WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ

SME/78.13
ENGLISH ONLY

THE DEMOCRATIC REPUBLIC OF THE SUDAN

THE ERADICATION OF SMALLPOX

IN SUDAN

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D. SPECIAL FIELD OPERATIONS

A N N E X E S

SUMMARY

A. Background Information

Records of smallpox incidence and deaths in Sudan, dating back to 1925, show that there were repeated importations as well as endemic disease. Both variola major and minor were present. A large scale WHO assisted mass vaccination programme in 1961-63 brought incidence to very low levels and was followed by the disappearance of variola major. However, variola minor persisted, particularly in the south.

B. The Eradication Programme

After thorough preparation and delays caused by the closing of the Suez Canal, the Attack Phase, based on mass vaccination, passive surveillance and containment began in the central provinces (Region II) in January 1969. Thirty months later this area was clear of smallpox and was placed in Maintenance Phase. The strategy was then changed to active surveillance and containment and mass primary vaccination. This was implemented in Kassala Province (Region I) and in the latter half of 1972, when the southern provinces became accessible, in Region III (the southern provinces of Upper Nile, Equatoria and Bahr el Ghazal). By the end of 1972 the last endemic focus had been contained. The last imported case was found and contained during the same month.

Assessments were built into the programme from the beginning, and take rates and coverage were consistently high. Outbreaks were discovered most often by mobile SEP teams, next by health units and thirdly by the public, except in Equatoria where most were reported by the public. Health education was combined with search and vaccination activities.

C. Maintenance Activities

From 1973 to 1976 active searches by mobile teams continued and sites of former outbreaks, border and other high-risk areas were repeatedly visited. Vaccination, particularly primary vaccination, was continued on a large scale. Checkposts, both permanent and seasonal, were maintained to monitor border areas and migration routes of seasonal labourers. From 1976 onward greater emphasis was placed on recording of suspected cases and chickenpox cases, collection of specimens for laboratory diagnosis, and the development of a system of regular NIL smallpox reporting. Between 1972 and May 1978 specimens were submitted to WHO from 86 suspected cases and all have been negative for smallpox. Systematic pockmark surveys were carried out on a very large scale and no persons were found with pockmarks whose illness had occurred after 1972. A reward for reporting a suspected case, which was confirmed as smallpox was increased stepwise to L.S. 100. In 1977 a final special search was made and no evidence of smallpox could be found.

D. Special Field Operations

Special programmes were developed for Upper Nile Province which the swamps and rainy seasons make inