figure 7.1). During the emergency drive, the recruitment of four to six local temporary searchers, with the chief of the locality (nabadon) as team supervisor, for five to six days proved to be effective. The first day the houses of town/village residents were searched, and during the second day all merchants were questioned about nomads and their location. On the third to sixth days nomadic population areas adjoining the village were searched. These locally organized searches had to be supervised carefully by the regional epidemiologist, WHO adviser and district team leader who, with assistance from the local administration, scheduled the search, provided training and investigated information about rash-with-fever cases. In 1978, the "local" teams were gradually replaced by semi-permanent surveillance agents who were allotted to such areas for one week, at the end of which they were met by the regional epidemiologist or WHO adviser who verified diagnosis of rash-with-fever cases, collected samples and transported the searcher to his next area of search.

#### Nomadic Population Searches

In bush areas where nomadic groups are more or less constantly on the move, searching was more difficult and provided a special challenge to the programme. The discovery, as described in chapter 4, of continuing transmission in small nomadic groups which had been unnoticed for several months, emphasised the importance of searching all of these mobile groups. As they were often found in areas reported to be "empty", all bush areas had to be searched. Searchers in these areas had to search first for nomads and then for smallpox among them. In nomadic population areas, the living and working conditions for searchers were more difficult; when walking in the bush, often for several days, they were never sure whether they would find people with whom to eat and spend the night. Furthermore, in many areas it became necessary, for reasons of safety, including the danger from wild animals, to send two searchers together.

FIG. 7. 1  
VARIOUS RURAL POPULATION SMALLPOX SEARCH METHODS  
SOMALIA 1977-1979



In searching areas of nomadic population, problems arose in the scheduling of the search and subsequent assessment. The constant movement of the population created obvious problems in assessing the reliability of the searcher's report and also with the checking of rash-with-fever cases. Therefore, searchers were provided with specimen collection kits and instructed in their use.

Three special search techniques were utilized concurrently in nomadic areas:

Simple search: Two-man search teams of one literate worker from the zonal centre and one nomad familiar with the area and its nomadic groups were assigned a specific geographic area between recognized landmarks. A good knowledge of the terrain was an essential for an effective search, however, the fact that even relatively small areas of the bush (say, 10 km<sup>2</sup>) usually have specific names known to the nomads, allowed preparation of a simple search schedule. Smoke from morning camp fires, fresh faeces of domestic animals and other traditional tracking signs helped searchers to locate nomad encampments. Supervision and assessment of this type of search was extremely difficult.

"Drop and move" search (figure 7.1 B): Teams of five to ten searchers were dropped at intervals along a bush area to be searched, with instructions to list and search all nomad encampments or travelling groups encountered on the 50 to 150 km walk back through the bush to a fixed point, usually a zonal village. Again supervision was difficult and the presence of a supervisor in the team only partially improved the search performance.

"Criss-cross" search (figure 7.1 C): Several two-man teams criss-crossed a delineated bush area moving, each from a different starting point and by a different route, between designated checkpoints. One person was identified to verify the searchers' arrival at checkpoints by signing the search form.

Practised, friendly approaches by the search teams, along with the distribution of vitamin pills, antimalarial drugs and in some instances, simple treatment for other diseases, helped to obtain the cooperation of the majority of nomads and stimulated their interest in meeting smallpox surveillance agents.

During the emergency drive when outbreaks were occurring among the nomads, the affected bush areas were divided among semi-permanent surveillance agents who were to conduct continuous searches. This method proved to be highly effective for the limited time necessary but with the altered epidemiological situation and a reduction in programme staff this method was abolished at the end of 1977.

Special problems arose in areas inhabited by mixed and nomadic populations. In these areas searchers usually neglected the nomadic population and a technique was developed combining features of the settled population and nomadic population searches.

#### Modified Rural Population Searches

It was necessary to adapt further the search methods in particular areas and at certain times.

Combined search and vaccination rounds: In bush areas, especially in those where search activities were not reaching the expected level of effectiveness, search and vaccination activities were sometimes combined, however, when a searcher was required to vaccinate he often forgot to search. Therefore, where searching was combined with vaccination, special training, supervision and assessment were required and it was stressed that vaccination efforts were no substitute for surveillance. Generally nomads tried to avoid vaccination to the extent that they would inflict themselves with scars resembling those of vaccination by burning the skin in the deltoid area with a stick from a fire or rubbing in the sap of "warankol" and "darken" trees which also cause scarification. Searchers who tried to vaccinate nomads often limited their future cooperation in surveillance activities.

Progressive searches: In regions with a limited number of programme personnel and transport facilities it was recommended that the search should not start at the same time in all districts. Resources were concentrated in perhaps half of the districts at a time and three to four weeks later moved to the remaining districts.

Two phase searches: In some regions or districts it proved worthwhile to cover first the settled areas and later the nomadic population areas. In many districts this type of search obtained better results, improved the morale of the workers and also allowed closer supervision.

#### Urban Population Searches

Urban areas with their higher concentration of population always presented a significant threat to the programme and periodic searches in these areas were given high priority. Organization of urban area searches was relatively more simple but required ingenuity in coordinating the diverse resources both of the programme and of voluntary agencies. Searches were conducted separately from vaccination activities and from searches in surrounding rural areas and schools, shops and markets were searched during inter-search periods. Searchers moved from house to house inquiring about rash-with-fever cases and explaining the reward for reporting smallpox and where to report. Concurrently intensive publicity campaigns were conducted.

As a guide for calculating staff requirements it was estimated that one searcher could search 50-100 houses per day and therefore around 5000 persons. Accordingly, 20 searchers, with three to four supervisors, were usually required for every 100 000 population. Pre-search meetings were held at central level attended by administrative and health officers, supervisory programme staff, the regional epidemiologist and the WHO adviser. Zonal meetings were held afterwards for searchers and their supervisors.

The search schedule for urban searches was usually completed one week before the start of the search and each searcher was provided with sufficient copies of the search report. By keeping searchers working together in the same urban sector on any particular day greater supervisory control and, thus, search performance, was ensured. The most productive times for searching were the early morning, the late afternoon and the evening. Special attention was paid to searching in areas surrounding a town and in villages within the jurisdiction of a municipality. When a suspected smallpox case was discovered the searcher himself immediately informed his supervisor and the programme managers. Investigation of such cases was done immediately and other rash-with-fever cases visited within 48 hours.

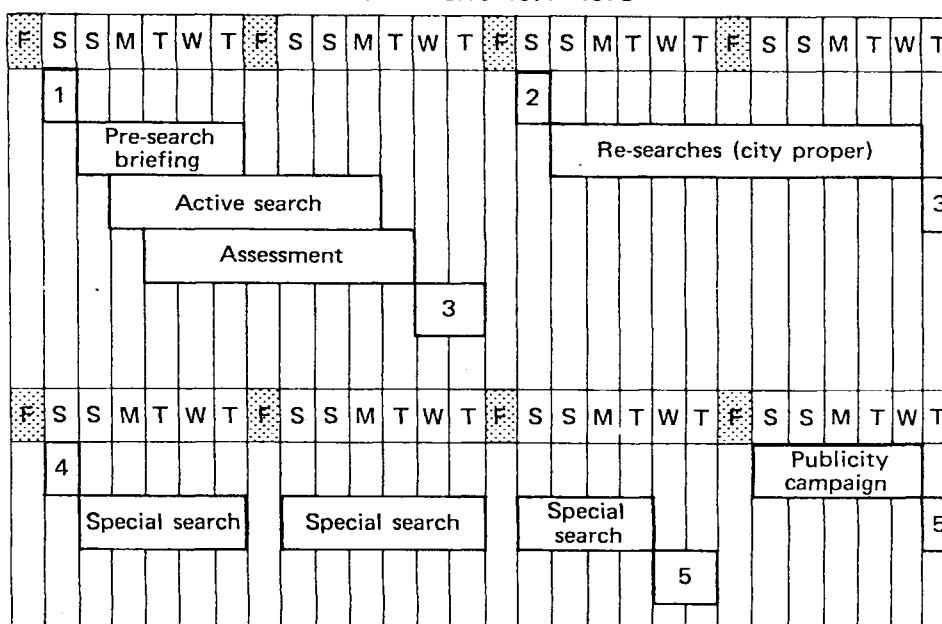
#### 1.4 Surveillance in Mogadishu

On 13 October 1976 the first city-wide house-to-house search was launched and more than 2000 workers were mobilized. From October 1976 to January 1977 a further four intensive night searches each utilizing approximately 2000 workers were undertaken. In February 1977 a detailed plan for active searches was laid out and about 70 voluntary workers provided by the Red Cross were employed, 56 working as searchers and 14 at fixed checkpoints. In the second half of 1977 the surveillance activities were reorganized to make them more effective and the number of surveillance workers was gradually reduced from 70 to only 30 who were trained in the duties of surveillance agents. Each of them was allotted to a certain area of two to three xaafadda (subdistricts) covering a population of about 15 000. An intensified house-to-house search was designed to take place once every two months, each round lasting 7-10 days and utilizing, in addition, 120 temporary searchers provided by the district chairman. During these operations, the surveillance agents acted as supervisors, one to each four to five temporary searchers, while during the inter-search periods they conducted repeat searches, as necessary, special searches, publicity campaigns and vaccination scar surveys. The two-monthly schedule for the surveillance activities in Mogadishu capital is shown in figure 7.2.

The main difference in the search methodology compared with other regions was that only private houses were visited by the searchers. All other places, including orientation centres, schools, shops, restaurants and markets, were visited by surveillance agents during the inter-search period.

FIG. 7. 2

TWO MONTHLY TIME SCHEDULE FOR SURVEILLANCE ACTIVITIES  
MOGADISHU 1977 - 1978



- 1 Supervisors pre-search briefing
- 2 Post-search review with supervisors
- 3 Submission of report - Data analysis - Identification of weak areas
- 4 Special search pre-search meeting
- 5 Submission of report - Data analysis - Individual assessment

WHO 79561

Surveillance agents were deputed to the airport and seaport during the Haj pilgrimage season to assist the sanitarian in checking outgoing passengers and vaccinators joined the vaccination team at the Municipality Health Office which was particularly overtaxed during this season.

Certain surveillance activities were terminated in January 1978 in accordance with the changed epidemiological situation. These included the police checkpoints which had screened for rash and fever all travellers coming into Mogadishu and the checking of outgoing passengers at air and sea ports. The isolation unit annexed to the Infectious Diseases Hospital was also closed at this time. In compensation, surveillance workers were deputed to each of the seven health centres and four hospitals to ensure the proper maintenance of the smallpox rumour registers and regular submission of weekly epidemic reports.

From April 1978 onward, more comprehensive schedules were planned for surveillance agents. Up until the end of 1978 they were instructed to perform vaccinations, especially primary vaccination and in addition to surveillance activities they were



expected to visit 40-50 houses per day and their whole area within 60 days. Table 7.2 shows population, houses and staff requirements involved in search operations in Mogadishu capital.

In January 1979, the surveillance network in Mogadishu region was again reviewed and slightly modified. The strategy implemented throughout 1979 had the following main components.

Active surveillance: Each of 20 surveillance agents was allotted to a certain well defined duty area, ranging from three to four sub-districts to one district, covering a population of approximately 20 000-25 000. They had a regular schedule to visit each and every house, shop, tea shop, restaurant, school, market and public office in their area of responsibility. At each place they followed the standard search procedure (see page ). Newly detected rash-with-fever cases were recorded on their daily work report and cases claiming to have been already seen at a hospital or health centre were noted for checking, to avoid duplicate reporting. In addition they were to mark with a pencil on the houses the date of their visit and to paste posters in strategic public places, shops and restaurants. They covered about 75-100 houses daily, enabling them to complete one cycle of their allotted duty area within 20-25 working days. The system was designed for easy absorption into other basic health services once the SEP had finished.

Passive surveillance: Four surveillance agents were specially trained and deputed to the 10 health centres, the six hospitals, the insurance clinic and the municipal health office. Their duties were:

- to visit regularly the health establishments allotted to them and maintain the rash-with-fever rumour registers by scrutinizing the outpatients' attendance register with the doctor or medical assistant in charge;
- to interview outpatients as to when their houses were last visited by surveillance agents, and whether the houses had been marked accordingly; and
- to inform outpatients about the reward of 200 shillings and where to report cases.

Cross-checking of data collected: Every alternate Thursday afternoon, a meeting was held for all the SEP workers to submit reports. The findings of the surveillance agents working in the field were cross-checked with reports of those engaged in passive surveillance.

Assessment: This was done by the district team leaders as part of their routine supervision. The regional epidemiologist and the WHO adviser also conducted independent assessment of both active and passive surveillance.

Investigation of cases: All chickenpox cases, measles outbreaks and severe skin rash cases were immediately reported to "Zeropox" Mogadishu for personal verification of the diagnoses by the team leaders, regional epidemiologist and WHO epidemiologist.

## 2. Surveillance in the Inter-search Period

When smallpox was widely prevalent, the discovery of an outbreak was a common and routine occurrence, however, as the country approached zero smallpox incidence it became increasingly important to discover outbreaks while they were still small in size and before the disease had disseminated. Therefore the periodic active searches were supplemented by continuous routine surveillance and special operations. This had the added benefit of making the work less monotonous and more interesting for the programme staff.

### 2.1 Continuous Routine Surveillance

Essentially this involved three elements: surveillance by regional surveillance teams, surveillance by surveillance agents and the secondary surveillance network.

### Regional Surveillance Teams

These teams operated under the guidance of the regional epidemiologist, the regional team leader and the WHO adviser. Their specific tasks during the inter-search period have been detailed in chapter 6 (page 107).

### Surveillance Agents

In each district a team of surveillance agents headed by a district team leader carried out continuous surveillance. These agents were usually selected, on the basis of their demonstrated initiative and reliability, from among the large number of workers involved in the 1977 emergency drive. Chapter 6 (page 104) lists the responsibilities of surveillance agents. At times during field checks of rash-with-fever cases they were required to take specimens for laboratory examination, particularly if the cases were part of a nomadic group on the move.

As a part of their important role, surveillance agents assisted in the collection of the demographic data essential to the planning of effective surveillance.

### Secondary Surveillance System

This system was complementary to the more important periodic searches and continuous routine surveillance by full-time SEP personnel. It was based on the involvement in the programme of all political, administrative and social institutions. This involved contacting officials at various levels of the government and party structure and the police and military, village and local leaders, school teachers and public service organizations including the Somali Youth Organization, the Somali Workers' Organization, the Somali Women's Democratic Organization and the Somali Red Crescent Society.

They were encouraged to report any suspected smallpox cases or other rash-with-fever cases which they encountered and reminded of the reward for reporting and where to report. Those who came in contact with people from remote areas or themselves made field visits were asked to enquire about rash diseases and specifically the last occurrence of smallpox in any area. As such visits were intermittent and infrequent their role in the regular reporting system was limited, however, policemen, "victory pioneers" and school teachers were frequently informers of rash cases.

## 2.2 Special Surveillance Activities

The inter-search period provided an opportunity to concentrate some efforts on sectors of the population which might not have been adequately contacted during the periodic searches or, at least, to vary the approach to the population in general.

### Water Point Searches

Somalia's climatic conditions and the pastoral occupations of most of the population make water points obvious collecting places for people in rural areas. This is particularly true during the dry seasons (August-September, January-March). As people are busy collecting water and watching their herds, access to them for surveillance purposes was not always easy.

The value of water point searches varied considerably from one area and one season to another, depending largely on the number of water points and, therefore, the extent to which they gathered the population together. In fact, not a single case of smallpox was detected during a waterhole search and field experience, notably a survey of 647 nomadic groups conducted in Baidoa District in 1978, indicated that minimal rash-with-fever information was obtained by this method. On the other hand, in some areas persons encountered at waterholes were able to give valuable information on the current location and movement patterns of nomadic groups which could then be visited. Government guards at water points were often helpful in this respect.

### School, Market, Health Unit and Public Gathering Searches

These places and events provided an obvious opportunity both for informing and collecting information from a large number of people in a relatively short time. Each class of both state and Koranic schools was visited regularly and information solicited by use of the smallpox recognition. Markets were found to provide reasonable information about cases in localities within a 10-15 km radius, however, their value varied considerably. It was noted that the female population at markets were reluctant informers.

Staff of health units were repeatedly informed about smallpox surveillance and motivated to question patients about rash-with-fever occurrences.

In general, all public gatherings were included in the surveillance programme, however, their contribution to the total information received varied from one area to another, depending to some extent on local habits and customs and the consequent accessibility or otherwise of persons in public.

### "Problem Area" Searches

In all districts certain geographical areas or population groups presented special problems related to inaccessibility, the mobility of the population or high risk of exposure to smallpox.

Areas of nomadic population: For effective surveillance amongst this group a thorough understanding of their habits was essential, especially a knowledge of the limited time periods during which they were more accessible, such as, harvest times and times of water shortage. Contact with nomads could be made either at their original dwelling sites (near to their farms in the case of the semi-nomadic population) or at their temporary grazing sites. In addition, they could be intercepted moving between these two areas, usually along known routes and especially at river crossings or places of easy passage through large areas of flooding or dense bush. As mentioned earlier, although follow-up of all rash-with-fever cases by supervisory personnel was mandatory, searchers were instructed to take laboratory specimens from all cases among travelling groups.

Areas of recent smallpox outbreaks: Experience had shown that undetected smallpox foci often persisted near to known smallpox outbreaks. With this in mind, a search was conducted within a 15 km radius of each of the last five outbreaks in each district. Villages in contact with the affected area were also searched. In addition, searches were organized in areas where it was thought possible that reports of a smallpox outbreak had been suppressed. Local authorities were met and the undesirable consequences of case suppression discussed and their future cooperation sought.

Border areas: To compensate for the tendency to neglect the peripheral areas of each district or region, special searches were organized which ensured reasonable overlap into neighbouring areas.

Areas omitted in major searches: Search assessments identified areas which had been inadvertently missed or inadequately searched during the periodic searches and were therefore made the object of special activities.

Areas sheltering displaced populations: In the five border regions of Gedo, Bakool, Hiran, Galgadud and Galbeed there were refugee camps. Regional epidemiologists were advised to search the camps weekly, verify diagnoses of rash cases, collect specimens for laboratory analysis, check the immunity status of the camp dwellers, and conduct a pockmark survey. One vaccination round was conducted in each camp and thereafter newcomers were vaccinated on arrival. Refugee camps were ultimately listed among the "fixed search units" and included in the periodic searches.

### 3. Search Results

#### 3.1 Identification of Targets

The initial absence of basic demographic data severely hampered the preparation of comprehensive search schedules. Similarly, the absence of denominators made accurate assessment of the data collected virtually impossible. Extensive efforts were made to fill this gap and by the end of 1977 a list of inhabited places and areas of nomadic population had been compiled. In 1978 much more detailed demographic data was collected by field staff. It included the names and/or numbers of houses, inhabitants, schools, tea shops, restaurants, water points, health units, administrative and political offices, markets and village leaders. This enabled the preparation of lists of "search units" as summarized in Table 7.1. It is apparent that there was constant fluctuation in some of these areas, however, the lists were constantly updated according to information collected during surveillance rounds. Search units for 1979 are shown in Annex .

In addition to the lists of search units, wall charts were prepared on which those visited each month could be marked. An example of these charts is shown in figure 7.3. The distribution of "locality surveillance record cards" to the headman of each fixed search unit (figure 7.4), and later to nomadic groups also, facilitated assessment of surveillance coverage. Entries were made on these cards at the time of each surveillance visit and, thus, they served as recording forms and assessment indicators as well as smallpox recognition cards and reward publicity.

FIG. 7.3 SECTION OF WALLCHART:

# SURVEILLANCE IN SEARCH UNITS AT GLANCE

## JOWHAR DISTRICT

Name of Search Unit	No. of houses	Visited and Search Conducted															
		1978															
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
<u>IV ZONE CEEL CAD</u>																	
71 MOORO DHOOREY	21	●	⊙	●	●	⊙	●	●	●	⊙	●	⊙	●	●	⊙		●
72 MOORO DABLEY	35	●	●	●	⊗	⊙		●	⊙	●	⊙		●	⊙	●	●	●
73 DHIGTAAREY	35	⊙	●	●	●	●	●	⊙	●	●	●		●	⊙	⊙	●	⊙
74 CEEL CAD	40	●	●	●	⊙	●	●	●	●	●	⊙		⊙	●	●	●	●
75 BILAY	105	⊙	●	⊙	●	●		●	⊙	●	●		⊙	●	●	●	●
76 BOOD GUBO	20	●	●	●	●	⊙		●	●	⊙	●		⊙	⊙	●		●
77 GAAWAY	30	●	●	●	⊙	●		●	●	⊙	●		●	●	●	●	●
78 LIBILOW	66	⊗	⊙	●					⊙	●	●		●	●	●	●	⊙

● reported searched

⊙ assessed — found searched

⊗ assessed — found not searched

TABLE 7.1  
SUMMARY OF SEARCH UNITS BY REGION, SOMALIA 1978

No.	Regions	No. of zones	Fixed <sup>a</sup> search units	Perma- nent houses	Schools		Tea shops	Restaurants	Health estab- lishments	Public offices	Water <sup>b</sup> points	Markets	Recog- nized nomadic areas <sup>c</sup>
					State	Koranic							
1	Bakool	29	327	7 357	32	128	132	95	11	21	1 731	17	1 389
2	Bari	22	79	10 181	45	45	575	17	15	28	215	18	380
3	Bay	67	2 654	75 844	88	1 523	750	369	20	99	1 935	53	NR
4	Galbeed	33	209	38 634	96	229	875	1 076	53	474	147	92	NR
5	Galgadud	20	49	8 540	51	71	383	664	13	108	161	52	NR
6	Gedo	31	331	13 079	47	211	254	46	14	38	251	10	144
7	Hiran	21	166	13 416	55	151	356	359	23	29	210	34	NR
8	L. Juba	31	236	29 481	231	96	572	333	32	117	579	57	542
9	M. Juba	68	302	23 261	74	335	178	123	16	111	353	42	551
10	Mogadishu	NA	NA	46 893	69	1 113	←2 118→		15	94	NA	58	NR
11	Mudug	20	69	8 029	26	80	349	197	16	125	829	43	399
12	Nugal	26	49	12 960	36	55	389	141	16	125	294	21	NR
13	Sanaag	13	54	4 812	25	43	133	71	15	133	24	15	NR
14	L. Shabelli	58	920	67 731	178	690	406	141	66	223	230	79	223
15	M. Shabelli	32	440	38 155	86	321	460	522	39	97	458	71	1 535
16	Togdheer	23	142	17 454	62	139	1 322	352	17	476	3 896	93	NR
Total		494	6 027	415 827	1 201	5 230	7 134	6 624	381	2 298	11 313	764	

<sup>a</sup> Fixed search unit: any locality with permanent inhabited houses such as: villages, hamlets, farms, plantations etc.

<sup>b</sup> Waterpoint: only those used permanently or locally recognized for common watering of animals (this definition apparently not observed in Togdheer Region)

<sup>c</sup> Recognized nomadic areas: areas usually or frequently harbouring nomadic population.

NR = not reported

NA = not applicable

FIG. 7.4 LOCAL SURVEILLANCE RECORD CARD

[illegible]

NOMAD GROUP SURVEILLANCE RECORD CARD

# QAADO 200 SH

### 3.2 Frequency of Searches

The months and regions in which searches were conducted from July 1977 to August 1979 are shown in figure 7.6 and the relative frequency of searches in areas of differing smallpox incidence summarized in Table 7.2. In fact, most parts of the country, except those in the north-west, were searched seven times in 1978 and three times in 1979, as during each inter-search period one full round of surveillance was generally completed. In 1978 the full search procedure usually lasted one month, however, in 1979 with less frequent searches more time was allowed and greater attention to detail became possible, particularly more thorough independent assessment.

FIG. 7. 6  
FREQUENCY OF SEARCH OPERATIONS, BY REGION  
SOMALIA 1977-1979

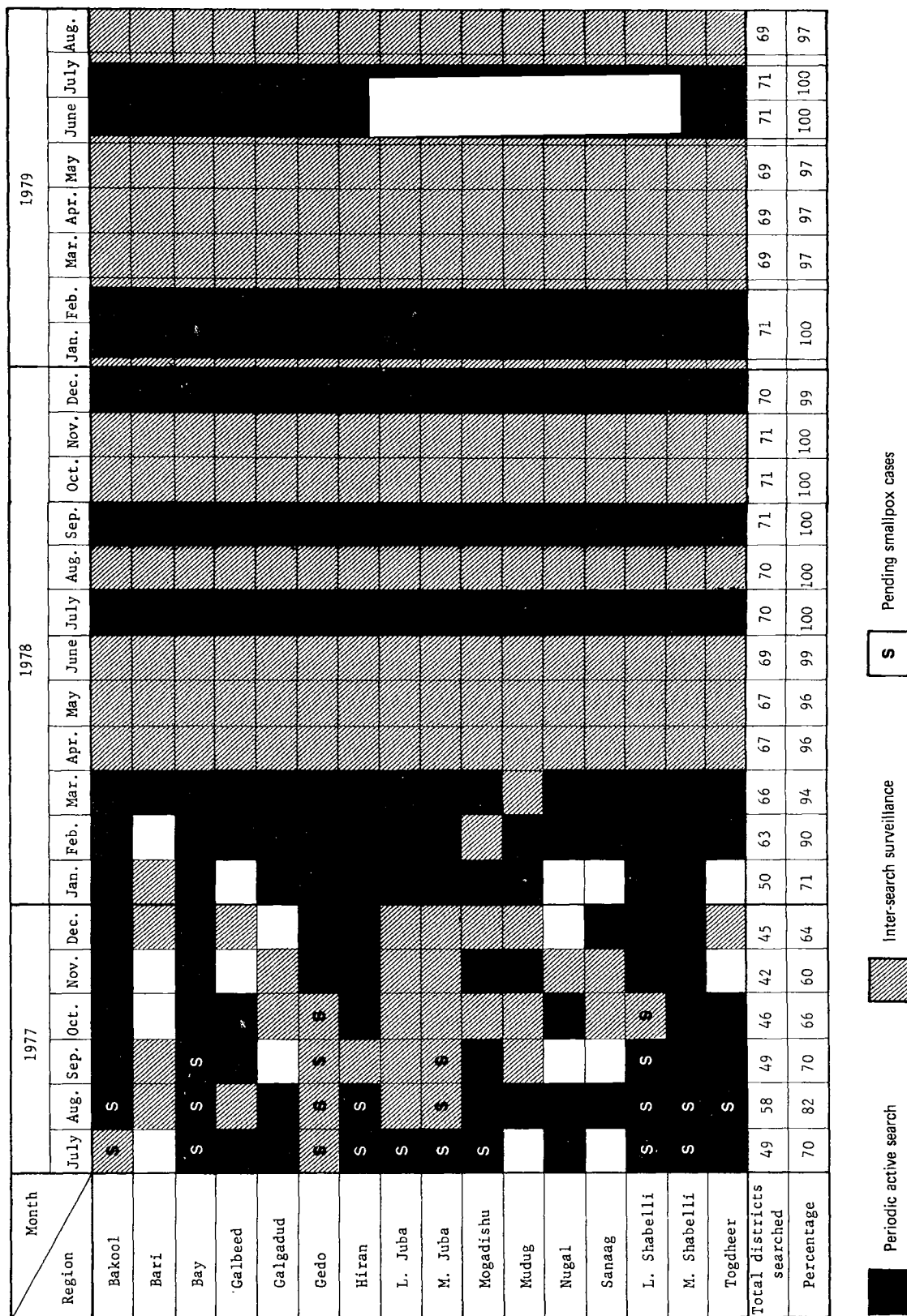




TABLE 7.2  
FREQUENCY OF SEARCHES COMPARED WITH PAST SMALLPOX INCIDENCE, SOMALIA 1977-1979

Areas of smallpox incidence in 1977	Minimum number of searches per year		
	1977	1978	1979 <sup>a</sup>
High	10	6	2
Low	4	5	2
Nil	2	5	2

<sup>a</sup> To end August

### 3.3 Search Findings: 1977

As the epidemiological situation changed and the surveillance system was progressively developed through the year, it is of interest to consider the surveillance findings during two separate periods.

#### The Early Months of Active Surveillance

In mid-February 1977 the smallpox-free status of Mogadishu, following containment of an outbreak which had persisted for almost six months, was confirmed by a house-to-house search which detected no new cases. Attention was immediately concentrated on those regions in closest contact with the capital, Lower and Middle Shabelli. Two mobile teams were sent to each, one team covering also Hiran Region and the other Bay, Gedo and Bakool Regions. These teams conducted rapid, random checks, visiting Regional Medical Officers, hospitals, schools, major water points and government establishments and investigated rash-with-fever cases. The coverage and findings of these teams are shown in Table 7.3. Sixty rash cases were found: no smallpox cases, 11 chickenpox and the remainder other skin diseases.

TABLE 7.3  
SEARCH RESULTS OF MOBILE TEAMS, SOMALIA JANUARY-MID-MARCH 1977

Region	Number seen							No. of rumours collected <sup>a</sup>
	Villages/towns	Nomad groups	Tea shops	Water-holes	Houses	Schools	Markets	
Bakool	11	21	23	—	240	18	4	5
Bay	26	17	52	—	976	21	9	2
Gedo	24	36	41	—	700	19	8	6
Hiran	57	21	156	13	1 593	17	3	21
L. Shabelli	36	42	223	—	2 872	96	26	22
M. Shabelli	67	20	148	6	3 382	31	9	4

<sup>a</sup> Three specimens collected and laboratory tested: all smallpox negative.

At the time of these activities, in March 1977, a plan was drawn up for a wider systematic surveillance effort. Detection of outbreaks in Bakool, Bay and Mogadishu Regions and later, in April, in Galgadud, Hiran, Lower and Middle Juba and Lower and Middle Shabelli Regions, prevented this plan from being implemented. It was apparent that a larger, more effective search operation was indicated.

#### Surveillance during the Emergency Drive

The emergency strategy coupling extensive and sensitive surveillance with effective containment was rapidly developed. There was a consequent striking increase in the reported smallpox incidence from May into July. The results of the massive nationwide search operation conducted during the latter half of 1977 are shown in Table 7.4

TABLE 7.4  
NATIONAL SEARCH COVERAGE, SOMALIA, JULY-DECEMBER 1977

Visited and searched	July	Aug.	Sept	Oct	Nov	Dec
Settled villages	3 553	5 094	4 887	2 943	5 925	6 764
Nomadic encampment	14 564	12 925	16 618	12 560	18 374	16 696
Permanent houses	130 840	161 181	253 596	171 233	245 802	339 053
Temporary huts	62 481	89 727	158 811	89 362	116 252	135 880
Locality headmen	3 013	5 093	6 792	8 042	5 205	9 123
Schools	2 629	3 334	3 243	2 698	3 881	5 157
Water points	4 415	4 209	4 685	7 973	4 025	7 540
Markets	357	366	409	288	280	219
Tea shops, restaurants	3 235	3 964	1 483	6 921	1 182	2 369
Health establishments	168	206	150	147	241	146
Public places, offices	493	447	314	483	137	308

During each one month surveillance period an average of 14 900 settled villages, with 217 000 permanent houses, and 15 300 nomadic encampments having 109 000 temporary huts were visited and searched and their inhabitants informed about programme activities. In each month the searchers contacted an average of 6200 locality headmen, and searched at 5500 water points, 3500 schools, the same number of tea shops and restaurants, 180 health establishments and over 360 administrative offices and orientation centres.

As explained earlier, lack of demographic data hampered accurate evaluation, however, the field assessment carried out by regional epidemiologists and WHO advisers at the end of 1977 confirmed that every assessed locality had been searched from six to ten times in high incidence areas, four to five times in low incidence areas and twice or three times in smallpox-free areas. Ninety-five per cent of the assessed localities were found to have been searched during each search-round in 1977.

Table 7.5 summarizes the numbers and diagnoses of rash-with-fever cases detected.

**TABLE 7.5**

**RASH-WITH-FEVER CASES DETECTED DURING ACTIVE SEARCHES  
SOMALIA, JULY-DECEMBER 1977**

Number of rumours	July	Aug	Sept	Oct	Nov	Dec	Total
Reported	1 595	705	915	496	1 336	1 678	6 725
Investigated	1 345	704	578	418	1 234	1 578	5 857
Percentage	84	99	62	84	92	94	87
Diagnoses verified to be:							
Smallpox	226	188	31	0	0	0	445
Chickenpox	357	245	608	224	307	381	2 122
Measles	11	4	24	6	99	87	230
Other*	998	262	246	261	917	1 210	3 894

\*Other skin diseases including herpes, secondary syphilis, eczema and drug reactions.

Of the total of 6 725 rumours received by searchers and supervisory staff during search activities of the second half of 1977, 5 857 (87%) could finally be traced and visited and their diagnoses verified; 445 smallpox cases were found, the last being detected in September. No new smallpox cases have been detected by any search operation since that time in spite of extensive countrywide searches. Table 7.6 is a summary of smallpox cases detected by month and by separate region during active searches and their contribution to the total cases detected. In August the highest proportion of cases, 85%, was detected by this method. If figures for the months of May and June are included, 43.9% of all smallpox cases for the period May to December were discovered during active searches. The other cases were mainly located during special searches around known foci, contact or source of infection tracing, or during follow-up visits to outbreaks.

**TABLE 7.6**

**SMALLPOX CASES DETECTED DURING ACTIVE SEARCHES, BY MONTH AND REGION,  
SOMALIA, JULY-DECEMBER 1977**

Region	July	Aug	Sept	Oct	Nov	Dec	Total
Bakool	10	4	0	0	0	0	14
Bay	183	175	9	0	0	0	367
Gedo	6	1	6	0	0	0	13
Hiran	3	0	0	0	0	0	3
M. Juba	6	0	0	0	0	0	6
Mogadishu	1	0	0	0	0	0	1
L. Shabelli	0	6	16	0	0	0	22
M. Shabelli	17	2	0	0	0	0	19
Total	226	188	31	0	0	0	445
Percent of Total cases <sup>a</sup>	33.6	85.4	26.3	0 <sup>b</sup>	— <sup>c</sup>	— <sup>c</sup>	22.0

<sup>a</sup> i.e. percentage of cases detected by all means of surveillance

<sup>b</sup> 27 cases detected by other means

<sup>c</sup> no cases detected in country

TABLE 7.7  
NATIONAL SEARCH COVERAGE, SOMALIA 1978

Units visited and searched	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Settled villages	8 262	6 374	7 096	5 505	5 791	4 500	6 587	2 739	6 578	4 372	3 336	5 580
Nomadic camps	18 442	16 578	18 167	11 129	10 342	17 589	15 872	12 095	18 371	9 875	7 040	12 541
Permanent houses	325 673	303 458	268 675	147 818	184 428	174 181	357 151	158 429	387 825	242 069	166 921	319 452
Temporary huts	170 114	136 248	119 732	130 527	131 972	158 948	187 407	132 537	189 087	121 017	103 916	176 238
Locality headmen	13 358	10 577	8 749	7 462	6 559	7 593	9 836	6 079	10 547	6 607	5 249	8 884
Schools	6 742	6 226	5 388	4 396	4 712	4 923	6 877	4 144	6 920	5 107	3 776	6 813
Waterpoints	9 258	7 494	8 115	5 713	6 859	6 254	9 624	6 845	11 347	7 455	6 527	9 490
Markets	173	374	315	408	315	236	418	285	617	599	360	596
Tea shops/ restaurants	1 497	3 156	3 555	7 269	3 966	3 944	6 877	5 760	11 261	7 006	5 593	8 849
Health establishments	94	149	173	171	264	150	287	122	448	300	187	317
Public offices	165	414	590	709	535	502	794	381	1 216	822	830	1 334
Extent of search*	Full	Full	Full	Limited	Limited	Limited	Full	Limited	Full	Limited	Limited	Full

\* Full search = periodic active search operation

Limited search = inter-search surveillance

### 3.4 Search Findings: 1978

The maximum search activity amongst all urban, settled and nomadic populations was carried out in 1978 when the programme staff had been totally released from containment activities and had diverted its full attention to surveillance.

#### Coverage Achieved

The number of search units visited during active searches carried out by programme staff during 1978 is shown in Table 7.7. An average of 6700 settled villages, with 327 000 permanent houses, and 16 500 nomad encampments comprising 163 000 temporary huts were visited each month, searched and their inhabitants informed about search activities. Simultaneously, on average, 10 000 locality headmen, 6500 schools, 9000 water points, 415 markets, 5800 tea shops and restaurants, 244 health establishments and 752 public offices were visited and enquiries made. In many districts the number of units reported as searched exceeded the number listed due to the constant variability in the number existing, and also because searchers were instructed to overlap substantially into neighbouring territories.

It should be noted that during the inter-search period a substantial coverage was also maintained. During each month of inter-search surveillance, an average of 4400 settled villages, with 179 000 permanent houses, and 11 000 nomad encampments containing 130 000 temporary huts were visited and searched. Six thousand five hundred locality headmen, teachers and pupils in 4500 schools and thousands of persons around 6000 water points were contacted. Searchers also visited 360 markets, 5500 tea shops and about 200 health establishments and 600 public offices.

Table 7.8 compares the monthly average number of search units reported as searched, by each search method, with the number of listed search units.

**TABLE 7.8**  
**COMPARATIVE COVERAGE BY PERIODIC ACTIVE SEARCHES AND INTER-SEARCH SURVEILLANCE,**  
**SOMALIA 1978**

Search units	Total number listed 1978	Units reported as searched by:			
		Periodic active search		Inter-search surveillance	
		Monthly average	Percent of listed total	Monthly average	Percent of listed total
Settled villages	6 027	6 746	100	4 373	72
Nomadic encampments	-	16 661	-	11 345	-
Permanent houses	415 827	327 039	78	178 974	43
Temporary huts	-	163 137	-	129 819	-
Locality headmen	-	10 325	-	6 591	-
Schools	6 431	6 491	100	4 499	69
Water points	11 313	9 221	81	6 608	58
Markets	706	415	58	367	51
Tea shops/restaurants	13 758	5 865	42	5 589	40
Health establishments	381	244	64	199	52
Public offices	2 298	752	32	629	27

TABLE 7.9

RASH-WITH-FEVER CASES DETECTED DURING ACTIVE SEARCHES, SOMALIA, JANUARY-DECEMBER 1978

Number of rumours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reported	1 371	1 022	1 001	1 107	1 592	1 718	2 425	1 949	2 320	1 841	1 823	2 694	20 863
Investigated	1 151	1 018	897	1 043	1 413	1 625	2 303	1 942	2 306	1 834	1 824	2 456	19 812
Percentage investigated	87	99	85	94	88	94	94	99	99	99	96	91	95
Diagnoses verified to be:													
Smallpox	0	0	0	0	0	0	0	0	0	0	0	0	0
Chickenpox	359	308	392	286	341	291	363	357	483	338	278	274	4 070
Measles	101	94	230	318	579	671	878	682	838	707	783	1 324	7 205
Other	852	609	402	502	641	759	1 139	903	985	789	763	1 117	9 461
Extent of search <sup>a</sup>	Full	Full	Full	Limited	Limited	Limited	Full	Limited	Full	Limited	Limited	Full	

<sup>a</sup> Full search = periodic active search operation; Limited search = inter-search surveillance

Rash-with-Fever Cases Detected

During 1978, 20 863 rumours concerning rash-with-fever cases were received by searchers or supervisory staff, of which 19 812 (95%) were subsequently traced and investigated. A diagnosis of chickenpox was verified in 4070 cases (20.5%) and 7205 cases (36.4%) were found to be measles. No smallpox cases were detected. Monthly findings for the entire country are shown in Table 7.9. The average number of rumours received each month was around 1700 with no significant difference in monthly averages for active search and inter-search surveillance, which at a local level was less intensive, was almost as effective as the periodic house-to-house searches. It is certain, however, that visits to every house substantially improved public awareness of the need to report cases.

3.5 Search Findings: 1979

As the time interval since the last smallpox case increased, the probability of detecting an unknown focus of infection decreased. It was reasonable, therefore, to reduce the frequency of periodic active search and gradually decrease the number of temporary searchers. In compensation the length of each search was extended to two months and inter-search surveillance was emphasized. Nevertheless, efforts were made to ensure that the two active searches conducted in 1979, in January-February and June-July, were of the highest standard. Extensive inter-search surveillance was carried out from March to May.

Table 7.10 shows the units searched throughout the country from January to July 1979 and Table 7.11 the numbers of rash-with-fever cases detected.

TABLE 7.10  
NATIONAL SEARCH COVERAGE, SOMALIA, JANUARY-JULY 1979

Visited and searched	Jan-Feb	March	April	May	June-July
Settled villages	5 803	3 614	2 266	2 275	5 066
Nomadic encampments	19 432	10 147	10 433	5 670	15 959
Permanent houses	341 985	209 954	152 465	185 354	370 615
Temporary huts	231 205	107 581	115 120	89 834	196 140
Locality headmen	12 731	7 298	7 062	4 952	11 476
Schools	8 809	4 657	3 944	3 669	7 312
Water points	9 067	4 640	3 869	3 741	7 554
Markets	639	343	316	346	600
Tea shops/restaurants	11 058	7 320	5 413	6 330	12 878
Health establishments	443	277	204	255	358
Public offices	1 275	799	627	788	1 437
Extent of search <sup>a</sup>	full	limited	limited	limited	full

<sup>a</sup> Full search = periodic active search operation  
Limited search = inter-search surveillance

TABLE 7.11

SEARCH FINDINGS - RASH-WITH-FEVER RUMOURS, SOMALIA, JANUARY-JULY 1979

Number of rumours	Jan-Feb	March	April	May	June-July
Reported	4 427	1 748	1 592	1 115	2 139
Investigated	4 370	1 706	1 573	1 094	2 074
Percentage investigated	98	97	98	98	97
Diagnoses verified to be:					
Smallpox	0	0	0	0	0
Chickenpox	613	228	218	123	275
Measles	2 021	796	779	506	999
Other	1 757	736	595	487	872
Extent of search <sup>a</sup>	Full	Limited	Limited	Limited	Full

<sup>a</sup> Full search = periodic active search operation  
Limited search = inter-search surveillance

As shown in table 7.11, a total of 11 021 rumours were received by searchers and supervisory staff during search activities over the January-July 1979 period. Of these, 1 457 cases (13%) were found to be chickenpox, 5 101 cases (46%) measles and the remaining 41% other skin diseases. Despite all the described search activities carried out during this given period no smallpox case was discovered.

In view of their importance as the final nationwide smallpox searches in Somalia and their extensive coverage and thorough assessment, the two searches of 1979 are considered in some detail. They are referred to by the names of the seasons in which they were conducted.

#### "Jilal" Search Campaign: January-February 1979

This search lasted two full months and involved 740 programme staff including 531 surveillance agents, 77 supervisors and 31 supervisors/assessors. The coverage achieved in each region is shown in Table 7.12. It can be seen that altogether 5803 settled villages, with 341 985 houses, and 19 432 nomadic encampments with 231 205 temporary huts were reported searched by experienced surveillance agents and their inhabitants informed about the programme. Twelve thousand seven hundred and thirty-one locality headmen, teachers and pupils in 8809 state and Koranic schools and persons round 9067 water points were contacted and interviewed about the occurrence of any person suffering from rash-with-fever in the visited locality. Searchers also reported having visited and searched 639 markets, 11 058 tea shops and restaurants, 443 health establishments and 1275 public offices, orientation centres or other places where people gather.



TABLE 7.12  
COVERAGE BY "JILAL" SEARCH CAMPAIGN, SOMALIA, JANUARY-FEBRUARY 1979

Regions	Number visited and searched										
	Settled villages	Nomadic encampments	Permanent houses	Temporary huts	Locality headmen	Schools	Water points	Markets	Tea shops/ restaurants	Health establishments	Public offices
Bakool	369	2 387	8 703	34 218	2 855	938	1 053	17	127	7	20
Bari	119	785	9 737	11 784	458	136	353	24	625	29	73
Bay	2 004	2 276	48 832	26 158	2 503	1 498	2 099	61	407	19	95
Galbeed	277	4 087	9 297	14 033	355	271	629	38	865	31	91
Galgadud	65	357	6 670	9 967	191	240	157	36	367	10	69
Gedo	341	1 742	24 303	25 995	1 950	776	565	16	421	23	42
Hiran	265	1 360	7 851	11 305	236	270	336	90	325	30	52
L. Juba	213	809	22 267	14 477	664	669	282	40	1 115	25	104
M. Juba	297	372	22 005	9 053	392	559	418	25	245	15	65
Mogadishu	4	19	61 496	335	4	1 075	11	32	3 771	19	52
Mudug	100	2 662	5 058	16 797	293	360	674	55	282	25	149
Nugal	39	587	11 564	16 433	39	118	143	38	559	9	93
Sanaag	88	347	5 103	5 881	406	243	373	3	151	14	19
L. Shabelli	997	440	63 702	13 681	1 250	1 092	642	89	419	153	108
M. Shabelli	440	530	23 106	13 356	428	409	451	19	624	25	105
Togdheer	185	672	12 291	7 726	707	155	881	56	739	9	138
Total	5 803	19 432	341 985	231 205	12 731	8 809	9 067	639	11 058	443	1 275

During this two-month intensive search, 4427 rumours were collected (an average of about four per searcher per month) and the diagnosis of 98% of them was verified either during or immediately after the search. Six hundred and thirteen cases (14%) were found to be chickenpox, 2021 cases (46%) measles, and the remaining 1757 (40%) persons suffered from other skin diseases, in many cases scabies. Altogether 422 specimens for laboratory examination were collected, mostly from chickenpox cases. About 40 000 smallpox vaccinations were given, especially among the nomadic population. Despite these activities no smallpox case or suspected smallpox case was discovered.

#### "Hagaa" Search Campaign: June-July 1979

This search was conducted over a full two-month period and involved 419 surveillance agents, 77 supervisors and about 30 assessors. The coverage achieved in each region is shown in table 7.13. It can be seen that altogether 5 066 settled villages, with 370 615 houses, and 15 959 nomadic encampments, with 196 140 temporary huts, were reported searched by experienced surveillance agents. The inhabitants were questioned and informed about the programme. 11 476 locality headmen, teachers and pupils in 7 312 state and Koranic schools and persons around 7 554 waterpoints were contacted and interviewed about the occurrence of rash-with-fever. Searchers also reported having visited and searched 600 markets, 12 878 tea-shops and restaurants, 358 health establishments and 1 437 public offices, orientation centres and other places where people gather.

During this search, 2 139 rumours were collected (an average of two and a half per searcher per month) and the diagnoses of 2 074 of them (97%) were verified either during or immediately after the search. 275 cases (about 13%) were found to be chickenpox, 999 cases (47%) measles and the remaining 872 persons suffered from other skin diseases. Altogether, 158 specimens for laboratory examination were collected, mostly from chickenpox cases. About 18 000 smallpox vaccinations were given, especially among nomads and displaced persons. Despite these activities no smallpox case or suspected smallpox case was detected.

#### Evaluation of Search Effectiveness

The assessment of search activities is dealt with in detail in the following chapter. This analysis deals only with the detection of rash-with-fever cases as an indicator of the effectiveness of searches.

As chickenpox is the disease which most closely resembles smallpox, particularly that caused by variola minor, outbreaks of this disease were given special attention. Diagnoses were verified by a regional medical officer, regional epidemiologist or WHO adviser and specimens collected for laboratory examination. Table 7.14 shows the cases of chickenpox detected during search activities from 1977 to 1979, by quarter and region.

TABLE 7.13  
COVERAGE BY "HACAA" SEARCH OPERATION, SOMALIA, JUNE-JULY 1979

Regions	Number visited and searched										
	Settled villages	Nomadic encampments	Permanent houses	Temporary huts	Locality headmen	Schools	Water points	Markets	Tea shops/ restaurants	Health establishments	Public offices
Bakool	315	2 251	12 522	27 373	1 669	725	851	23	159	11	15
Bari	88	801	12 158	9 253	436	80	406	29	539	21	117
Bay	1 515	1 500	48 098	14 838	1 675	1 176	1 819	92	518	19	70
Galbeed	215	2 691	34 250	12 074	808	537	344	44	1 691	24	332
Galgadud	165	400	6 185	5 447	468	145	118	54	363	9	80
Gedo	249	1 543	20 002	26 171	1 782	712	556	24	622	21	39
Hiran	142	827	5 871	7 216	102	222	237	42	307	30	53
L. Juba	207	600	20 565	11 948	607	426	453	32	1 070	23	75
M. Juba	294	482	28 581	6 905	595	478	375	35	405	16	88
Mogadishu	177	6	54 181	3 742	76	1 037	13	39	3 725	21	72
Mudug	60	1 966	2 847	11 746	201	264	337	28	426	12	73
Nugal	40	532	9 323	15 318	518	60	269	26	494	11	66
Sanaag	101	627	3 807	4 404	322	72	303	15	151	13	24
L. Shabelli	922	359	65 678	10 036	1 102	797	516	81	440	78	201
M. Shabelli	437	676	35 493	19 693	492	437	550	18	970	37	83
Togdheer	139	698	11 054	9 976	623	144	407	18	998	12	49
Total	5 066	15 959	370 615	196 140	11 476	7 312	7 554	600	12 878	358	1 437

**TABLE 7.14**  
**CHICKENPOX CASES DETECTED DURING ACTIVE SEARCHES, SOMALIA 1977-1979**

Regions	1977		1978				1979	
	Third quarter	Fourth quarter	First quarter	Second quarter	Third quarter	Fourth quarter	First quarter	Second quarter
Bakool	109	93	239	241	308	285	188	87
Bari	1	0	11	1	0	0	3	19
Bay	375	371	336	110	258	174	235	109
Galbeed	6	33	17	11	12	24	12	13
Galgadud	17	23	18	40	17	29	13	34
Gedo	163	58	64	84	109	51	60	28
Hiran	42	42	43	40	73	54	49	54
L. Juba	71	13	11	92	121	37	59	28
M. Juba	119	12	16	25	96	29	22	3
Mogadishu	72	43	34	52	41	22	23	12
Mudug	4	1	9	24	17	33	14	5
Nugal	3	5	0	28	11	14	5	8
Sanaag	2	3	3	16	10	8	13	12
L. Shabelli	109	33	35	11	39	48	80	62
M. Shabelli	99	133	198	121	87	74	61	27
Togdheer	18	49	25	22	4	8	4	4
Total	1 210	912	1 059	918	1 203	890	841	505

The figures presented in Table 7.14 reflect less intense search activities in the north-eastern part of the country and support the epidemiological observation that chickenpox cases there resulted in a few additional cases in the same hut or camp but due to the extremely low population density did not start the usual extensive chain of transmission.

The numbers of all rash-with-fever cases detected during the search were also an index of the effectiveness of the searches. Table 7.15 summarizes search findings of rash-with-fever cases from 1977-1979 by quarter and by region.

It is noted that the 20 863 rash-with-fever cases detected in 1978 represent 549 cases per 100 000 population for the year. This ratio exceeds those recorded in even the most sophisticated previous smallpox surveillance programmes, for example, on the Indian subcontinent. This in itself indicates highly effective surveillance.

Considering the number of rash-with-fever cases detected per district per quarter, the number rose from 45 in the third quarter of 1977 progressively to 95 and 90 in the third and fourth quarters respectively of 1978 by which time all efforts were concentrated on surveillance.

As expected there were wide variations in the number reported from individual regions. Figure 7.7 illustrates the number of rash-with-fever cases detected in each district for various quarters from 1977 to 1979. Preparation of similar maps for each quarter allowed easy identification of districts in which surveillance appeared to be deficient.

FIG. 7. 7  
RASH WITH FEVER CASES DETECTED  
DURING ACTIVE SEARCHES BY DISTRICT

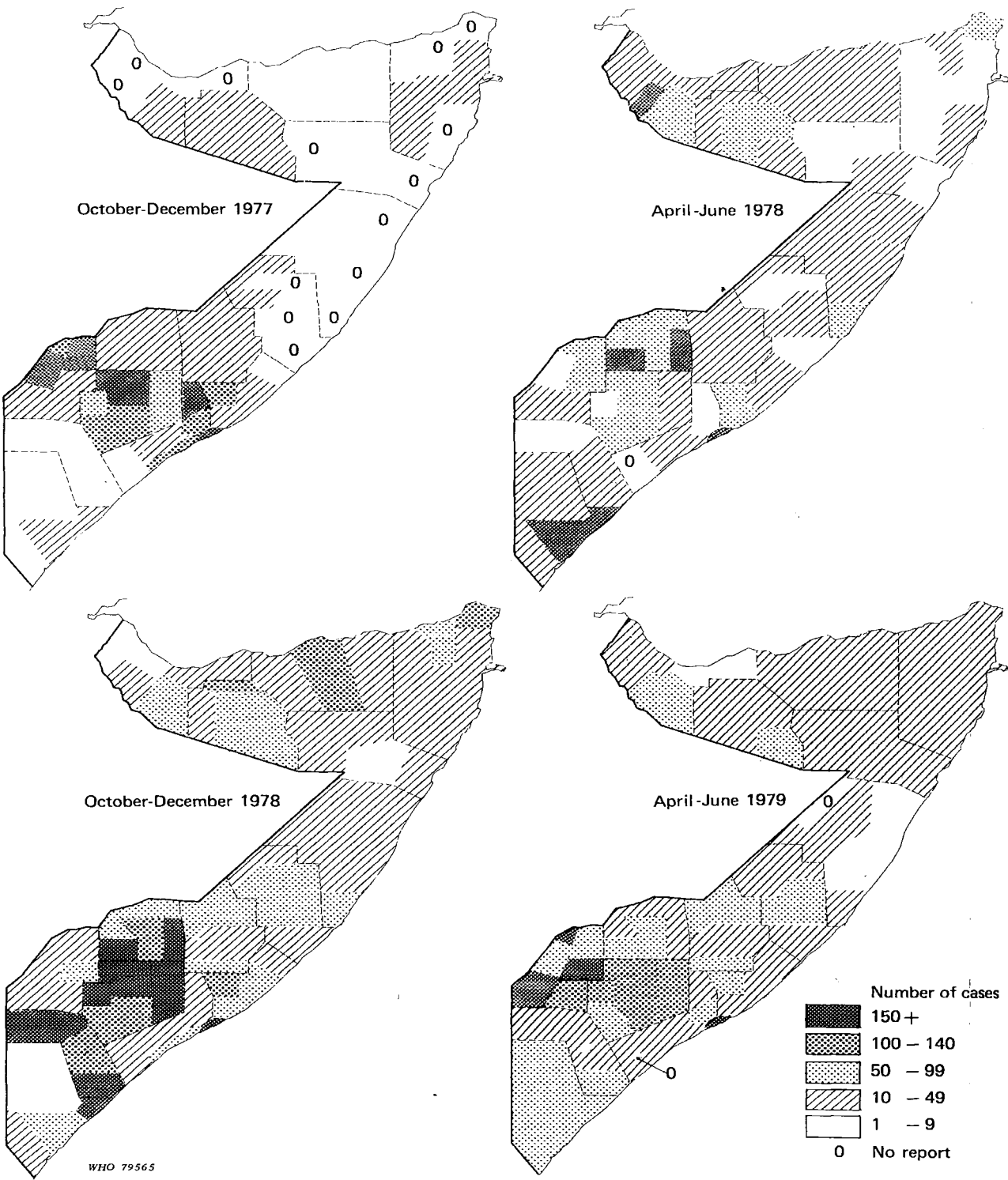


TABLE 7.15  
RASH-WITH-FEVER CASES DETECTED DURING ACTIVE SEARCHES, SOMALIA 1977-1979

Regions	1977		1978				1979	
	Third quarter	Fourth quarter	First quarter	Second quarter	Third quarter	Fourth quarter	First quarter	Second quarter
Bakool	177	122	519	745	957	649	418	184
Bari	21	74	59	104	212	259	222	193
Bay	1 458	932	1 099	192	657	929	606	407
Galbeed	45	47	36	352	270	194	305	204
Galgadud	273	26	25	75	102	302	173	172
Gedo	212	552	319	377	504	281	547	808
Hiran	62	89	75	82	209	166	146	145
L. Juba	169	74	65	413	658	335	336	287
M. Juba	209	16	89	67	673	655	396	164
Mogadishu	122	403	322	1 387	1 365	1 390	1 331	571
Mudug	65	5	71	153	151	141	94	43
Nugal	6	7	13	36	53	74	69	65
Sanaag	28	5	20	54	104	172	170	109
L. Shabelli	202	851	336	65	311	196	404	170
M. Shabelli	139	171	259	210	257	279	346	138
Togdheer	27	136	87	105	211	336	83	137
Total	3 215	3 510	3 394	4 417	6 694	6 358	5 646	3 797

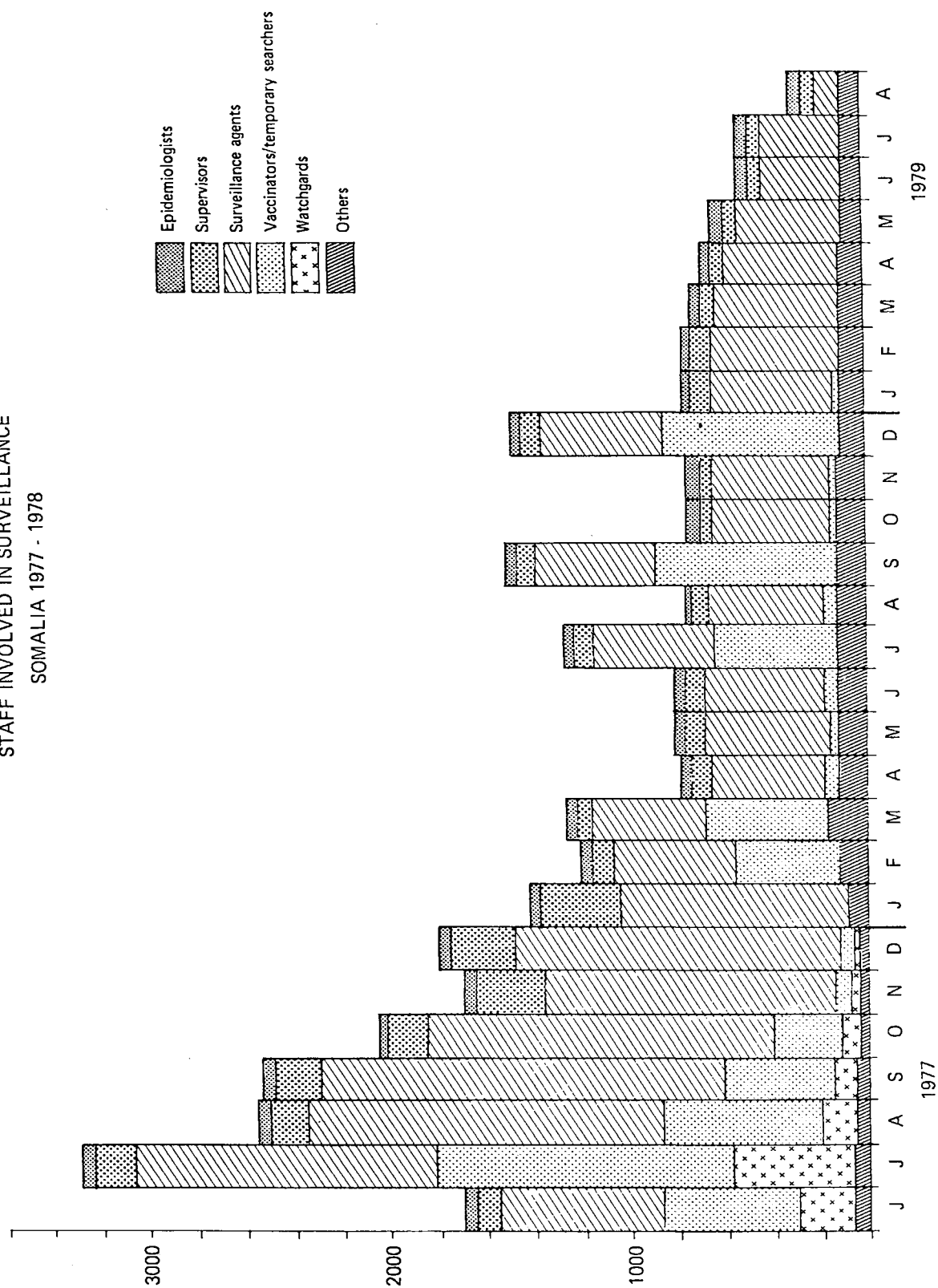
### 3.6 Personnel involved in Surveillance

From figure 7.8 it can be seen that the number of programme staff employed reached its maximum in July 1977 and during that year the workforce averaged about 2200. Early in 1978 the number fell to a permanent core of around 700-800, supplemented during the 1978 active searches by a further 600-800 workers. In 1978, to maintain control within the limits of available funds for wages, while at the same time allowing flexibility at regional level, a plan was devised which allotted a certain number of temporary searcher man-days to each region for each active search. The allotments are shown in Table 7.16. In Bakool Region the regional epidemiologist and WHO adviser could have chosen to use, for example, 50 temporary searchers for 20 days or 100 for 10 days, depending on needs and logistics.

TABLE 7.16  
REGIONAL ALLOTMENTS OF TEMPORARY SEARCH MAN-DAYS FOR ACTIVE SEARCHES, SOMALIA 1978

Region	Man-days	Region	Man-days
Bakool	1 000	M. Juba	400
Bari	430	Mogadishu	560
Bay	800	Mudug	320
Galbeed	480	Nugal	320
Galgadud	320	Sanaag	240
Gedo	1 200	L. Shabelli	980
Hiran	420	M. Shabelli	560
L. Juba	400	Togdheer	320

FIG. 7. 8  
STAFF INVOLVED IN SURVEILLANCE  
SOMALIA 1977 - 1978



#### 4. Public Participation and Programme Publicity

In the past neither the health worker nor the general public were motivated to report smallpox cases, although at the time when the smallpox eradication programme started in 1968 efforts were made to encourage the public acceptance of vaccination. During the Mogadishu smallpox outbreak in 1976 the population was encouraged to report smallpox cases and to cooperate with vaccination and containment teams.

##### Rewards

In 1977 it was recognized that, as public participation in smallpox eradication activities was essential, a wide publicity campaign explaining the programme was necessary. A cash reward for the reporting of smallpox cases was offered and announced throughout the country. Local administrative and health authorities were encouraged to offer the cash reward to the first person giving information about any smallpox outbreak which had not previously been reported. During the emergency drive, it became apparent that field searchers were not disseminating information about the reward to the general public for fear that the public and not the health workers would receive the reward. In many instances searchers would report a smallpox outbreak which they had been informed about by the general public but would claim the reward for themselves. To overcome this problem a dual reward was introduced and detailed criteria for its payment were outlined.

A reward of 200 Somali Shillings was offered by the Government of Somalia, to be paid from WHO funds to: (1) the first member of the public reporting an outbreak (even if a smallpox case himself), and (2) the local smallpox or health worker to whom this information was given and who notified his supervisor. The notified outbreak had to be previously unknown to health authorities, and had to have had a case with onset of rash in the previous six weeks. Furthermore, the diagnosis of smallpox had to be confirmed by laboratory investigation. In addition, a reward of 5 Somali Shillings was paid by regional epidemiologists or WHO advisers to surveillance agents or temporary searchers who detected a previously unknown chickenpox outbreak, provided correct programme documentation procedures had been followed and a specimen for laboratory testing collected. This incentive was suspended under certain epidemic conditions and in practice was paid only in the northern part of the country.

Programme workers did not delude themselves that a knowledge of the reward automatically implied that people would report smallpox if they saw it. Despite the intensive publicity, credibility about the large reward in smallpox-free regions, or in regions where there had been few outbreaks and hence few rewards paid, was inevitably low and consequently the reward was not necessarily a strong incentive. Among some nomadic groups there was even some suspicion about why the programme offered a reward for smallpox, especially when "there is not any in Somalia." These few negative aspects did not significantly hinder programme publicity.

##### Publicity Methods

Publicity of programme activities and of the reward for the reporting of cases was achieved by a variety of methods:

- Mass media publicity was organized by programme management through national radio (Mogadishu, Hargeisa) or newspapers and at regional level through regional propaganda networks.
- Posters and placards were widely distributed for pasting in public places, shops tea shops and restaurants, schools, health establishments, public offices.
- Megaphone announcements were made in urban areas, in markets, bus stops, road checkpoints and at other places where people gathered.



- Banners or signboards, painted in vivid colours were displayed along main roads in prominent places.
- During house-to-house searches the searchers informed inhabitants about programme activities and about the cash reward and indicated the place where suspected cases should be reported. Reward slogans were chalked on the walls of some houses.
- Rewards were paid in public with special ceremonies, often with large attendances.
- A special exhibition of reward posters and programme achievements was prepared during national and international fairs held in Mogadishu.
- The film "The Search" was projected free of charge in district towns and at fairs.
- Recognition cards, locality surveillance record cards and smallpox diagnostic folders were widely distributed among the public and officials.
- Smallpox workers were provided with special identification tags publicizing the 200 shillings reward; it was mandatory that they carried them during field work.

In general, the publicity campaign resulted in thousands of responses from the public and the cash reward became an important epidemiological tool for discovering many unknown foci of smallpox.

#### 5. Reinforcement of the Reporting System

A network of basic reporting units, regularly reporting to the regional level and through it to the Mogadishu headquarters was gradually established in the second half of 1977. By 1979, there were 14 reporting centres in Mogadishu capital and 69 district "Zeropox" offices covering the whole of Somalia. The efficiency of the weekly epidemic reporting was satisfactory in 1978, with an average of 60% of reporting units sending their reports every week in January, 72% in February, 88% in March and from then onwards 97-98% of reports were filed each month. In 1979, there has been no missing report at all. Further details on the reporting system are given in chapter 10.

## 8 PROGRAMME ASSESSMENT

Periodic assessment, as objective as possible, was essential to test the assumptions on which the smallpox eradication programme was based. Assessment activities were built in to programme planning to evaluate:

- to what extent the objectives of the programme were being achieved,
- how the programme should modify its plans, methods and deployment of resources in order to be more effective,
- public awareness of the programme activities,
- what and where were the population sectors or areas where the programme performance was substandard and needed strengthening.

To quantify assessments and facilitate analysis, simple criteria were derived at the beginning of the emergency drive and maintained throughout both the containment and surveillance phases of the programme. Regional epidemiologists, WHO advisers and headquarters staff were responsible for providing programme management with monthly assessments. District team leaders, who provided supervision of field activities, were also trained in assessment methodology but their findings were utilized at district level only and their conclusions are not included in results given below.

### 1. Assessment Methods

Search assessment measured the effectiveness of searchers in detecting suspected smallpox and other rash-with-fever cases as well as their success in disseminating information about the programme. During the emergency drive in the second half of 1977, the assessors, usually WHO advisers or regional epidemiologists, were advised to visit at least one remote locality in each zone assigned to each surveillance agent. The searchers were requested to re-search the whole problematic area (usually the whole zone) if the locality was found to be unsearched. They were advised to question 30-100 persons (older than six years of age) in each locality assessed, asking persons individually about the items listed below. The smallpox recognition card kept by the locality headman was to be checked and observations made on visual publicity seen. The assessors also inquired about and investigated cases of rash-with-fever and checked their findings against those of the searchers. Findings were noted on a special form (SOM 4) shown in Annex 14. Assessors were advised not to interview persons in groups but to try to select them individually and randomly throughout the locality. The character of the population was noted as one of three main categories: urban, rural settled or nomadic groups, the latter category including semi-nomadic and semi-settled groups.

At the end of each month, assessors sent a summary of assessment findings to Mogadishu HQ on form SOM 5 (Annex 15), including the following figures:

- the numbers of each assessed and numbers found searched for: villages, nomad camps, schools and markets.
- the total number of households interviewed and the number and percentage who:
  - had seen the searcher
  - had seen the recognition card
  - knew of the reward
  - knew where to report cases.

It was stressed, however, that the objective of assessment was not to provide "assessment percentages" but to revise and improve the programme, as suggested in the opening paragraph of this chapter.

In addition to the improvements made as a result of assessment findings, the performance of searchers was lifted by the knowledge that their work, even in the remotest areas, may be assessed directly by a locally well reputed physician or by an official of the Ministry of Health. It was realized in 1977 that thorough assessment rather than the hiring of more searchers was the solution for inadequate search coverage.

From mid-1978, WHO advisers and regional epidemiologists were requested to prepare advance assessment plans and schedules for their whole region. District team leaders were trained in assessment which they conducted in their own districts. The "current assessment" procedure was systematized and was composed of two parts:

- Assessment of randomly selected settled villages and nomad encampments, with the houses or huts also randomly selected. This type of assessment was carried out in the month during and the month following each active search which was expected to have covered all areas.
- Assessment of "high risk" or "problem" areas. This assessment included remote areas, border areas, areas with difficult accessibility, inadequately searched areas and inadequately staffed areas and was carried out during the inter-search periods when search activities were focused on these areas.

The WHO adviser and regional epidemiologists selected a method of random sampling suitable to their area, using one household (or the dwellers of one nomad hut) as the basic unit. Generally it was advised that 5% of permanent houses and the same number of nomadic huts should be visited and assessed by assessors in every district during each assessment round of 2-3 months. Assessors were asked to prepare sketch-maps showing areas they had recently assessed and findings were entered on office wall charts (figure 8.3). Assessment results were reported separately for the settled and nomadic populations.

Assessment carried out among nomads represented a challenge to every assessor and for a variety of reasons data gained were not always reliable.

## 2. Assessment Findings

As mentioned earlier, assessment was always viewed as an integral part of the programme, however, the pressure of containment work limited its scope for some months in 1977. The first results were reported in July 1977 when searchers' performance in 60 localities in Galgadud and Middle Shabelli Regions had been assessed. In August the assessment extended into a further seven regions, Galbeed, Gedo, both Jubas, Mudug, Lower Shabelli and Togdheer and altogether 280 localities were assessed in that month and 311 in September. Actually during the July-August period assessment started throughout the country but results were summarized and reported only from some regions, where epidemiologists were not so busy with outbreak-containment.

### Search Coverage

The reported results of this early assessment carried out in the second half of 1977 are summarized in Table 8.1.

TABLE 8.1  
SEARCH COVERAGE ASSESSMENT, SOMALIA, JULY-DECEMBER 1977

Month 1977	Total number of localities		
	Assessed	Found to be searched	
		Number	Percent
July	60	56	93.3
August	280	268	95.7
September	311	304	97.7
October	131	126	96.2
November	540	504	93.3
December	645	629	97.5

Along with search activities, the scope of assessment steadily increased from November 1977, as both national and international epidemiologists previously engaged in containment supervision were freed for assessment activities.

The extent of assessment carried out by epidemiologists and the overall thoroughness of the search operations in Somalia from July 1977 to June 1979 are shown in Table 8.2. On average about 1 700 localities, both settled villages and nomadic encampments, were assessed per quarter (15 to 25 localities per assessor per month). This independent check indicated that while the maximum coverage possible was not achieved the effort was nevertheless satisfactory.

Table 8.3 shows the assessment findings by region. In regions showing a below average coverage it was generally due to bad performance in several, not all, districts.

TABLE 8.2  
SEARCH COVERAGE ASSESSMENT BY QUARTER, SOMALIA 1977-1979

Year	Quarter	Total number of localities		
		Assessed	Found to be searched	
			Number	Percent
1977	Third	651	622	95.5
	Fourth	1 316	1 259	96.6
1978	First	1 670	1 543	92.4
	Second	1 754	1 551	88.4
	Third	2 998	2 836	94.6
	Fourth	1 607	1 513	94.1
1979	First	1 856	1 757	94.6
	Second	2 704	2 506	92.7

TABLE 8.3  
SEARCH COVERAGE ASSESSMENT BY REGION AND BY QUARTER - SOMALIA 1977-1979

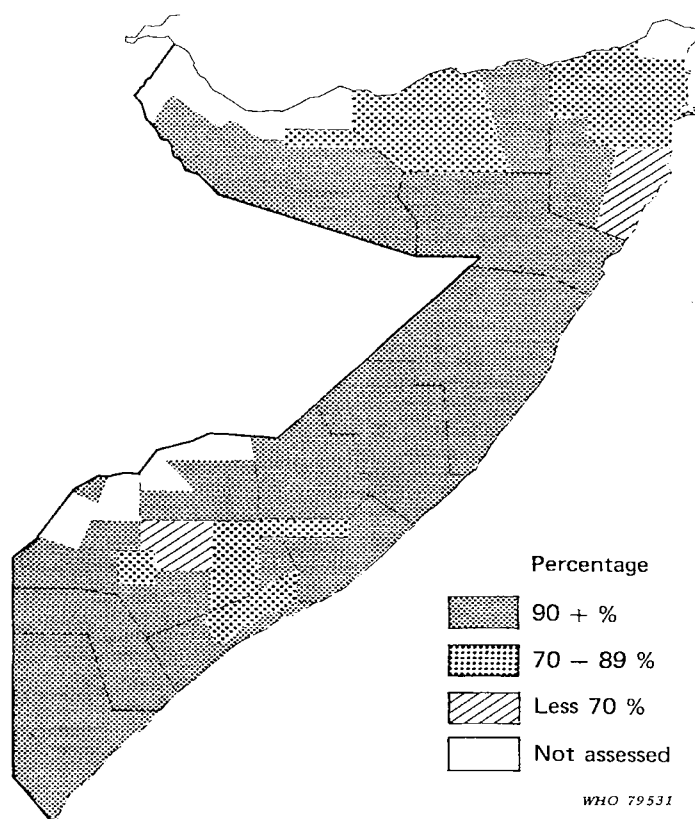
Regions	Average percentage of localities assessed and found to be searched							
	1977		1978				1979	
	Third quarter	Fourth quarter	First quarter	Second quarter	Third quarter	Fourth quarter	First quarter	Second quarter
Bakool	95	98	92	96	(100)	97	94	95
Bari	80	(100)	94	NR	87	62	90	82
Bay	96	91	82	95	94	89	93	100
W.Galbeed	88	(100)	75	NR	63	96	13	88
Galgadud	91	(100)	91	83	99	98	(98)	100
Gedo	(100)	96	91	100	86	100	91	91
Hiran	(100)	(100)	94	81	95	97	95	94
L.Juba	94	(100)	86	99	100	100	98	95
M.Juba	94	(100)	90	99	98	100	98	100
Mogadishu	NR	100	NR	100	100	100	99	100
Mudug	(100)	97	94	(100)	83	100	98	86
Nugal	NR	NR	(100)	96	98	95	(100)	100
Sanaag	NR	NR	(94)	82	95	42	77	89
L.Shabelli	(100)	94	94	95	96	99	94	99
M.Shabelli	97	92	94	100	100	100	100	96
Toghdeer	(100)	(100)	(100)	(100)	94	88	97	72
Somalia	95.5	95.6	92.4	88.4	94.6	94.1	94.6	92.7

NR = Not reported, ( ) = less than 50 localities assessed

District percentages were entered on maps and comparison with those of previous quarters allowed identification of districts where performance was consistently substandard. Coverage achieved by district, as assessed in the first quarter of 1979, is shown in figure 8.1.

When the percentages of settled localities and nomad encampments found searched were compared in any one district, the coverage of the latter was generally found to be lower.

FIG. 8. 1  
LOCALITIES FOUND TO BE SEARCHED  
NATIONAL ASSESSMENT - MARCH 1979



#### Public Awareness

The knowledge of the population about the SEP was evaluated in terms of four parameters, the proportions of persons or households questioned who (1) had seen the searcher during a recent search, (2) had seen the smallpox recognition card, (3) knew of the 200 Somali shilling reward and (4) knew where to report suspected smallpox cases.

At the height of the epidemic from July to September 1977 a total of 21 747 persons in all districts except Nugal and Sanaag were questioned about these items. The results of that first organized enquiry indicated that even at that early stage of the programme public awareness was high. Proportions for parameters (1) - (4) in the order listed above were 85%, 78%, 80% and 73% respectively. As expected, knowledge was greatest in those areas where the programme had been most active, that is, areas of high smallpox incidence.

The wide extent of assessment activities and the large numbers of persons contacted are shown in Table 8.4.

TABLE 8.4  
PERSONS OR HOUSEHOLDS INTERVIEWED AND DISTRICTS COVERED  
DURING ASSESSMENT, SOMALIA 1977-1979

Year	Quarter	Persons interviewed	Households interviewed	Districts assessed
1977	Third Fourth	21 747 49 168		<u>a</u> 48
1978	First Second Third Fourth	62 214 32 027 49 305	35 777	65 68 68 67
1979	First Second		21 825 25 215	69 69

a = 14 regions

From 1977 through to 1979 the public remained well informed about the SEP. For each zone or district assessment findings were classified as "good" (over 60% of households interviewed giving positive responses to questions) or "poor" (less than 40% giving positive responses). The percentage of districts falling into these two categories for each quarter of assessment are shown in figure 8.2.

Local assessment results indicated a lower awareness among the nomadic population and from the second half of 1978 separate reports were made for each of the two main population types (Table 8.5).

TABLE 8.5  
PUBLIC AWARENESS BY POPULATION TYPE, JULY 1978 - JUNE 1979

Year	Quarter	Population type	Total households interviewed	Percentage who had seen		Percentage who knew	
				Searcher	Recog. card	Reward	Where to report
1978	Third	Settled Nomadic	36 529 12 776 <u>a</u>	78 73	79 73	77 70	72 64
	Fourth	Settled Nomadic	26 967 8 810	80 76	80 69	79 78	74 68
1979	First	Settled Nomadic	15 000 7 000 <u>b</u>	79 67	79 68	81 68	74 60
	Second	Settled Nomadic	17 516 7 699	78 74	86 80	81 75	78 71

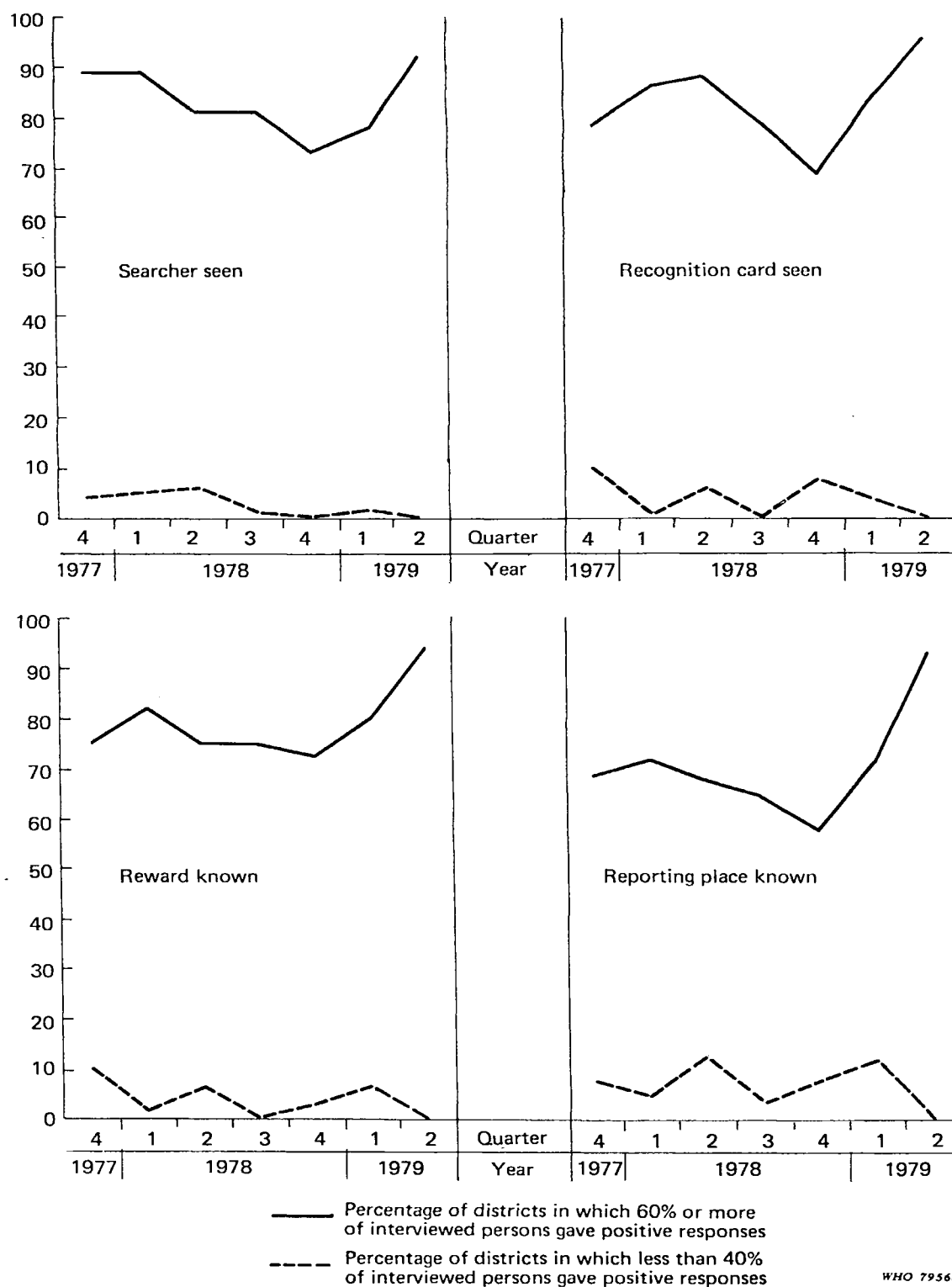
a Persons interviewed, not households.

b Approximate figures.

Thus, in 1979 a total of almost 33 000 households were interviewed, including the inhabitants of nearly 15 000 nomad huts (Table 8.5). As in late 1978 programme awareness was less among the nomadic population than amongst the settled inhabitants.

FIG. 8. 2

ASSESSMENT OF FOUR PARAMETERS OF PUBLIC AWARENESS  
SOMALIA 1977-1979





### Effectiveness of Publicity Methods

In order to establish the means by which the public most often became informed of programme activities a study of 4 688 households in 13 regions was carried out in late 1978. Inhabitants were asked how they came to know of the 200 Somali shilling reward.

There were, as expected, differences between the two main population types. Results are summarized in Table 8.6

TABLE 8.6  
RELATIVE IMPORTANCE OF DIFFERENT PUBLICITY METHODS

Percentage of persons learning of the reward from:	Settled population	Nomadic population
Searcher	63	55
Posters/Slogans	13	5
Meetings/Schools	2	2
Radio	1	0.5
Friends/Relatives	2	2
Health establishments	2	1
Unknown source	17	34.5

It was clear from this assessment that the information conveyed verbally by searchers and vaccinators was of paramount importance in educating the public about SEP activities.

### 3. Annual Independent Assessments

In an endeavour to ensure greater objectivity of assessment, teams were formed of physicians, senior supervisory personnel and WHO advisers who were independent of the regional staff in the areas of their assessment. Such teams conducted evaluations in October 1978 and March 1979.

#### October 1978 Independent Assessment

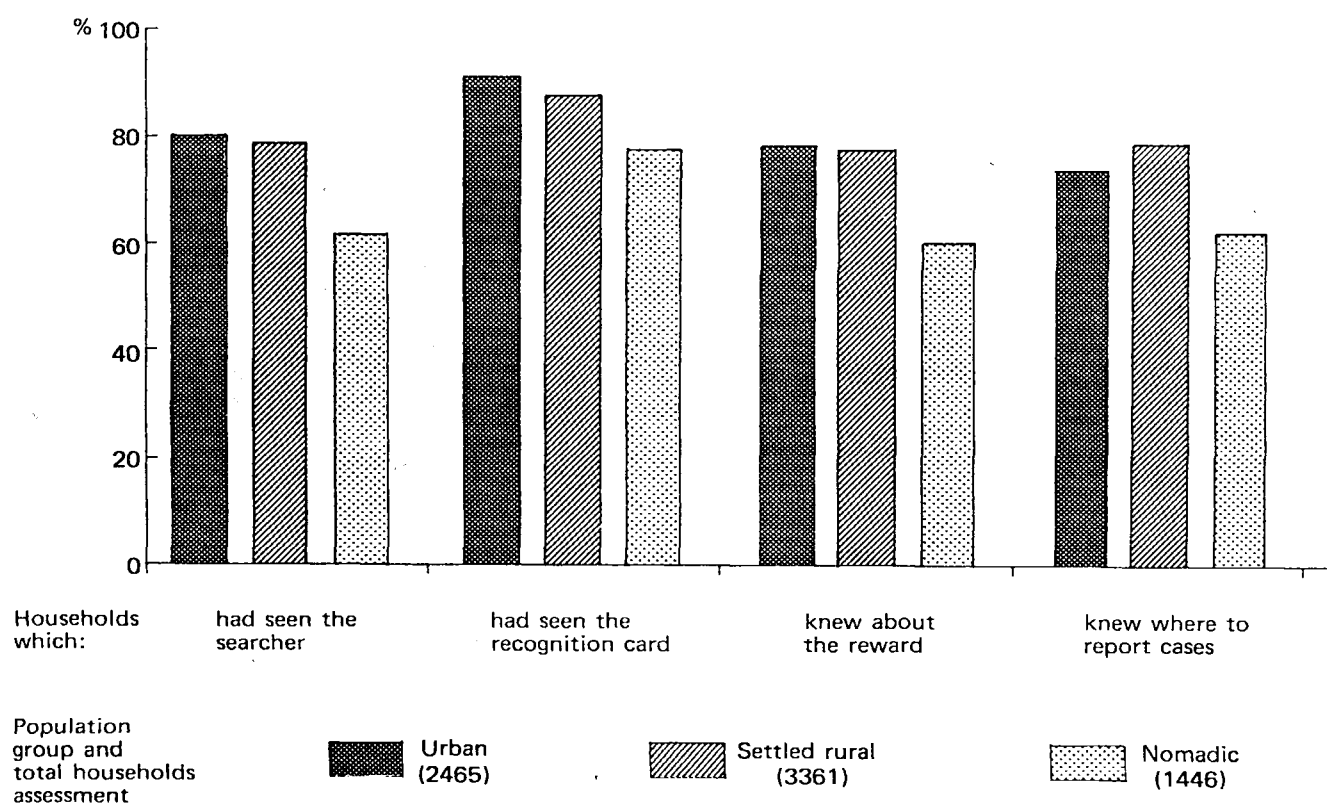
Senior personnel conducted an assessment among almost 7 300 households (1% of the estimated total in the country) in about 600 localities in 57 districts. The sample included 3 360 households of the settled rural population, 1 440 households of nomads and 2 460 urban households in Mogadishu, Hargeisa, Berbera, Baidoa, Kismayo and Merka.

All assessors worked in areas other than those for which they were normally responsible and the standard assessment technique was followed.

The results of this assessment are graphically displayed in figure 8.3. As had been previously found the nomadic population was less well informed than the rural settled or urban population. This reflected the greater difficulties of thorough surveillance among this group. The areas yielding the poorest overall assessment results were the nomadic population areas of Galgadud, Hiran, Mudug and Nugal regions. Some areas were found where search coverage and effectiveness had apparently been very poor. Surveillance was intensified in these areas.

FIG. 8. 3

PUBLIC AWARENESS OF PROGRAMME ACTIVITIES, BY POPULATION GROUP  
INDEPENDENT ASSESSMENT – OCTOBER 1978



March 1979 National Independent Assessment

In March 1979 an operation known as an "internal technical audit" of the SEP was executed and regional assessment commissions, as part of a national assessment commission, were created. The regional commissions were headed by the Regional Medical Officers and included the highest level government administrator in the region, as well as SEP supervisory staff as technical advisors.

The commissions were charged with confirming that there was no evidence of continuing smallpox transmission, evaluating whether the surveillance systems were sufficiently sensitive and determining the level of public knowledge of the programme. Areas of particular risk were emphasized and, in general, the nomadic population focused upon.

The extent and overall results of the assessment which was in fact an assessment of the January-February 1979 active search operation are shown in Table 8.7.

TABLE 8.7

RESULTS OF INDEPENDENT SEARCH ASSESSMENT, SOMALIA, MARCH 1979

Type of locality assessed	Number assessed	Found to be searched	
		Number	Percentage
Settled villages	421 <sup>a</sup>	407	97
Nomadic encampments	272 <sup>b</sup>	245	90
State schools	115 <sup>c</sup>	115	100
Market centres	58 <sup>c</sup>	55	95

<sup>a</sup> 4 462 households, or 11 per locality, were assessed.

<sup>b</sup> 1 643 huts, or 6 per encampment, were assessed.

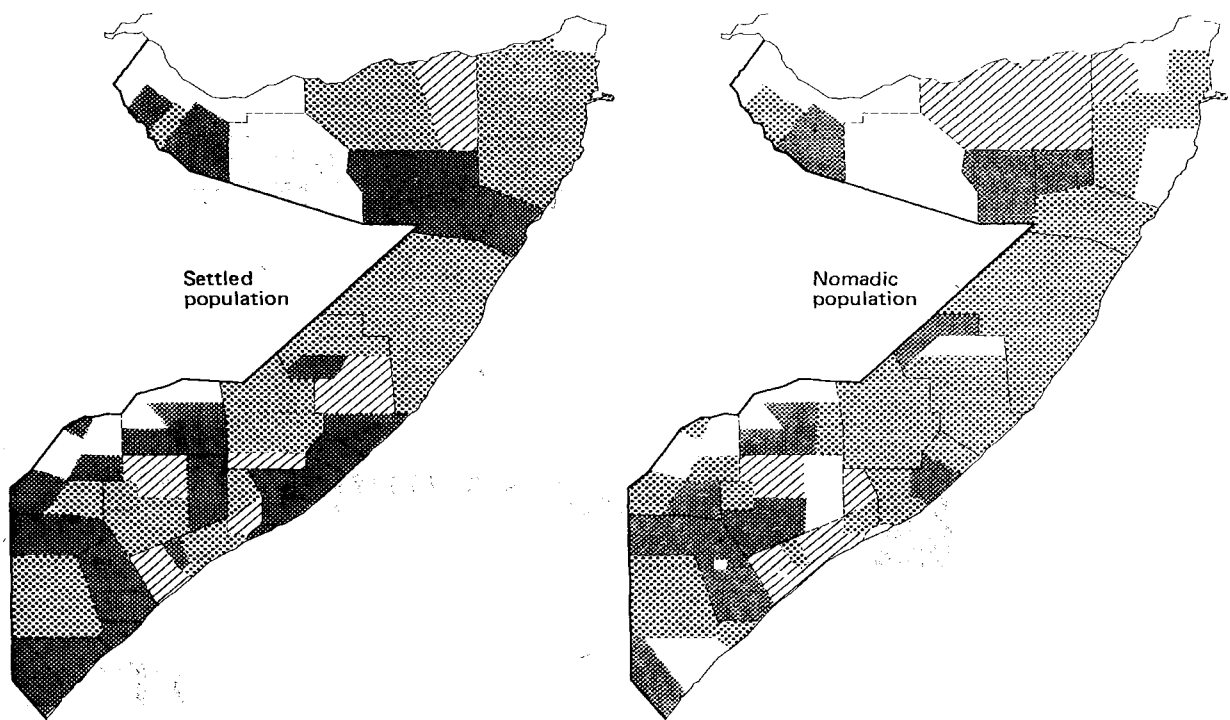
<sup>c</sup> Not all teams reported schools and markets assessed.

An overall comparison of the awareness of the programme in the two main population groups is given in Table 8.7. The generally impressive assessment findings are vividly shown in figure 8.4 which also indicates that, as expected, there was variation from district to district. Immediate remedial action was suggested in areas where findings suggested deficiencies in surveillance.

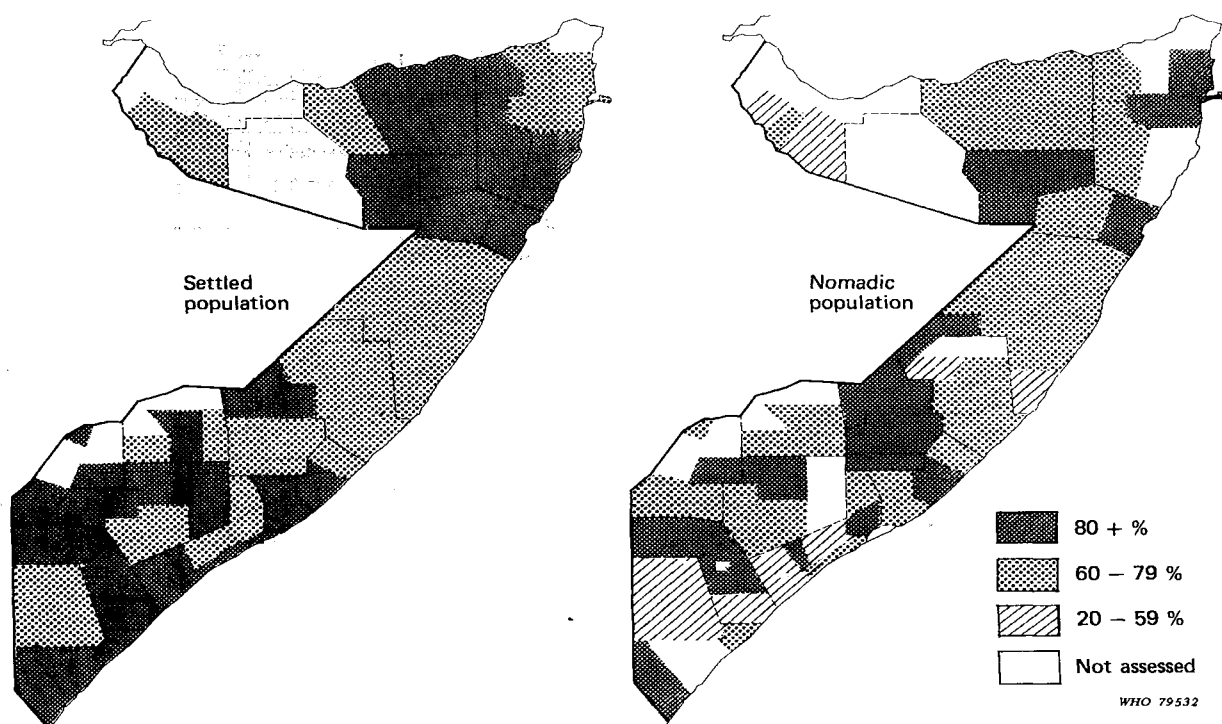
On evaluation of their findings, the National Assessment Commission reached the following conclusions:

- Public awareness of programme activities was fairly high, signifying that SEP workers had reached the population and conveyed their message. It was thought unlikely that smallpox transmission could continue undeclared amongst such a well informed population.
- Despite the tendency of the nomads to be elusive in responding to questions it was concluded that their knowledge of the programme was high and compared reasonably with that of the settled population.
- The percentages recorded as assessment results were of secondary importance to the remedial action taken for deficiencies identified.

FIG. 8. 4  
NATIONAL ASSESSMENT – MARCH 1979  
HOUSEHOLDS HAVING SEEN SEARCHER DURING LAST SEARCH



HOUSEHOLDS KNOWING ABOUT CASH REWARD



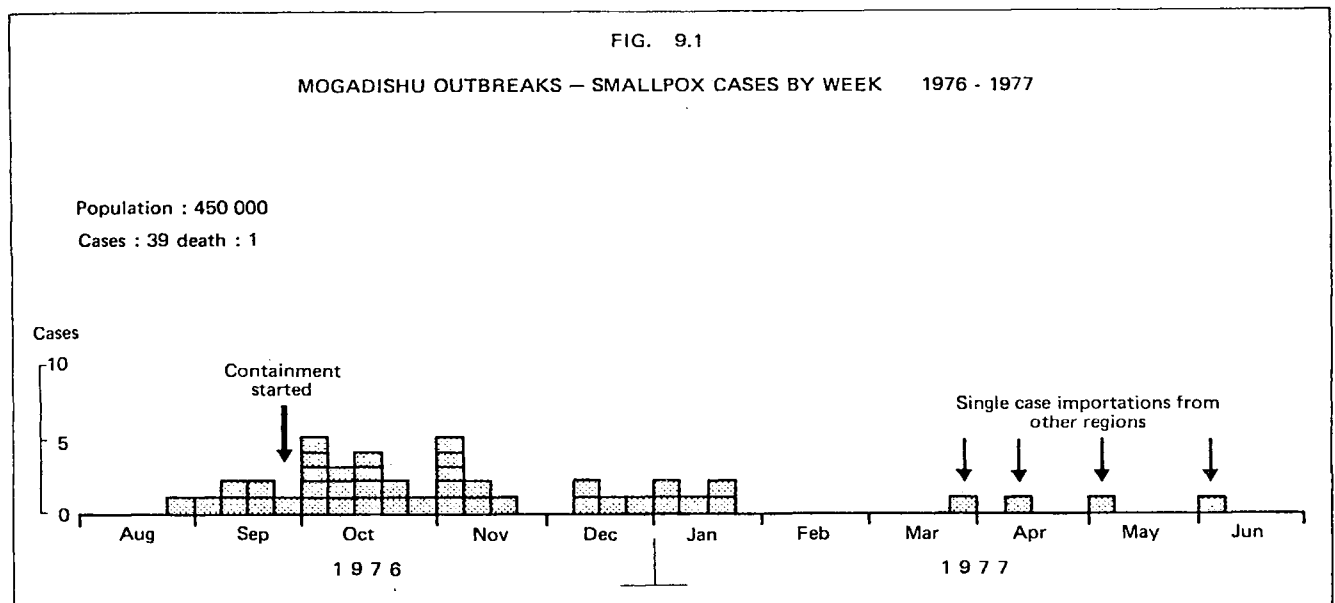


Example of poster used to publicize the 200 Somali Shillings reward for reporting a case of smallpox.

## 9 OUTBREAK CONTAINMENT

Prior to the 1977 smallpox epidemic in Somalia, and especially before the emergency drive, public health staff as well as smallpox project staff were unprepared to cope quickly and effectively with smallpox outbreaks. The resultant failure to achieve effective containment is reflected in the persistence of the August 1976 to January 1977 outbreak in Mogadishu (figure 9.1)

During the emergency drive, when resources, manpower and organizational efforts were maximized, starting in May 1977, top priority was given to thorough containment measures along with complete outbreak investigation.



### 1. Containment Methods and Organization

On detection of smallpox or suspected smallpox outbreaks the aim was to achieve effective containment as rapidly as possible. Close team work, night duty, continuous motivation of staff, particularly locally hired staff, and the cooperation of the affected population were essential to this process. In general a regional epidemiologist or team leader or a WHO adviser was personally responsible for the containment.

At the start of the emergency drive each containment team usually consisted of a supervisor, a surveillance agent, one or two vaccinators and two locally hired watchguards. Gradually the strength of the teams was increased and from September 1977 a typical containment team consisted of a team leader, two to four surveillance agents, four to eight vaccinators, two to four watchguards and one or two "motivators". In urban areas the number of workers was often several times larger. It was compulsory for the containment teams to stay in the affected locality as many nights as were needed for containment vaccination to be completed. Working hours were arranged so that work was done mainly in the early morning, late afternoon and at night when a greater proportion of the population was at home.

In low-incidence areas as well as in smallpox-free areas (areas subject only to importation) every outbreak of smallpox or suspected smallpox was treated as a public health emergency. Containment measures were promptly instituted by containment teams headed by a regional epidemiologist, regional team leader or WHO adviser.

In high-incidence areas, especially in those districts harbouring many active smallpox foci, containment work differed substantially. Such districts were divided into "operational areas" so that no such area contained more than 30-35 outbreaks. An epidemiologist, national or international, was provided to each operational area. The operational areas were further subdivided into "team areas" containing no more than 10-15 outbreaks or covering an area small enough to be traversed in one day on foot. In district offices sketch maps were posted showing operational and team areas with outbreaks: newly detected, under containment or being followed up. Weekly review sessions were held with containment teams and area responsibilities redistributed according to the development of the epidemic. Initial attempts to provide a radio link between affected regions and Mogadishu headquarters to expedite field support were later abandoned.

Annex 17 shows the instructions for containment activities developed during May-June 1977 when the recently hired, inexperienced staff began to receive their first field experience in smallpox outbreak containment. Containment activities were progressively and substantially improved and consisted of the following components.

#### Case Finding

On arrival at the affected locality the team leader met the locality leader and other respected persons, sought their cooperation and obtained information about the number and location of households with rash-with-fever cases in the locality and immediate surrounding area. Meanwhile surveillance agents and vaccinators made a rapid but careful house-to-house search showing recognition cards and asking for rash-with-fever cases. All such cases discovered were carefully listed and the team leader then visited all listed households and verified the diagnoses.

#### Numbering of Houses and Enumeration of Population

When a case of smallpox or suspected smallpox was detected the population of the affected locality (village, hamlet, nomad encampment, urban sector) was enumerated before containment vaccination was started. Meanwhile the team leader evaluated the situation and quickly planned containment. A sketch of the affected locality always facilitated the organization of work and areas of responsibilities of each team member. Usually the surveillance agent who knew the locality handled the numbering of the houses. Numbers were painted on a visible part of the house close to the door or if this was not possible numbers were drawn on recognition cards which were fixed on the doors. Containment forms or plain exercise books were used for enumeration of all residents in each house, including absentees and visitors. House number, names of occupants and their ages, and subsequently dates of vaccination, dates of observed take and remarks were recorded (Annex 18 ).

### Containment Vaccination

When enumeration of the entire population of the affected area was completed all persons living in the locality were vaccinated regardless of previous vaccination status, health status (excluding seriously ill persons), nutritional status or age. Over enthusiastic vaccinators were repeatedly instructed to avoid approaches which frightened children or the elderly. Patient but persistent efforts with the assistance of local leaders and the team "motivators" always proved more effective than the use of force or police assistance. In smaller villages and nomad encampments vaccination was usually achieved within a few hours. In vaccinating larger villages or urban sectors the following priorities were established:

- i. all members of the affected house(s),
- ii. all other known face-to-face contacts,
- iii. all residents of the affected locality,
- iv. persons living in the nearby area up to 1-5 km radius or further if living along main roads leading to the affected locality, and
- v. households of relatives of cases regardless of contact history.

Usually residents and visitors in each large village were vaccinated within 24 hours following outbreak detection. As daytime absenteeism was usually high (50-75%), evening and early morning vaccination was always required. Absenteeism of residents during early containment was often as high as 20%. For this reason an "outbreak vaccinator" remained in the affected locality for three weeks after the onset of the rash of the last smallpox case. He recorded and vaccinated all residents who might have been missed when the containment team worked in the locality, all temporary absentees returning to the locality, and all visitors and newcomers to the affected locality.

A "blind containment" procedure was sometimes used in very remote areas when an outbreak was discovered by a single searcher, usually in a small nomad encampment where there was a fear that the affected group might move on before the outbreak had been notified to a supervisor. The searcher who was equipped with vaccine was asked to isolate cases, engage watchguards and himself vaccinate all persons in the encampment before leaving to report the outbreak. This approach proved to be rather successful in this difficult situation. Blind containment was also utilized early in the programme when outbreaks were being found faster than containment staff could be hired, trained and deployed to the areas.

### Patient Isolation

Clearly the aim was to isolate all patients to the maximum extent possible and without delay. In Somalia, isolation of smallpox cases had traditionally been in isolation camps, developed by public health staff and local authorities near district centres. This method provided better supervision and tighter isolation but in general proved to have certain inherent disadvantages. Families concealed smallpox cases for fear of their being taken to an isolation camp. A second negative factor was that the focus of attention of containment staff was shifted from the affected area to the isolation camp to the detriment of village or encampment containment and the search for additional cases suffered. Furthermore transfer of patients was often delayed and time consuming and further susceptibles were exposed to the disease. Logistics and distances made camp isolation feasible only for urban areas or densely inhabited areas with widespread transmission.

Home isolation of cases as initially planned also proved ineffective in many instances. Small houses or nomadic huts with many family members and frequent visitors were in no way satisfactory for adequate isolation.



To meet the programme objectives of acceptable isolation without excessive inconvenience to family life, a separate "isolation unit" was developed in each affected locality. This was used for one or more hamlets or nomad encampments within walking distance. Such a unit consisted of a central structure (temporary shelter, hut or tent) to house the patients, a kitchen and a latrine area. Surrounding this unit was a thick protective traditional thorn barrier ("haro"). Patients were usually provided with water, adequate food and cooking facilities. The payment of five shillings per day per patient for each day spent in isolation made isolation acceptable to most patients. In many nomad areas patients were provided with new clothes when released from isolation, a strong incentive to remain in isolation for the full duration of their infectivity. The proximity of the isolation unit to the affected area offered further advantages in that it provided for immediate isolation of new cases at the time of their detection. In dense urban areas, a special isolation ward, usually located on the outskirts of the town, was preferred to home isolation. All cases admitted to the isolation unit, including apparently obvious smallpox cases, were vaccinated on entry to prevent the needless infection of misdiagnosed cases. All isolation guards and their family members were also vaccinated. Several omissions to this rule led to further spreading of the disease. Supervision of isolation day and night by a resident supervisor or regional supervisor was essential.

Smallpox patients remained isolated until all scabs had fallen. Face-to-face contacts of patients, in addition to being vaccinated, were placed under daily surveillance. If these persons developed fever between 7 and 17 days after the first exposure, they were placed in the isolation unit until it was determined whether or not the fever represented the early stages of smallpox.

Isolation did not present the problems which had been expected and feared. Even travelling nomadic groups, following explanation, cooperated and willingly settled in a nearby area with water and grass. Alternatively, they left their smallpox patients in an isolation unit with a family member to take care of them if the groups were obliged to move on for water and grazing for their animals. Assignment of a group of vaccinators to the moving group provided continuous surveillance over this "travelling potential focus". Programme containment records often show the transfer of an outbreak from one district to another as a group under surveillance crossed district boundaries.

#### Isolation Guards

Two isolation guards were placed at every affected house, if home isolation was used, or at isolation units. One was on duty during the day and the other during the night, this round-the-clock system being maintained throughout the isolation period. The isolation guards were responsible for:

- keeping the patient isolated from all other persons and preventing his movement;
- restricting entry of visitors to the affected household or isolation unit;
- carrying food, water and fire into the isolation unit; and
- vaccinating new smallpox patients or suspected cases on admission to the unit.

Later in the programme a simple log-book of the guard's activities and a list of patients was maintained in each isolation unit. Isolation guards had to be frequently supervised and their performance regularly assessed.

#### Disinfection

Disinfection depended on the facilities available. In nomad areas clothes, bedding and other articles were usually exposed to direct sunlight for several hours. As mentioned, some patients received new clothes, in which case the old ones were destroyed. In settled or urban areas as well as in hospitals, the floors, furniture and hard surfaces were thoroughly washed with soap and water. Clothes, bedding and other laundry were boiled. Rooms and non-washable articles were usually exposed to direct sunlight.

### Daily Supervision

The daily follow-up by the "outbreak" vaccinator or resident supervisor was organized with the aim of searching each house or hut in the affected locality for new rash or fever cases and identifying and vaccinating returning absentees and newcomers.

The results of vaccination were carefully checked by an experienced supervisor after about five days and persons without a major reaction revaccinated, repeatedly if necessary.

### Special Searches and Extension of Vaccination Coverage in Surrounding Areas

At the time containment was started in the affected area, a house by house or hut by hut search for rash-with-fever cases was organized and implemented within a 10 km radius of the affected locality. This search was repeated after two weeks to detect cases which might have been in the incubation period during the first search. Another search of the whole area was carried out six weeks after the onset of rash of the last smallpox case in the outbreak. Only after completion of containment vaccination in the affected locality itself and after the initial search within the 10 km radius was started, were vaccination activities extended to the larger area.

### Outbreak Follow-up

Throughout Somalia all smallpox outbreaks were considered "pending" until six weeks had elapsed since the onset of the outbreak's last case. The regional epidemiologist and WHO adviser accompanied by local staff usually visited the affected locality twice per week for the first four weeks and once per week in the fifth and final weeks. The objectives of their visits were to verify the diagnosis of all new fever cases with skin eruptions, to assess the effectiveness of containment vaccination and "take" rate, to assess the work of isolation guards, to check the security of isolation patients and to release those without scabs. An outbreak follow-up sheet was used to record their findings (figure 9.2). They also assessed the performance of vaccinators in neighbouring areas. WHO advisers themselves usually conducted a house-to-house search in the affected locality and in adjacent areas of high risk.

A search of the whole area (10 km radius) and, in low incidence or smallpox free areas, the whole district, was organized as a basic condition before proclaiming the area smallpox-free, six weeks after the onset of rash of the last case. All cases with fever and rash found during this search were verified personally by regional epidemiologists or WHO advisers.

After August 1977 each newly detected smallpox outbreak was visited and assessed by a programme management officer from Mogadishu or by a visiting officer from WHO headquarters, Geneva.

### Determining the Source of Infection

The first case ("index case") in each outbreak was carefully determined by questioning patients, their families and neighbours. Frequently, the first person affected was fully aware of where and from whom he had contracted smallpox but patience and interviewing skill was necessary to gain his full trust before he disclosed the pertinent information. Epidemiologists were advised to sit with the patient, drink tea with the head of the affected family and when friendly contact had been established to enquire as follows:

- had any ill person, relative, friend, guest or traveller visited the home two or three weeks prior to the onset of rash of the first case?
- had the first case visited other villages or areas two to three weeks prior to the onset of his rash; and, specifically, had he seen a smallpox case?
- were there any fever or rash cases among relatives or friends in the same locality or adjacent areas?

**FIG. 9.2**

# OUTBREAK FOLLOW-UP AND SUMMARY SHEET

[illegible]

It was recommended that a detailed day-by-day calendar of past activities, travel and contacts with suspected cases be reconstructed over the course of repeated interviews. Usually two or three visits and interviews were necessary to get accurate information. A list was compiled of all possible contacts, especially face-to-face contacts, and included information facilitating the tracing of such persons.

#### Further Epidemiological Investigations

Early in 1977, determination of the source of infection of outbreaks as well as tracing of contacts was inadequate. The situation was complicated by the persistence of a number of outbreaks, undetected and unreported, for many months. Furthermore, investigation of past outbreaks cost time and transport facilities, both vitally needed at that time for the implementation of containment and surveillance at active outbreaks. Priority was inevitably given to case detection and containment vaccination and only a rudimentary investigation of the source was made. Programme management advised epidemiologists to limit their investigations and in the majority of instances only cases occurring since January 1977 were recorded. As a consequence the extent of the smallpox problem in some districts of high smallpox incidence was not immediately recognized as only active or recent cases were recorded and subsequently reported to Mogadishu headquarters. Later in the programme more time could be devoted to source tracing and records became more detailed.

#### Confirmation of the Source of Infection and Cross-notification

The source of infection was immediately investigated if it was in the same district, however, if the source was outside the area of the outbreak investigation, a cross-notification was sent. Cross-notification to another district in the same region was sent by special messenger, cross-notification to another region was transmitted by immediate telephone call or telegram through the Mogadishu "Zeropox" office.

Many times the possible source of infection or suspected area were ill-defined and screening of an extensive area was necessary. Investigation was further complicated by the fact that several areas within the same district or even within the same zone might have similar names.

#### Tracing of Contacts

Household contacts, such as visitors, friends or relatives, who might have left the affected village or nomad encampment before containment started, were listed and an attempt to trace them was made by the leader of the containment team. This was often true of camel herders among nomadic groups. Priority was given to face-to-face contacts. When outbreak vaccinators or isolation guards supplied information about face-to-face contacts moving from the affected locality to other areas, the leader of the containment team forwarded this information by special messenger to the regional epidemiologist for transmission to the region and district concerned.

It is notable that only a few new outbreaks were detected by this method of investigation and cross-notification probably due more to poor communications than to inaccurate information.

#### Reporting and Documentation of Outbreak Investigations

When epidemiological investigation of newly detected outbreaks was completed, the investigating officer documented the results on two simple forms:

Outbreak summary sheet: This sheet contained a line-listing of outbreaks with basic data for identification of the affected localities, the estimated populations, the number of cases and deaths, the date of onset of rash of the first and last cases, the presumed source of infection and remarks about its confirmation and, finally,

the weeks when follow-up was finished and each outbreak declared closed. Annex shows an example of this form, kept at both regional and central levels.

Outbreak information sheet: Basic data about the outbreak and affected households was recorded and a line-listing of smallpox patients. For each case details included name, sex, age, previous vaccination history, date of onset of rash, date detected, place of isolation and whether a specimen for laboratory investigation was taken. Annex shows an example of this form.

Usually completed copies of both forms were handed to the "Zeropox" office, Mogadishu, at each monthly review meeting. Originals kept in the regional offices were continually updated and corrected as the investigation progressed.

From October 1977 onwards more detailed reports of all outbreak investigations were required as is described in chapter 10.

### 3. Evaluation of Containment Activities

#### Number of Outbreaks Contained

For the implementation and documentation of the smallpox eradication programme an outbreak was defined as one or more smallpox cases, epidemiologically related and occurring in a clearly limited area such as a settled village, nomad encampment, nomadic group during their travel, or urban sector.

The number of outbreaks contained weekly in 1977 in comparison with those newly detected is shown in figure 9.3 and Table 9.1 shows the monthly totals. In July a maximum of over 330 smallpox outbreaks were contained in a single month. It appears that containment ability developed more slowly than the case finding component and although intensified field activities started in March, it was not until the second half of May that the first outbreaks had been contained and subsequent follow-up completed. The majority (about 90%) of smallpox outbreaks detected during 1977, including some having continued unreported from the previous year, were contained during three crucial months: June, July and August. It was in week 29 in July that for the first time the number of contained outbreaks (121) exceeded those newly detected (45). From this turning point the general epidemic situation started to improve.

Altogether 947 smallpox outbreaks were reported from March to November 1977, however, the recorded number of contained outbreaks is a little higher. This discrepancy was caused by the movement from one administrative region to another, or the divisions, of smallpox affected nomadic groups resulting in more than one containment being recorded for essentially the same outbreak. Such situations were followed up and finally the two containments closed separately. The last six outbreaks occurring in the country were contained in October and early November but careful follow-up continued for a further two months before the country was considered smallpox-free at the end of 1977.

The scope of containment activities depended on the number of smallpox foci to be contained at any one time and on the size of the affected population. It was influenced by local habits and the level of acceptance of the population concerned. In low incidence areas usually only a few foci had to be contained per district per month, while in the centre of the epidemic (Bay and Bakool Regions) heroic efforts by the local staff were needed to cope with about 60 foci per district in peak months. The extent of the epidemic is illustrated in figure 9.4, showing the approximate geographic distribution of smallpox outbreaks in the most heavily affected area, Bay Region, in 1977. Such heavily affected areas could only be adequately managed by dividing the territory into "operational areas" and "team areas" as described earlier in this chapter.

**TABLE 9.1**  
SMALLPOX OUTBREAKS CONTAINED BY MONTH IN COMPARISON WITH THOSE NEWLY REPORTED  
SOMALIA, MARCH-DECEMBER 1977

Month	Smallpox outbreaks	
	Newly reported	Contained
March	3	0
April	60	0
May	175	19
June	416	227
July	214	336
August	55	285
September	17	58
October	6	23
November	1	7
December	0	6

FIG. 9.3

SMALLPOX OUTBREAKS CONTAINED BY WEEK IN COMPARISON WITH THOSE NEWLY DETECTED  
SOMALIA MARCH - DECEMBER 1977

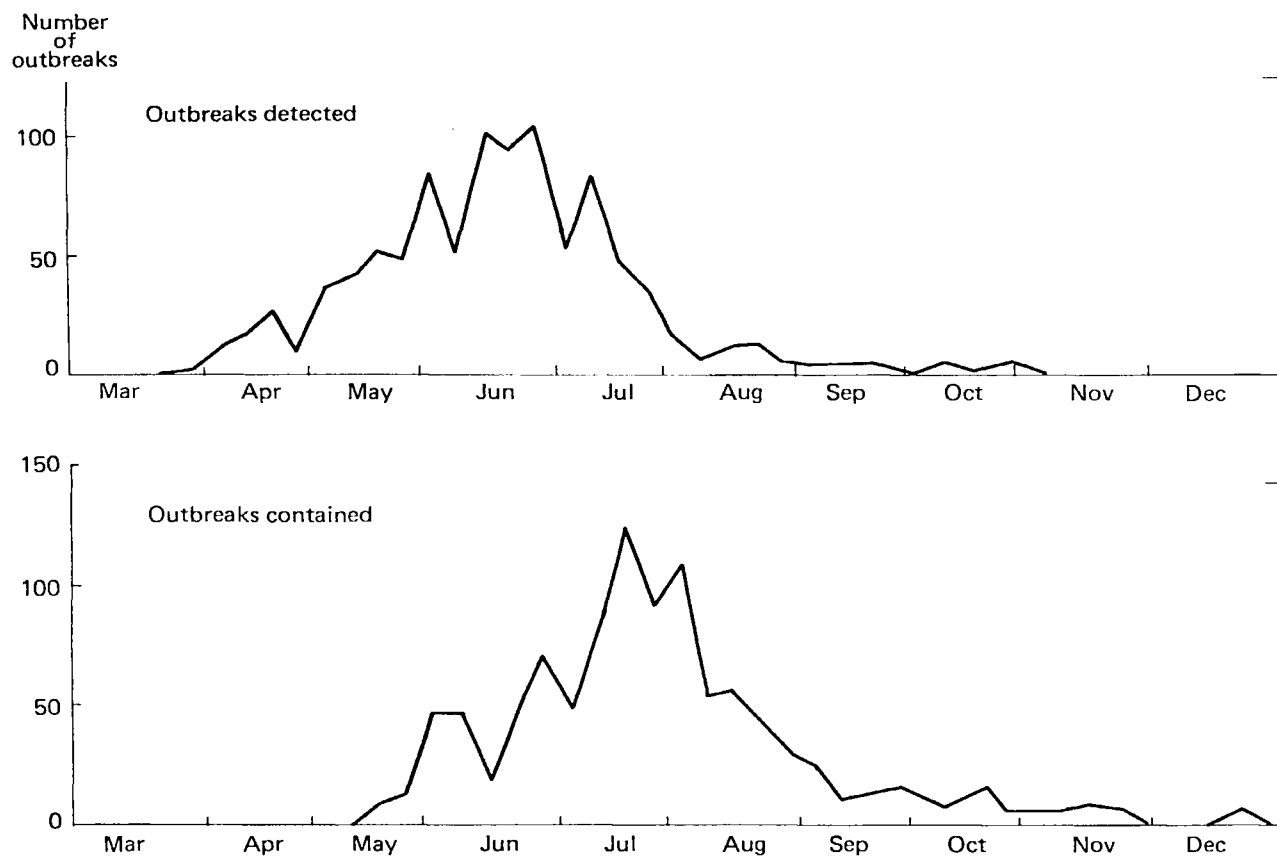
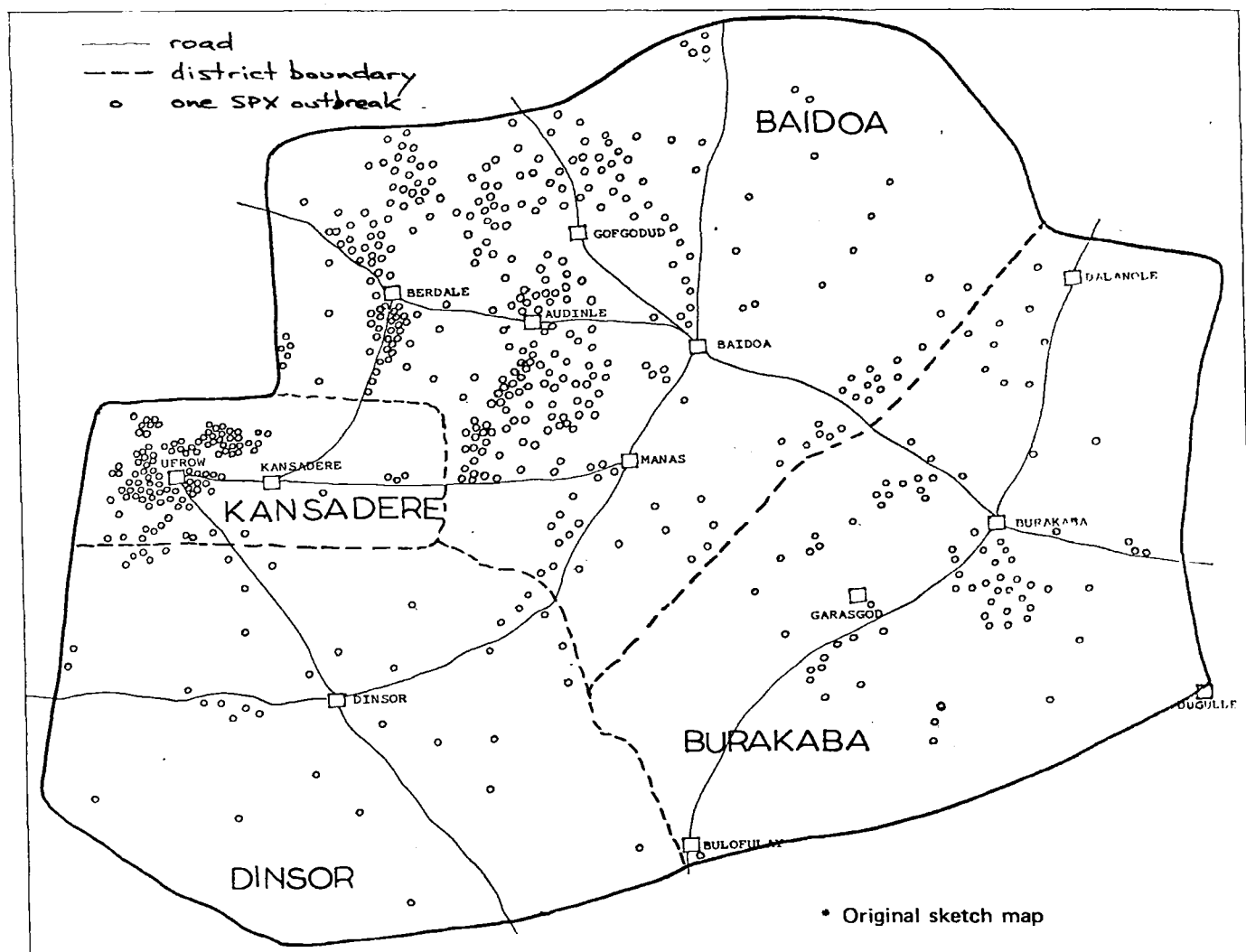


FIG. 9.4  
LOCATION OF SMALLPOX OUTBREAKS  
BAY REGION, 1977\*



It is worth noting that as the centre of the epidemic lay in the inter-riverine area of southern Somalia (figures 3.1 and 4.10), three factors considerably facilitated containment of the epidemic as a whole. Firstly, the rivers provided a natural barrier to population movement. Secondly, the people of this area are predominantly of common and local origin and do not generally travel far outside to visit relatives. Thirdly, population movement, particularly into the Ogaden area, was limited by civil disturbances at the time.

#### Effectiveness of Surveillance and Containment

During the intensified drive against smallpox in Somalia, simple indicators were used in the field and at the operational headquarters in Mogadishu to measure the effectiveness of surveillance and containment activities that were carried out in the country during the 1977 epidemic.

Clearly defined and realistic targets and appropriate quantifiable indicators were established and their use to measure programme performance proved to have an important impact on the whole operation. The indices were used as follows.

Time interval between the onset of the first case and the discovery of the outbreak (surveillance index)

The time interval between the occurrence of the first case in a focus and the date of its discovery reflects the effectiveness of surveillance. Information on this time interval is available for 935 smallpox outbreaks that occurred in all 11 infected regions after January 1977 (Table 9.2).

TABLE 9.2

TIME INTERVAL BETWEEN THE ONSET OF THE FIRST CASE IN AN OUTBREAK  
AND THE DATE OF DISCOVERY OF THE OUTBREAK (SURVEILLANCE INDEX)

Month of onset of outbreak	Total No. of out-breaks*	Time interval - outbreak detected in:									
		Week 1		Week 2		Weeks 3-4		Weeks 5-8		After 8 weeks	
		No.	%	No.	%	No.	%	No.	%	No.	%
March**	91	2	2.1	7	7.6	9	9.9	28	30.7	45	49.5
April	132	18	13.6	18	13.6	46	34.8	45	34.1	5	3.9
May	273	82	30.0	63	23.1	85	31.1	38	13.9	5	1.8
June	271	134	49.4	60	22.1	70	25.8	4	1.5	3	1.1
July	124	79	63.7	19	15.3	19	15.3	7	5.7	0	-
August	34	17	50.0	5	14.7	6	17.6	5	14.7	1	2.2
September	6	1	16.7	3	50.0	1	16.7	1	16.7	0	-
October	4	3	75.0	1	25.0	0	-	0	-	0	-

\* On which data available

\*\* And before

At the beginning of the intensified drive in April 1977, only 13% of outbreaks were detected within the first week after the onset of the first case, about 62% were detected within the first month, 34% during the second month and about 4% in the third month, or later. A substantial improvement in surveillance, starting in the second half of May, reduced the delay in outbreak detection and in June about 50% of outbreaks were discovered in the first week and about 97% in the first month; only 2.6% remained undiscovered until the second month or later. A further substantial improvement in the speed of outbreak discovery was recorded in July, when about 64% of outbreaks were discovered within the first week. During the period August-October, when smallpox transmission had been substantially reduced by effective containment activities, the search activities, in spite of the rainy season, detected a further 44 outbreaks, mainly in remote areas, however, some of them had been continuing for more than five weeks.

In May about 10%, and in June, 21% of outbreaks were detected during the first three days after the onset of the first case in the outbreak. This percentage rose to 37% in July and finally reached 47% in August. Of the total 935 outbreaks analysed, 16% were detected during the first three days after the onset of the first case in the outbreak, 36% within the first week. Approximately 80% were detected within the first month, about 14% during the second month and, finally, 6.3% in the third month and later. Of these 6.3%, 4.8% were outbreaks which developed in March 1977 or earlier, and were clearly a setback to the operation.

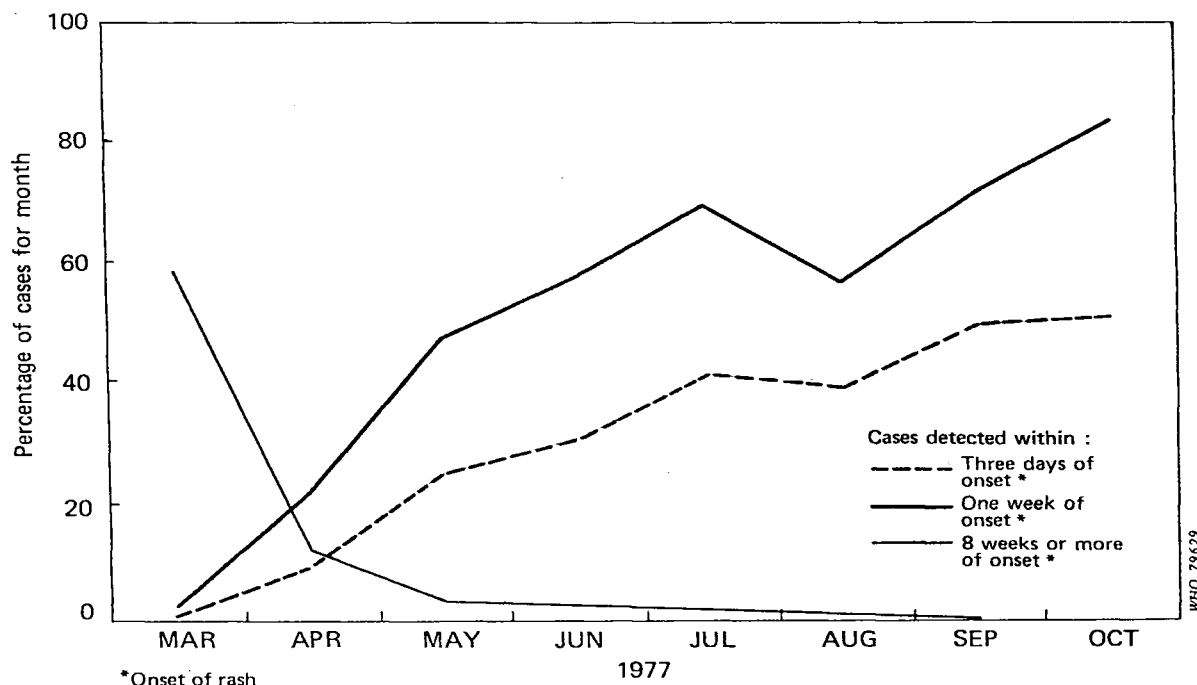


The target for surveillance activities, to detect at least 70% of all outbreaks within 14 days after onset of the first case, was reached in June and was maintained thereafter. From field observations, it is clear that if outbreaks are detected within 14 days and contained, further transmission and development of "satellite" outbreaks is minimal.

When records were analysed in terms of cases (data were available on 3161) a similar pattern as seen for outbreaks (figure 9.5) was observed. From April to May the proportion of cases detected within one week of the onset of their smallpox increased from 22% to 47%. By October this proportion had reached 83%.

FIG. 9.5

PERCENTAGES OF SMALLPOX CASES BY DELAY IN DETECTION  
BY MONTH MARCH – OCTOBER 1977



Time interval between the discovery of an outbreak and its being reported (reporting index)

This reflects the rapidity with which an outbreak is reported to the level that provides technical assistance for containment activities and epidemiological investigation. In Somalia, this assistance provided by national and international epidemiologists and their special containment teams, was available at regional level in low-incidence areas and at district level in highly affected ones. In the majority of cases, the date of outbreak detection and the date of its being reported was the same.

Pertinent data about this interval is available for 416 outbreaks that occurred from April to July 1977. This data indicates that 71% of outbreaks were reported to the epidemiologist or smallpox control room on the day of detection, another 23.4% were reported within the first three days and the remaining 5.6%, mainly those discovered in the bush areas among nomads, were reported with a delay of three days and more. Delays of one week or more in reporting occurred only exceptionally and usually as a result of misdiagnosis.

Time interval between the discovery of an outbreak and the commencement of containment vaccination at that outbreak

The rapidity with which smallpox outbreaks could be effectively covered by containment vaccination depended greatly on the organizational ability of the field staff.

Throughout the affected regions of Somalia, there was a relatively rapid response following the detection of a new smallpox outbreak. In the majority of outbreaks containment activities were initiated by local staff without substantial delay.

The delay in commencement of containment was analysed for 694 outbreaks that were discovered from April to October 1977 and for which exact dates were reported (Table 9.3).

It is apparent that containment activities started in the majority of the outbreaks (88%) within the first three days after detection. Figure 9.6 shows a gradually increasing percentage of outbreaks in which containment started on the same day as detection. On average, commencement of containment was delayed more than three days after detection in only about 6% of outbreaks.

According to operational guidelines, all surrounding villages and nomad camps within a 10 km radius of an affected locality were searched and their populations vaccinated. In fact, about 6% of new foci developed in localities where vaccination had been completed just before the discovery of a new case. In most cases, this was an already infected contact vaccinated during the incubation period.

FIG. 9.6  
PERCENTAGE OF OUTBREAKS WHERE CONTAINMENT STARTED  
ON THE SAME DAY AS DISCOVERY  
BY MONTH, APRIL-OCTOBER 1977

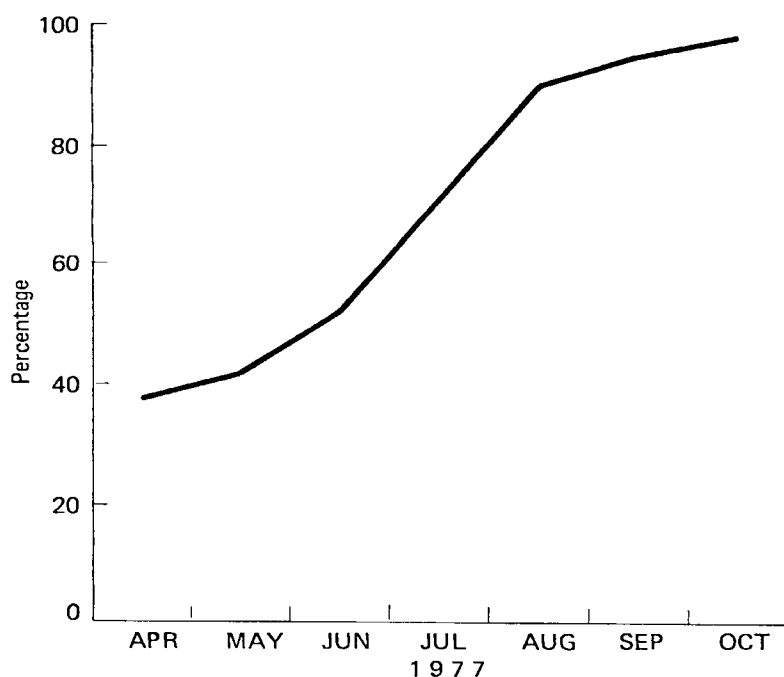


TABLE 9.3

TIME INTERVAL BETWEEN OUTBREAK DISCOVERY AND COMMENCEMENT OF CONTAINMENT VACCINATION

Month of outbreak discovery	Total No. of out-breaks*	Time interval - containment started							
		Same day		2-3 days		After 3 days		Before discovery	
		No.	%	No.	%	No.	%	No.	%
April	44	17	38.6	17	38.6	8	18.2	2	4.5
May	206	85	41.3	87	42.3	18	8.7	16	7.8
June	235	122	51.6	85	36.2	10	4.3	18	7.7
July	147	105	71.4	33	22.4	6	4.0	3	2.0
August	39	35	89.7	3	7.7	0	-	1	2.6
September	16	15	93.7	0	-	0	-	1	6.3
October	7	7	-	0	-	0	-	0	-

\*On which data available

Time interval between starting containment and the onset of the last case in an outbreak (containment index)

It was stated as an objective that no further case should occur in any outbreak more than 20 days after containment had started (i.e., three days containment and maximum 17 days incubation period). At the beginning of intensified activities, each outbreak in which cases occurred after 20 days was notified to the Mogadishu headquarters and an experienced epidemiologist visited the outbreak to determine why the containment had not been effective. Usually the newly occurring cases were unprotected children, hidden at the time of vaccination, or unvaccinated newcomers. From July 1977 a new target was set: to interrupt transmission within 15 days of outbreak detection.

The time interval between starting containment activities and the date of onset of the last case for 945 of the outbreaks which occurred in Somalia during 1977 is shown in Table 9.4.

TABLE 9.4

TIME INTERVAL BETWEEN STARTING CONTAINMENT VACCINATION  
AND DATE OF ONSET OF LAST CASE IN AN OUTBREAK

Month when containment started	Total No. of out-breaks*	Time interval					
		14 days or less		15-20 days		21 days or more	
		No.	%	No.	%	No.	%
April or before	92	75	81.5	6	6.5	11	11.9
May	240	209	87.1	13	5.4	18	7.5
June	357	340	95.2	5	1.4	12	3.4
July	191	186	97.4	2	1.0	3	1.6
August	41	39	95.1	2	4.8	0	-
September	17	17	100.0	0	-	0	-
October	7	7	100.0	0	-	0	-

\*On which data available

In 92% of outbreaks no additional smallpox case occurred more than 14 days after containment had been initiated. In 3% of outbreaks cases still occurred within three weeks of initiating containment and, finally, in about 5% of outbreaks cases occurred three weeks and more after starting containment activities. Occurrence of cases after three weeks was considered evidence of inefficient containment.

As expected, surveillance effectiveness varied with time and place. Earlier in the year, smallpox cases occurred three weeks or more after containment activities started in about 12% of outbreaks. As containment team members gained further field experience, this percentage decreased to 7.5 in May and further to about 3.4 in June and, finally, to 1.6 in July. No smallpox cases occurred three weeks or more after starting containment in outbreaks which were detected from August onwards, indicating a high level of performance of containment.

#### Time interval between the onset of the first and last cases in the same outbreak

This time interval is an index of the effectiveness of both surveillance and containment activities. Data are available for 931 outbreaks that occurred after January 1977 (Table 9.5).

In many instances, especially in rural and nomad areas, smallpox outbreaks developed comparatively slowly. Infected individuals usually transmitted the disease to no more than two or three other persons and between each generation of cases there was a period of about two weeks. An interval of 14 days between onset of the first and last cases in an outbreak suggests only one generation subsequent to the index case; a month, two generations; two months, three or four generations; and three months or more, at least five generations.

The collected data suggests that overall, about 61% of outbreaks ended after one generation, about 19% endured two generations and about 15% ended with three or four generations. Less than 6% had five, six or more generations, before being contained. In May, about 54% of outbreaks ended after one generation. Less than 3% had five generations or more before being contained. In July, about 81% of outbreaks ended after one generation and less than 1% had five generations or more. From August onwards, outbreaks with five generations did not occur.

TABLE 9.5  
TIME INTERVAL BETWEEN ONSET OF THE FIRST CASE  
AND THE LAST CASE IN THE SAME OUTBREAK

Month of onset of outbreak	Total No. of outbreaks*	Time interval between the onset of the first and last cases							
		Within 14 days		15-30 days		2nd month		3rd month and more	
		No.	%	No.	%	No.	%	No.	%
March & before	90	17	18.9	8	8.9	30	33.3	35	38.9
April	130	62	47.7	29	22.3	31	23.8	8	6.2
May	267	145	54.3	60	22.5	55	20.6	7	2.6
June	272	208	76.4	52	19.1	10	3.7	2	0.7
July	128	104	81.2	15	11.7	8	6.2	1	0.7
August	34	26	76.5	6	17.6	2	5.8	0	-
September	6	2	33.3	4	66.6	0	-	0	-
October	4	4	100.0	0	-	0	-	0	-

\*On which data available.

Size of Smallpox Outbreaks

The number of smallpox cases which occurs in an outbreak is another index of the effectiveness of surveillance-containment activities. Rapid detection and effective containment should result in small outbreaks.

From the analysis of 946 smallpox outbreaks which occurred from the beginning of 1977, it was found that about 40% were "single case" outbreaks and only about 6% resulted in 10 cases or more. As expected these proportions varied in both time and place (Table 9.6).

TABLE 9.6

DISTRIBUTION OF SMALLPOX OUTBREAKS BY SIZE AND MONTH

Month of onset of outbreaks	Total No. of outbreaks	No. of cases in the outbreak				Percentage	
		1	2-4	5-9	10+	Single case outbreaks	5 cases or more
March & before	93	9	39	25	20	9.7	48.4
April	132	44	54	28	6	33.3	25.7
May	277	89	107	62	19	32.1	29.2
June	272	124	109	32	7	45.6	14.3
July	128	77	45	1	5	60.1	4.3
August	34	19	10	2	3	55.8	14.7
September	6	2	2	1	1	-	-
October	4	4	0	0	0	-	-

In April and May 1977, about 30% of outbreaks were "single case" outbreaks, but nearly the same percentage had five cases or more. As a result of intensified search operations and improved containment activities in the second half of May, the percentage of single case outbreaks rose in June to about 46%, in July to about 60% and, finally, remained at 56% during the August-October period. Simultaneously, the proportion of outbreaks having five and more cases decreased to 14% in June, further dropped to 4.3% in July, but increased to 15% during the August-October period, when surveillance activities identified the last outbreaks in remote and difficult access areas.

Continuous evaluation of the effectiveness of surveillance and containment using these indicators allowed rapid detection of areas of poor performance and corrective measures could be implemented.

The change in these indices from month to month shows the gradual but steady improvement that took place in both surveillance and containment activities. The results demonstrate that in Somalia an effective level of programme performance was achieved within two months of beginning intensified smallpox eradication activities. Furthermore, they indicate that the Somali programme achieved a level of performance that can be favourably compared with the smallpox eradication programmes developed in India and Bangladesh.

### Effectiveness of Source of Infection Tracing

The source and chain of transmission of smallpox infection could usually be identified if an outbreak was discovered sufficiently early, and an investigation made by a competent person. Patience, interviewing skill and often frequent revisits were necessary to obtain the pertinent information. Data concerning sources of infection are available from 494 outbreaks and are summarized in Table 9.7.

About 60% of outbreaks had their source of infection in a neighbouring village or encampment or other locality of the same district. Just over 8% of outbreaks resulted from infection brought from a different district within the same region and 14% of outbreaks were imported from another region. A number of outbreaks were located in border areas especially between the regions of Bay and Gedo, Bay and Bakool, and Lower Shabelli and Middle Shabelli. The source of infection could not be traced in about 20% of outbreaks despite wide screening around the suspected areas.

TABLE 9.7

LOCATION OF SOURCE OF INFECTION OF SMALLPOX OUTBREAKS, SOMALIA, 1977

Month in which outbreak started	Total No. of out- breaks*	Source of infection in									
		Unknown		Same region				Other region			
				Same district		Other district		Adjacent district		Other district	
		No.	%	No.	%	No.	%	No.	%	No.	%
March & before	57	22	38.6	20	35.1	6	10.5	5	8.8	4	7.0
April	81	32	38.3	36	44.4	5	6.2	5	6.2	4	4.9
May	85	10	11.8	53	62.4	10	11.8	9	10.6	3	3.5
June	130	18	13.8	83	63.8	10	7.7	16	12.3	3	2.3
July	100	9	9.0	66	66.0	7	7.0	18	18.0	0	-
August	33	6	18.2	25	75.7	1	3.0	1	3.0	0	-
September	4	0)		2)		1)		1)		0)	
October	4	1)	12.5	2)	50.0	1)	25.0	0)	12.5	0)	-
Total	494	97	19.6	287	58.1	41	8.3	55	11.1	14	2.8

### Means of Detection of Smallpox Outbreaks

Only limited data are available regarding the way in which outbreaks were detected. As an example, in Teyeglow District the reward for reporting new smallpox outbreaks was paid to: the public for reporting 52 new outbreaks (66%); searchers and vaccinators for reporting 21 outbreaks (27%); and, administrative officers, police and teachers for reporting five outbreaks (6%). In Jowhar, one third of all outbreaks were notified by the public, one third by programme staff and one third by the administration and village headmen. The pattern varied in different regions and districts.

Information is available on the means of detection of 141 outbreaks which occurred in Bakool, Bay, Hiran, Middle Shabelli and Togdheer during July 1977. As shown in Table 9.8, 47% of these outbreaks were reported by the general public, 37% of smallpox foci were detected by searchers or vaccinators during village to village or camp to camp searches. About 7% of outbreaks were reported by general health services staff, and the last 10% were reported by police, administrative workers, teachers and community leaders. No outbreak was reported to be detected during water-point surveys or market searches.

TABLE 9.8  
DETECTION METHODS AND INFORMANTS OF 141 SMALLPOX OUTBREAKS, SOMALIA, 1977

Method	First informant	Smallpox outbreak	
		Number	Percent
Public report	General population	67	47.0
Search operation	Programme staff	52	37.0
Regular surveillance	Other health staff	9	6.5
Secondary surveillance	Police, teachers, administration	9	6.5
	Village leaders, Nabadons	4	3.0
Total outbreaks detected		141	100.0

## 10 REPORTING AND RECORDING

As no well organized disease notification system existed throughout Somalia, it was necessary to develop a means by which information from the village level could be conveyed to the Ministry of Health with appropriate action being taken in the process. Appropriate analysis of data at all levels and a statistical unit at central level also required development.

Efforts to establish a reporting system were accelerated from March 1977 with the establishment of the intensified Smallpox Eradication Campaign, ultimately with staff at all levels from central to zonal. Reporting of smallpox and other rash-with-fever cases was ensured by the staff themselves and through their motivation of the country's well structured administration, existing health services, education facilities and religious and political leaders. The centres of reporting were the regional and district "Zeropox" offices (figure 10.1). The introduction of the 200 Somali shilling reward was an additional stimulus to the reporting of cases.

### 1. Reporting of Smallpox Outbreaks

Accurate and complete reporting of smallpox outbreaks was the basis on which the eradication programme's emergency campaign was built and progressively adapted. Searchers reported initially to their supervisors who in turn notified the district team leader. A regional epidemiologist or WHO adviser was in contact with each district team leader every one or two days. Containment measures were initiated by the team, reinforced by support from district or regional level as necessary. The regional "Zeropox" offices were the collecting points for data by which the epidemic could be followed and control measures evaluated.

Reports were generally made from regional to national level weekly, by one of several methods. In the regions close to Mogadishu information was conveyed and analysed at each district and for each week the following details were reported.

Smallpox outbreaks:    - pending at beginning of week,  
                             - newly detected during week,  
                             - closed during week,  
                             - pending at end of week,  
                             - with active cases at end of week.

Smallpox cases:        - detected during week,  
                             - pending at end of week.

Smallpox deaths:       - occurring during week, if any.

Summary of new outbreaks and of closed outbreaks.

In the 10 regions more distant from Mogadishu similar data were communicated by cable using the code letters A to L, as shown on the Weekly Epidemiological Report (figure 10.2), which was simultaneously sent by mail. Cables often contained confusing information and posted reports frequently did not arrive. The resultant misunderstandings were clarified at the time of national review meetings.



FIG. 10.1  
REGIONAL AND DISTRICT 'ZEROPOX' OFFICES, SOMALIA, 1978 – 1979

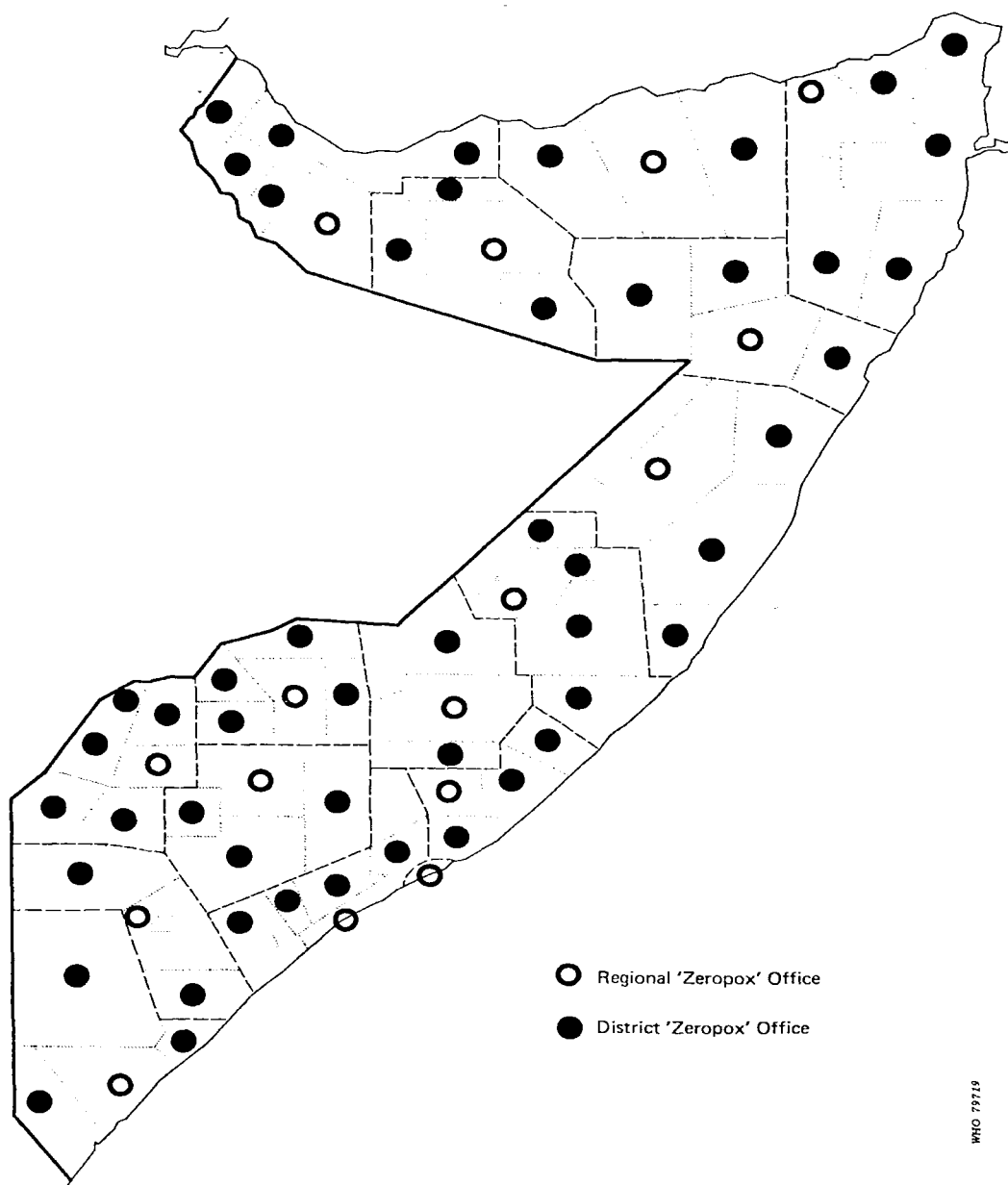


FIG. 10.2 WEEKLY EPIDEMIOLOGICAL REPORT

SMALLPOX ERADICATION PROGRAMME

Mashruuca Ciribtirka Furuqa

Weekly Epidemiological Report (Posted Copy) Warbixin Todobaad

Report Week No: Ending At: Reporting Officer: Region: Gobol:

Warbixinta Todobaadkii: Dhamaanaya: Warbixiyaha: Gobol:

Code	District Degmada	District Degmada	District Degmada	District Degmada	District Degmada	District Degmada	Region Total Gobol Wadar
(A)							
(B)							
(C)							
(D)							
(E)							
(F)							
(G)							

(J)	Outbreaks Closed: National Numbers - Tirada Taxan ee Goobaha la Xiray Todobaadkas					
(K)	Outbreaks with Active Cases: National Numbers - Goobaha Buqaan Cusub ku Jiro:// Lambarka Dalka					
(L)	Date of Onset of Latest Smallpox Case in District - Degmada Qofka Furuq ugu Dambeeyey Taariikhdu Qaaday					

Crossnotification: (other regions or states) Details:  
War-Iswaydaarsi (Gobolada dalaalka Kale)

H. Line Listing - New Outbreaks - MAGACYADA GOOBAHA CUSUB

District	Affected Locality	Estim. Popula.	Cases	DATES OF		Source of Infection
				First Case	Last Case	
DEGMO	MEESHA SADHEY-SAN	QIYAASTA TIRADA DADKA	TIRADA BUKA-ANKA	KAUGU HOREYA	KAUGU DANBEYA	MEESHA CUDURKURKA YIMI

CODE INSTRUCTIONS:

(A) No. of outbreaks pending at the beginning of given week  
TIRADA GOOBAHA AAN WELI LA XIRIN BILONGA TODOBAADKAA

(B) Number of outbreaks newly detected during given week  
TIRADA GOOBAHA CUSUB EE TODOBAADKAA LA HELAY

(C) Number of outbreaks closed during the given week  
TIRADA GOOBAHA AAN WELI LA XIRIN BILONGA TODOBAADKAA

(D) Number of outbreaks pending at the end of given week  
TIRADA GOOBAHA AAN WELI LA XIRIN DHAMAADKA TODOBAADKAA

(E) Number of outbreaks with active cases  
TIRADA GOOBAHA QABA FURUQ CUSUB

(F) Number of new cases detected during week  
TIRADA DADKA FURUQ CUSUB QABA EE TODOBAADKAA LA HELAY

(G) Total number of active cases pending  
TIRADA GUUD EE AH DADKA FURUQ CUSUB QABA

(J) Serial number of outbreaks closed in given week (By District)  
TIRADA TAXAN EE GOOBAHA LA XIRAY TODOBAADKAA (DEGMO AHAAN)

(K) Outbreaks with active cases - national numbers  
GOOBAHA BUKAAN CUSUB KU JIRO: LAMBARKA DALKA

(L) Date of onset of latest smallpox case in district  
DEGMADA QOFKA FURUQ UGU DAMBEYEY TAARIKHDU QAADAY

## 2. Suspected Smallpox Reporting

In October 1977 the reporting procedure was reorganized. The new system incorporated the following elements.

### Urgent Notification

Suspected smallpox outbreaks were notified immediately by cable, telephone or messenger to the regional "Zeropox" office. This was to allow prompt on-the-spot investigation, if possible within 24 hours. Mogadishu headquarters were to be immediately notified by the regional staff by cable or telephone of any suspected smallpox outbreak.

### Cross-notification of Source of Infection

Investigating officers suspecting sources of infection outside their area of jurisdiction were required to transmit details to Mogadishu and the region concerned by cable and/or telephone, followed by a mailed copy. Investigation of cross-notifications was expected within three days with results communicated by the same means. Both Mogadishu and the region of origin of the information were informed.

### Outbreak Investigation Reports

At the completion of each outbreak investigation a full report was filed. This was expected to reach Mogadishu within seven days of the initial notification and to include the following information on an "Outbreak Information Sheet":

- affected locality: name, population, households affected;
- size of outbreak: cases, deaths, dates of onset of first and last cases, date of detection;
- clinical diagnosis: disease, who made the diagnosis and when, whether specimen collected;
- travel and contacts of patients: day-by-day accounts of patient's movements in three weeks prior to rash onset and since;
- source of infection: full details of suspected area and/or persons;
- containment activities: persons at risk, primary vaccinations and revaccinations performed;
- area search: area covered (usually 10 km radius), date started and completed, localities and staff involved, rash-with-fever cases found.

## 3. Weekly and Monthly Epidemiological Reports

By the end of 1977 a network of reporting units had been established and regular reporting of basic epidemiological data was achieved. At district level the district team leaders, and at regional level the regional epidemiologists, were responsible for ensuring weekly reporting to the central level. A weekly smallpox incidence cable was sent from districts to regions, and regions to Mogadishu, including 'NIL' reports if no smallpox was reported.

Early in 1978 a register which doubled as a rumour register and a record of weekly epidemiological reports was introduced at all district offices (figure 10.3). All rash-with-fever information, from whatever source, was to be entered under the supervision of the district team leader. Every Thursday two copies were sent to the regional

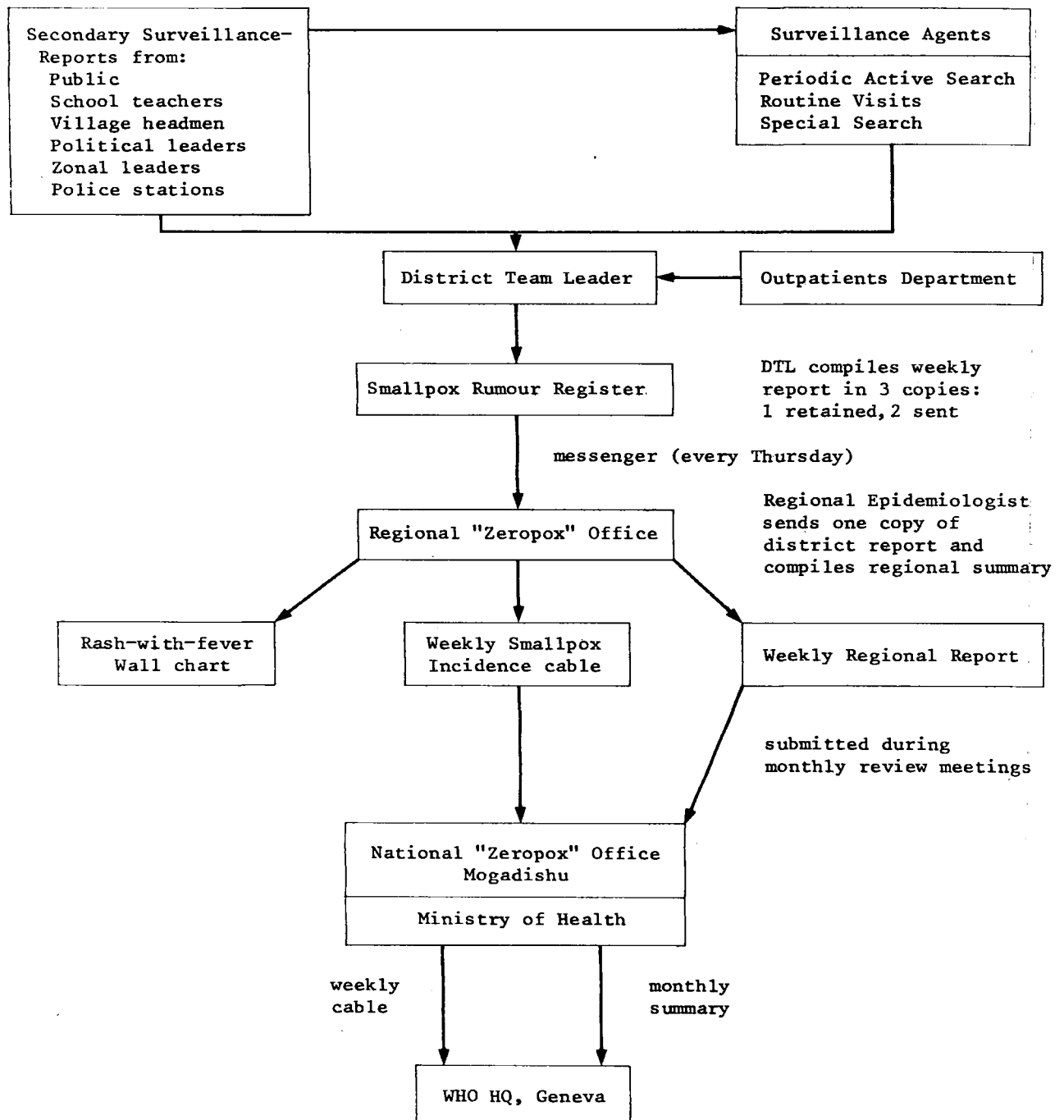
**FIG. 10.3**

**SAMPLE PAGE FROM SMALLPOX RUMOUR REGISTER AND WEEKLY REPORT**

[illegible]

Keep first copy in book. Send second and third copy to Regional Zeronox Office every week on Thursday. third copy will be sent to Mogadishu by Region.

FIG. 10.4  
WEEKLY SMALLPOX AND RASH-WITH-FEVER REPORTING, SOMALIA, 1978 – 1979



"Zeropox" office, one of which was forwarded to Mogadishu headquarters. Every Sunday a cable was sent from Somalia to the WHO headquarters in Geneva reporting smallpox incidence (figure 10.4).

Monthly summary reports were compiled in each region and, nationally, as the "Zeropox Bulletin".

In addition to these regular reports, supplementary documentation was to be forwarded to Mogadishu on the investigation of all suspected smallpox cases or deaths from rash-with-fever illnesses

#### 4. Reporting of Surveillance Activities

After the last reported case of smallpox in October 1977 the reporting system was somewhat modified to suit the forthcoming two years of intensive surveillance. The extent of the documentation during these years is outlined in the following sections.

##### Search Reports

Before each search, pre-search meetings were held at various levels as described in previous chapters. The preparation of detailed agenda for these meetings was considered essential.

The actual search schedule, the day-by-day search findings and the various search result summaries were entered on the following special forms (listed with code numbers) (Annexes 11 - 15).

Search Schedule - SOM 1: At pre-search meetings the district team leader prepared one such form for each searcher in his area using a list of fixed search units. A copy was given to the appropriate supervisor and another filed for reference.

Search Report - SOM 2: This form was used by each searcher to record his daily work programme (following SOM 1) and, on the reverse side, all details of rash-with-fever cases detected. At the end of the search forms were collected by the district team leader for compilation and investigation of any rash-with-fever cases not previously investigated.

District Search Summary - SOM 3: This summary of search results was prepared by district team leaders in two copies: one for the regional "Zeropox" office and one for the district file.

Assessment of Activities - SOM 4: Used by district team leaders, regional epidemiologists, regional team leaders and WHO advisers, this form was designed for the recording of assessment findings in their respective areas.

Regional Monthly Summary of Search Activities - SOM 5: This was used for summarizing the data submitted by the districts on SOM 3, in two copies: one for Mogadishu HQ, the other for the regional file. The reverse side of the form compiled assessment findings.

National Summary and Assessment Report: Results of all search activities were compiled for the entire country and printed monthly in the "Zeropox Bulletin" which was distributed to all levels of the health services and smallpox programme and also to the WHO Office for the Eastern Mediterranean Region and Geneva headquarters.

##### Inter-search Period Reports

Essentially the same system of reporting was used as during active searches and the forms SOM 1-5 served equally well for both purposes.

### Tour Diaries

From April 1978 it was required that all programme leaders from district team leaders to epidemiologists should record their activities in a tour diary. This practice was to document further the extent of surveillance coverage, case investigation, active supervision and contact with various officials. The diaries facilitated discussion of the previous months' activities and were used to plan and record a programme for the following month.

### Vaccination Reports

The number of vaccinations performed were recorded on the various reporting and summary forms already mentioned.

### Information Feedback

Time constraints were placed on the preparation and forwarding of all surveillance reports. This allowed prompt analysis and identification of problems and immediate remedial action if appropriate. In addition to this specialized feedback a routine system existed for transmitting compiled data back to the most peripheral level of the programme

Information feedback was mainly by the following means:

- direct contact and discussion between supervisors at various levels during regular visits;
- more formal analysis and discussion during pre- and post-search meetings;
- special visits to "problem areas";
- circulars from Mogadishu HQ to regional epidemiologists;
- the monthly "Zeropox Bulletin".

## 5. Permanent Office Records

Staff at the programme offices at district and regional level were required to maintain in good order a number of files and wall charts.

At district level the following records were available:

### (a) Wall charts:

- i. Placards
  - differential diagnosis poster,
  - 200 Somali shilling reward placard,
  - US\$ 1000 reward placard.
- ii. General information
  - map showing location of districts,
  - operational district map (roads, zones, fixed search units, risk areas),
  - pertinent demographic and geographic information,
  - summary of search units,
  - organizational structure (Ministry of Health, SEP, etc.),
  - calendar of programme activities in 1979.
- iii. Smallpox
  - line-listing of smallpox outbreaks, 1977,
  - last smallpox outbreak in district (map, pertinent information).
- iv. Surveillance
  - search summaries by month, 1978, 1979,
  - search assessment by month, 1978, 1979
  - surveillance in search units at a glance.

- v. Vaccination
  - vaccination performance by month, 1978, 1979.
- vi. Reporting
  - rash-with-fever reports, by week 1978, 1979.
- (b) Files, Lists Books:
  - smallpox rumour register book(s),
  - district team leaders' diaries,
  - search operation files (SOM-3, SOM-4, SOM-2, SOM-1 by month),
  - smallpox file with outbreak information sheets and line-listing of outbreaks,
  - suspected smallpox cases investigation reports,
  - list of fixed search units,
  - list of specimens collected (results of laboratory tests).

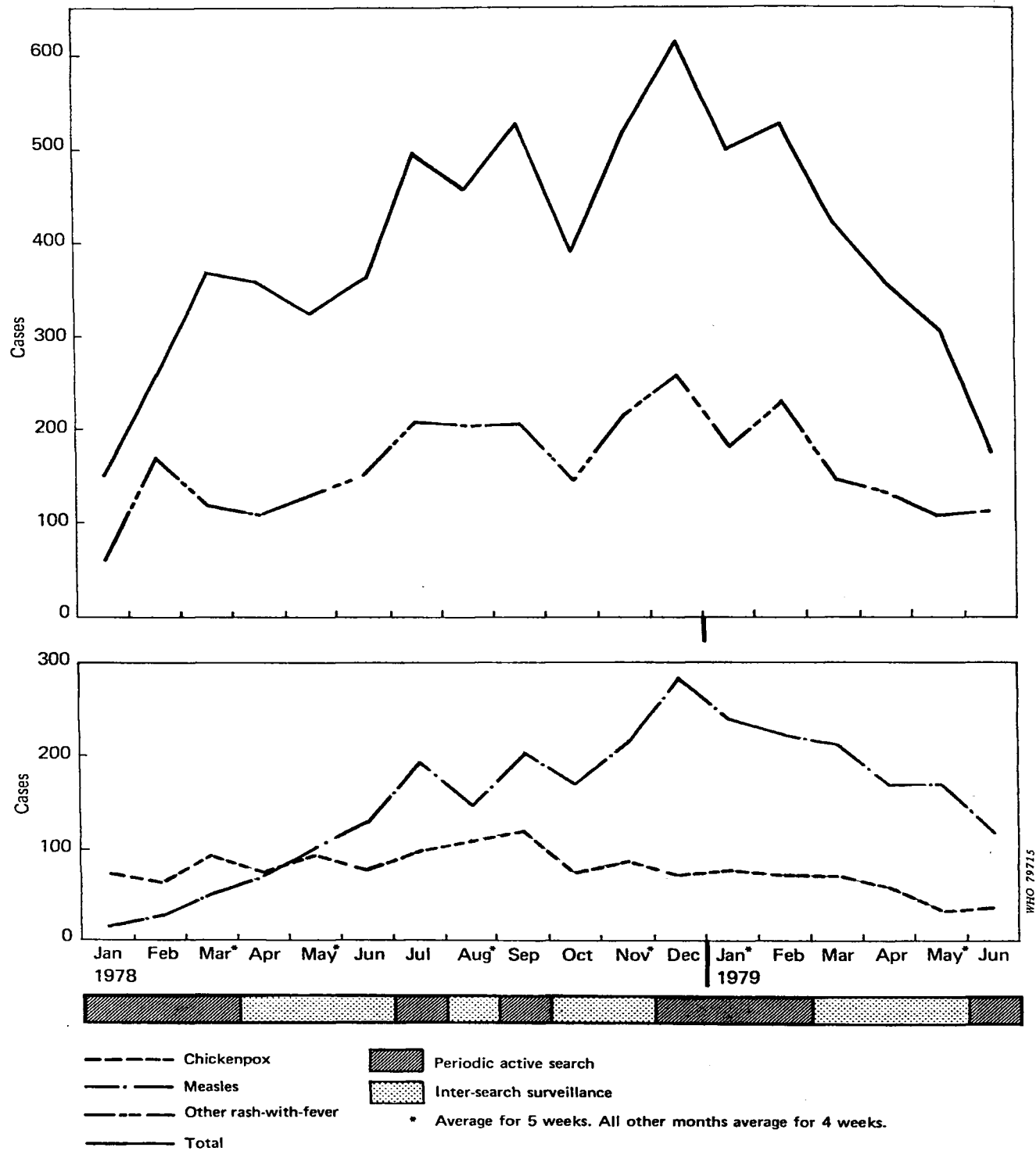
At regional level similar files and wall charts existed which contained or summarized the reports from the districts. In addition there were the tour programmes and diaries of the regional epidemiologists and team leaders. Search summaries included the data of forms SOM-5. A cross-notification file was maintained recording relevant information transmitted to other regions and the responses.

All office records were available at any time for the perusal of visiting supervisory staff during regular meetings or special visits.



FIG. 11.1

AVERAGE NUMBER OF RASH-WITH-FEVER CASES REPORTED WEEKLY  
SOMALIA JANUARY 1978 – JUNE 1979



## II RASH WITH FEVER DETECTION 1978-79

As it was believed that smallpox transmission had been interrupted in Somalia by the end of 1977, it became of even greater importance that every suspected case, and in fact all cases of rash-with-fever, should be detected, reported and carefully investigated. Correct diagnosis of rash-with-fever cases became very important, as misdiagnosis of mild smallpox cases, as caused by variola minor, and consequent failure to take containment action could have caused a serious setback in the progress towards global smallpox eradication. From January 1978, a new element of surveillance was developed: rash-with-fever surveillance.

This required that every smallpox programme worker and each member of the general health staff knew that cases of rash-with-fever should be reported and that they knew where to report them. Rash-with-fever cases detected during active surveillance by programme staff, as summarized in chapter 7, as well as cases reported by general health and administrative staff, together with information notified by the general public or collected through secondary surveillance systems were entered into "smallpox rumour registers". These were kept in every district and regional "Zeropox" office and a few selected hospitals and generally maintained by district team leaders and regional epidemiologists. Each report received was to be promptly verified by an experienced worker, usually the district team leader. Random checks were made by the supervisory staff at regional level. If there was any doubt about the diagnosis, the regional team leader, regional epidemiologist or WHO adviser were called in to confirm the diagnosis. Every outbreak of chickenpox, the majority of outbreaks diagnosed as due to measles and a random sample of persons suffering from "other skin diseases" were revisited by regional epidemiologists or WHO advisers who verified the diagnosis and entered the findings in the rumour register. The system of reporting of these cases has been described in detail in the previous chapter. In mid-1979 there were 70 rural units and 14 municipal units regularly reporting all rash-with-fever cases notified within their area, covering fully the territory of Somalia. The data collected in the "smallpox rumour registers" during 1978 and 1979 is presented and discussed.

### Rash-with-fever Cases

A total of 19 623 rash-with-fever cases were entered into smallpox rumour registers during the year 1978 and 9821 cases during the first half of 1979.

Figure 11.1 shows the weekly distribution of these reported cases, further subdivided into three main diagnostic categories: chickenpox, measles and other skin diseases. At the beginning of 1978, only a limited number of the district reporting units observed proper reporting procedures for rash-with-fever cases. This proportion increased from about 60% in January to 75% in February. By April the submitted reports reached 97% and from May 1978 onwards reports were missing only exceptionally. Reporting incompleteness at the beginning of 1978 precludes analysis of seasonal incidence trends for 1978. These initial reporting deficiencies also explain the differences between the rumour register figures and those derived from active surveillance activities and reported by epidemiologists through the monthly surveillance reports (SOM 5) and recorded in chapter 7.

The reported cases of rash-with-fever and incidence per 100 000 population is shown in Table 11.1 for 1978 and the first six months of 1979. On average 1635 cases were reported throughout the country monthly in 1978. The annual incidence for the entire country in 1978 was 562 cases per 100 000 population. The average number of cases reported monthly in each region was around 100 and on average district team leaders had to investigate 23 reported cases each month. Similar figures apply to the first half of 1979. The reported incidence varies substantially from region to region reflecting, in addition to the local epidemiological situation, the relative adequacy of surveillance and reporting. Nevertheless, the overall number of detected rash-with-fever cases is very high and reflects the effectiveness of surveillance activities.

In October 1978 and again at the beginning of 1979 an independent assessment was carried out in the majority of districts (64), smallpox rumour registers were checked and localities where rash-with-fever cases had recently been reported were revisited. Pertinent epidemiological data were collected from 16 415 rumours entered into rumour registers. It was found that 3648 of these (22%) were diagnosed as chickenpox, 5372 (33%) as measles and the remaining 7395 (45%) were found to be cases suffering from other skin diseases. The average proportion of chickenpox cases was lowest in urban areas, for example about 5% in Mogadishu, while the proportion of other diseases was high (Mogadishu - 67%).

Of 16 415 entries scrutinized, 291 (about 2%) were found to have remained uninvestigated and therefore with unverified diagnoses. The majority of these were rumours from nomad areas where patients had moved on before a visit could take place, or the area indicated by the searcher was simply not relocated. About 40% of verification visits were made by surveillance agents who, during 1978, acted as first-level supervisors for temporarily hired searchers.

A further 40% of rumours were visited and their diagnoses verified by district team leaders while epidemiologists from regional level were able to visit about 20% of rash-with-fever cases, especially those whose initial diagnosis was chickenpox or measles. In urban areas, about 67% of chickenpox and measles cases were verified by municipal physicians or medical assistants.

Efforts were made to improve further verification of diagnoses in 1979. Regional staff were advised that every chickenpox outbreak should be seen by a WHO adviser or regional epidemiologist, not only to confirm the clinical diagnoses, but also to take a specimen for laboratory examination. Every focus of measles was to be visited by a regional epidemiologist or regional team leader. Furthermore, they were advised to sample every fifth case of skin disease and to verify the original diagnosis made by district team leaders. In areas where the incidence allowed, epidemiologists made an effort to revisit and see every reported case themselves.

The proportion of rash-with-fever cases detected among the nomad population varied from 24% to 44%, increasing substantially during the dry season when surveillance activities were focused on areas with a high concentration of nomads. In comparison with settled areas, the chickenpox and measles outbreaks in nomad encampments were substantially smaller, affecting a few persons only before transmission was spontaneously interrupted.

On average, about 12% of rumours were reported by the public or through the secondary surveillance system. This proportion is substantially less than the 47% of smallpox outbreaks detected by these means. This difference suggests that once smallpox was no longer present the response to publicity campaigns was not so great. Even in urban areas where maximum publicity was provided the percentage of rumours notified by the public was small; for example in Mogadishu, it was only 1.2%.

TABLE 11.1

REPORTED RASH-WITH-FEVER INCIDENCE BY REGION, SOMALIA, 1978-1979<sup>a</sup>

No.	Regions	Estimated Population (1975)	1 9 7 8				1 9 7 9			
			Fever and Rash Cases		Average No. of Cases		Fever and Rash Cases		Average No. of Cases	
			Total Number	per 100 000 population	per Month per:		Total Number	Per 100 000 population	per Month per:	
					Region	District			Region	District
1	Bakool	100 097	2 780	2 777	231	46	578	1 154	96	19
2	Bari	154 352	588	381	49	8	475	614	79	13
3	Bay	302 054	2 478	820	206	51	1 532	1 014	255	64
4	W. Galbeed	439 833	804	183	67	11	452	204	75	13
5	Galgadud	181 655	552	304	46	9	599	658	100	20
6	Gedo	212 091	1 315	620	109	18	1 290	1 216	215	36
7	Hiran	147 281	533	362	44	15	289	196	48	16
8	L. Juba	123 013	1 554	1 263	129	32	777	1 262	129	32
9	M. Juba	123 013	1 622	1 318	135	33	572	928	95	24
10	Mogadishu	370 671	3 944	1 064	328	23	1 333	718	222	17
11	Mudug	215 142	446	207	37	7	120	110	20	4
12	Nugal	85 140	166	195	14	4	138	324	23	6
13	Sanaag	145 408	316	217	26	9	275	378	46	15
14	L. Shabeelli	398 086	756	189	63	10	611	306	101	14
15	M. Shabeelli	236 299	1 008	426	84	21	436	368	73	18
16	Togdheer	257 771	761	295	63	16	344	266	57	14
TOTAL			19 623	562	102	23	9 821	562	102	23

<sup>a</sup> 1 January - 30 June

<sup>b</sup> Adjusted to one year period

## 2. Chickenpox

Chickenpox is the disease most likely to be mistaken for smallpox, especially for clinical forms caused by variola minor. For this reason the major emphasis in rash-with-fever surveillance was placed on detecting and investigating chickenpox cases. Field experience indicated that, in fact, in the majority of cases differentiation between chickenpox and smallpox caused by variola minor was comparatively easy. An examination of the distribution and nature of the lesions, the vaccination history and the clinical history allowed positive diagnosis in most cases.

A total of 4240 chickenpox cases, representing an annual incidence of 121 cases per 100 000 population, were entered in the smallpox rumour registers in the year 1978 and a further 1395 cases in the first half of 1979. Table 11.2 shows chickenpox incidence by region for 1978. This ranges from 16 per 100 000 in Bari Region to 1148 in Bakool Region. Data collected during the independent assessment of 64 districts in 1978 confirmed that in Somalia, as in other countries, chickenpox is predominantly a disease of childhood but may occur, even with significant incidence rates, among persons of all ages. Figure 11.2 shows that only about 55% of registered cases were children under 15 years of age. Within the 0-15 age group the distribution was relatively uniform except among those less than 1 year old who contributed less than 0.5% of all cases. In contrast to Europe and North America where chickenpox is rare after the age of 15 years, the data collected in Somalia shows that about 27% of cases are young adults from 15 to 29 and the remaining 18% older adults, 30 years old and more. Collected data showed that chickenpox was more prevalent among males (63%) than in females (37%), although this difference was less marked in the younger age groups.

In general there was a difference between the clinical picture of chickenpox in children and that observed among adults. In children, the prodromal illness occurs infrequently or not at all, and usually the rash begins the illness which is generally mild and uncomplicated. In adults, the illness tends to be more severe with a higher incidence of complications. A prodromal state is typically seen for about two days before a profuse rash appears accompanied by fever, headache, backache, shivering, sore throat and cough. It is not surprising that such cases were frequently labelled as "suspected smallpox" and were, therefore, carefully investigated by WHO advisers. Field observation in 1977 showed that if a sparse rash followed a severe prodromal illness, variola minor rather than varicella was usually the cause of the disease.

In contrast to the Indian sub-continent where chickenpox has a marked seasonal distribution, the highest incidence being between January and May, in Somalia there seems to be little evidence of any seasonal variation. From the assessment carried out in 64 districts in 1978, it was found that the proportion of chickenpox cases from which material for laboratory testing was collected increased from about 20% at the beginning of the year to 40% at the year's end. No specimen collected from a chickenpox case in 1978 or 1979 was found positive for variola virus.

## 3. Measles

Measles represents a serious public health problem in African countries including Somalia. The high attack rate, frequency and severity of complications and significant case fatality rate place measles as a priority among preventable diseases. Except for isolated, remote and inaccessible areas, measles is endemic throughout the country, occurring in irregular waves in limited areas the whole year round.

Summarizing data collected through rash-with-fever surveillance, it was found (Table 11.2) that a total of 6979 measles cases were entered into smallpox rumour registers in 1978, representing a reported incidence of 199 cases per 100 000 population per year. An additional 4759 cases were recorded from January-June 1979. That incidence varies substantially ranging from 63 in Lower Shabelli Region to 688 in Lower Juba Region. Of all registered measles cases 85% were children under 15 years of age and 70% of them were still in their first decade of life (figure 11.2). Males constituted 56% of the

FIG. 11.2

AGE AND SEX DISTRIBUTION OF CHICKENPOX AND MEASLES CASES COMPARED  
WITH WHOLE POPULATION, SOMALIA, 1978

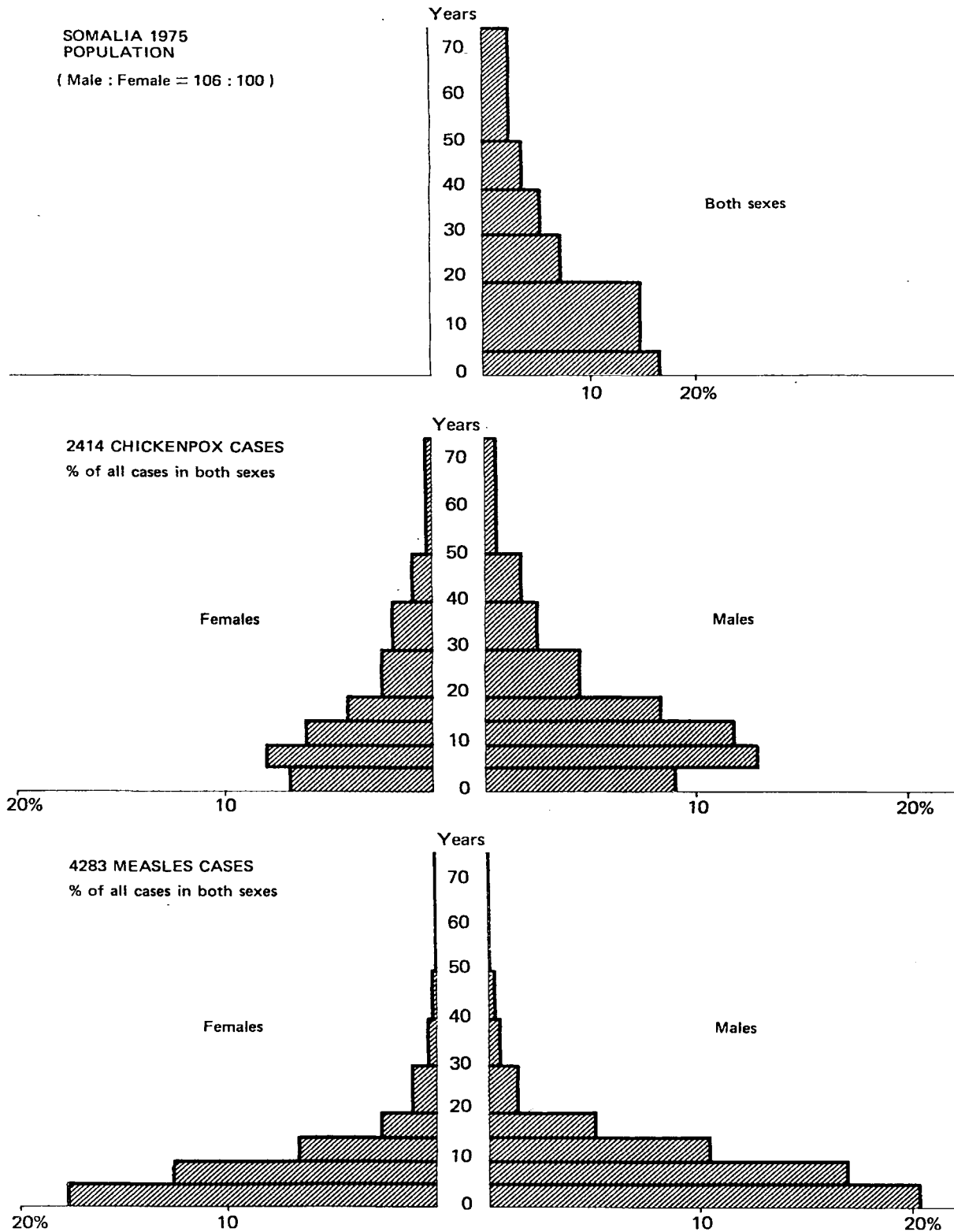
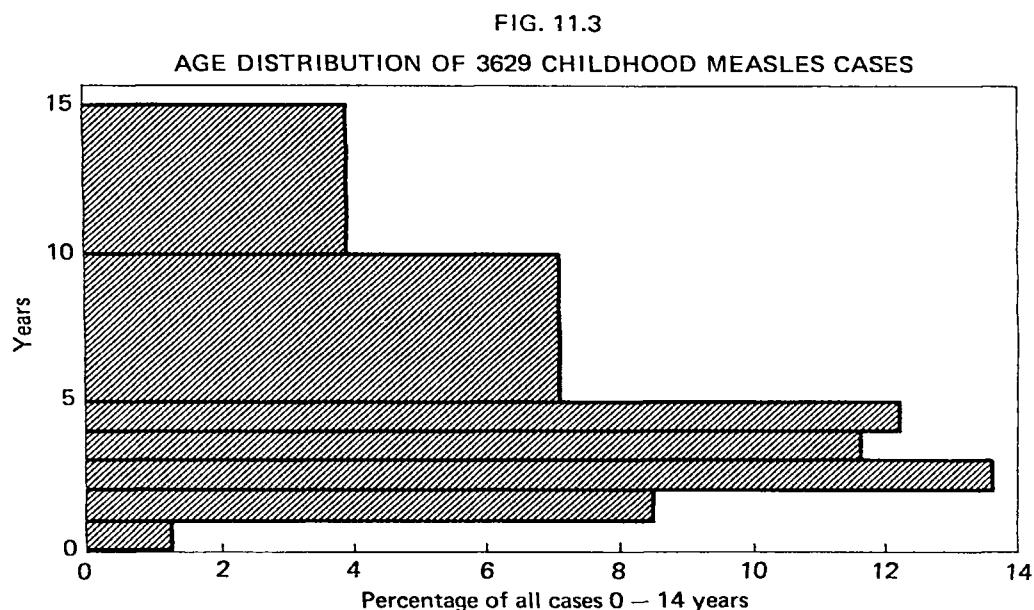


TABLE 11.2  
FEVER AND RASH CASES BY DIAGNOSTIC CATEGORY AND BY REGION - SOMALIA 1978

No.	Regions	Estimated Population*	Chickenpox		Measles		Other skin diseases
			Abs.No.	Per 100 000	Abs.No.	Per 100 000	
1	Bakool	100 097	1 150	1 148	430	429	1 200
2	Bari	154 352	25	16	364	236	199
3	Bay	302 054	817	275	400	132	1 261
4	W. Galbeed	439 833	75	17	590	134	139
5	Galgudud	181 655	130	71	264	145	158
6	Gedo	212 091	299	141	618	291	398
7	Hiran	147 281	205	139	222	151	106
8	L. Juba	123 013	301	244	847	688	406
9	M. Juba	123 013	216	176	816	663	590
10	Mogadishu	370 671	158	43	1 019	275	2 767%
11	Mudug	215 142	75	35	167	77	204
12	Nugal	85 140	54	63	67	78	45
13	Sanaag	145 408	39	27	177	121	100
14	L. Shabelli	398 086	172	43	250	63	334
15	M. Shabelli	236 299	435	184	415	176	158
16	Togdheer	257 771	89	35	333	129	339
Total		3 491 906	4 240	121	6 979	199	8 404

\* 1975

cases. Figure 11.3 shows the age distribution of measles cases in the 0-15 years age group and identifies the ages 2-4 years as contributing the highest proportion of cases. However, field experience suggests that in densely populated areas most children have been attacked by the age of 3 years.



Seasonal variation in the incidence of measles was observed (figure 11.4) with peaks occurring in July and November, following the two rainy seasons and coinciding with the colder weather. It is postulated that this increase is due to greater contact between members of the population during these relatively cold periods, rather than to climatic effect on the virus. As it was observed that measles incidence patterns were irregular and localized, it was considered a less reliable indicator of surveillance than chickenpox incidence.

To characterize measles in Somalia further, a study was conducted in Jamame District of Lower Juba Region in 1978. Forty-two villages, or one third of those in the district, were affected by measles in a ten month period. In all, 910 cases occurred among a population of 39 248 persons, including 26 cases in 13 nomad groups. Incidence rates per 1000 population were found to be 12.3 for the district as a whole, 23.2 for the affected villages and 332.6 when only the affected households were considered. The highest age specific incidence rates were found in 2 and 3 year olds, 51.7 and 49.9 per 1000 district age-group population respectively. No significant difference between the sexes was observed. The overall case fatality rate was 1.7% and the mortality rate 0.2 deaths per 1000 for the total population being significantly higher in females. This study is fully documented elsewhere (see references). It is concluded that measles is a serious health problem in Somalia and any efforts towards measles vaccination appear justified.

#### 4. Other Rash Diseases

A total of 8404 cases of other rash diseases, with or without accompanying fever, were entered into smallpox rumour registers in 1978, followed by 3669 further cases detected and registered in the first half of 1979.



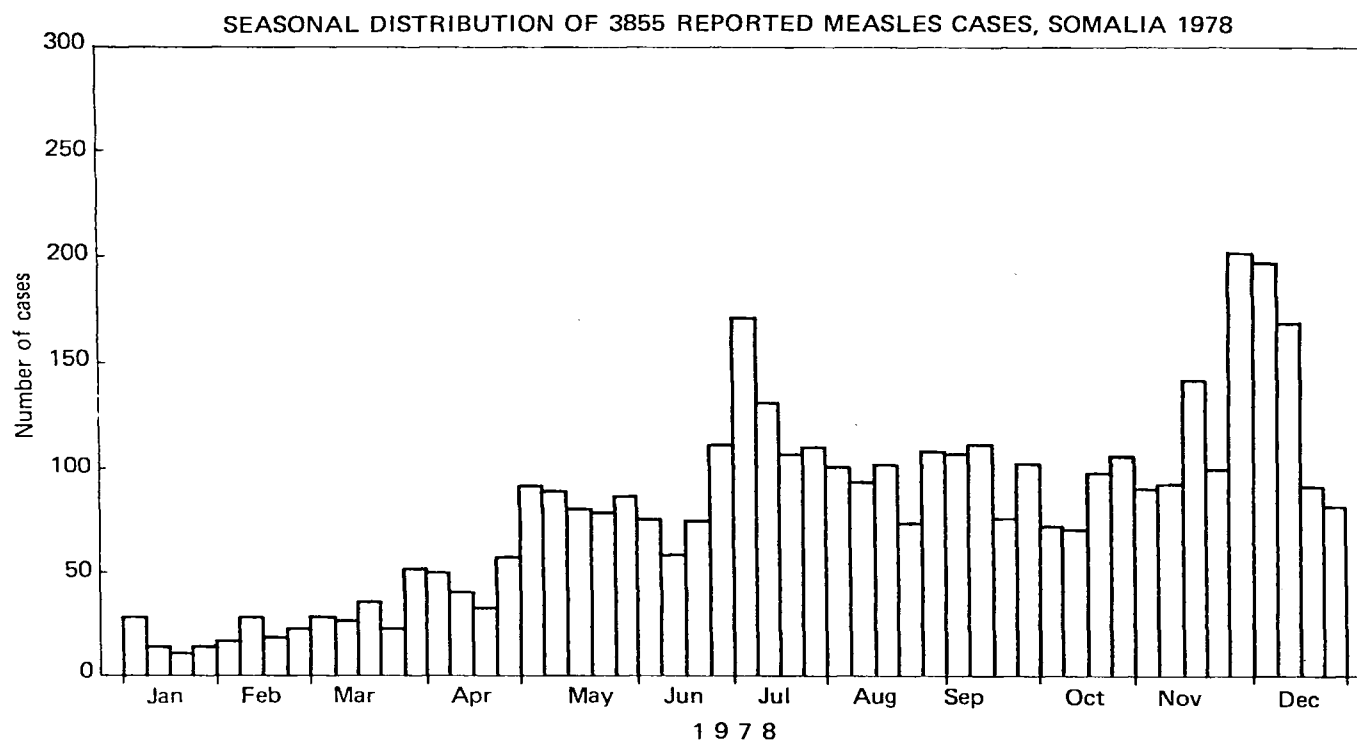
The distribution of cases registered in 1978 by separate regions was shown earlier in Table 11.2. These cases were finally diagnosed as cases of scabies, miliaria rubra, acne, impetigo, secondary syphilis, eczema, urticaria, sensitization to drugs and, in some cases, unclassified skin diseases. Almost 60% occurred in persons less than 15 years of age of whom 63% were male.

#### 5. Suspected Smallpox Cases

It is obvious that the primary objective of rash-with-fever surveillance was the detection of smallpox cases or those suspected of being smallpox and requiring prompt investigation. Speed of reporting such cases was emphasized and each case was considered, during 1978 and 1979, as a public health emergency. Investigation was mandatory within 12 hours of notification, in urban areas, and in rural areas, within 24 hours.

To help avoid confusion in the initial diagnosis, hundreds of differential diagnosis charts were distributed to programme staff and health establishments. However, where a diagnosis of smallpox could not be excluded, staff were instructed to start containment pending further clarification of the situation.

FIG. 11.4



In 1978 a total of 25 suspected smallpox cases was detected and reported from 10 regions and in the first half of 1979 a further four cases were reported (figure 11.5). Following thorough clinical, epidemiological and, where possible, laboratory investigation, none of these cases proved to be smallpox.

The pertinent details of all 29 suspected smallpox cases reported in 1978 and 1979 are summarized in Table 11.3. About 16% of suspected smallpox cases were pre-school children, 40% school-age children, about 28% young adults and the remaining 16% 40 years or older. Chickenpox was easily the disease most often mistaken for smallpox. The final diagnoses are summarized in Table 11.4.

TABLE 11.3  
SUSPECTED SMALLPOX CASES, SOMALIA, 1978-1979

Date reported	Region	District	Locality	Patient's initials	Sex	Age	Date of		Vaccination		Final diagnoses
							Rash	Death	Scar	Challenge	
16.2.78	M. Juba	Gelib	Mereray	A.I.A.	M	24	6.2.78	-	no	positive	secondary syphilis
25.2.78	Border area	Hargeisa	Dhagabur	S.M.M.	F	14	11.2.78	-	no	positive	chickenpox
2.3.78	Togdheer	Bohodle	Bohodle	D.M.Y.	F	7	15.2.78	-	yes	not done	camel pox sus.
4.3.78	Bakool	El Berde	Howle	A.M.O.	M	13	April 77	-	no	not read	suspected smallpox
5.3.78	Bakool	Huddur	Gudow	F.I.A.	F	28	2.2.78	-	yes	not done	chickenpox
5.3.78	Bakool	Huddur	Gudow	F.A.M.	F	3	17.4.78	-	yes	not done	chickenpox
5.3.78	Bakool	Huddur	Gudow	A.A.M.	F	10	25.2.78	-	no	positive	chickenpox
5.3.78	Bakool	Huddur	Gudow	S.A.M.	M	6	17.2.78	-	yes	positive	chickenpox
8.3.78	Bakool	Wajid	Gubay	M.S.A.	M	16	17.2.78	-	yes	not done	chickenpox
8.3.78	Bakool	Wajid	Gubay	F.A.M.	F	3	24.2.78	-	yes	not done	chickenpox
8.3.78	Bakool	Wajid	Gubay	C.M.S.	M	8	4.3.78	-	yes	not done	chickenpox
8.3.78	Bakool	Wajid	Gubay	M.A.M.	M	7	4.3.78	-	yes	not done	chickenpox
8.3.78	Bakool	Wajid	Gubay	I.A.M.	M	5	4.3.78	-	yes	not done	chickenpox
25.3.78	M. Shabelli	Jowhar	El Jerife	M.A.A.	M	13	2.1.78	-	yes	positive	chickenpox
25.3.78	M. Shabelli	Jowhar	El Jerife	M.A.A.	F	26	20.1.78	-	no	positive	chickenpox
25.3.78	M. Shabelli	Jowhar	El Jerife	A.A.	M	11	25.1.78	-	no	positive	chickenpox
25.3.78	M. Shabelli	Jowhar	El Jerife	H.A.	F	3	30.1.78	-	no	positive	chickenpox
4.4.78	L. Juba	Afmadu	Xagar	A.A.X.	M	15	11.3.78	-	no	positive	fungus dermatitis
12.4.78	Gedo	Bardere	Bulabar	-	M	36	21.3.78	-	yes	not done	chickenpox
27.4.78	M. Juba	Sako	Deggars	C.M.H.	M	68	12.4.78	-	no	positive	chickenpox
17.5.78	Bakool	Yet	Bejinni	A.A.A.	M	55	21.4.78	-	1978	?	Moluscum contagiosum
10.6.78	Galbeed	Hargeisa	Hargeisa	I.J.A.	F	30	15.5.78	-	?	positive	secondary syphilis
12.7.78	L. Shabelli	Merca	Bajinajay	A.A.A.	M	3	6.7.78	-	12.7	not done	vaccinia
16.9.78	Bari	Iskushopan	Bargel	A.M.A.	F	45	7.9.78	-	yes	not done	drug rash
9.12.78	Bay	Baidoa	Duduno	F.H.	F	60	7.11.78	8.12.78	yes	not done	chickenpox
16.1.79	Nugal	Taleh	Hurdume	F.M.D.	F.	newborn	7.1.79	19.1.79	no	not done	congenital syphilis?
28.2.79	M. Juba	Gelib	Mereray	D.H.M.	M	20	24.2.79	-	no	positive	chickenpox
17.2.79	Bay	Dinsor	Welgras	G.A.I.	M	40	?	24.12.78	?	not done	Herpes zoster*
24.4.79	Togdheer	Bohodle	Reega	K.S.A.	F	20	March 79	-	yes	not done	secondary syphilis

FIG. 11.5

SUSPECTED SMALLPOX CASES BY DISTRICT  
SOMALIA 1978 – 1979\*

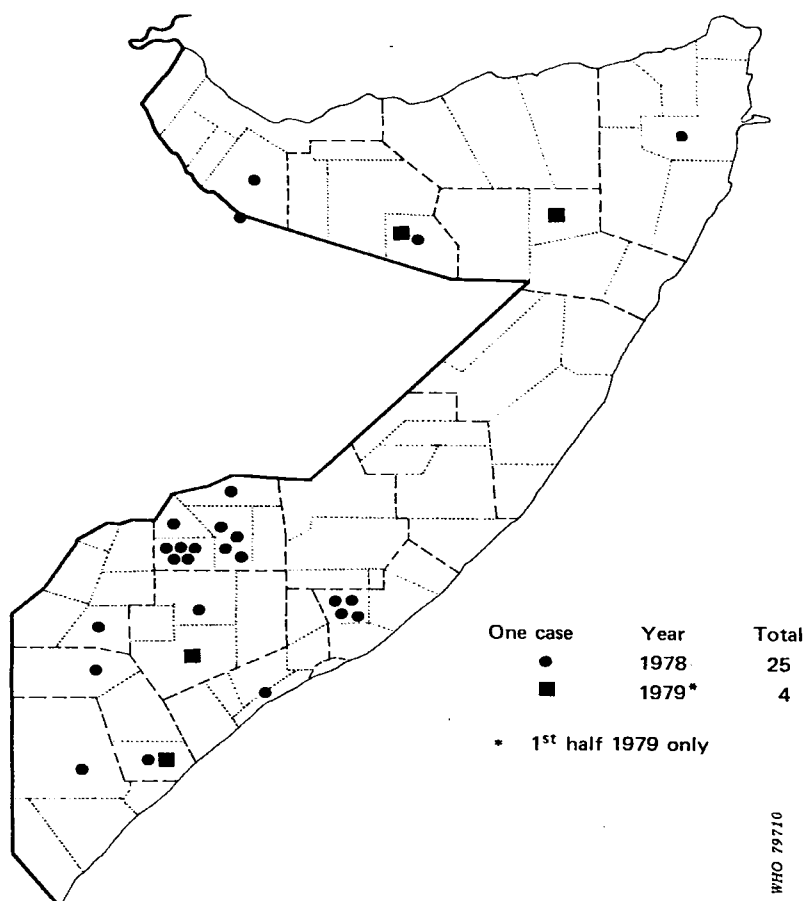


TABLE 11.4

FINAL DIAGNOSIS OF SUSPECTED SMALLPOX CASES, 1978-1979

Final diagnosis	1978		1979
	Number of cases	Percent	Number of cases
Chickenpox/Herpes zoster	18	72	2
Secondary syphilis	2	8	1
Congenital syphilis	0	0	1
Animal pox (suspected)	1	4	0
Dermatitis	1	4	0
Drug rash	1	4	0
Moluscum contagiosum	1	4	0
Vaccinia	1	4	0
Total	25	100.00	4

## 12 LABORATORY INVESTIGATION

In typical cases of variola major smallpox, as seen in Asia, clinical diagnosis was usually straightforward and laboratory tests often unnecessary, at least until the latter stages of eradication programmes when it was essential to diagnose accurately even remotely suspicious cases. With variola minor smallpox, however, particularly in its milder forms, laboratory assistance in achieving a diagnosis was relatively more useful. With this in mind, a large number of specimens for laboratory examination were collected by the Somali smallpox eradication programme.

In 1960, the possibility of establishing laboratory diagnostic facilities in Somalia was explored but in view of the non-availability of trained staff, the idea was abandoned. Specimens were, therefore, forwarded to WHO for testing in reference laboratories.

### 1. Policy for Specimen Collection

With the initiation of the intensified eradication campaign in March 1977, policy and procedures for specimen collection were more clearly stated. WHO advisers and regional epidemiologists were made responsible for specimen collection and held training sessions for programme staff on collection technique, correct completion of the appropriate forms and dispatch procedures. Specimen collection kits were distributed to all concerned. Specimens were carried by messengers to Mogadishu from whence they were forwarded to WHO HQ Geneva and on to reference laboratories in Moscow, USSR, and Atlanta, USA.

Criteria were defined for collection of specimens. It became mandatory to collect specimens from every outbreak:

- of clinically diagnosed smallpox (from August 1977),
- of suspected smallpox,
- of chickenpox, and particularly from unvaccinated cases,
- of rash-with-fever where a death had occurred,
- where containment measures had been initiated (from October 1977),
- in which there was doubt about the diagnosis of a rash-with-fever case, and
- where a case was suspected as suffering from post vaccination complications.

In July 1978, epidemiologists were requested to train all staff, including district team leaders, surveillance agents and temporary searchers, in specimen collection. These staff were then encouraged to take advantage of their contact with the population, particularly the nomads in remote areas, for the collection of specimens from rash cases. In fact, a further criterion was added to the above list: a specimen was to be collected from any rash-with-fever case encountered in a remote area. This was to compensate for the possibility of losing contact with an affected group before a verification of the diagnosis could be made by a supervisor.

In January 1979, WHO HQ reported that 17% more specimens had been collected in Somalia in 1978 than in 1977. As the reference laboratories were feeling the strain of this enormous work load, the criteria for specimen collection were somewhat modified. In 1979, cases from which specimen collection was essential were:

- suspected smallpox cases,
- at least one case in every chickenpox outbreak,
- hospitalized chickenpox cases, and
- severe or atypical chickenpox cases, including those with lesions on the palms of the hands and soles of the feet.

## 2. Laboratory Tests Performed

All specimens, in most cases vesicular fluid, crusts or scabs, were initially tested by electron microscopy (EM). Those showing poxvirus particles were then immediately tested by inoculation on chorioallantoic membrane (CAM) of chicken embryos and for the presence of antigen by the gel precipitation test (PIG). These three tests were routinely used for all specimens, priority for testing of individual specimens being decided by EM screening.

## 3. Specimens Collected

From September to December 1976, 52 specimens were collected from the Mogadishu smallpox outbreak. In the first quarter of 1977, a further 38 specimens were collected from this outbreak and throughout the country a total of 879 specimens were taken in 1977. The origin of these specimens by district and by quarter is shown in Table 12.1. In 1978, 1646 specimens were collected in Somalia, as is also shown in Table 12.1. In both years the greatest numbers of specimens were collected in the last half of the year. Figure 12.1 illustrates more clearly that in 1977 and in 1978 most specimens were collected in those regions heavily affected by smallpox in 1977.

TABLE 12.1

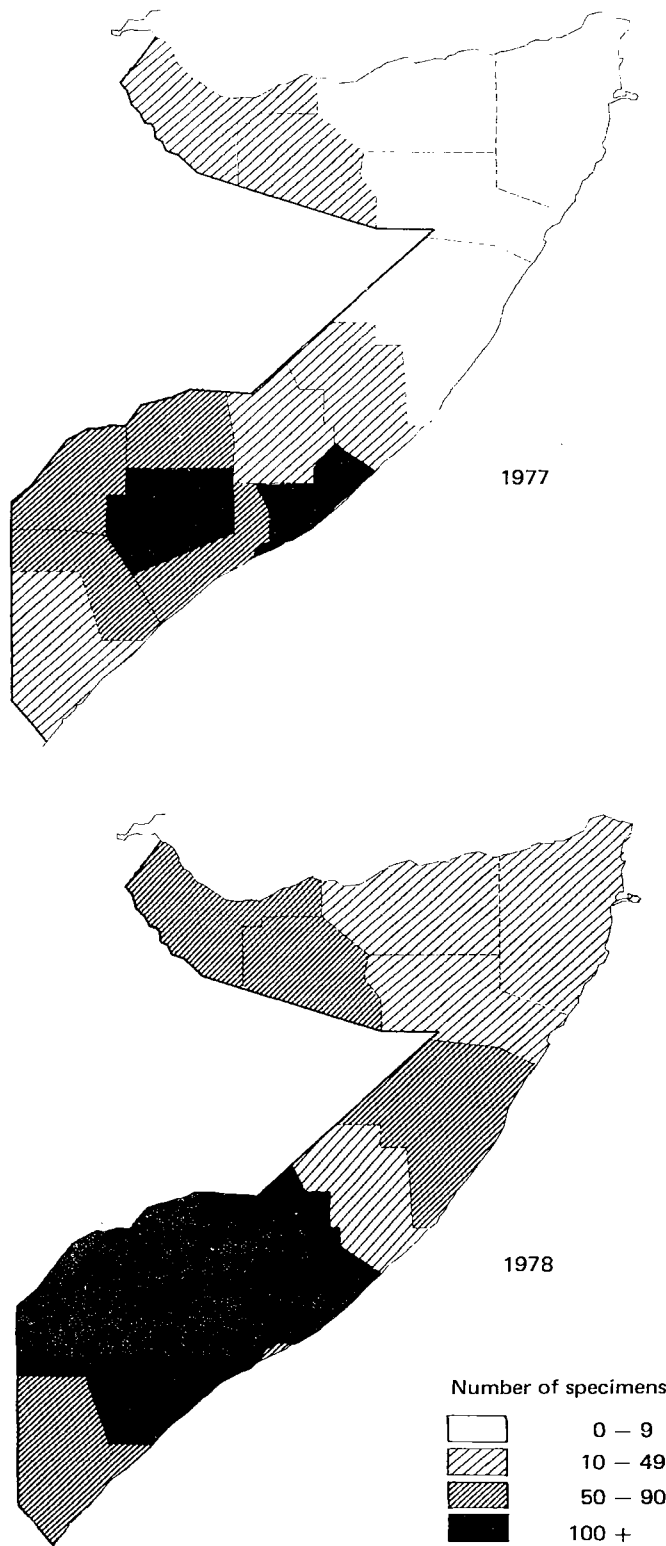
ORIGIN OF LABORATORY SPECIMENS BY REGION AND BY QUARTER OF COLLECTION,  
SOMALIA, 1977-1978

Region	1977					1978				
	1st	2nd	3rd	4th	Total	1st	2nd	3rd	4th	Total
Bakool	-	30	11	43	84	381	50	99	84	267
Bari	-	-	1	-	1	2	4	10	8	24
Bay	-	36	103	55	194	32	30	60	85	207
Galbeed	-	4	2	15	21	13	10	20	24	67
Galgadud	-	4	2	8	14	5	4	15	22	46
Gedo	-	15	35	21	71	23	28	32	24	107
Hiran	-	18	7	15	40	31	25	40	17	113
Lower Juba	-	6	9	12	27	6	19	37	17	79
Middle Juba	-	25	26	4	55	11	10	60	49	130
Mogadishu	38	17	15	31	101	27	19	22	17	85
Mudug	-	-	5	3	8	5	9	18	19	51
Nugal	-	-	-	7	7	2	11	11	10	34
Sanaag	-	-	1	2	3	-	20	16	11	47
Lower Shabelli	-	41	39	16	96	20	18	48	85	171
Middle Shabelli	-	28	56	29	113	32	31	24	23	110
Togdheer	-	-	6	26	32	40	15	10	34	99
Somalia	38	224	318	287	867 <sup>a</sup>	283	303	522	529	1 637 <sup>b</sup>

<sup>a</sup> Not including 12 specimens of unknown region - total specimens for 1977 therefore 879

<sup>b</sup> Not including 9 specimens of unknown region - total specimens for 1978 therefore 1646

FIG. 12.1  
REGIONS FROM WHICH LABORATORY SPECIMENS WERE COLLECTED,  
SOMALIA, 1977 – 1978



The age and sex distribution of patients from whom specimens were collected in 1977 and 1978 is shown in Table 12.2. The 1977 distribution roughly corresponds to the distribution of smallpox cases in 1977 (Table 4.8), although specimens were collected from a disproportionate number of 20-29 year olds. This excess is probably accounted for by specimens taken from rash-with-fever cases among nomadic herdsmen, particularly in view of the relatively low vaccination coverage in this group, when it was felt that supervisory follow-up visits for diagnosis verification may have been difficult. The age distribution for 1978 shown in Table 12.2 corresponds quite closely to that of chickenpox cases reported in 1978 (figure 11.2).

TABLE 12.2

AGE AND SEX DISTRIBUTION OF PATIENTS FROM WHOM LABORATORY SPECIMENS  
WERE COLLECTED, SOMALIA, 1977-1978

Age group (years)	1977				1978			
	Male	Female	Both sexes		Male	Female	Both sexes	
			Number	% of total			Number	% of total
0-4	58	62	120	13.6	144	114	258	15.7
5-9	64	43	107	12.2	147	124	271	16.5
10-14	61	59	120	13.6	158	95	253	15.4
15-19	82	41	123	14.0	169	57	226	13.7
20-29	107	51	158	18.0	186	72	258	15.7
30-39	58	33	91	10.4	92	56	148	9.0
40-49	39	17	56	6.4	54	27	81	4.9
50+	41	24	65	7.4	62	33	95	5.7
Unknown	17	22	39	4.4	22	34	56	3.4
Total	527	352	879	100.0	1 034	612	1 646	100.0
Percent	60.0	40.0	100.0	-	62.8	37.8	100.0	-

The vaccination status of patients from whom specimens were collected was generally recorded. In 1977, 40% had vaccination scars, 55% did not, and for 5% this information was not recorded. In 1978, the comparative proportions were 68%, 23% and 9%. The change from 1977 to 1978 reflects two features: in 1977, but not in 1978, many specimens were taken from smallpox cases who were in general unvaccinated, and in 1978, the vaccination coverage of the population was, in any case, higher than in the previous year.

### Results

The laboratory diagnoses made in 1977 and 1978 are shown in Table 12.3. The distribution of the variola positive specimens by region and by three month period in 1977 is shown in figure 12.2. The single vaccinia positive specimen in 1977 was taken from a case in Merca District, Lower Shabelli Region, and the molluscum contagiosum positive specimen of 1978 was from Yet District, Bakool Region.

**TABLE 12.3**  
**RESULTS OF LABORATORY TESTING OF SPECIMENS FROM SOMALIA, 1977-1978**

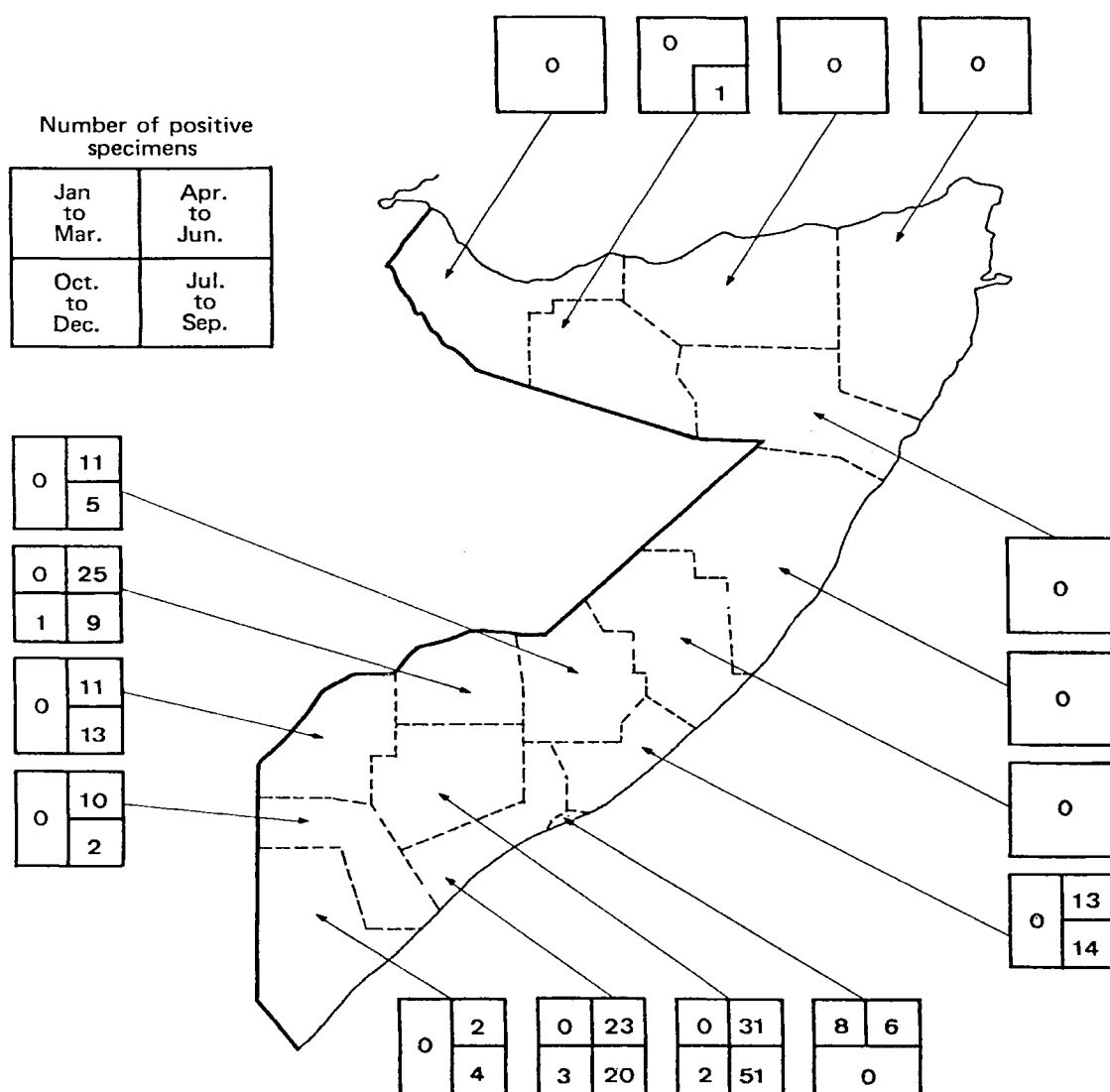
Month	1977				1978			
	Number specimens examined	Number positive for:			Number specimens examined	Number positive for:		
		Variola virus	Herpes varicella	Other		Variola virus	Herpes varicella	Other
January	22	8	7	0	87	0	33	0
February	11	0	5	0	88	0	36	0
March	5	0	3	0	108	0	42	0 <sup>b</sup>
April	83	53	10	1 <sup>a</sup>	113	0	42	1 <sup>b</sup>
May	51	26	6	0	105	0	48	0
June	90	53	13	0	85	0	19	0
July	72	40	11	0	163	0	30	0
August	122	55	29	0	153	0	35	0
September	124	24	38	0	206	0	82	0
October	104	6	34	0	168	0	39	0
November	111	0	33	0	169	0	23	0
December	72	0	18	0	192	0	30	0
Unknown	12	0	6	0	9	0	4	0
Total	879	265	213	1	1 646	0	463	1

<sup>a</sup> Vaccinia

<sup>b</sup> Molluscum contagiosum



FIG. 12.2  
DISTRIBUTION OF VARIOLA VIRUS POSITIVE LABORATORY SPECIMENS,  
SOMALIA, 1977



## 13 IMPORTANT EVENTS, SURVEYS AND STUDIES

### 1. Preliminary International Commission Visit

From 16 November to 2 December 1978 two members of the Global Commission for the Certification of Smallpox Eradication, Drs J. Kostrzewski and P.N. Shrestha, visited Somalia to assess the progress of the smallpox eradication programme. Accompanied by government and WHO officials, they visited a total of 16 districts in 7 regions and conducted field evaluations in 34 villages and 12 health facilities, as well as schools, markets and refugee camps.

The Commission members reviewed all aspects of the programme and reported their findings under a number of specific headings. In general they found that the surveillance in the six previously heavily endemic southern regions visited was of uniformly high quality and that the public were well informed. In Galbeed Region, in the north, the standard was found not to be as high. In addition, it was found that the search activities, training of personnel, specimen collection, vaccination coverage and documentation of the programme were satisfactory. On visiting the sites of previous smallpox outbreaks, the Commission members were unable to find previously unidentified past smallpox cases. The inappropriateness of pockmark surveys in this regard, in Somalia, was noted.

#### Recommendations

Various recommendations were made and may be summarized as follows.

- Surveillance activities should continue at the current high level of effectiveness until the visit of the International Commission in October 1979.
- In areas where certain inadequacies in the programme were found, for example Hargeisa, and in areas bordering Kenya and Djibouti, surveillance should be strengthened and attention paid to cross-notification of suspect smallpox cases to the other countries.
- Inter-country cross-notification of information should be improved.
- The planned programme of activities for 1979 should be implemented.
- A comprehensive document on the programme should be prepared.
- Some further smallpox rumours should be checked by medically trained epidemiologists.
- The collection of laboratory specimens should be continued according to existing guidelines.
- The time interval between the dispatch of specimens and receipt of results should be decreased.
- The current vaccination policy should be maintained.
- Cooperation of the health facilities in reporting rash-with-fever should be improved.

Following the visit, every effort was made to implement these suggestions.

## 2. The National Assessment Commission

Knowing that, in order to confirm independently smallpox eradication in Somalia, an International Commission was scheduled to visit the country in October 1979, it was decided that a preliminary assessment be conducted by national personnel.

The "National Commission" was headed by Dr A. Deria, Director of Public Health, with Dr M. Alaghbari (Acting WHO Programme Coordinator) and Dr Z. Jezek (WHO Epidemiologist) as secretaries. In every region a subcommittee or "National Regional Assessment Commission" was established, consisting of the Regional Health Coordinator as chairman, Senior Regional Administrators, the Regional Epidemiologist as secretary and WHO Advisers to assist in technical matters. Depending on the epidemiological importance of the region, its size and its accessibility, further commission members were co-opted as necessary.

The objectives of the National Commission were stated to be:

- (a) to confirm by extensive field investigation in the area of their responsibility:
  - that no sign of continuing smallpox transmission has been found,
  - that the surveillance system in the region has been sufficiently sensitive to have detected smallpox transmission should it have occurred,
  - that public awareness about programme activities is sufficiently high;
- (b) to motivate health and administrative staff at all levels to maintain a high standard of surveillance until the arrival of the International Commission;
- (c) to observe in detail the process of smallpox surveillance and recommend any improvements to strengthen it.

### Activities and Findings

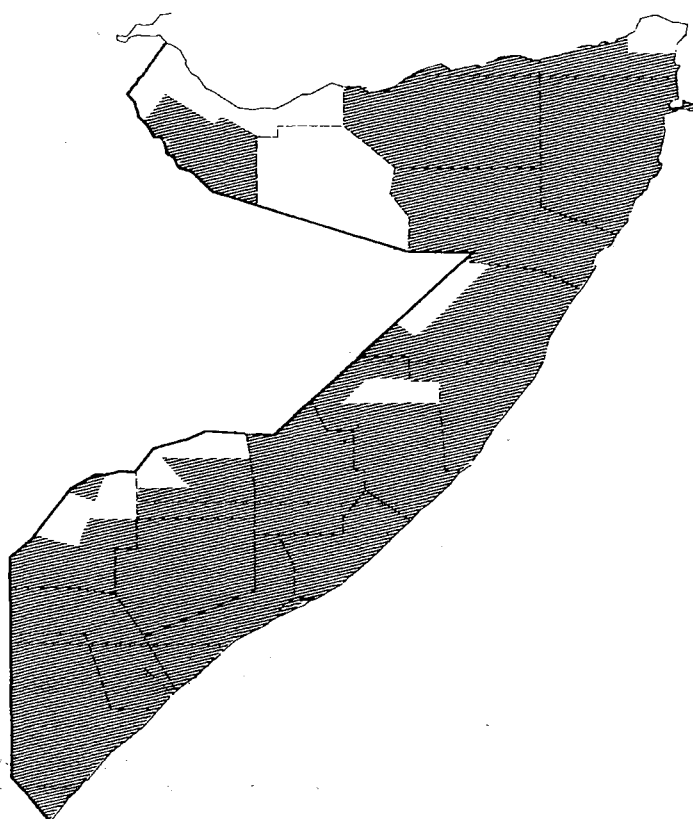
The initial briefing was given as a part of the review meeting held in Mogadishu, at the Ministry of Health on 4 March 1979, when procedures for assessment were discussed and finalized. Representatives of the regional committees were present. Similar briefing sessions were held in all regions in the second week of March for all members of the respective regional assessment commissions. Assessment method was discussed and the smallpox programme structure, operational guidelines, reporting system and documentation at "Zeropox" offices, were reviewed. Commission members were divided into groups, each responsible for several districts to be assessed over a 6-10 day period. The districts visited are shown in figure 13.1.

In view of the limited time available, it was recommended that commission members should select those areas in which it was thought possible that smallpox could persist. These areas were chosen after a thorough review of the regional and district programmes and following discussions with local health staff and public administrators. The following criteria were applied in the selection of areas for visits:

- the site of the last known smallpox outbreak in each district,
- areas reporting suspected smallpox cases or deaths due to rash-with-fever,
- areas most deficient in submitting routine reports or reporting no cases of rash-with-fever,
- areas bordering other districts, regions or neighbouring countries,
- areas which have shown no improvements in the assessment findings,
- areas inhabited by nomadic populations.

FIG. 13.1

DISTRICTS VISITED BY  
NATIONAL ASSESSMENT COMMISSION  
MARCH 1979



In addition to the general impression gained by the commission members, the following indices of the programme's effectiveness were recorded:

- Search operations: target areas and completeness of search, number of rash-with-fever cases detected, number of specimens taken and number of vaccinations performed;
- Search assessment: selected areas and size of sample for assessment, assessment results among settled and nomadic sectors of the population;
- Inter-search surveillance: the effectiveness of detection and reporting of rash-with-fever cases during the inter-search period;
- Verification of diagnoses: the percentage of rash-with-fever reports verified personally by regional epidemiologists, WHO advisers, district team leaders; knowledge of district team leaders about smallpox and its differential diagnosis; presence of differential diagnosis posters in "Zeropox" offices;
- Reporting and documentation: the regularity of periodic reports and the maintenance of records and programme documentation in the form of maps, charts and files at regional and district levels;
- Public awareness: the extent and effectiveness of the publicity of the reward of 200 Somali shillings for the reporting of a smallpox outbreak;
- Involvement of health personnel: the degree of cooperation and awareness of regional health staff and general administration at district and regional levels.

During visits made to settled villages or to nomad areas the following items were checked and examined:

- whether or not the village or nomad encampment was searched in the most recent search;
- whether or not the school was searched in the most recent search;
- whether or not the headman of the village or camp was contacted and the locality surveillance card signed during the most recent search;
- the proportion of people who saw the recognition card;
- the proportion of people who knew of the reward;
- the proportion of people who knew where to report suspected cases;
- the number of reward posters pasted on houses.

The commission members also investigated any current outbreak of rash-with-fever disease and satisfied themselves that a diagnosis of smallpox could be excluded. The results of the commission's assessment are recorded in chapter 8.

### 3. Facial Pockmark Survey

During the month of October 1978, WHO advisers, in collaboration with their national counterparts, conducted an independent assessment of the performance of smallpox surveillance activities, exactly one year after the last case of the disease had been detected in the country. The main objectives were to assess:

- the effectiveness of the regional SEP programme;
- the awareness of the general public about programme activities;
- the vaccination status of the sampled population,
- the history of smallpox transmission by observing facial scar (pockmark) rates among the surveyed population.

The first three items have been covered fully in chapters 5 and 8 and only the results of the facial pockmark survey will be presented here.

All 16 regions of Somalia were visited within 10-15 days and 55 of the existing 71 districts were assessed. The localities and nomad encampments to be visited were selected by a multi-stage random sampling method.

Details of the field visits are shown in Table 13.1. In general assessment teams were able to visit five or six localities per day.

TABLE 13.1  
LOCALITIES, HOUSEHOLDS AND PERSONS CONTACTED DURING PROGRAMME ASSESSMENT  
AND FACIAL POCKMARK SURVEY, SOMALIA, OCTOBER 1978

Particulars	Urban areas	Rural areas		Total
		Settled localities	Nomad encampments	
<u>Total number of:</u>				
Localities visited	59	234	217	510
Households interviewed	1 358	3 323	1 457	6 138
Persons contacted	4 289	9 968	3 889	18 146
<u>Average number of:</u>				
Households interviewed per locality visited	23	14	7	13
Persons contacted per locality visited	73	43	18	36
Persons contacted per household interviewed	3.2	2.9	2.7	3.0

### Findings

The number of previous smallpox cases, by age and sex, detected during the survey is shown in Table 13.2. Any persons with one or more facial pockmarks and from whom a history of smallpox was obtained by a skilled interviewer are included. In total, of 18 146 persons who were physically examined and interviewed, only 261 persons met these two criteria. The observed average prevalence rate per 1000 population examined was 14.4, with only a slight difference between the sexes; 13.1 in males and 15.3 among females. None of these previous smallpox cases were found among children less than 10 years of age. Except in the 40-49 years age group, the prevalence rate was significantly higher among males than females.

In Table 13.3 it is shown that there was no significant difference in the prevalence rate of the settled and nomadic populations. The prevalence rate amongst the female nomadic population was, however, slightly higher than in the male nomads.

From the total of 261 pockmarked persons, only five individuals were found to have a vaccination scar. These were older persons, who had suffered from smallpox during childhood and had vaccination scars resulting from vaccinations performed in 1976.

TABLE 13.2

POCKMARKED CASES DETECTED BY AGE AND SEX, SOMALIA, OCTOBER 1979

Age group	Male			Female			Total		
	Persons examined	Facial pockmark	Rate per 1000 population	Persons examined	Facial pockmark	Rate per 1000 population	Persons examined	Facial pockmark	Rate per 1000 population
0-4	1 710	-	-	1 397	-	-	3 107	-	-
5-9	1 282	-	-	1 025	-	-	2 307	-	-
10-14	969	3	3.09	1 112	-	-	2 081	3	1.44
15-19	810	4	4.94	1 437	2	1.39	2 247	6	2.67
20-29	1 121	9	8.03	1 793	10	5.58	2 914	19	6.52
30-39	597	14	23.45	1 752	25	14.27	2 349	39	16.60
40-49	570	23	40.35	898	44	48.99	1 468	67	45.64
50-59	240	23	95.83	645	30	46.51	885	53	59.89
60+	167	22	131.74	621	52	83.74	788	74	93.91
Total	7 446	98	13.13	10 680	163	15.26	18 146	261	14.38

Note: Pockmarked person = person with any facial pockmarks accompanied by smallpox history.

TABLE 13.3

POCKMARKED PERSONS BY POPULATION TYPE, OCTOBER 1978

Population examined	Settled population			Nomadic population		
	Males	Females	Total	Males	Females	Total
Total number of persons examined	5 474	8 783	14 257	1 992	1 897	3 889
With facial pockmarks	77	131	208	21	32	53
Rate per 1000 population	14.1	14.9	14.6	10.5	16.9	13.6

The geographical distribution of the 261 pockmarked persons detected, by district, is shown in figure 13.2. Nugal Region contributed 75 of these cases: 44 were detected in Taleh District, 17 in Garoe and 14 in Eil. Twenty-eight cases were detected in Mudug Region, 13 in Mogadishu and 35 in Bay Region. The distribution of these previous smallpox cases according to the place where they were attacked by the disease is similar although the numbers are reduced by the subtraction of 21 cases which occurred outside Somalia: 19 in Ethiopia and one each in North Yemen and Djibouti. It seems obvious that in the past smallpox was prevalent widely in the country.

The annual distribution of the 231 smallpox cases alleged to have occurred since 1930 is presented in figure 13.3. Two major smallpox epidemics are recorded in this period: in 1938-39 an epidemic appears to have been centred in the south and in 1953-54 a more extensive epidemic occurred predominantly in the north-east of the country.

Of the 19 cases reporting Ethiopia as the place of attack with smallpox, seven occurred in 1953, suggesting that Ethiopia was also affected by the 1953 epidemic.

The most significant finding of the survey, from the current viewpoint, is that no person was found who had pockmarks and/or claimed to have been affected by smallpox after the occurrence of the last smallpox case, in Merca, on 26 October 1977.

FIG. 13.2

DISTRIBUTION OF THE 261 PERSONS WITH POCKMARKS  
ACCORDING TO DISTRICT OF DETECTION

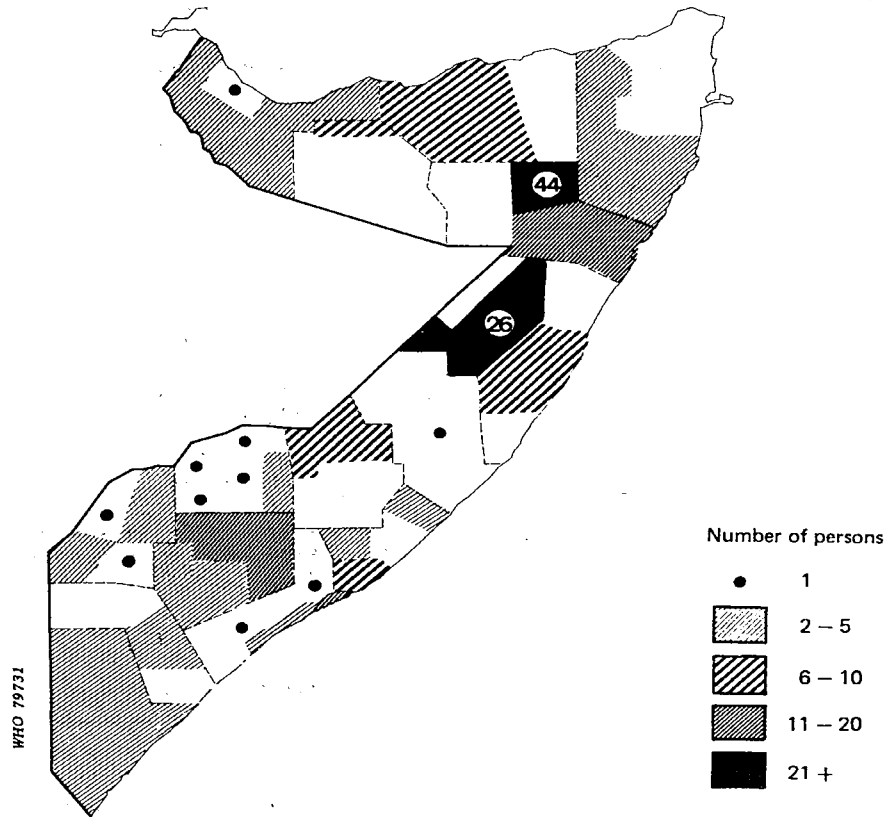
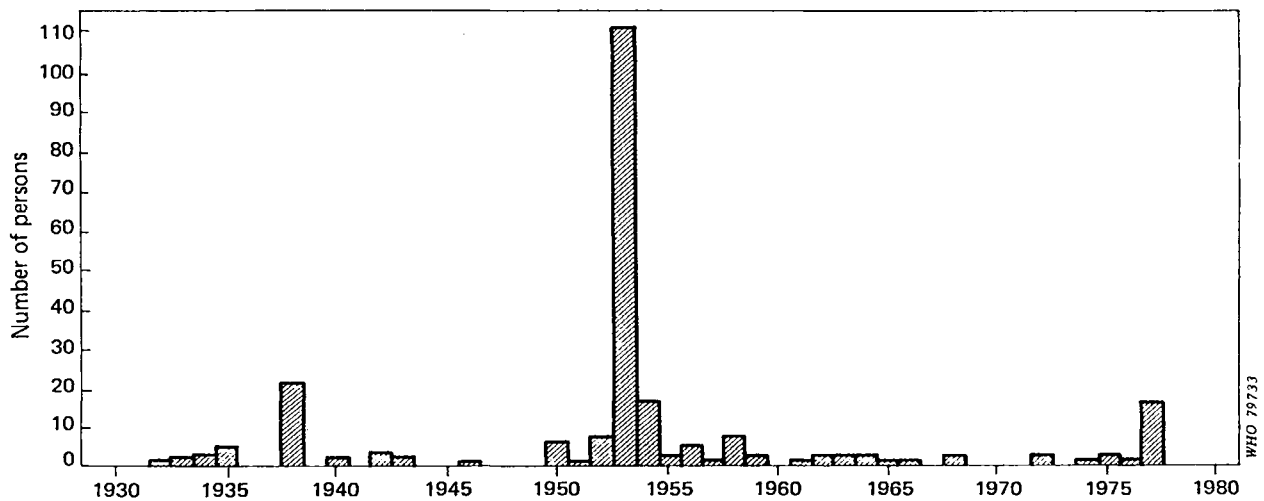


FIG. 13.3

DISTRIBUTION OF 261 PERSONS WITH POCKMARKS BY REPORTED YEAR  
OF SMALLPOX ATTACK





#### 4. Study of Residual Skin Changes following Variola Minor Infection

Facial pockmark surveys have proved a useful method for assessing the past occurrence of smallpox in countries of Asia and west and central Africa. Controlled studies in India showed that about 75% of patients known to have recovered from smallpox had five or more facial pockmarks when examined one to two years later; such scars usually persist for life.

Although extensive rash often occurs in variola minor, ulceration is usually shallow and it is widely believed that persistent pockmarks are rare. Controlled studies in patients with known histories of recovery from variola minor had not, however, been carried out. The smallpox surveillance programme in Somalia in 1977-78 provided an opportunity for such a study.

Of 3268 cases which occurred in Somalia during 1976 and 1977, only 12 died, indicating extremely mild smallpox - which is characteristic of infection by variola minor.

A follow-up study was made in May-August 1978 of 175 patients from five regions of Somalia heavily affected by smallpox in 1977. To ensure that only persons known to have suffered smallpox were included in the study, the following procedure was followed. Recorded patients identified by name were selected from outbreaks which occurred 11-13 months previously, in 1977, and in which at least one case had been confirmed by laboratory diagnosis. In order to facilitate investigation and follow-up, only outbreaks among settled or semi-settled populations, at localities accessible throughout the year, were included.

Individual subjects were identified, demographic and epidemiological data checked, and examinations made of the face, arms and hands, legs and feet, and other visible parts of the body. Facial pockmarks or residual scars elsewhere on the body were counted, and vaccination scar(s) and corneal opacities recorded.

#### Results

The sex, age and vaccination status of the subjects examined are shown in Table 13.4.

TABLE 13.4

SEX AND AGE DISTRIBUTION AND VACCINATION STATUS OF PREVIOUS SMALLPOX PATIENTS EXAMINED, SOMALIA, 1978

Age group	Number examined	Males		Females	
		Vaccination scar		Vaccination scar	
		Present*	Absent	Present*	Absent
0-4	28	7	12	3	6
5-9	37	4	13	2	18
10-14	28	4	10	5	9
15-19	22	7	6	3	6
20-29	23	5	4	4	10
30-39	15	2	6	1	6
40+	22	3	5	2	12
Total	175	32	56	20	67

\*All subjects with a vaccination scar had been vaccinated during the incubation period or after the onset of the rash.

The results of the examination for facial skin changes are shown in Tables 13.5 and 13.6.

Only eight males and four females out of the 175 subjects (6.8%) had facial pockmarks that would be acceptable on current criteria (five or more depressed circular scars) as evidence of past smallpox. Some others (14 males and 15 females) had between one and four facial pockmarks and 24 subjects had clearly visible spots of skin discolouration that were probably due to variola minor infection. A further 38 had non-depressed hyper- or hypo-pigmented areas visible only on very careful examination. The remaining 48 had no visible skin changes at all.

TABLE 13.5

FACIAL SKIN CHANGES DUE TO VARIOLA MINOR, SOMALIA, 1978

Persons examined		Total cases	No significant changes	Pockmarks	
				1-4	5 or more
Males	No. %	88 (100)	53 60.3	14 15.9	8 9.1
Females	No. %	87 (100)	57 65.5	15 17.2	4 4.6
Total	No. %	175 (100)	110 62.8	29 16.6	12 6.8

TABLE 13.6

FACIAL SKIN CHANGES DUE TO VARIOLA MINOR, BY AGE GROUP, SOMALIA, 1978

Age group	Number examined	Number with pockmarks			
		1-4	%	5 or more	%
0-4	28	3	10.7	2	7.7
5-14	65	15	23.0	4	6.1
15-24	33	5	15.1	4	12.1
25-44	29	4	13.7	1	3.4
45+	20	2	10.0	1	5.0
Total	175	29	16.5	12	6.8

There were no significant sex differences in the occurrence of facial lesions, nor any differences associated with the presence or absence of a vaccination scar (in these individuals, vaccination scars were the result of vaccination during the incubation period or clinical illness due to variola minor).

Although the numbers were small, the highest proportion of individuals with facial pockmarks was found in the age group 15-24 (Table 13.6).

In only one individual was a single pockmark found elsewhere on the easily visible parts of the body. A further 58 subjects had non-depressed spots of skin discolouration which were readily visible on the exposed parts of the body other than the face.

### Discussion

In view of the criteria for selection of cases, and the high levels of diagnostic capability and recording accuracy achieved by the eradication programme in 1977, it is probable that all persons examined had indeed suffered smallpox. Thus, the results confirm the impression widely held among smallpox workers that, unlike variola major, variola minor rarely caused permanent facial scarring. Only 7% of previous patients in this study had five or more pockmarks, compared with 75% after recovery from variola major smallpox.

This difference is presumably due to the nature of the lesions caused by variola minor, which were relatively more superficial and evolved more rapidly than those of variola major. Epidermal damage appeared to be repaired often without leaving a scar. Only those lesions deepened by a secondary infection, especially by staphylococcus aureus, appeared to form the typical facial pockmarks.

On the faces of a high proportion of the patients the local inflammatory process seemed to affect melanocytes so that their ability to form pigment was substantially reduced initially and later hyperactivated. The highest proportions of those without any skin changes on the face were among the younger age groups, among females and among those having vaccination scars.

The rapid disappearance of skin discolouration limits the usefulness of examination for this feature, except, perhaps, in those areas recently affected by variola minor. Facial pockmarks may persist substantially longer, but their frequency among patients limits their applicability as an index of past infection.

These findings indicate that pockmark surveys are not useful in detecting the occurrence of past smallpox in areas where variola minor was the infecting agent.

### 5. Nomadic Population Survey

The majority of Somalia's population lives in rural areas which include settled villages and semi-settled hamlets, as well as semi-nomad and nomad encampments. Limited data is available regarding the actual proportion of each of these sectors of the population, the nature of the nomad encampments and the pattern and extent of the nomads' movements. This lack of data posed a problem in planning and establishing an adequate surveillance system, particularly with regard to the organization of transport, logistics and manpower. In an attempt to obtain some basic information about the nomadic population, which could then be utilized for better planning and more effective implementation of the programme activities, a cross-sectional survey was conducted in 1978.

#### Method

The survey was conducted in 1978, with September, which is the end of the dry season, and December being considered as appropriate times, both for accessibility and because it was expected that the nomads' movements would reach their peak at these times. A special questionnaire designed to obtain basic information about the nature of nomad encampments and the pattern of the nomads' movements was provided to senior surveillance agents and their supervisors. Searchers were personally trained by regional supervisors to ensure that the questions to be asked and the completion of the forms was well understood. Collection of information was carried out simultaneously with the distribution of nomad locality surveillance record cards.

The survey was carried out in all regions except Mogadishu and Galbeed, and completed questionnaires were received from 50 selected districts. Some zones within them, where surveillance agents were found to be inexperienced in data collection, were excluded from this survey.

In consideration of the geographical features of Somalia, the selected districts were grouped into those belonging to:

- the northern regions: predominantly barren lands, semi-deserts and rocky hills; sparsely populated; livestock raising is the main occupation of the people; and
- the southern regions: predominantly plateau and more densely populated; the land is more fertile and agriculture, aside from raising livestock, represents a significant livelihood.

They were further subdivided into:

- the coastal districts: having an average altitude of up to 30 m above sea level; predominantly plain savannah and sandy areas;
- the highland plateau areas: having an average altitude of more than 30 m above sea level; desert bush and farmlands predominate.

### Results

A total of 8940 nomad encampments with 81 074 huts and 287 155 inhabitants were registered in the survey (Table 13.7).

TABLE 13.7  
NOMAD ENCAMPMENTS, HUTS AND INHABITANTS, SURVEYED BY REGIONS AND AREAS,  
SOMALIA, 1978

Regions	Area	Total registered			Average number of		
		Encampments	Huts	Inhabitants	Huts per camp	Persons per camp	Persons per hut
Northern	Coastal	514	3 848	20 241	7.5	39.4	5.3
	Highland	4 076	17 196	73 033	4.2	17.9	4.3
Southern	Coastal	679	10 224	31 591	15.1	46.5	3.1
	Highland	3 671	49 806	162 290	13.6	44.2	3.3
All Somalia	Coastal	1 193	14 072	51 832	11.8	43.5	3.7
	Highland	7 747	67 002	235 155	8.7	30.4	3.5
Total	Both	8 940	81 074	286 987	9.1	32.1	3.5

### Encampment Size

The average sizes of encampments and "households" is also shown in Table 13.7. In general, the nomad encampments average: nine huts with 32 inhabitants; 3-5 persons per hut. It was observed that the average number of huts and persons per encampment in the coastal areas tended to be more than in highland plateau areas; the southern coastal areas and northern highlands representing the extremes. In the northern regions 67% of the nomad encampments in the highland areas had only 1-4 huts per camp. In coastal areas, however, the pattern was similar to all of the southern regions, having a mode of 5-20 huts per encampment. A relatively small percentage of encampments had more than 20 huts.

### Encampment Location

The proximity of encampments to water-points was also evaluated. The findings of this enquiry are graphically summarized in figure 13.4. Except in the coastal area of the northern regions around 40% of encampments were stated to be within one hour's walk (around 5 km) of the nearest watering point and around 80% within three hours' walk (15-20 km). In the northern coastal area, distances to the nearest water-points were generally greater.

Considering the proximity of the nearest settled village, a pattern very similar to that shown for water-points in figure 13.4 was observed. However, the discrepancy between the northern coastal areas and the other areas of Somalia was greater. In the northern coastal areas only 60% of encampments were within a four hour walk of a settled village, whereas in all other areas this proportion was more than 80%.

From the practical point of view this information was useful in that it indicated that by searches within a five hour walk radius of each water-point or each settled village in an area one could be expected to contact 90% of the existing encampments.

### Frequency and Extent of Nomadic Movement

In an attempt to evaluate the degree of movement of the nomads' encampments, they were asked how far their present encampment was from the locality at which they stayed one week and one month earlier, respectively. In the highland areas 27% of encampments had not moved in the previous one week and 19% not in the previous one month. In the coastal areas the encampments were relatively more permanent, the corresponding proportions being 45% and 34%. Of those encampments which had moved, over 96% were within one week's walk and over 77% within three days' walk of their encampment location of one month earlier.

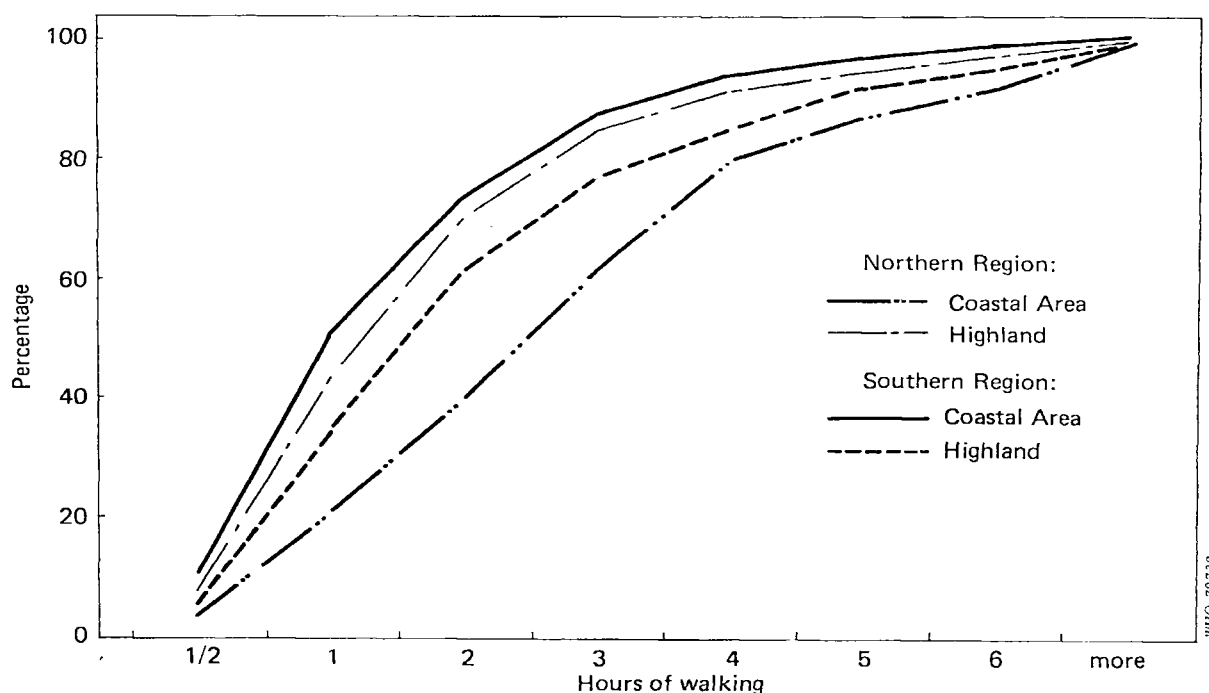
These enquiries indicated that with the exception of a more mobile minority, nomads do not frequently shift their camps over large distances. In general, supervisors going to verify diagnoses were able to find nomad encampments in the same locations as those indicated by the searchers reporting cases within the previous week.

### Factors Affecting Nomadic Movements

The variation from region to region in the findings recorded above and the overall patterns of behaviour are a result of the interaction of various factors including the following.

- The availability of water: The nomads need "soft" water for their cattle, goats and sheep and for their own consumption, but brackish water is needed for their camels. Usually they have to herd their cattle, goats and sheep once every two to three days to the soft water-point, whereas their camels need brackish water every seven to ten days.
- The availability of pasture
- Seasonal changes: During the rainy season, when pasture and water are abundant the nomads will stay much longer in one locality.
- Daily commodity requirements: The nomads have to go to the nearest market to get sugar, salt and other commodities, usually weekly.
- Epidemics of livestock diseases: If there is an epidemic, the nomads usually abandon their encampment immediately to move to another locality they consider to be safer.

FIG. 13.4  
DISTRIBUTION IN HOURS OF WALKING OF THE DISTANCES BETWEEN NOMADIC  
ENCAMPMENTS AND THE NEAREST WATERPOINT  
CUMULATIVE PERCENTAGES



- Insect infestations: The type and number of insects prevailing in the grazing areas is important, for example, during the rainy season certain areas are infected by blood sucking flies. The nomads completely abandon areas where they observe these tse-tse flies.

Certain nomadic groups tend to follow rather permanent and predictable patterns of circulation within a defined area. In some areas, once the nomads abandon their encampment, they will not settle in the same place for five to six months or even a number of years.

Combinations of all these factors produce a complex situation which needs further study to be well understood. This is necessary for the future planning and more effective and efficient implementation of basic health services.

## 6. Study of Challenge Vaccination in Persons Affected by Variola Minor

In order to determine the value of challenge vaccination as an epidemiological tool in arriving at a correct diagnosis in variola minor smallpox infection, a study was undertaken in Somalia in autumn 1978 among persons known to have suffered smallpox one year earlier.

The selection of localities and patients for this study was made from the general list of smallpox outbreaks where the diagnoses of outbreaks, if not necessarily the patients, had been confirmed by laboratory investigation. Furthermore, preference was given to localities accessible during all seasons, so that follow-up of patients was possible.

Challenge vaccination was performed on 92 persons, 43 males and 49 females, who had suffered from variola minor smallpox one year before. Interviewing, physical examination, challenge vaccination and verification of results was performed by two qualified medical officers. In the majority of cases the "take-verification" was done twice, 3-5 and again 7-9 days after challenge vaccination.

### Results

Of the total of 92 challenge vaccinations, only 65 persons were available for "take-verifications"; results are shown in Table 13.8.

TABLE 13.8

RESULTS OF CHALLENGE VACCINATION AMONG PERSONS PREVIOUSLY AFFECTED BY VARIOLA MINOR, SOMALIA, 1978

Take verification	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
Total vaccinated	32	100.0	33	100.0	65	100.0
Negative vaccination	8	25.0	6	18.2	14	21.5
Positive vaccination						
Major	20	62.5	21	63.6	41	63.1
Accelerated	4	12.5	6	18.2	10	15.4

Altogether 14 persons (21.5%) were found to have negative reactions to challenge vaccination, while 51 patients (78.5%) showed positive reactions. The typical "major" reaction of a central vesicle, pustule, ulcer or scab of a diameter of 5 mm or more surrounded by induration, was found in 63.1% of the individuals studied.

No significant differences were found between the sexes or age groups.

This challenge vaccination study showed that the majority of patients suffering from variola minor one year ago showed a positive reaction and a high proportion of those a "major" reaction. This observation contrasts sharply with findings among those affected by variola major: in India among a sample population given challenge vaccination one year after recovery from smallpox, only 13% showed a major reaction

It was concluded that the usefulness of challenge vaccination in Somalia as an aid to correct diagnosis of presumed recent or past smallpox cases is very limited.

## 14 INPUT

From its inception in 1969 as a mass vaccination campaign, until the resolutions of the first Nairobi coordination meeting of 14-16 March 1977 were introduced, the Smallpox Eradication Programme in Somalia had been an integral part of the national health services. In a similar way to many other sectors of the health services, it was supported by WHO through its Regional Office for the Eastern Mediterranean.

The plan of action for the eradication programme, agreed in June 1969, called for the establishment of a central administrative unit to direct the planned nationwide programme. A WHO senior adviser, acting as counterpart to a senior national administrative officer, was appointed to assist the Government in the smooth development and implementation of the project. Fifty-four other staff were scheduled to be appointed but only 42 posts were actually created. Office accommodation and space for the storage of project supplies and equipment was erected within the premises of the Ministry of Health, Mogadishu, in 1969-70.

### 1. Financial Resources and Expenditure

WHO assistance in the early years of the programme was limited to the assignment of an epidemiologist (senior adviser) and the provision of the necessary vaccine and certain items of equipment. The annual expenditure of WHO, excluding personnel costs, from 1968-1976 is shown in Table 14.1.

TABLE 14.1

WHO EXPENDITURE<sup>a</sup> ON THE SMALLPOX ERADICATION PROGRAMME, SOMALIA, 1968-1976

Year	US\$	Year	US\$
1968	30 000	1973	30 300
1969	17 000	1974	30 000
1970	27 000	1975	55 800
1971	10 000	1976	140 000
1972	10 000		

<sup>a</sup> Excluding personnel costs

Until the end of 1976 the majority of the WHO funds were spent on the importation of 19 vehicles to transport the mobile teams involved in the vaccination/surveillance programme. Approximately 30% of the total was used to subsidize local project staff salaries.

With the adoption of the resolutions of the March 1977 coordination meeting, an expansion of the Somali Smallpox Eradication Programme (SEP) was initiated. A draft plan of action was developed with an estimated local budget requirement of US\$ 182 500 to cover a six-month intensified programme. One WHO medical officer and one administrative officer were assigned to Somalia to assist the Government programme. WHO personnel in the SEP was thus increased to six, additional staff having arrived earlier to assist in the control of the Mogadishu smallpox outbreak on 1976-77.



The massive Government commitment in 1976 to the control of the Mogadishu outbreak overstretched the resources of the Ministry of Health, both administratively and financially. WHO eventually subsidized the Mogadishu outbreak containment operation with over 800 000 Somali shillings. Considerable efforts were expended to determine the financial obligation that was incurred but the full cost to Somalia of containing that outbreak is beyond calculation.

In view of the necessity for flexible financial support to the envisaged expanded programme, the project was provided with additional funding from WHO HQ, supplementing the regular funds from the regional office. A local account was opened in the name of the programme avoiding the extended administrative procedures that had previously prevailed when the account was controlled through the offices of the WHO Programme Coordinator, Somalia.

Early plans for a systematic and controlled expanded surveillance programme rapidly became obsolete when smallpox foci were quickly detected in Bakool, Bay, Middle Shabelli and Lower Juba Regions. Extensive activities for the containment of outbreaks, with the additional personnel and resources required, necessitated a much greater financial input than had been anticipated. Fortunately, a basic system for the supply and control of monetary resources to the periphery, through sub-imprest accounts, had already been established. It was quickly realized that the high costs incurred by the unexpected containment programme could not be administered by a simple project imprest account. In response, WHO established an independent double-entry book-keeping system at the "Zeropox" office in Mogadishu and an experienced WHO accountant was seconded to the programme. Despite the rapid expansion of the field operations, they were never affected by financial constraints. The Government increased its own commitment by providing 30 experienced English-speaking sanitarians as counterparts to the rapidly increasing number of WHO advisers.

By the end of May 1977, it was recognized that the extensive epidemic constituted a problem beyond the resources of the country and beyond, also, the assistance that WHO could provide at that time. The cost of providing the immediately required material support was estimated at over US\$ 400 000, none of which was available from the existing WHO budget for smallpox eradication. The Ministry of Health declared an emergency and the United Nations Disaster Relief Office was asked to intervene. In response to the UNDR0 appeal on behalf of Somalia, cash contributions of US\$ 215 500 were received from Canada, the Netherlands, Norway, the League of Red Cross Societies, Sweden and the United Kingdom. Table 14.2 gives details of these contributions.

These donations through UNDR0 represented the biggest collective contribution to the programme and was exceeded only by that of WHO. Additional cash and material donations were received from several other quarters:

France arranged for an airlift of military medical and paramedical personnel from Djibouti. The team of nine arrived complete with their own transport and under the guidance of WHO field coordinators performed valuable containment and investigative work in Bay Region for two weeks during the height of the epidemic.

Iran donated ten four-wheel-drive vehicles which, however, were ultimately not used.

The United Kingdom supplied two additional vehicles in November 1977 to intensify border surveillance.

The League of Arab States donated two vehicles, also in November 1977.

Locally, assistance was received from many quarters, particularly from the Somali Red Crescent Society which loaned two vehicles and supplied tents for isolation purposes. The Bishop of Mogadishu donated almost US\$ 1000 to the programme in early 1978.

TABLE 14.2  
DONATIONS TO EMERGENCY PROGRAMME, SOMALIA, JUNE 1977

Date WHO notified of contribution	Donor	Donations in kind	Cash donations	Value or amount in US\$
30.5.77	United Kingdom	3 vehicles from UK, 1 airlift via commercial air charter		74 000
1.6.77	Norway		Used to purchase vehicles	9 487
1.6.77	Netherlands		Used to purchase vehicles	64 763
1.6.77	League of Red Cross Societies	Medical supplies and cash for purchase of 1 vehicle which was airlifted with the 3 from the United Kingdom		41 500
3.6.77	Canada	Estimated value of 2 Royal Canadian Air Force airlifts		100 000
3.6.77	Sweden		Used for purchase of airlift, 1 vehicle, 100 tyres, 100 tubes spare parts, 20 batteries, 20 battery chargers, 10 two-way radios, spare parts and other supplies	120 000
30.6.77	Sweden		Used for spare parts	50 000
TOTAL				459 750

Government Commitment to the Programme

The balance between external assistance and internal resources is difficult to analyse. The Ministry of Health does not budget by individual programmes so the data base is too dispersed to estimate monetary input accurately. In fact, the major commitment of the Government was in terms of staff. Regional epidemiologists were retained for every region throughout the programme (more were made available during the emergency phase) and the majority of drivers were from the Ministry pool. Many of the district "Zeropox" offices were provided by courtesy of either the Ministry of Health or other Government departments.

WHO Financial Assistance

Apart from salary payments to Government employees, WHO supplied and controlled the majority of the local funding to the programme from March 1977 onwards.

Table 14.3 gives the local cost expenditures from 1977 to 1979. It may be noted that the accounting system was changed in June 1977 and adjustments have been incorporated in an attempt to illustrate more accurately the actual expenditure incurred in each month. It should be recognized, however, that field costs only became "expenditure" once accounts had been processed in Mogadishu. Therefore, actual field costs were recorded with a one month lag; two months field expenditure is reflected in the December figures (when yearly accounts were closed) and none in the January figures. The latter represents the expenditure incurred by the Mogadishu headquarters.

TABLE 14.3

MONTHLY LOCAL COSTS INCURRED BY WHO (IN SOMALI SHILLINGS), 1977-1979

Month	1977	1978	1979
January	90 690.00	73 602.45	54 693.50
February	179 116.55	615 799.68	702 544.92
March	314 773.42	557 054.35	673 672.27
April	416 768.00	603 980.93	532 201.23
May	642 109.17	503 924.83	
June	1 064 715.76	609 108.33	
July	1 462 041.81	535 138.32	
August	1 356 871.87	676 715.44	
September	929 564.91	552 748.37	
October	1 065 685.67	651 892.69	
November	1 105 330.42	457 762.85	
December	1 621 050.02	1 466 703.01	
Total	10 249 717.60	7 304 431.25	

Bearing in mind the points noted above, from the table it is seen that the greatest field expenditure was in June 1977. This one month alone was more expensive than the whole proposed six-month expanded surveillance programme planned in March. It corresponds with the height of the outbreak containment operation. Large staff reductions at the end of August 1977 were not paralleled by financial savings as staff salaries were increased in September. Considerable reorganization was conducted in early 1978 and further staff economies effected. However, rising prices and increased salary overheads maintained monthly costs at an even level. Nonetheless, 1978 saw the programme change from a containment operation, for which the expenditure was unpredictable, to an organized

surveillance programme. Accurate project budgetting was facilitated and the unforeseen high costs of 1977 became part of history. The high figure estimated for October 1979 includes service gratuities payable under Somali law to the surveillance staff on termination of their employment.

## 2. Transport

The elongated geographical configuration of Somalia combined with its enormous area of over 600 000 km and the limited communications infrastructure made transport the most essential support element of the whole smallpox eradication programme.

As mentioned earlier, the programme from 1967 onwards received vehicles as part of the assistance from WHO. Until the end of 1976, 17 vehicles had been supplied specifically for the programme, however, they were part of the Ministry of Health vehicle pool and were maintained and repaired there.

Although 14 of these vehicles were recorded as operational in January 1977, by April only nine were functioning and of these, five were in urgent need of major repair. To accommodate the envisaged expanded surveillance programme, 14 new vehicles were ordered from Kenya, four arrived in January 1977, two in April and the remainder in early June. For the first five months of 1977 transport was the most critical logistical problem facing the programme, especially after the first smallpox outbreaks were detected.

From 8 September to December 1976, the Ministry of Health utilized 38 vehicles in containing the Mogadishu outbreak. Most of these vehicles were loaned from other departments of the Ministry of Health and almost all had to be returned at the end of 1976 to their respective allotted tasks. Four vehicles from the Ministry pool, one from the Malaria Department and one from the Tuberculosis Control Programme, remained with the Smallpox Eradication Programme. Until April 1977, fuel issue and maintenance remained the responsibility of the programme transport officer through the Ministry of Health transport pool.

With the discovery of extensive smallpox outbreaks in the provinces and the consequent concentration of staff in those areas, the transport situation became acute. In early April, WHO explored the possibilities of obtaining additional vehicles from Kenya and Saudi Arabia. The response was disappointing - over six months elapsed before suitable vehicles became available.

Local resources were investigated; the Ministry of Health could no longer support the programme as it had done in late 1976 and political developments precluded the intervention of other Government departments. Heavy duty vehicles were simply not available. The possibility of airfreighting vehicles was considered, but delivery times from factories both in Europe and Japan were unacceptable. Several of the older vehicles were overhauled and pressed into service. Fortunately, through the offices of the UNICEF representative in Somalia, contact was established with UNICEF supply services who maintained a stock of the preferred type of four-wheel-drive vehicles; for emergencies, in Copenhagen. Four vehicles were purchased and shipped to Somalia, the shipping time ostensibly being one month; they did not, in fact, arrive until July.

With the numbers of reported smallpox outbreaks escalating daily, the Ministry of Health declared an emergency and through WHO an appeal was made to UNDRO to supply 16 vehicles, spare parts and communications equipment. UNICEF agreed to sell additional vehicles and within one month of the appeal being issued the 16 vehicles had been purchased, airfreighted to Somalia and were in operation in the field. From June 1977, WHO assisted the programme with a transport adviser. Spare parts to maintain the entire fleet of vehicles were ordered and imported, initially by air.

Vehicle repairs were carried out largely on a unit replacement basis. Initial spare parts acquisition included engine, gearbox and differential assemblies. The practice was to replace a defective unit and repair the offending unit once the vehicle had returned to the field.

The technical expertise provided through WHO and the unceasing support of the WHO HQ in supplying spare parts meant that vehicles could be maintained for two years and an average of 150 000 km in some of the most rigorous operating conditions in the world. The SEP vehicle spares store eventually became the most comprehensive stockist of a wide range of spare parts in Somalia.

### 3. Communications

Although the communications infrastructure in Somalia has developed rapidly during the last decade and continues to do so, it remains a fact that the problem of internal communications was always paramount for the SEP amongst many other obstacles.

Somali Airlines operates an efficient internal air service connecting Mogadishu with Hargeisa, Burao and Kismayo on a regular basis. A somewhat irregular service connects Mogadishu with Garoe, Erigavo, Bosasso, Alula and Kardo. The once-weekly flight to Alula from Bosasso was, until very recently, the only means of entry to Alula for most of the year. Due to civil disturbances on the northern border, the Mogadishu-Hargeisa connexion was disrupted for much of 1977-1978. However, when available, this flight was widely used by the programme, as was the Mogadishu-Kismayo flight, particularly for epidemiologists travelling to and from monthly review meetings. A weekly pouch service was established between Mogadishu and Kismayo and Hargeisa for mail and supplies, such as vaccine and vehicle spare parts. In the early stages of the intensified programme it was suggested that helicopters be used, but the problems of ground support overwhelmingly outweighed the advantages.

High specification metalled roads connect Mogadishu with Baidoa (260 km), Merca/Golweyne (120 km) and with Burao (1200 km). Good metalled roads also connect Hargeisa with Berbera (100 km) and Kismayo with Jelib (120 km). Other roads are under construction. Apart from Bay Region which has a considerable mileage of graded "murrum" roads, made-up road surfaces are virtually absent from the remainder of the country.

All field teams by necessity utilized four-wheel-drive vehicles in every region, however, even with good road surfaces, a journey from Mogadishu to Hargeisa entailed 20 hours of drive (effectively two days) and inter-district journeys in some regions required an extremely arduous journey of up to 12 hours. Nevertheless, virtually all movement of epidemiologists was by use of road communications.

Apart from the use of ferry services at some points on the Juba river and occasional assessment trips by local boat on the Juba and Shabelli rivers, water communication played a minor role in the programme. At certain times of the year (October-January) Alula, Kandala and Bosasso are connected by a sea-going vessel which was occasionally used and some assessment on the Banjun islands was made by boat in 1978.

After early experiments by the programme, postal services were rarely used because of the usual lengthy delivery times. The telegraph service was used extensively for weekly reports and emergency requests for vehicle repairs. The telephone service between Mogadishu and Kismayo, Burao, Baidoa, Hargeisa and Bosasso was infrequently used mainly due to the long wait usually required before the call was connected.

The problems associated with postal and telecommunications were recognized early in the development of the intensified programme. It was planned to install shortwave radio transceivers in each regional headquarters and radio connexion was in fact established between Mogadishu and Baidoa in June 1977. Various factors precluded the extension of the network and in early July 1977 plans for a radio network were abandoned. Apart from infrequent use of the police radio system, radio communications were never again used in the programme.

Vehicle maintenance was carried out under the supervision of the WHO transport adviser and his national counterpart, utilizing commercial workshops. An experienced mechanic was seconded from the Ministry of Health workshop to assist with field repairs. Due to the rather poor facilities outside Mogadishu, the vast majority of repairs were carried out in Mogadishu, mainly in the form of preventive maintenance during the period of monthly review meetings. The provision of new vehicles in June and July 1977 greatly assisted the containment operation as the problems of transport failure were largely removed from the already enormous responsibilities of the field supervisory staff.

As the condition of the vehicles would obviously have deteriorated rapidly, necessitating additional repair, in March 1978 WHO provided a mechanic supervisor to supervise workshop repairs directly.

A total of 65 vehicles were imported for the smallpox programme from 1967 to 1979. Of this total, seven were handed to the Ministry of Health prior to the end of the programme and one was severely damaged by the flood relief project of 1978 (to which it had been loaned) and was never recovered. The remainder were handed to various beneficiaries at the end of the programme according to the decisions of the WHO property survey committee. The year of importation of each of the 65 vehicles is shown in Table 14.4.

TABLE 14.4

VEHICLES IMPORTED FOR SMALLPOX ERADICATION PROGRAMME, SOMALIA, 1967-1979

Year	Number	Year	Number
1967	2	1974	-
1968	-	1975	3
1969	5	1976	3
1970	1	1977	38*
1971	2	1978	7
1972	1	1979	3
1973	-		

\*Includes one vehicle transferred from Ethiopian SEP

Since the beginning of the intensified programme in March 1977 it is estimated, from the data available, that programme vehicles covered over 5 000 000 kilometres throughout Somalia.

Many initial problems were encountered in supporting an urgent programme which had to be implemented under largely unprecedented conditions. For example, all vehicles had, prior to the initiation of the intensified programme, been fitted with six ply rating tyres as standard equipment. It was realized, however, that once off the road thick thorn bushes could leave a vehicle with four flat tyres within 100 metres. The solution was heavy-duty ten ply truck tyres which quickly became standard equipment on all smallpox programme vehicles outside Mogadishu. Experiments with high-technology self-sealing components in tyres did not prove successful.

All vehicles were provided with full tool kits, equipment for tyre repairs in any situation and later, with a comprehensive medical kit in case of accidents.

#### 4. Supplies and Equipment

Smallpox programme supplies, from the first request to the final delivery, were given high priority by all the handling departments at WHO headquarters. During the earliest stages of the intensified programme the shortage of spare parts was partly alleviated by the location of shipments to the smallpox programme and other WHO programmes that had lain in customs stores for up to two years. By establishing good relations with storekeepers and officials, these shipments were cleared and utilized. Spare vehicle engines were airfreighted from Europe to recondition older vehicles.

WHO provided a transport/supply adviser in early June 1977 and large spare parts orders were made for both air and sea freight. Owing to early notification of delivery and excellent cooperation from air and sea freight departments and the Somali customs authorities, smallpox programme supplies were always given top priority for clearance. Airfreight was usually off-loaded directly from aircraft to programme vehicles.

Once the authorities were convinced of the urgency of the programme, demonstrated by the presence of programme staff at any hour of any day when shipments were scheduled to arrive, many formalities were waived and friendly cooperation was the rule. In fact, their motivation came partly from the progress of the eradication programme which was followed closely and with great interest by a surprisingly diverse range of the peripheral support personnel.

The difficulties of finding accommodation for field teams constantly on the move was partly solved by the supply of camping equipment. Military-style camp beds, pressure stoves, mosquito nets, blankets, sheets, torches and water carriers were all supplied to epidemiologists, and camp beds, blankets and water carriers to all drivers and interpreters. Table 14.5 gives the total amount of camping equipment imported for the intensified programme.

TABLE 14.5  
CAMPING EQUIPMENT IMPORTED FOR THE SMALLPOX ERADICATION PROGRAMME,  
SOMALIA, 1977-1979

Tents (6 man)	10	Field compasses	40
Tents (2 man)	80	Steel jerrycans	
Camp beds	230	(20 litres capacity)	260
Mosquito nets	200	Plastic jerrycans	300
Blankets	200	Combat rations	
Primus stoves	140	(12 meal packs)	600
Flash lights	200	Medical kits	
Snake bite kits	100	(1 for each field vehicle)	50

Malaria prophylaxis, fly repellants, water purification tablets, pocket calculators, hand tools, ropes and fly sprays were among other items provided to field teams as required.

High local printing costs precluded the use of printed forms for the technical operation. Instead, forms were duplicated either in Mogadishu or at times of exceptionally high demand, particularly early in 1977, in the regions themselves. It is estimated that over 1 500 000 forms have been printed and distributed since March 1977. Publicity posters and technical literature were imported, including: 156 000 posters (coloured and black and white), 144 000 recognition cards, 35 000 nomad surveillance record cards, and 30 000 settled population record cards. Additionally, 1500 differential diagnosis wall charts, 2000 differential diagnosis folders, district maps, accounting forms, rumour registers, duplicating paper and office supplies were all provided by WHO and imported.

Also, 362 500 bifurcated needles, 12 000 needle containers, and 10 370 specimen containers were imported along with vaccine supplies as detailed in chapter 5.

Since the intensified programme began in 1977, 33 shipments of spare parts containing 592 different items and 21 023 individual parts have been imported to maintain the above vehicles. It is estimated that 3000 other parts have been purchased locally.

## 5. Personnel

Due to the restricted manpower resources of the Ministry of Health, only a limited number of national health personnel were involved in the field implementation of the Smallpox Eradication Programme.

At the central level, planning and direction were, of course, the responsibility of the National Programme Manager and the National Director, with technical advice from their WHO counterparts. The administrative structure of the programme is detailed in chapter 2.

As can be seen from Table 14.6, in June 1977 over 3300 staff were engaged in the surveillance and containment operation at field level. The rapid recruitment of this staff posed many problems for the epidemiologists as the majority had no training in health related problems and for many it was their first attempt at remunerative employment. Many left their posts after the first few days, often without seeking their payment, finding themselves unsuited either to a disciplined task or to living away from their usual residences. It was quickly realized that it was much more profitable to take staff from local areas rather than "en masse" from district towns. However, this presented training problems as the staff were then widely scattered and in small groups. Of massive benefit to the programme, however, was the innate honesty and industry of the basic staff. Without this, eradication would have taken much longer as supervision was limited in the early stages.

Depending on the epidemiological situation, different staff structures prevailed in 1977. Some areas had groups of searchers/containment vaccinators working under a supervisor who was always with them in the field. Others established a system which was adopted and regularized throughout the programme in 1978: each district was subdivided into zones and each was under the control of one surveillance agent. These agents were then supervised by a district team leader, chosen from the best supervisors in each district. In turn, the district team leaders were supervised by epidemiologists and, in some regions, regional team leaders.

In total over 34 000 man months of effort were directed in the field towards the eradication of smallpox from Somalia from March 1977 onwards.

On average 15 people were also engaged full time in Mogadishu headquarters to direct and support the field operation. The WHO administrative support for the programme at national level consisted of an administrative officer, a finance officer, seconded from the Regional Office for the Eastern Mediterranean, a transport officer, and from early 1978 a technical adviser for vehicle maintenance.

As the staff were almost exclusively hired directly by the programme, on behalf of the Ministry of Health, the administrative responsibilities of the epidemiologists were increased. All staff were entitled to leave, sickness benefits and service gratuities under Somali law. Maintaining leave records and making salary payments therefore became part of each epidemiologist's daily routine. The poor communications and lack of suitable candidates in the regions precluded the creation of regional administrative assistants, although interpreters and drivers often helped in routine matters. Local headquarters administrative staff were recruited as necessary and eventually a typical office staff comprised: a finance assistant, two administrative assistants, one storeman (maintaining inventory records), one assistant storeman/duplicator operator and two secretaries/typists.



The international staff was selected almost exclusively for both the field and headquarters support from persons with experience in previous smallpox eradication programmes. Fortunately, with the certification of eradication in India in May 1977 and in Bangladesh in December 1977 many of the best smallpox epidemiologists in the world were available for a tour of duty in Somalia. In all, staff from 23 countries participated (Annex 5). Their wealth of experience and adaptability was undoubtedly a primary factor in the rapid eradication of smallpox from Somalia.

Many regions of Somalia can prove to be extremely inhospitable and apart from the provision of camping equipment as mentioned, the only special arrangement made for international staff was the provision of combat rations to supplement the local diet which is largely composed of milk and goat meat. Both national and international staff worked long hours, usually from daybreak to nightfall, without rest days and far from their families for months on end, particularly during the occurrence of smallpox outbreaks. Without this dedication and self-sacrifice the essential close supervision of containment would have been absent and the transmission of the disease could have lingered or spread elsewhere, creating a massive setback to the global campaign.

TABLE 14.6

SMALLPOX ERADICATION PROGRAMME FIELD STAFF, SOMALIA, 1977-1979

Year	Month	Epidemiologists		Team Leaders	Supervisors	Surveillance Agents	Vaccinators	Watch Guards	Others	Total	
		WHO	National								
1977	March	4	8	-	10	110		6	-	138	
	April	7	10	6	20	290		48	-	381	
	May	15	13	36	70	722	593	215	30	1 693	
	June	18	22	54	113	1 288	1 221	562	23	3 301	
	July	20	24	50	146	1 480	658	176	13	2 567	
	August	20	27	55	148	1 707	484	89	21	2 551	
	September	18	27	47	153	1 444	311	56	25	2 081	
	October	19	27	73	213	1 229	69	23	23	1 676	
	November	21	28	71	240	1 343	55	12	20	1 790	
	December	20	20	71	250	980	30	0	0	1 375	
	Man months	162	206	463	1 363	10 593	3 420	1 187	159	17 553	
	Year	Month	Epidemiologists		Interpreters	Office Guards	Drivers	District Team Leaders	Surveillance Agents	Temporary Searchers	Others
WHO	National										
1978	January	11	20	10	25	36	66	1 015	529	3	1 715
	February	15	20	10	24	38	54	530	495	-	1 186
	March	14	20	10	53	36	63	498	550	14	1 258
	April	14	21	10	56	36	65	523	38	4	767
	May	12	22	12	64	36	70	524	41	4	785
	June	10	23	10	66	34	69	516	53	10	791
	July	10	23	9	66	34	69	513	520	-	1 244
	August	8	23	6	66	33	70	515	11	12	744
	September	7	24	7	67	35	69	522	748	16	1 495
	October	8	24	6	66	32	70	527	8	14	755
	November	7	24	7	66	33	69	497	2	14	719
	December	8	20	7	69	34	71	534	718	-	1 461
	Man months	124	264	104	688	417	805	6 714	3 713*	91	12 920
1979	January	8	20	7	67	34	70	550		1	757
	February	8	20	7	68	34	70	531		1	739
	March	9	22	8	69	35	67	516		1	727
	April	8	21	5	67	31	67	496		1	696
	May	8	21	4	66	32	65	433		1	630
	June	8	21	6	66	33	65	433		1	633
	July	9	21	7	66	33	65	433		1	635
	August	9	16	7	66	28	65	200		-	391
	September	9	16	7	66	28	65	200		-	391
	October	8	16	7	66	28	65	200		-	390
	Man months	84	194	65	667	316	664	3 992		7	5 989

\*This total is an over-estimate as temporary searchers were employed on average for only 14 days per calendar month.

## 15 ANIMAL POX DISEASES

The validity of the assumption that smallpox virus has no animal reservoir is very important for the success of the global smallpox eradication programme. In recent years the possibility of there being a non-human reservoir of variola virus has been reinvestigated, with negative results. Simultaneously, there has been a general reappraisal of other poxviruses, their natural hosts and reservoirs and their possible pathogenicity for man.

In Somalia poxvirus diseases are widely prevalent among farm animals, including cows, camels, sheep and goats. Epidemics of infections caused by cowpox and paravaccinia (milker's nodule virus) as well as by camelpox, sheep-pox and goatpox viruses occur among their natural hosts. In view of the fact that much of the human population lives in close contact with these animals, the smallpox programme workers were alert for evidence of transmission of these diseases to man.

In 1978, the surveillance agents and temporary searchers were instructed to collect information about areas affected by these animal pox diseases during their regular field rounds between active searches. Relevant information was recorded. It was recommended that areas affected by animal pox should be visited by regional supervisory staff, investigations made and persons who had been in close contact with diseased animals examined. If vesicles, pustules or scabs were found, a specimen for laboratory investigation was to be taken. In addition, persons were to be vaccinated if found to be without a vaccination scar.

In 1979, no special efforts were made and information was only collected as a result of nomads seeking help for their affected herds or flocks.

### 1. Camelpox

In Somalia, to camel herdsmen camelpox ("Geel furuq") is a well known and feared disease as it causes a frequently fatal, exanthematous disease in the animals. As the disease creates long lasting immunity, mainly young animals are affected. The virus usually attacks the surface of mucosa of the lips and nose and is spread by direct or indirect contact. It seemed likely that man might be infected through handling the affected animals. The possibility that the disease might be found among the Somali human population was, therefore, considered.

#### Camelpox in Camels

The species studied is *Camelus dromedarius* and the type is generally the Bendir of Somalia.

The onset of the disease is manifested by a low grade fever lasting one to three days. The lips and mucosa of the nose swell and the first lesions appear as papules which quickly evolve into vesicles and then into pustules. Facial oedema is usually obvious. Thick crusts accumulate over the lesions within eight to 12 days of the onset of the rash, forming scabs which drop off three to four weeks later, leaving deep scars. The rash usually appears in all areas within one day and is located mainly on the head and neck and less frequently on the forelegs. Occasionally more generalized infections occur, especially among young camels, and involve the whole body with the highest density of lesions on the neck, chest and legs. The udder, genitalia and anal area are sometimes affected, with superinfection often resulting in deep ulcers.

In the southern parts of Somalia an unusual form of camelpox accompanied by high fever was sometimes observed, especially when the head of the animal was heavily affected. The lesions were concentrated around the mouth and eyes, frequently blinding the animal and this form had a high case fatality rate.

More detailed information was collected in the southern part of the country among 30 camel herds (figure 15.1) whose infection by camelpox was confirmed by laboratory investigation. Altogether, 295 cases of camelpox were detected among the 1052 camels of these 30 herds. Table 15.1 shows the sex distribution of cases and deaths and sex specific case fatality rates.

**TABLE 15.1**  
SEX DISTRIBUTION OF CASES AND DEATHS IN 30 CAMELPOX OUTBREAKS,  
SOMALIA, 1978

Sex	Total number of animals in herds	Cases		Deaths		Case fatality rate
		Number	Per 1000	Number	Per 1000	
Males	217	68	313	6	27.6	8.8
Females	835	227	272	10	11.9	4.4
Total	1 052	295	280	16	15.2	5.4

The duration of illness was from 10 to 32 days with an average of 18 days. Generally it was longer during the rainy season; up to three months. In these long lasting illnesses superinfection commonly resulted in a putrid smell coming from the sick animals. Deaths occurred in nine out of the 30 observed outbreaks and the highest case fatality rate in a single outbreak was 28.5%. The age distribution of cases and deaths is presented in Table 15.2. The highest age specific case fatality rate, 13.5%, was observed in the 0-1 year age group.

**TABLE 15.2**  
AGE DISTRIBUTION OF CASES AND DEATHS IN 30 CAMELPOX OUTBREAKS,  
SOMALIA, 1978

	Age (years)											Total
	0-1	2	3	4	5	6	7	8	9	More	Unknown	
Number of cases	52	87	46	30	10	12	5	10	1	3	39	295
Number of deaths	7	5	2	-	1	1	-	-	-	-	-	16
Case fatality rate	13.5	5.7	4.3	-	10.0	8.5	-	-	-	-	-	5.4

### Laboratory Examination

During 1978, specimens of scabs and pustules of 81 diseased farm animals were taken and forwarded for laboratory examination. As shown in Table 15.3, 62 of them were taken from camels of which 67.7% were found to be positive for poxvirus.

TABLE 15.3

FARM ANIMALS FROM WHICH SPECIMENS WERE LABORATORY INVESTIGATED FOR ANIMAL POXVIRUSES, SOMALIA, 1978\*

Kind of domestic animal	Total number examined	Laboratory examination positive for poxvirus	
		Number	Percentage
Camel	62	42	67.7
Goat	13	4	30.1
Sheep	4	2	50.0

\*One cow and one hen not included

The 42 positive camelpox specimens each came from different outbreaks, representing 77.7% of the total of 54 separate herd-outbreaks studied.

Table 15.4 shows the age and sex distribution and laboratory results for 56 of the affected animals. It is clear that a higher proportion of positive laboratory specimens were found among the younger camels.

TABLE 15.4

AGE AND SEX DISTRIBUTION AND LABORATORY RESULTS OF 56 CASES OF CAMELPOX, SOMALIA, 1978

Age group	Males	Females	Total	Laboratory examination positive for poxvirus	
				Number	Percentage
0-1	4	8	12	11	92
2	3	5	8	5	62
3	5	8	13	8	61
4	2	10	12	7	58
5+	6	9	11	6	54
Total	16	40	56	37	66

All specimens of scabs or pustules taken from the 62 affected camels were tested by electron microscopy, 50 (80%) were tested on chorioallantoic membranes of embryonated chicken eggs, 30 (48%) by precipitation test and only 10 by tissue culture. Table 15.5 shows the comparative results of these separate laboratory tests carried out at the Center for Disease Control, Atlanta, USA.

TABLE 15.5

RESULTS OF DIFFERENT LABORATORY TESTS OF SPECIMENS FROM 62 CAMELS

		Electron microscopy	Isolation on CAM	Precipitation test	Tissue culture
Total number of specimens examined		62	50	30	10
Positive for poxvirus	Number	42	20	5	3
	Percent	67.8	40.0	16.7	30.0

Electron microscopy was found to be the most reliable and sensitive test for the detection of poxviruses in the collected and subsequently tested material. A similar conclusion can be derived from Table 15.6 showing results of laboratory examination of 25 selected specimens where all three principal laboratory tests were used.

TABLE 15.6

RESULTS FOR 25 CAMEL SPECIMENS LABORATORY TESTED BY THREE METHODS

	Total number of specimens examined	Laboratory examination positive for poxvirus	
		Number	Percentage
Electron microscopy	25	25	100.0
Isolation on CAM	25	14	56.0
Precipitation test	25	5	20.0

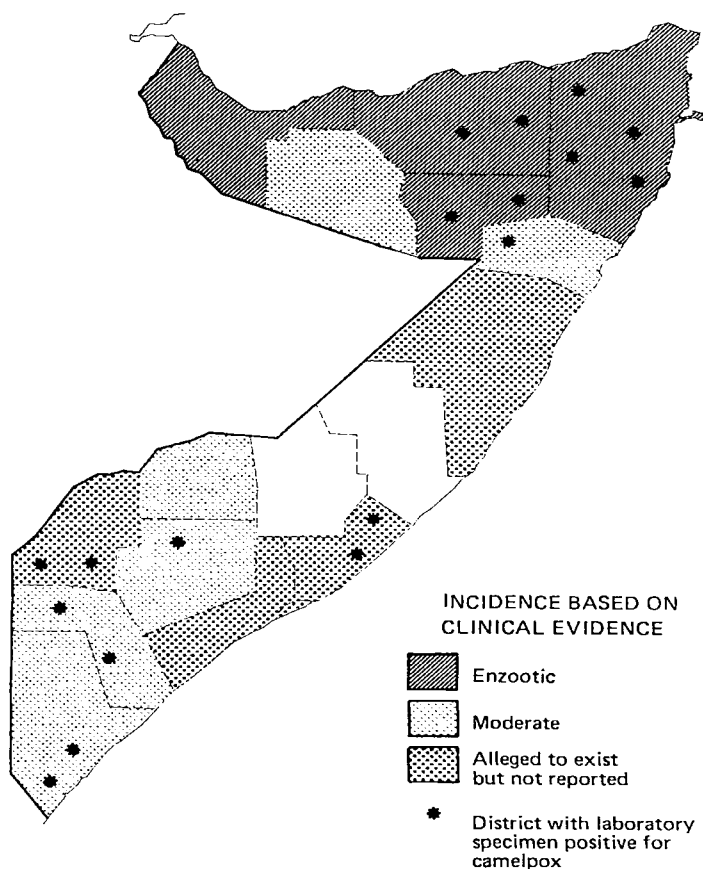
At least four different strains of camelpox virus have been reported from various parts of the world: a strain from Iran investigated by Baxby that very closely resembled variola virus but could not be differentiated when cultured in tissue cultures; strain T-72 investigated by Marennikova and her colleagues that resembled monkeypox virus when grown on chorioallantoic membranes but could be differentiated by its reaction on rabbit skin; the Ramayar and Hessami strain which resembled vaccinia virus by the pock morphology on CAM; and Roslyakov's strain, which morphologically resembled orf but antigenetically related to the vaccinia-variola group.

About 53 virus isolates from diseased camels in Somalia isolated on chorioallantoic membrane are at present undergoing various laboratory tests at the Center for Disease Control, Atlanta, USA. The aim is to determine the strain(s) causing this disease among camels in Somalia. Different case fatality rates and clinical features among the outbreaks suggest that more than one strain of camelpox virus may exist in Somalia. So far only two separate strains of camelpox have been identified. Thirty-five are identical to Iran type strains (orthopoxvirus) and five with Roslyakov "Auzduk" type strains (paravaccinia). The testing is still incomplete.

#### Geographical Distribution

The geographical distribution of camelpox infection based on clinical observation in Somalia in 1978 is shown in figure 15.1; the north-east and south-west parts of the country especially seem to have been heavily affected. Continuous chains of camelpox transmission among camels could be easily identified in Galbeed, Sanaag, Bari, Nugal and Lower and Middle Juba Regions.

FIG. 15.1  
DISTRIBUTION OF CAMELPOX, SOMALIA, 1978



Using the FAO "rough" classification, the incidence of camelpox in 17 districts might be labelled as "enzootic". A further 22 districts showed "moderate" incidence and finally in 21 districts camelpox infection among camels was said to exist but was not specifically reported by local owners or local authorities.

Superficial observations made in 62 camel herds randomly selected in four "enzootic" districts found 19 herds (30.6%) currently or recently affected. In four districts with "moderate" incidence, from a total of 50 camel herds checked, eight (16%) were found with camelpox affected animals.

Figure 15.1 also shows the location of districts where camelpox infection was confirmed by laboratory examination during 1978.

#### Investigation of Pathogenicity of Camelpox in Man

As mentioned earlier the epizootological features of camelpox and its possible pathogenicity for man were studied in 50 laboratory-confirmed camelpox outbreaks in north-east and south-west Somalia. Altogether, 465 persons, mostly males in the age groups 6-14 years and 40 years and over were accompanying the sick camels. All of them were physically checked for any rash as well as for smallpox vaccination scars and pockmarks. The findings of this examination are summarized in Table 15.7

TABLE 15.7  
RESULTS OF PHYSICAL CHECK OF 465 PERSONS IN DIRECT CONTACT  
WITH CAMELS INFECTED BY CAMELPOX, SOMALIA, 1978

		Investigated area		Total
		North-east	South-west	
Number of nomadic groups enumerated		20	30	50
Number of persons at risk		179	286	465
Vaccination scar present	Number	22	95	117
	Percent	12.3	33.2	25.2
Rash cases detected	Number	5	3	8
	Percent	2.8	1.1	1.7
Laboratory examination for poxvirus*		negative	negative	negative

\*Specimens from humans with rash

Thirty-three per cent of those examined in the south, but only 12% of those examined in the north, were found with vaccination scars and a history of smallpox vaccination. Skin lesions were found in eight cases and were clinically diagnosed as tropical ulcer (2), scabies (2), acne (1) and impetigo (1). Specimens taken from six of them were negative for poxviruses.

All persons were interviewed to discover if they had ever seen or heard of any person with rash, especially on the hands or face which had appeared after handling diseased animals. Only one rumour was obtained, in the south-west from a local programme worker; this case is reported below.

Local surveillance agents and their supervisory staff were briefed about follow-up activities. They were to look for persons with influenza-like symptoms including low-grade fever of two or three days, followed by local lesions appearing as papules, vesicles, pustules and crusts especially on hands and arms of camel herdsman and their family members. Furthermore, they were asked to collect specimens from any rash-with-fever case who might have come into direct or indirect contact with diseased camels in the whole "enzootic" area. By the end of the year 1978, a total of 117 specimens were collected in "enzootic" areas in the north and 218 in the "south". None were found to be positive for poxviruses.

At present it is estimated that there are 3 500 000 camels in Somalia, in about 70 000-100 000 camel herds. On average there are two to four persons in daily direct contact with each herd, that is about 200 000 persons. If, for example, only 5-10% are exposed to camelpox infected animals, the population at risk is around 10 000-20 000. Nevertheless, despite surveillance only one report of a possible case of human camelpox, in the south-west "enzootic" area, was notified. This suggested that human infection, if it occurs at all, is very rare.

#### A Possible Case of Human Camelpox

In July 1978, a member of a nomadic group which had settled in a bush area of Sako District, Middle Juba Region, met a smallpox eradication programme surveillance agent and reported that one of his family was suffering from camelpox. This was surprising because nomads generally consider that camelpox is not transmissible to man. However, in this case the man who developed the rash believed that he had contracted the disease from his camel and had expressed this opinion to other members of his group. The surveillance agent reported the case to the Sako District team leader who immediately investigated the outbreak.

The nomadic group concerned consisted of three families with 38 members. They had been settled for 10 days in an area called Maytfor, 18 km from Salagle, the nearest village in Sako District, Middle Juba. For the past 20 years this group had been living only within Sako District. They owned three herds of camels with a total of 61 animals. They were not land cultivators and had no permanent houses.

The first case of camelpox occurred during May 1978. By 13 July, 16 camels were affected in the three herds (Table 15.8); none of them died. The rash, in most cases, had a typical distribution - the extremities and the head, around the mouth, were most affected. Some of the animals had severe lesions in the genital area and on their milk glands.



TABLE 15.8

CAMELS WITH CAMELPOX IN SAKO DISTRICT, MIDDLE JUBA, SOMALIA, 1978

Herd No.	No. of camels		Cases		Onset of rash	
	M	F	M	F	First case	Last case
1	11	39	3	2	10.6	2.7
2	3	7	3	7	10.5	28.6
3	1	0	1	0	16.6	-
Total	15	46	7	9		

Specimens taken from camels and results of laboratory investigation are shown in Table 15.9.

TABLE 15.9

RESULTS OF LABORATORY TESTING OF SPECIMENS TAKEN FROM FOUR CAMELS, SAKO DISTRICT, 1978

Specimen No.	Herd No.	Age	Sex	Onset of rash	Date of collection	Results	
						EM	Isolation
1906	1	3	M	3.6	2.7	Poxvirus	Positive
1907	1	4	F	30.6	2.7	Poxvirus	Positive
1712	2	6	F	28.6	2.7	Poxvirus	Negative
1716	*	3	M	5.6	1.7	Poxvirus	Negative

\*Specimens collected in the same area but from different nomadic group

The number of persons in the three families and their vaccination status is shown in Table 15.10.

TABLE 15.10

IMMUNITY STATUS OF FAMILIES WITH CAMELS

Family Number	Number of members	Vaccination scar present	
		Number	Percentage
1	14	3	21
2	7	0	0
3	17	5	29
Total	38	8	21

A 40 year old man, who was unvaccinated and the head of family no. 2, developed a rash on 12 June 1978, two to three days after feeling discomfort. There were three lesions on the left arm and one on the right arm. They all appeared on the same day and took seven days to develop to full size vesicles. The vesicles then changed to pustules and later to scabs which fell off 14-15 days after the onset of rash. The pustular stage was clearly described by another member of the group and by the patient himself. The lesions were circular in shape having a central depression encircled by pus. Five days after the scabs had fallen off the patient was seen by the district team leader who found scars 7-8 mm in diameter having a pale pink centre. After another 11 days scars were clearly visible, were 0.5 mm deep and a similar colour to the surrounding skin. They resembled smallpox vaccination scars.

No vaccinations had been performed in the area for at least two months before the onset of the patient's rash, therefore, it is unlikely that the illness was due to vaccinia.

The adult male, described above, is the only case encountered who may theoretically have been infected by camelpox virus.

## 2. Other Animal Pox Diseases

### Sheep-pox

This is a highly infectious and frequently fatal exanthematous disease of sheep with an incubation period of four to seven days. The disease usually causes a severe system disturbance with widespread lesions. The eruptions are mostly prevalent on the cheeks, nostrils, lips and wool-free skin. The vesicular stage is followed by the development of pustules and there is a marked tendency to generalization of lesions. The lesions may also occur in the pharynx and alimentary tract. Mortality may vary from 5-50%.

Figure 15.2 shows the distribution of sheep-pox in the country according to observations of clinical evidence. Thirteen districts in the northern part of the country may be classified as "enzootic" and 10 others are with "moderate" incidence.

Only a few specimens were taken from diseased animals in 1978 for virus identification. No rash-with-fever cases were observed among persons in close contact with diseased herds.

### Goatpox

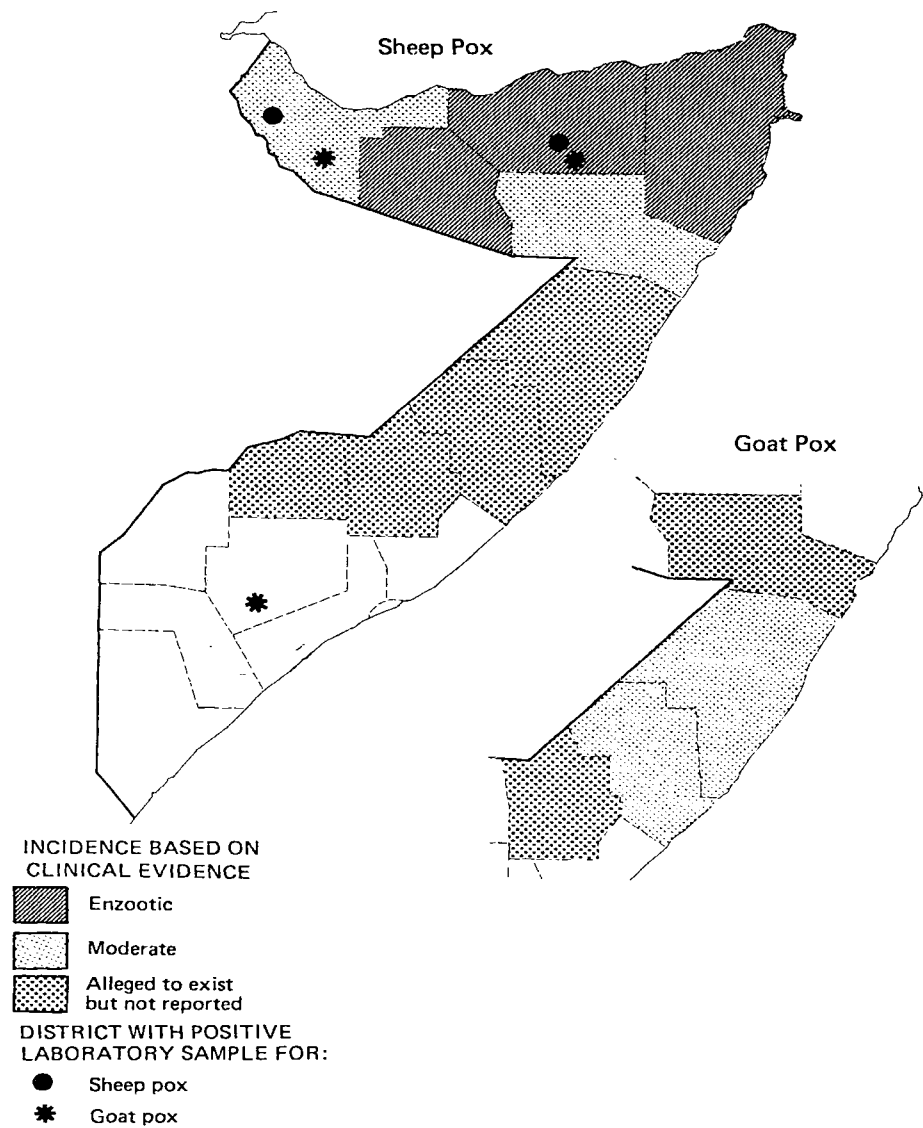
An infectious exanthematous disease of goats, this infection is manifested by the appearance of pocks on the mucous membranes and skin following an incubation period of five to 10 days. The disease tends to attack male kids and females in milk. In the initial stages there may be a slight pyrexia but other constitutional disturbances are not marked. The lesions are not so widespread as in sheep-pox being confined to the mouth, nose and other hairless regions. In the female the udder may also be involved. The lesions are typical pox lesions but usually smaller than those of sheep-pox.

Figure 15.2 shows the distribution of goatpox in the country according to observed clinical evidence. The disease is especially widespread in the middle part of the country where the incidence may be labelled as "moderate".

Only 13 specimens were collected from diseased goats during 1978 and about 30% of them were found to be positive for poxviruses. No rash-with-fever cases were observed among persons in close contact with diseased goats or among those consuming meat and milk taken from affected herds.

Observation showed that neither sheep-pox nor goatpox represented a danger to the human population having direct contact with diseased animals or using milk and meat products from affected herds. Both sheep-pox and goatpox may be considered as non-human animal poxviruses having a minimal, or possibly no predilection for man.

FIG. 15.2  
DISTRIBUTION OF GOATPOX AND SHEEP POX, SOMALIA, 1978



## 16 CONCLUSION

In 1967, WHO in collaboration with many national governments launched an intensified programme to eliminate smallpox throughout the world. Ten years later, as the staff of the Somali Smallpox Eradication Programme strove to bring under control the smallpox epidemic then prevailing, they were not only working towards eradication of the last focus of the disease in Somalia but in the Horn of Africa, and indeed in the entire world. In late October 1977, the last case was recorded in Merca town in southern Somalia. This success came just 20 weeks after the declaration by the Ministry of Health that the epidemic constituted a national emergency. It is the more remarkable for the fact that only one in a hundred of the staff involved in the programme had previous training and experience in public health activities. The events leading up to this achievement and the efforts made to confirm it are the subject of this report.

The eradication of smallpox in Somalia, with its harsh geographical and climatic conditions, its scarce communications and health facilities and, in particular, its predominantly nomadic population, provided many challenges. When intensified efforts towards eradication began in 1977, the recent successes in the Indian subcontinent provided a wealth of experience on which to draw in planning the strategy. Although the basic principles of surveillance and containment were applied, constant adaptation to the local conditions was necessary. Search and surveillance operations had to deal with the sparseness and mobility of the population in much of the country. Containment activities, too, required unique approaches; home containment, as often used in other smallpox eradication programmes, proved impractical and hospital isolation facilities were rarely within easy reach. The degree to which the programme conformed to the local needs is exemplified by the use of "travelling containment", whereby a surveillance agent moved permanently with an affected nomadic group to ensure that all those coming into contact with it were vaccinated. The adjustments made to deal with such newly encountered problems proved highly successful. Overall, in 92% of instances no new cases occurred more than 14 days after a smallpox outbreak's discovery.

Planning and assessment of surveillance activities in Somalia were initially hampered by lack of basic demographic data. A lasting contribution made by the programme, therefore, was the collection and listing of information on population, settled localities, water points, nomadic movement patterns and other facts vital to health service planning. Around 1700 localities (up to 97% of those existing) were visited each quarter and assessment showed that in all areas awareness of programme activities was high. Throughout the global eradication campaign and in the years of its culmination in Somalia, objective assessment of reported programme activities proved essential. Only through this concurrent evaluation could problems be identified and remedial actions taken.

In addition to the diverse and complementary methods of surveillance for smallpox, collection of specimens for laboratory examination was also stressed. In 1978 and 1979 over 2 900 specimens collected in Somalia from cases of rash-with-fever have been tested; none proved to be smallpox.

No accurate estimate has been made of the financial savings to be made worldwide by the elimination of smallpox, however, the figure is certainly in hundreds of thousands of US dollars annually. This cost includes vaccine production and administration, health certificate checking and quarantine measures, and also that of full scale eradication programmes. By the population of Somalia, and of many other countries, the benefits will be appreciated in the elimination of the suffering once caused by smallpox. They will be content to know that this disease, which has for centuries disfigured and killed, no longer poses a threat.

In the minds of the workers of the Smallpox Eradication Programme in Somalia there is no doubt that no case of the disease is to be found in the country. It remains for the International Commission in its assessment in October 1979 to arrive at the same conclusion and to certify the country as smallpox-free. If this is done the programme will have eliminated one public health problem. Perhaps as important, however, is what the programme will leave behind: an example of friendly, effective international cooperation based on sound management and clear identification of objectives. In addition, there will remain a nationwide structure for the implementation of other health programmes, and above all a core of skilled health workers without whose initiative, dedication and tirelessness the battle would never have been won.

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ANNEX 1

MESSAGE OF THE DIRECTOR - GENERAL OF WHO TO THE SMALLPOX  
ERADICATION PROGRAMME, MOGADISHU, 26 OCTOBER 1978

This meeting marks one year of freedom from smallpox in Somalia. I should, therefore, like to express my congratulations to all of you who have contributed to this historical achievement. This is a truly significant moment, and I should like to briefly review the importance of this event.

The origin of smallpox is obscure, but historical records suggest that the disease occurred in the eastern part of the Asian continent many thousands of years ago. This scourge travelled westwards following movements of the population, these movements were related to trade, natural calamities and wars. By the eighteenth century smallpox was rampant almost everywhere people lived, throughout the world. Millions died, became blind or disfigured with smallpox.

Man's first effort to control the disease occurred in the late eighteenth century. Edward Jenner, British physician, discovered a vaccine which protected people from smallpox. During the nineteenth and early twentieth centuries there was wide-scale use of this vaccine, now further improved. By 1950 disease transmission had been successfully stopped in many countries in the northern hemisphere. However, countries with tropical climates were not as successful because the vaccine rapidly lost potency due to the lack of refrigeration in such areas. The first breakthrough came in the 1950's when Dr L. H. Collier, in the UK, developed a method for mass production of freeze-dried vaccine. This freeze-dried vaccine could resist the excessive heat of tropical climates. Thus, one problem was solved. But the countries in tropical zones still had difficulties with the disease because they lacked sufficient resources to establish an effective health delivery system to administer the vaccinations.

The second breakthrough for the achievement of eradication was not technological but was administrative. As you are well aware, intensified efforts for the global eradication of smallpox started in 1967. This combined the commitment of nationals, WHO and donor countries and was translated into action in all the then smallpox endemic countries. By then the technology of producing heat stable vaccine was available and epidemiological methods for combatting the disease were known. Most important, however, was the concerted world effort to fight for the common goal.

The programme has been successful. Smallpox transmission, which continued for at least 3 000 years, has apparently come to an end. The last endemic focus in the world appears to have been eliminated one year ago today.

The contribution of Somalia to this historical event is considerable. Here national and international programme staff have successfully fought the final battle despite limited resources, limited communications and the recent frontier disputes.

In addition to the incredible work done in Somalia, I specifically appreciate the continuing efforts made for the last 12 months to verify whether nil incidence has truly been achieved. The surveillance teams have visited the remotest areas of the country to detect smallpox. I am fully aware of the devotion to duty and sacrifices made by programme staff to verify smallpox freedom. While I now congratulate you on the magnificent work done over the past two years, I am aware that the work will continue for another 12 months and I will be following your progress closely. And I wholeheartedly expect that on 26 October 1979 Somalia will have convincing proof of smallpox eradication, so that the world community will have absolutely no doubts that the job has been properly accomplished.

With smallpox vanquished, there are still a great number of priority health areas in Somalia. The recent Alma Ata Conference on Primary Health Care declared that the existing gross inequality in the health status of the people, particularly between the developed and developing countries, is unacceptable and is, therefore, of common concern to all countries. Unity is necessary to achieve better health in the world population. Smallpox eradication has shown that unity is possible and the programme in Somalia is an excellent example of this. Furthermore, the country has shown tremendous self-confidence in discovering that if a nation wishes to do something then it can be done.

Halfdan Mahler, M.D.  
Director-General  
World Health Organization



ANNEX 2

MESSAGE OF THE DIRECTOR, WHO EASTERN MEDITERRANEAN REGION  
MOGADISHU, 26 OCTOBER 1978

The Global Smallpox Eradication Programme, initiated in 1967, has indeed achieved unique success in eradicating this disease which has taken a great toll of life throughout centuries of human recorded history. The "Zero Case" target has been reached a year ago, when the last known man-to-man transmitted case occurred in Merca town in Somalia. This is an important landmark in the history of international health as well as man's fight against devastating epidemics.

The Smallpox Eradication Programme achieved success because it has been using efficient but simple techniques appropriate both to conquer the disease as well as to the conditions prevalent in countries involved in the programme.

Although important international assistance was made available for the cause, smallpox eradication could only be achieved as a result of self-reliance by national health authorities in the first place and through their planned mobilization and utilization of their own resources.

As the last endemic focus was wiped out in Somalia, a country of the Eastern Mediterranean Region, after hundreds of cases were detected and effectively dealt with through an effective scheme of case search, surveillance, containment and vaccination, it is now my privilege to emphasize the remarkable success achieved by the Somali national authorities, in collaboration with WHO and other international agencies within the overall global programme.

It is my pleasure to extend my greetings and sincere congratulations to His Excellency, the Minister of Health, and to the hundreds of Somali health workers at all levels who have actively participated in the programme, for their continued and successful efforts.

I also wish to express my appreciation to all WHO staff who have actively collaborated with national authorities in the successful achievement of the programme.

It is worth mentioning that a number of countries of this Region are at present engaged in activities for International Certification of Smallpox Eradication, as part of the global effort for certification, and we are looking forward to 1979 when we hope to see the officially-documented end of this longstanding scourge.

Dr A. H. Taba  
Director  
WHO Eastern Mediterranean Region

ANNEX 3

MESSAGE OF H.E. THE MINISTER OF HEALTH\* TO THE SMALLPOX  
ERADICATION PROGRAMME, MOGADISHU, 25 OCTOBER 1978

In September 1976, smallpox was reintroduced into Somalia from Ethiopia. Immediate action was taken to alert local authorities in the most vulnerable areas. Two night searches were conducted in Mogadishu using a total of 3 500 persons. Their brief was first to locate any active cases and secondly to vaccinate anyone who had escaped vaccination during earlier routine campaigns. The Ministry of Health was assisted by the Armed Forces, students, para-medical staff and volunteers from the public. We also requested assistance from WHO and we are grateful to them for their prompt response.

With increased activities and the discovery of more outbreaks, the Ministry of Health declared an emergency situation. The Government appealed for assistance to WHO, UNDP and all countries as a result of which funds, transport and advisory personnel were made available at short notice.

During 1977 a total of 3 229 cases of smallpox were discovered in 10 regions. At the height of the epidemic over 3 100 staff were engaged in surveillance and containment operations and over 40 vehicles were utilized. The last case of smallpox in Somalia suffered the onset of the rash on 26 October 1977 in Merca town, Lower Shabelli Region. Country-wide search operations have been regularly conducted since that date utilizing, at times, over 1 000 staff. We are convinced from these activities that there is no possibility of any ongoing transmission or any hidden foci anywhere in Somalia.

To satisfy the world community we shall continue surveillance activities and prepare programme documentation to meet the requirements of the International Commission for the Certification of Smallpox Eradication whom we shall expect to visit Somalia in October 1979.

At this historic moment both for our country, and for the world, the Ministry of Health conveys its sincere thanks to all those countries who responded to our requests during the emergency period, to WHO and its experts and last, but not least, my own personal thanks to Ministry personnel, local administrators, students, party officials, the Armed Forces and the Somali public for their united efforts in eliminating smallpox from our land.

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\* Summarized from a longer speech made on the occasion of a programme review meeting.

ANNEX 4  
NATIONAL SUPERVISORY STAFF IN THE SOMALIAN  
SMALLPOX ERADICATION PROGRAMME, 1977-79

REGIONAL EPIDEMIOLOGISTS

Dini Shire Jama	Dugsie Raygal Warsame
Hassan Alasow Nur	Mohamed Hassan Abdulle
Adan Mattan	Jama Ahmed Mohamoud
Mohamed Ali Abdi	Mohamed Farah Adan
Mohamed Ali Hassan	Mohamed Yusuf Adan
Farah Sahil Deria	Mohamed Adan Ibrahim
Abukar Mohamed Ahmed	Mohamed Ali Hayleh
Haji Abdi Farah	Hussein Ali Ahmed
Hassan Yellahow	Ahmed Abdi Bayra
Mohamed Abdi Adan	Yusuf Mohamed Ali
Muse Abdulle	Bashir Ali Roble
Mohamed Yusuf Guleed	Abdulqadir Mohamed Issa
Anshur Ali Barrow	Abdullahi Jama Nageye
Abdulkadir Sheikh Hassan	Ismail Osman Awad
Ali Abdi Farah	Ahmed Salah Soleyman
Ali Said Haji	Mohamoud Ahmed Gure

DISTRICT TEAM LEADERS

Mohamed Ahmed Abdi	Mohamoud Abdi Ali
Abdurahman Abdi Ali	Nur Ahmed Yusuf
Mohamed Ahmed Salah	Abdulkadir Mohamed Jama
Isak Ibrahim Abdirahman	Rashid Nur Ibrahim
Ali Mursal Ali	Ibrahim Mohamed Mohamoud
Ali Hashi Salad	Ali Mohamed Issa
Farah Hasan Hersi	Abdulkadir Diriye Mohamed
Mohamed Rashid Haji	Ali Haji Mohamed
Ali Sheikh Ibrahim	Omar Elmi Mohamed
Jeylani Maio Hassan	Mohamed Hussein Omar
Suleyman Roble Jama	Mohamoud Agag Abokor
Mohamed Abdi Sudi	Nur Barkhadle Fiidow
Yusuf Sheikh Ali	Ahmed Mohamed Jimmille
Mohamed Hassan Elmi	Hassan Ali Garow
Mohamed Abdullahi Ibrahim	Ahmed Maow Mohamed
Mohamed Abdi Shire	Ali Warsame
Ahmed Ismail Yusuf	Abdirahman Adan
Abduirahman Hassan Arale	Adam Jama Diriye
Ibrahim Adan Abdi	Elmi Ibrahim Hussein
Isaq Ali Muday	Yusuf Mohamed Ahmed
Mohamed Mohamed Isaq	Mohamed Dahiye Nur
Mohamed Nur Hassan	Abdi Mohamed Wehiliye
Abdi Wahaab Abdi	Abdilahi Sheikh Ibrahim
Abdullahi Mohamoud	Ahmed Warsame Wehiliye
Hawa Jama Hirsi	Mohamed Wehiliye
Abdalla Ahmed Igal	Habibo Hassan Ado
Saeed Haji Ereg	Mohmed Hassan Artan
Ahmed Hassan Arab	Mohamed Hassan Geedi
Yusuf Sh. Hussein	Mohamed Egeh Ali
Diriye Mohamoud Ahmed	Osman Jibril Boni
Kulmiye Abdi Roble	Adan Mohamoud Artan
Bulle Shiye Ali	Hussein Abdullahi Raja
Ibrahim Hussein Abdirahman	Abdi Alas Nur
Adan Ali Yusuf	Mohamoud Elmi Frah
Ismail Shikh Adan	Adan Ali Bule
Khalif Warsame Mohamd	Sidow Mohamed Yarow
Osman Hassan Muhtar	

ANNEX 5

INTERNATIONAL STAFF OF SOMALIA SMALLPOX ERADICATION PROGRAMME, 1976-1979

<u>Name</u>	<u>Nationality</u>	<u>Date arrived</u>	<u>Date of departure</u>
Alaghbari, Dr M.K.	N. Yemen	15. 3.77	31.12.79
Andrews, Dr J.S.	USA	16. 1.78	5. 4.78
Arita, Dr I.	Japan	Oct. 1976	Nov. 1976
Bachman, Dr J.P.	Switzerland	17. 5.77	25. 8.77
Blumenthal, Dr D.S.	USA	9. 7.78	5.10.78
Carrasco, Mr P.A.	USA	18. 9.77	1. 6.78
Chaudhary, Dr M.R.	Pakistan	24.11.77	30.10.78
Claquin, Dr P.	France	24. 1.78	27. 5.78
Elford, Mr J.	UK	11. 5.77	31. 8.77
Elnaggar, Dr M.N.E.	Egypt	24.10.77 27. 6.79	10. 1.78 31.10.79
Elsid, Mr A.Q.H.	Sudan	8. 3.77	12.10.77
Erben, Dr J.J.	USA	21.11.78	15. 2.79
Evans, Mr D.R.	UK	6.10.77 17. 6.79	30. 8.78 30. 9.79
Fitzgerald, Mr S.A.	USA	4. 4.78	23. 6.78
Foster, Dr S.O.	USA	8. 6.77	31. 8.77
Gaafar, Dr M.T.A.	Egypt	6. 9.78 3. 6.79	25. 2.79 31.10.79
Gosset, Dr I.G.	Mexico	10. 8.77	18.12.77
Graabek, Mr L.	Denmark	19. 2.78	9. 8.78
Hanson, Dr S.	Sweden	27. 7.77	22. 2.78
Hardjotanojo, Dr W.	Indonesia	29. 4.77	31.12.79
Hassan, Dr M.N.	Egypt	14.12.77	12. 3.78
Hasselblad, Mr C.D.	USA	8. 6.77	29.11.77
Hatfield, Mr R.J.	UK	27. 3.77	31.12.79
Heijbel, Dr H.	Sweden	11. 5.77	12. 9.77
Huber, Mr C.W.	USA	8. 6.77 19. 9.78	31. 8.77 6.12.78
Hughes, Dr K.	UK	19. 2.78	9. 8.78
Ibrahim, Mr M.W.	Egypt	4. 4.79	31.12.79
Janout, Dr V.	Czechoslovakia	21. 2.78	28. 5.78
Jezek, Dr Z.	Czechoslovakia	10. 5.77	31.12.79
Johnson, Mr D.A.	USA	1. 4.79	17. 6.79
Jones, Dr T.S.	USA	7. 7.77	4. 9.77
Khattab, Dr R.A.L.	Egypt	17.12.78	31.10.79
Kimmel, Mr T.R.	USA	3.10.78	20.12.78

<u>Name</u>	<u>Nationality</u>	<u>Date arrived</u>	<u>Date of departure</u>
Kopecky, Dr K.	Czechoslovakia	14.12.77	28. 5.78
Kriz, Dr B.	Czechoslovakia	10. 5.77 28. 6.79	8.12.78 31.10.79
Lewis, Mr J.O.	USA	8. 6.77	31.12.79
Lichfield, Mr P.R.	USA	4. 4.78	25. 6.78
McConnon, Mr P.J.	USA	15.11.77	12. 2.78
McPoland, Mr M.L.	UK	13. 8.78	31.12.79
Madjaric, Dr D.	Yugoslavia	13. 8.78	4.10.78
Mahfuz Ali, Dr S.	Pakistan	29. 8.71	31. 8.77
Markvart, Dr K.	Czechoslovakia	13. 9.77 14. 4.79	11.12.77 30. 9.79
Masar, Dr I.	Czechoslovakia	6. 1.79	29. 3.79
Mendis, Dr N.M.P.	Sri Lanka	3. 8.78	14. 9.78
Miller, Mr R.G.	USA	17. 8.77	22. 1.78
Miner, Mr H.G.	USA	11. 5.78	9. 8.78
Mitchell, Mr W.H.	USA	6. 1.79	25. 3.79
Mitter, Dr C.R.	India	13.11.78	10. 5.79
Mohammed, Dr O.S.	Sudan	2. 1.77	17. 3.77
Mourad, Dr A.S.	Egypt	16. 1.77 7. 6.78	5.10.77 8.10.78
Nakhla, Mr E.T.	Egypt	17. 7.77	26. 3.78
Olakowski, Dr T.	Poland	31. 8.77	14.12.77
Oles, Dr A.	Poland	26.11.67	19. 2.68
Rajput, Dr A.S.	Pakistan	4.12.77	16. 3.78
Ramshorst, Dr B. Van	Netherlands	23. 5.77	16.11.77
Rangaraj, Dr A.G.	India	1. 2.79	31.10.79
Reiman, Dr S.	USA	7.10.78	15.12.78
Rousar, Mr F.D.	USA	1. 3.78	31.12.79
Ryst, Dr J.P.	France	1. 4.77 4. 5.78	15. 9.77 6. 8.78
Salehi, Dr M.Y.	Afghanistan	5. 4.77	29. 9.77
Samostrelski, Dr A.	USSR	1. 6.68 3.11.76	1. 6.70 31. 1.77
Santarelli, Mr M.A.	USA	17. 8.77	25.12.77
Schnur, Mr A.H.	USA	29.11.77	24. 5.78
Silveira, Dr C.M.	Brazil	5.12.78	25. 2.79
Singh, Dr K.M.	India	10. 9.78	8. 3.79
Sramek, Dr J.	Czechoslovakia	28.11.78	22. 3.79
Straka, Dr S.	Czechoslovakia	31. 8.77	26. 1.78
Taylor, Mr G.R.A.	UK	15. 1.78	12. 7.78

<u>Name</u>	<u>Nationality</u>	<u>Date arrived</u>	<u>Date of departure</u>
Verani, Mr J.F.	Brazil	10. 5.77	8. 9.77
Weeks, Mr R.M.	USA	22. 1.78	18. 4.78
Weisfeld, Dr J.S.	USA	8. 6.77	26. 1.78
Whipple, Mr D.	USA	6.10.77	28.12.77
Williams, Mr G.O.	USA	14. 3.79	5. 5.79
Wilson, Mr C.W.	UK	29. 5.77	26. 4.78
Wise, Dr H.S.	USA	3. 2.79	4. 5.79
Younan, Mr Y.	Egypt	18. 3.78	8. 4.79
Zabicki, Dr W.	Poland	4. 7.78	4.10.78
Zikmund, Dr V.	Czechoslovakia	15.10.76 5. 5.79	24.12.76 31.10.79

ANNEX 6

SMALLPOX CASES DETECTED IN SOMALIA, 1972-1976

Reference Number <sup>a</sup>	Name	Locality (District)	Age	Sex	Rash onset	Date of Detection	Probable source in Ethiopia Locality (Awraja) or Contact
1	Mohamed Noor Shaheed Omar	Allaibadi (Gebile)	28	M	28.10.72	31.10.72	(Kebri Dehar)
2	Abdi Haji Omar Mohamoud	Tugwajale (Gebile)	16	M	3.11.72	10.11.72	(Kebri Dehar)
3	Ismail Hared Omar	Hargeisa	28	M	6.11.72	16.11.72	Hodaeo (Warder)
4	Numio Mohamed Mohamoud	Hargeisa	5	F	8.11.72	14.11.72	(Jijiga)
5	Mohamed Omar Borama	Hargeisa	16	M	9.11.72	11.11.72	Lafa Isa
6	<u>b</u>	Mogadishu	9	F	28. 4.73	29. 4.73	Mustahil (Kelafo)
7	<u>b</u>	<u>b</u>	<u>b</u>	<u>b</u>	May 1973	<u>b</u>	El-Halimo
8	<u>b</u>	<u>b</u>	<u>b</u>	<u>b</u>	May 1973	<u>b</u>	Mustahil (Kelafo)
9	<u>b</u>	Mataban	<u>b</u>	<u>b</u>	May 1973	<u>b</u>	<u>b</u>
10	Mohamed Mohamoud Nuri	Allaibadi (Gebile)	40	M	10. 8.73	10. 8.73	Faafan (Jijiga)
11	<u>b</u>	(Beletweine)	<u>b</u>	<u>b</u>	Oct.1973	<u>b</u>	Bulo Olow (Kelafo)
12) 13)	Mohamed Isak Adan	Sheedley (Dolo)	30	M	29.12.73	2. 1.74	Diir Haar (Bale Region)
14	Qah Mohamoud Ibrahim	Sheedley (Dolo)	90	M	4. 1.74	4. 1.74	Contact of No.13
15	Hawa Ibrahim Mohamed	Sheedley (Dolo)	18	F	5. 1.74	5. 1.74	Contact of No.13
16	Osman Mohamoud Ibrahim	Sheedley (Dolo)	28	M	5. 1.74	5. 1.74	Contact of No.13
17	Sadiya Mohamoud Ibrahim	Sheedley (Dolo)	13	F	5. 1.74	5. 1.74	Contact of No.13
18	Ibrahim Moalim Abulkadir	Abesaleh (Huddur)	<u>c</u>	M	14. 3.74	20. 3.74	(Kelafo)
19	Abdi Ahmed Ali	Hargeisa	<u>c</u>	M	Mar.1974	Mar.1974	Medar (Hararghe Region)
20	<u>b</u>	(Burao)	<u>c</u>	F	Apr.1974	Apr.1974	(Hararghe Region)
21	Osman Abdi Arale	(Dinsor)	17	M	4. 9.74	6. 9.74	Fioh (Hararghe Region)
22	Aisha Dini Osoble	Kulbiyow (Badade)	16	F	23. 9.74	25. 9.74	(Kelafo)
23	<u>b</u>	(Jamame)	45	M	8.11.74	19.11.74	Fioh (Hararghe Region)
24	Maryan Hassan Ali	(Burao)	32	F	Jan.1975	14. 1.75	Qalaw (Warder)
25	Osman Farah Awale	(Burao)	20	M	Jan.1975	14. 1.75	Contact of No.24
26	Abdulrazaq Farah Awale	(Burao)	13	M	Jan.1975	14. 1.75	Contact of No.24
27	Laki Jama Abdi	(Burao)	7	F	Jan.1974	14. 1.75	Contact of No.24
28	Ebado Roble Hassan	(Burao)	16	F	18. 1.75	18. 1.75	Garlooghay (Warder): Contact of No.24
29	Mohamoud Omar Yusuf	(Yet)	17	M	mid Jan.	23. 1.75	Qaw
30	Ahmed Jama Raq	Beer Camp (Burao)	25	M	27. 2.75	27. 2.75	Garlooghay (Warder)
31	Zahra Ali Farah	Gaha (Berbera)	27	F	20. 3.75	20. 3.75	(Warder)
32	Ahmed Muse Nur	Hargeisa	19	M	25. 3.75	27. 3.75	Garlooghay (Warder)
33	Ahmed Musa N. Haji Saleh	Treksi (Burao)	<u>c</u>	M	26. 5.75	27. 5.75	Garlooghay (Warder)
34	Dahabo Mohamed	Hargeisa	40	F	10. 7.75	26. 7.75	Garlooghay (Warder)
35	Ahmed Hassan Hersi	Hargeisa	7	M	20. 7.75	26. 7.75	Contact of No.34
36	Zeinab Mohamed Ibrahim	<u>b</u>	<u>c</u>	F	30. 7.75	27. 7.75	Contact of No.34
37	Hassan Hersi Ahmed	Hargeisa	53	M	5. 8.75	27. 7.75	Contact of No.34
38	<u>b</u>	Bohodle (Burao)	<u>c</u>	F	17. 1.76	20. 1.76	(Warder)
39	<u>b</u>	(Wajid)	40	M	21. 1.76	25. 1.76	(El Kere)
40	<u>b</u>	Dafarur (Huddur)	<u>b</u>	<u>b</u>	2. 2.76	13. 2.76	(Kelafo)
41	<u>b</u>	Dafarur (Huddur)	<u>b</u>	<u>b</u>	5. 2.76	13. 2.76	(Kelafo)
42	<u>b</u>	(Huddur)	<u>c</u>	M	20. 2.76	25. 2.76	(Kelafo)

<sup>a</sup> Refers to numbers in figures 4.1A - 4.1E in text. b Unknown. c Adult.



ANNEX 7  
LINE LISTING OF SMALLPOX PATIENTS IN MOGADISHU OUTBREAK 1977

No.	Name	Age	Sex	Onset rash	Vaccination scar	Laboratory confirmation	Source	Onset - Isolation interval <sup>a</sup>
1	Sadia Hassan Abdulle	16	F	30 Aug.	no	+	<u>c</u>	2
2	Mohamed Jiale Abikar (died)	70	M	5 Sept.	no	+	<u>c</u>	8
3	Abshire Hasan Nur	18	F	12 Sept.	no	+	<u>c</u>	8
4	Faduma Mohamed Ali	30	F	17 Sept.	no	+	<u>c</u>	3
5	Nura Sheikh Yusuf	30	F	23 Sept.	no	+	<u>c</u>	5
6	Elmi Rage Jimale	28	M	1 Oct.	no	+	<u>c</u>	<u>c</u>
7	Fatuma Ismail Ali	33	F	25 Sept.	no	+	No.3	21
8	Asbshir Abukar Osman	11	F	6 Oct.	no	+	No.7	9
9	Hasan Abubaker Osman	9	M	6 Oct.	no	+	No.7	9
10	Asha Abubaker Osman	6	F	12 Oct.	no	+	No.7	3
11	Zahra Hassan Hiraway	15	F	6 Oct.	no	+	No.7	9
12	Adan Hassan Ismail	16	M	10 Oct.	no	+	<u>c</u>	5
13	Hassan Moalin Omar	25	M	8 Oct.	no	+	No.7	8
14	Mariam Mohamed Elmi	30	F	16 Oct.	no	+	<u>c</u>	4
15	Fatuma Omar Mohamed	19	F	8 Oct.	no	+	No.5	17
16	Maymona Ahmed Rage	13	F	22 Oct.	no	+	No.15	3
17	Ali Afrah Hilolay	20	M	21 Oct.	no	+	No.12	4
18	Hawa Adan Hussein	18	F	17 Oct.	no	+	No.13	8
19	Habiba Roble Hassan	20	F	25 Oct.	no	+	No.15	9
20	Olad Haji Yusuf	25	M	29 Oct.	<u>c</u>	+	<u>c</u>	5
21	Maryam Ali Gureh	20	F	4 Nov.	17 Oct.	+	No.19	5
22	Hassan Jilicow Jisow	40	M	12 Oct.	no	+	<u>c</u>	5
23	Fatuma Ali Nur	39	F	9 Nov.	5 Nov.	+	No.19	6
24	Hassan Bore Afrah	20	M	12 Nov.	10 Nov.	+	No.20	5
25	Mohamoud Moh'd Omar	14	M	13 Nov.	7 Nov.	+	No.20	4
26	Ahmed Abdi Ahmed	2m	M	12 Nov.	no	+	<u>c</u>	2
27	Halimo Abikar Ali	9	F	11 Nov.	no	+	No.20	3
28	Omar Mohamud Adan	20	M	19 Nov.	no	+	No.23	6
29	Son of Maryam Ali Gure	1m	M	18 Nov.	8 Nov.	+	No.21	1
30	Sadig Abdi Mohamoud	3	M	26 Nov.	no	+	No.23	6
31	Abdilrahman Isak Husein	20	M	10 Dec.	no	+	No.30	<u>b</u>
32	Medina Mohamed Kul.	26	F	20 Dec.	<u>b</u>	+	No.31	<u>b</u>
33	Aday Mohamed Rehmsu	25	F	12 Dec.	<u>b</u>	+	No.30	<u>b</u>
34	Medina Abdirahman	30	F	3 Jan.	<u>b</u>	+	No.33	<u>b</u>
35	Mohamed Nur Adow	28	M	27 Dec.	<u>b</u>	+	No.31	<u>b</u>
36	Maymona Bare Ahmed	14	F	6 Jan.	<u>b</u>	+	<u>c</u>	<u>b</u>
37	Hassan Mohamed Nur	7	M	17 Jan.	<u>b</u>	+	No.35	<u>b</u>
38	Ahmed Mohamed Nur	5	M	17 Jan.	<u>b</u>	+	No.35	<u>b</u>
39	Hussein Mohamud Moh'd	41	M	13 Jan.	<u>b</u>	+	<u>c</u>	<u>b</u>

<sup>a</sup> Patients were moved immediately after detection. This interval refers to days the patient stayed at home with rash before being moved into isolation.

<sup>b</sup> Information not available.

<sup>c</sup> Not traced.

## ANNEX 8

## SMALLPOX OUTBREAKS BY WEEK OF REPORT AND DISTRICT, SOMALIA 1977

Area	Month	March					April					May					June					July				
	Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
BAKOOL				1			1		2			14	4	14	12	-	13	28	23	17	10	7	4			
El Barde															1	-										
Huddur				1										2	2	-	6	5	5		1	1				
Teyeglow							1		2		14	4	5	3	-	4	9	10		9	6	3	3			
Wajid														7	5	-	2	14	8	8	3	3	1			
Yet															1	-	1									
BAY						1	8	6	8	3	13	9	25	19	42	29	68	51	70	33	62	28	26			
Baidoa						1	8	6	7	3	9	8	14	11	28	11	43	34	49	26	24	11	18			
Burakaba													6	3	1	15	8	7	9	5	4	2	2			
Dinsor									1		4	1	2			2	5	5	6	-	6	4	1			
Kansadere													3	5	13	1	12	5	6	-	28	11	5			
GALGADUD									1			2														
Abudwak									1																	
El Bur											2															
GEDO													1	-	1	1	13	6	6	1	3	7	3			
Bardere																	8	6		1	2	1	1			
Bulohawa															1											
El Wak																										
Garbahare																					1	3	1			
Luk													1			1	5		6			3	1			
HIRAN								3	3	2	3	3	1				1				1					
Bulo Burti								3	3	2	2	3	1				1				1					
Jalalaksi											1															
L. JUBA									1					2												
Jamame															2											
Kismayo									1																	
M. JUBA									1	2	2		1	2		1		1	1			1				
Boale																							1			
Gelib									1	2	2		1	2		1			1							
Sako																		1								
MOGADISHU						1			1		1				1						1					
L. SHABELLI							1	3	4	1	3	8	7	-	21	9	2	5	1		1					
Afgoi									1		1	1	1	-	11	6	1	2								
Koryole									2	2				-	1	1										
Kurtunwarey																										
Merca							1		2		2	6	6	-	4	1	1	2	1							
Wanlawein															5	1		1			1					
M. SHABELLI							1	3	4	1	15	5	12	10	3	1	2	2	1	1	4	2	2			
Adala											1	1														
Adenyabal											1															
Balad									1		1	1	2		1						2	1				
Jowhar							1	2	4		12	3	10	10	2	1	2	2	1	1	2	1	2			
TOGDHEER																										
Burao																										
SOMALIA TOTAL		0	0	1	0	2	11	15	25	9	37	41	51	47	80	41	99	93	102	52	82	45	35			

ANNEX 8

SMALLPOX OUTBREAKS BY WEEK OF REPORT AND DISTRICT, SOMALIA 1977

August					September				October				November				Total Outbreaks	Month	Area
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		48	
3		1	1															155	BAKOOL
				1														1	El Barde
3		1																24	Huddur
																		77	Teyeglow
																		51	Wajid
																		2	Yet
10	8	7	9	5	2	2		1										545	BAY
4	2	1	1					1										322	Baidoa
1		2	5	4	1	2												77	Burakaba
1																		38	Dinsor
4	6	4	3	1	1													108	Kansadere
																		3	GALGADUD
																		1	Abudwak
																		2	El Bur
		1					5			1		1		1				51	GEDO
							5			1		1		1				27	Bardere
			1															1	Bulohawa
																		1	El Wak
																		5	Garbahare
																		17	Luk
			1															18	HIRAN
				1														17	Bulo Burti
																		1	Jalalaksi
																		3	L. JUBA
																		2	Jamame
																		1	Kismayo
							1											13	M. JUBA
						1												2	Boale
																		10	Gelib
																		1	Sako
																		5	MOGADISHU
1		1	2		2	1	1	2		2		2						80	L. SHABELLI
											2		1		1			25	Afgoi
												1						11	Koryole
											1							1	Kurtunwarey
1		1	2		2		1							1				34	Merca
						1												9	Wanlawein
1	1	1		1														73	M. SHABELLI
																		2	Adala
																		1	Adenyabal
1	1	1		1														10	Balad
																		60	Jowhar
1																		1	TOGDHEER
1																		1	Burao
16	9	11	13	6	4	4	6	3	0	3	0	3	1	0	0	0	0	947	SOMALIA TOTAL

## ANNEX 9

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## SMALLPOX CASES BY WEEK OF REPORT AND DISTRICT, SOMALIA 1977

Area	Month	March					April					May					June					July				
	Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
BAKOOL				2			5			7		35	6	75	30	-	24	140	52	76	17	22	7			
El Barde															2	-										
Huddur				2			1							5	8	-	10	18	14	-	3	1				
Teyeglow							4			7		35	6	26	9	-	10	60	24	22	10	15	5			
Wajid														44	10	-	3	62	14	54	4	6	2			
Yet															1	-	1									
BAY						1	10	6	12	16	35	34	63	57	111	124	220	167	214	95	179	65	71			
Baidoa						1	10	6	10	15	24	27	36	28	86	41	148	101	142	69	48	22	48			
Burakaba													14	15	4	76	33	43	50	26	27	8	11			
Dinsor								2	1	11	7	2	0	3	4	11	18	14	-	15	13	1				
Kansadere													11	14	18	3	28	5	8	-	89	22	11			
GALGADUD										3		2														
Abudwak										3																
El Bur												2														
GEDO													3		2	5	60	35	8	22	21	23	4			
Bardere																	52	35	-	15	10	1	1			
Bulohawa															2											
El Wak																					7	17	2			
Garbahare																					4	5	1			
Luk													3			5	8		8	7						
HIRAN							10		33	8	11	10	7	2	1	1	2	1			8	1	1			
Bulo Burti							10		33	5	9	9	7	2	1	1	1	1			8	1	1			
Jalalaksi										3	2	1					1									
L. JUBA									1					2	3											
Jamame														2	3											
Kismayo									1																	
M. JUBA								19	11	5	8	3	7	2			1	1					3			
Bcale																										
Gelib										19	11	5	8	3	7	2			1				3			
Sako																		1								
MOGADISHU							1		1		1				1							1				
L. SHABELLI								4		11	14	37	11	-	59	21	2	9	1		1					
Afgoi										1	7	2	1	-	32	14	1	3								
Koryole								2		3		4		-	1	1										
Kurtunwarey																										
Merca								2		7	7	31	10	-	10	1	1	4	1							
Wanlawein															16	5		2			1					
M. SHABELLI							1	7	7	3	47	31	72	48	34	16	7	19	6	3	25	19	8			
Adala											3	1		1			1									
Adenyabal											1	7		1												
Balad									4	2	1	7	14		3	1					13	11	4			
Jowhar							1	7	3	1	42	16	58	46	31	15	6	19	6	3	12	8	4			
TOGDHEER																										
Burao																										
SOMALIA TOTAL				2		1	17	27	20	93	116	155	173	192	249	169	314	373	283	196	252	133	91			

- No report

ANNEX 9

SMALLPOX CASES BY WEEK OF REPORT AND DISTRICT, SOMALIA 1977

August					September				October				November				Total Cases	Month	Area
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		48	
6	1	7	5		1													518	BAKOOL
			3															2	El Barde
6	1	2	2		1													65	Huddur
		5																245	Teyeglow
																		204	Wajid
																		2	Yet
27	19	30	43	10	20	6	1	7	3									1 646	BAY
12	12	2	1	1				7	3									900	Baidoa
4	1	13	29	7	18	6												385	Burakaba
1		7																110	Dinsor
10	6	8	13	2	2		1											251	Kansadere
																		5	GALGADUD
																		3	Abudwak
																		2	El Bur
3	2	9	1	6			12		7	2		1	2					228	GEDO
2	2	5	1				12		7	2		1	2					148	Bardere
																		2	Bulohawa
		4		6														10	El Wak
																		26	Garbahare
1																		42	Luk
				1														97	HIRAN
				1														90	Bulo Burti
																		7	Jalalaksi
																		6	L. JUBA
																		5	Jamame
																		1	Kismayo
3						17	4	1	3									88	M. JUBA
3						17	4	1	3									31	Boale
																		56	Gelib
																		1	Sako
																		10*	MOGADISHU
2		7	15	13	23	9	1	16		6	1	4	1					268	L. SHABELLI
								16		1	1	3	1					61	Afgoi
										5								33	Koryole
																		5	Kurtunwarey
2		7	15	13	23	6	1					1						142	Merca
						3												27	Wanlawein
4	1	2		2														362	M. SHABELLI
																		6	Adala
			1															9	Adenyabal
1																		62	Balad
3	1	1		2														285	Jowhar
1																		1	TOGDHEER
1																		1	Burao
46	23	55	65	31	44	32	18	24	13	8	1	5	3	0	0	0	0	3 229	SOMALIA TOTAL

\* Mogadishu 5 cases in January

ANNEX 10

LAST SMALLPOX OUTBREAK IN EACH AFFECTED DISTRICT, SOMALIA - 1977

National Reference Number	Region	District	Locality	Population	Cases	Onset of Rash		Detected	Source of infection	Week closed
						First case	Last case			
318	Bakool	El Barde	Aba Saleh	300	3	1.5	14.5	15.5	Teyeglow	29
918	Bakool	Huddur	Beer Gudey	30	3	6.8	25.8	15.8	Gubile	38
903	Bakool	Teyeglow	Fayfay	50	3	15.7	22.8	14.8	<sup>a</sup>	38
866	Bakool	Wajid	Berber	60	1	20.7	20.7	21.7	<sup>a</sup>	35
364	Bakool	Yet	Farburaley	60	1	16.5	16.5	10.6	Burdhoble	26
939	Bay	Baidoa	Erinta	120	10	13.9	5.10	26.9	Kurtunwarey	47
931	Bay	Burakaba	Dunduphay	75	3	20.8	9.9	9.9	Jamacada	42
885	Bay	Dinsor	Warilow	2	2	1.8	15.8	4.8	unknown	39
923	Bay	Kansadere	Bulostosi	32	2	26.8	29.8	28.8	B. Gomer	42
33	Galgadud	Abudwak	Belebelle	1 300	3	10.2	28.3	21.4	Mogadishu	20
128	Galgadud	El Bur	Galhareri	500	1	1.5	1.5	4.5	Afgoi	23
945	Gedo	Bardere	Gumurta	40	1	8.10	18.10	18.10	Dinsor	52
264	Gedo	Bulohawa	Bulohawa	6 000	2	2.5	17.5	21.5	chickenpox <sup>b</sup>	23
905	Gedo	El Wak	Bam. Halima	40	10	25.7	25.8	20.8	Garbahar	42
868	Gedo	Garba Harey	Korfadud	20	1	24.7	25.7	25.7	Shabelli	36
869	Gedo	Luk	El Waran	50	2	26.7	31.7	26.7	Guday	36
906	Hiran	Bulo Burti	Dabadere	50	1	6.8	6.8	11.8	Shirahale	27
88	Hiran	Jalalaksi	Jalalaksi	5 000	7	5.4	20.6	26.4	unknown	24
237	L. Juba	Jamame	Kyambulu	200	4	1.3	31.5	25.5	unknown	29
59	L. Juba	Kismayo	Kismayo	40 000	1	1.4	1.4	19.4	Mogadishu	22
930	M. Juba	Boale	Aden Gureed	280	25	16.7	23.9	12.9	Bardale	47
599	M. Juba	Gelib	Bula Nasib	200	1	23.6	23.6	24.6	Farah	31
463	M. Juba	Sako	Bula Sablow	8	1	3.6	3.6	19.6	Dinsor	31
320	Mogadishu	Mogadishu	Yaasin	450 000	1	1.6	1.6	4.6	Bula Dher	27
465	L. Shabelli	Afgoi	Galalay	30	1	7.6	7.6	17.6	Falalay	26
946	L. Shabelli	Koryole	Duguile	80	3	20.9	18.10	23.10	Kurtunwarey	48
942	L. Shabelli	Kurtunwarey	Kurtunwarey	25	5	15.8	10.10	13.10	Koryole	47
947	L. Shabelli	Merca	Merca town	40 000	1	26.10	26.10	31.10	Kurtunwarey	52
929	L. Shabelli	Wanlewein	Hawal Shere	20	3	25.8	30.8	9.9	Galele	42
121	M. Shabelli	Adala	Godwher	100	1	4.5	4.5	9.5	<sup>a</sup>	26
51	M. Shabelli	Adenyabal	Adenyabal	500	13	14.4	6.5	27.4	<sup>a</sup>	25
834	M. Shabelli	Balad	Damaley	200	2	2.7	18.7	19.7	<sup>a</sup>	35
895	M. Shabelli	Jowhar	Aras Benat	200	3	27.7	22.8	15.8	War Musole	39
875	Togdheer	Burao	Burao	600	1	26.7	26.7	30.7	Bio Aade	35

<sup>a</sup> Not recorded.

<sup>b</sup> Not recorded as final diagnosis chickenpox.

ANNEXES 11 - 15: SEARCH FORMS

- ANNEX 11: FORM SOM 1 - SEARCH SCHEDULE  
ANNEX 12: FORM SOM 2 - SEARCH REPORT  
ANNEX 13: FORM SOM 3 - DISTRICT SEARCH SUMMARY  
ANNEX 14: FORM SOM 4 - ASSESSMENT FORM  
ANNEX 15: FORM SOM 5 - REGIONAL MONTHLY SUMMARY

MASHRUUCA CIRIBTIRKA FURUQA  
SOOMAALIYA  
BAARINTA FURUQA

SMALLPOX ERADICATION PROGRAMME  
SOMALIA  
SEARCH SCHEDULE SOM 1

Beel: Zone Sector:		Degmo: District:	Gobol: Region:
Magaca Kormeeraha: Name of Supervisor:		Taariikh: Date:	
Tiro taxan Serial No.	Magaca meesha Name of village Hamlet/Locality Urban area	Taariikhda la baaray Date to be searched	Magaca Baafiyaha Name of Searcher

Copy to: Supervisor  
District Team Leader

Og: Kormeeraha  
Madaxa Kooxda Degmada

(FRONT) MASHRUUA CIRIBIRKA FURUQA SOOMAALIYA SMALLPOX ERADICATION PROGRAMME SOMALIA  
FOOMKA BAARIDA SEARCH REPORT SOM 2

Magaca baaraha: Name of searcher:		Meesha: Zone:		Degmada: District:		Gobolka: Region:	
Taar.  Date	Magaca meesha (Tuulo, reer miyi, magaalo) (name of locality village, nomadic group, town).	Inta guri la baaray - No. of houses searched		Inta dugsi la baaray Schools searched	Magaca wata la baaray - Water place names	Inta tuhun la helay No. of rumours collected	Inta talaal la qabtay - No. of vaccinations performed
		Ma guurto Permanent houses	A gal miyi Nomadic huts				
							Saxiixa madaxa Tuulada - Village Headman signature

Qofkii finan iyo qandho leh tafaasiishiisa foomkan ku qor: List below any fever with rash cases detected:

Taar. Date	Magaca tuulada Name of village	Magaca bukaanka Name of patient	Da' L/Dh.	Taariikhda finanku ka soo baxeen	Talaal hore haa/ maya - previous vacc. yes/no	Nooca jirada Diagnosis	Caddeyn Verification remarks

Halkan ku qor magacyada meelaha la baaray: List names of visited and searched:

Meelaha caafimaadka/Health Establishment	Xafiisyada maamulka - Golayaasha Hanuunta/ Administrative Offices - Orientation Centres
Sayladaha/Markets	Baararka - Hudheelada/Teashops - Restaurants

(BACK)



MASHRUUCA CIRIBTIRKA FURUQA - SOOMAALIYA  
SMALLPOX ERADICATION PROGRAMME - SOMALIA  
MARKOOBKA BAAFINTA DEGMADA - DISTRICT SEARCH SUMMARY  
SOM 3

[illegible]



WHO Epidemiologist: \_\_\_\_\_  
Regional Epidemiologist: \_\_\_\_\_

Bisha \_\_\_\_\_ Sanadka \_\_\_\_\_  
Month \_\_\_\_\_ Year \_\_\_\_\_

Taariikhda la soo \_\_\_\_\_ (Date reported)  
Gobol \_\_\_\_\_ (Region)

[illegible]

[illegible]

ANNEX 16

SUMMARY OF FIXED SEARCH UNITS - SOMALIA 1979

REGIONS Districts	Zones	Fixed search units	Permanent houses	State schools	Koranic schools	Tea shops	Restaurants	Health establish- ments	Public offices	Recognized waterpoints	Markets	Recognized nomadic areas
BAKOOL	22	312	12 858	36	166	101	62	11	19	2 208	22	1 221
El Barde	3	4	421	3	3	3	7	2	3	131	7	136
Huddur	6	169	6 006	15	98	69	4	2	8	58	8	335
Teyeglow	6	96	2 742	8	35	13	11	3	3	1 943	4	692
Wajid	4	39	1 825	7	23	16	16	2	3	47	4	33
Yet	3	4	1 864	3	7	0	24	2	2	29	4	25
BARI	27	88	12 516	52	57	454	776	22	143	576	31	2 218
Alula	5	20	1 615	6	8	39	45	5	20	42	6	140
Bender Beile	4	3	895	2	4	20	17	2	11	50	2	370
Bosaso	4	17	5 115	13	13	132	344	6	37	108	8	320
Kandola	4	16	1 865	6	9	48	63	1	15	133	2	665
Kardo	5	20	1 612	12	11	147	194	2	41	128	7	493
Iskushopan	5	12	1 414	13	12	68	113	6	19	115	6	230
BAY	66	1 837	63 529	83	1 120	735	372	27	102	1 540	62	a
Baidoa	27	964	31 963	41	534	444	234	14	27	649	17	a
Burakaba	25	514	20 962	24	306	185	4	5	44	376	8	a
Dinsor	10	154	5 113	12	118	86	89	3	10	253	18	a
Kansadere	4	205	5 491	6	162	20	45	5	21	262	19	225
GALBEED	38	224	51 155	84	96	781	675	19	186	89	32	a
Berbera	6	13	1 267	6	7	76	9	1	8	13	2	111
Borama	6	45	4 363	19	18	113	10	3	8	26	6	305
Gebile	6	45	3 242	25	13	166	625	6	30	26	7	285
Hargeisa	8	95	41 000	23	48	302	25	4	121	1	12	a
Lughaya	6	10	411	6	3	39	2	1	6	8	1	102
Seyla	6	16	872	5	7	85	4	4	13	15	4	154
GALGADUD	20	57	8 973	24	169	323	1	10	44	122	40	a
Addado	4	7	548	4	24	62	0	2	20	16	0	a
Abudwak	4	10	3 044	3	41	58	0	3	3	20	11	a
El Bur	4	13	1 572	9	53	114	0	2	9	26	14	a
El Dere	4	10	1 286	5	15	56	0	2	7	14	5	a
Dusamareb	4	17	2 523	3	36	33	1	1	5	46	10	a
GEDO	28	251	19 612	40	304	444	a	15	42	241	19	17
Bardere	5	182	9 291	16	141	72	3	3	8	63	1	1
Bulo Hawa	4	8	1 233	5	14	67	35	1	1	7	5	1
Dolo	3	18	881	2	7	76	33	2	1	9	1	2
El Wak	5	5	367	4	5	64	7	1	12	26	2	4
Garbahare	5	15	1 127	7	15	49	16	3	11	15	2	6
Luk	6	23	6 713	6	122	116	a	5	9	121	8	3
HIRAN	20	172	12 803	59	125	407	359	25	28	252	37	a
Beletweine	7	77	6 998	32	59	218	163	13	11	89	20	a
Bulo Burti	7	47	3 191	17	51	115	122	6	6	73	9	10
Jalalaksi	6	48	2 614	10	15	74	74	6	11	90	8	a
L. JUBA	30	207	22 911	60	452	931	472	28	90	196	42	a
Afmadu	8	11	1 193	4	86	128	36	4	11	41	4	10
Badade	7	16	2 164	7	91	90	31	6	23	52	5	28
Jamame	8	132	12 380	32	133	279	91	8	39	62	20	a
Kismayo	7	48	7 174	17	142	434	314	10	17	41	13	13
M. JUBA	19	271	29 180	66	284	a	142	21	104	273	44	a
Boale	6	42	3 202	14	33	32	22	2	32	9	6	a
Dugiuma	1	3	6 542	4	90	a	1	8	6	4	2	a
Gelib	4	100	14 040	35	87	189	78	8	49	107	25	a
Sako	8	126	5 396	13	74	73	41	3	17	153	11	a
BANADIR	172	54 181	47	990	2 439	1 286	21	72	13	39	3	3
Mogadishu												
MUDUG	20	64	7 809	29	80	574	567	19	115	751	38	a
Galkayo	7	28	5 824	15	40	384	270	9	55	469	17	a
Goldogob			included in Galkayo									
Harardere	4	12	440	5	15	49	66	2	5	24	8	94
Hobyo	4	13	809	4	17	56	131	5	32	121	9	a
Jariban	5	11	736	5	8	85	100	3	23	137	4	a
NUGAL	19	40	13 127	29	40	445	a	18	120	822	26	a
Eil	4	6	1 942	6	6	99	a	6	28	45	6	a
Garoe	4	10	5 364	8	18	74	133	4	55	168	6	a
Las Anod	7	18	5 453	12	10	231	a	6	28	592	10	a
Taleh	4	6	368	3	6	41	a	2	9	17	4	a
SANNAG	14	57	7 873	40	45	247	a	10	71	132	31	a
Badhan	4	17	3 240	14	14	89	a	5	8	31	27	a
El Afwein	5	19	1 522	8	7	70	1	2	2	67	1	a
Erigabo	5	21	3 111	18	24	88	7	3	61	34	3	a
L. SHABELLI	63	978	89 185	190	760	574	188	80	236	641	94	291
Afgoi	13	246	17 910	47	192	63	12	14	42	169	24	26
Brava	10	74	8 211	16	109	58	6	24	26	63	9	53
Koryole	10	70	21 327	27	105	115	6	19	36	17	20	27
Kurtunware	4	31	9 216	6	35	12	3	8	12	6	5	18
Merca	12	223	19 000	80	182	233	152	13	64	148	28	67
Sablale			included in Brava									
Wanlewein	14	334	13 521	14	137	93	9	2	56	238	8	100
M. SHABELLI	30	437	35 493	71	437	970	a	37	83	550	18	676
Adala	3	13	2 097	8	36	186	a	4	21	24	4	112
Adenyabal	5	15	674	5	21	155	a	3	8	11	4	161
Balad	6	67	6 199	22	120	265	a	11	26	88	5	170
Jowhar	16	342	26 543	36	260	364	a	19	28	427	5	233
TOGDHEER	23	140	15 197	52	144	618	280	12	26	4 984	14	a
Bohodle	6	21	2 588	11	13	88	30	3	4	1 462	3	a
Burao	9	71	9 235	25	53	244	102	5	10	1 820	5	a
Odweine	4	31	2 192	7	40	204	120	3	8	1 534	3	a
Sheikh	4	17	1 182	9	38	82	28	1	4	168	3	a

a Not recorded.

## CONTAINMENT INSTRUCTIONS

## INSTRUCTIONS FOR SMALLPOX CONTAINMENT FOR SMALLPOX OR SUSPECT SMALLPOX

A. ISOLATION

1. Isolate patient in separate house or hut in or near village (isolation unit).
2. Isolation shall be separated from other houses by "Hawo" which will be closed at all times.
3. "Hawo" shall be large enough to include latrine area.
4. No-one shall be allowed in "isolation unit" except patients' mothers (vaccinated) of infected children, and isolation guard.
5. Two isolation guards shall be appointed to each unit. Unit guards will be vaccinated and trained to:
  - keep patients in unit
  - keep visitors out
  - carry food, water, wood and fire into isolation unit
  - keep "Hawo" closed at all times
  - five shillings per day will be paid for food for each patient in isolation. Final payment will only be made at end of isolation.

B. INITIAL VACCINATION OF AFFECTED VILLAGE

1. Two vaccinations minimum will be assigned to village.
2. All houses within 1/2 km area will be numbered, or
3. For each house all residents, including absentees and visitors, will be listed on "Form 6", or in an exercise book including the following columns:
  - house number
  - name
  - age
  - date of vaccination
  - date of take (successful vaccination)
  - date of fever
  - remarks.

(if exercise book used, suggest separate page for each house to allow listing of visitors)
4. All residents and visitors present should be vaccinated within 24 hours. One night house by house, person to person check between midnight and 6 a.m. is recommended to be carried out. Assistance of village headman or higher administrative official is important.

C. DAILY CHECK OF "1/2 KM" AREA

1. Check each house for new cases. If new cases are found, isolate in isolation unit.
2. Identify any unvaccinated - list and vaccinate.
3. Daily checking will continue each morning until outbreak is officially closed.

D. SEARCH AND VACCINATION OF SURROUNDING AREA

1. Prepare sketch map of all villages and nomadic groups in 10 km area in each direction.
2. At least once weekly each group of houses should be checked for smallpox per schedule developed by supervisor.
3. For each village or group of huts:
  - house should be numbered
  - list all residents and visitors including absentees
  - all should be vaccinated
  - vaccinator should spend at least one night in each group of houses to do night vaccination.

E. RESPONSIBILITIES OF SUPERVISOR

1. Supervisor should spend one night in each affected village to certify completeness of initial vaccination.
2. Village should be checked every 3-4 days to check on:
  - completeness of line listing
  - vaccination technique in using new vial each day, mixing of vaccine, vaccination technique and needle sterilization.
3. Completeness of vaccination coverage and successful takes.
4. Effectiveness of isolation in: providing food and water, keeping patients in, keeping visitors out and keeping Hawo closed.
5. Check on progress of search and vaccination of 10 km area including check of one village.

Line list of affected village should be kept in the affected village until outbreak is closed.



O U T B R E A K   I N F O R M A T I O N											
GOVERNMENT OF SOMALI DEMOCRATIC REPUBLIC						WORLD HEALTH ORGANIZATION					
NATIONAL SMALLPOX ERADICATION PROGRAMME						GLOBAL SMALLPOX ERADICATION PROGRAMME					
OUTBREAK NO. _____						REGION: _____					
DATE OF CONTAINMENT: _____						DISTRICT: _____					
SOURCE: _____						LOCALITY/VILLAGE: _____					
_____						POPULATION: _____					
1	2	3	4	5	6	7	8	9	10	11	12
NAT. CASE SER. NO.	O'BREAK CASE SERIAL NO.	INFECTED HOUSE	PATIENT'S NAME	AGE	SEX	PREVIOUS VACC. HISTORY	DATE ONSET RASH	DATE DETECTED	PLACE ISOLATED	SPECIMEN TAKEN	REMARKS



ANNEX 21

SMALLPOX ERADICATION PROGRAMME - SOMALIA  
INVESTIGATION OF SMALLPOX SUSPECT - OR DEATH ASSOCIATED WITH RASH

INFORMATION		Name: _____	Designation: _____	Date: _____
OBTAINED BY		Address: _____		
PERSON UNDER INVESTIGATION		Name: _____	Father's name: _____	
		Address: _____	Locality: _____	Zone: _____
		District: _____	Region: _____	
		Sex: _____	Age: _____	Occupation: _____
VACC. STATUS	Vaccination scar present: Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>			
	Vaccination history: Positive <input type="checkbox"/> Neg <input type="checkbox"/> Unknown <input type="checkbox"/>			
	Year of the latest vaccination (if possible date): _____			
	Facial Pockmarks: Yes: _____ No: _____ Discoloration only: _____			
	If yes: - how many on face: _____ - year, month when attached: _____ - locality where attached: _____ (state region, district)			
CLINICAL OBSERVATIONS	Date of onset of fever: _____ Date of onset of rash: _____			
	Rash: Character: _____ Distribution: _____ Evolution: _____			
	Drugs (used before rash occurred): _____			
	Locality of disease onset (if differs from given address): _____			
	Outcome: Recovered: <input type="checkbox"/> Died: <input type="checkbox"/> If "died" give date: _____ Locality: _____			
	Clinical diagnosis: Smallpox: Yes _____ No _____ other: _____ Specify: _____			
SPECIMEN	Specimen collected by: Name: _____ Designation: _____			
	Specimen taken: Person under investigation Yes <input type="checkbox"/> No <input type="checkbox"/> If yes date: _____ His close contacts Yes <input type="checkbox"/> No <input type="checkbox"/> If yes date: _____			
	Result of Laboratory testing: _____			
EPIDEMIOLOGICAL INVESTIGATION	FINDINGS AND OBSERVATIONS: (put only summary; for details use reverse side).			
	AFFECTED HOUSEHOLD: _____			
	NEIGHBOURING HOUSEHOLDS: _____			
	REMAINING LOCALITY: _____			
	CONTACT WITH DISEASED ANIMALS: _____			
	In affected locality: Population: _____ How many more cases: _____ Total households: _____ No of affected households: _____			
SUMMARY OF EPIDEMIOLOGICAL ASSESSMENT: _____				
Date: _____		Name of investigator: _____		Signature: _____

KEEP ONE COPY IN REGIONAL OFFICE: SEND THE SECOND ONE TO ZEROPOX Mogadishu.

## REFERENCES

- BISHOP, J.M., RONAGHY, H.A., TIDDEUS, H.A. Medical Education in Somalia, Wld Hlth Org. EMRO, EM/SOM/HMD/003/August 1976
- DERIA, A., JEZEK, Z., FOSTER, S. Outbreak Containment in the Somalia Smallpox Eradication Programme, Wld Hlth Org. Geneva (1978), WHO/SE/78.104
- Development Programme 1971 - 1973 Somali Democratic Republic, Ministry of Planning and Coordination (1971), Mogadishu
- FOSTER, S.O., EL SID, A.G., DERIA, A. Spread of Smallpox Among a Somali Nomadic Group, Lancet, (1978) Oct., 831 - 833
- HARDJOTANOJO, W. Notes on Smallpox Eradication Activities in Mogadishu Region, Wld Hlth Org. Geneva
- HENDERSON, D.A. Epidemiology in the Global Eradication of Smallpox, Int.J.Epid. (1972) 1, 25 - 30
- HOLBERT, D. Smallpox and Alastrim, Lancet (1957) 1, 1012 - 1014
- HUGHES, K. Fatality, Facial Scarring and Blindness from Smallpox in Bangladesh, Wld Hlth Org. Geneva (1978), WHO/SE/78.101
- HUNT, J.A. General Survey in Somaliland, Population Index, (1954) 20, 40
- ISMAIL, M.A. Somalia Today - General Information, Ministry of Information and National Guidance Mogadishu, 1971
- JEZEK, Z., BASU, R.N., ARYA, Z.S. Problem of Persistence of Facial Pock Marks Among Smallpox Patients, Ind.J.Publ.Hlth. (1978) 22, 1, 95 - 101
- JEZEK, Z., DERIA, A. Smallpox Eradication in Somalia, Status Report - October 1978 Wld Hlth Org. Geneva (1978), WHO/SE/78.128, Global Commission WP/78.14
- JEZEK, Z., HARDJOTANOJO, W. Residual Skin Changes in Patients who have Recovered from Variola Minor, Wld Hlth Org. Geneva (1978), WHO/SE/78.131, Global Commission WP/78.53
- KAPLAN, I., et all. Area Hand-book for Somalia, Sec.Edit., DA-Pam 550 - 86, 1977
- KRIZ, B. The Epidemiology of Measles in a Rural Community of Somalia, Mogadishu (1978) unpublished
- KRIZ, B., BUULE, A.A. Report on Possible Case of Camelpox in Man, Wld Hlth Org. Geneva (1979), SE/79.7
- KRIZ, B., HATFIELD, R.J. Nomadic Population Movement in South-Western Somalia, Wld Hlth Org. Geneva (SE series) - in press
- MACCHIAVELLO, A. Integral Dynamics of Health in Somalia, Ministry of Health, Mogadishu, 1965
- MARES, R.G. Animal Husbandry and Animal Diseases in Somaliland, Brit.Vet.J. (1954) 100, 411 - 423
- MORGANTINI, A.M. Demographica Della Somalia, Bull.Inst.int.Stat. (1954) 34, 377 - 391
- OLES, A.J. Smallpox Eradication in Somalia, Wld Hlth Org. EMRO, EM/SE/16, SOMALIA 0019/R May 1968
- Operational Guidelines for Smallpox Eradication in Somalia, Wld Hlth Org. Geneva (1978), WHO/SME/78.1.Rev.1
- Plan of Action for the Smallpox Eradication in Somalia, 1978-1979, Wld Hlth Org. Geneva (1978), WHO/SME/78.3
- PROTHERO, R.M. Population Movements and Problems of Malaria Eradication in Africa, Bull.Wld Hlth Org. (1961) 24, 405 - 425

WHO/SE/79.145  
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- PROTHERO, R.M. Public Health, Pastoralism and Politics in the Horn of Africa, Programme of African Studies, North-Western, University Press, Evanston 1968
- SAMATER, H.N. Some Health Problems in the Somali Republic, Int.J.Nurs.Stud., Britain (1969), 6, 1, 3 - 15
- SAMOSTRELSKI, A. Problem of Tribal Movement in Maintenance of Smallpox Vaccination, Wld Hlth Org. EMRO (1969), EM/SEM.SE/27
- Smallpox Eradication Unit, A Smallpox Outbreak in Merca Town, Somalia, Wld Hlth Org. Geneva (1978), WHO/SE/78.123
- WHO Expert Committee on Smallpox Eradication, Wld Hlth Org. Geneva (1968), Techn.Rep.Ser. No.393
- WHO Expert Committee on Smallpox Eradication, Second Report, Wld Hlth Org. Geneva (1972), Techn.Rep.Ser. No.493
- WHO Weekly Epidemiological Record, Wld Hlth Org. Geneva (1978), No. 14, 97 - 99
- World Health Organization: Report of the Global Commission for the Certification of Smallpox Eradication, Wld Hlth Org. Geneva (1978), WHO/SE/78,132
- World Health Organization: Report on the Preliminary Meeting for the Certification of Smallpox Eradication in Ethiopia, Kenya, Somalia and Sudan, Second Coordination Meeting, Smallpox Eradication Nairobi, 16 March 1977
- YOUNG, K. The Control of Smallpox Among Nomads in Somaliland Protectorate, Medical Officer (1961), 297 - 299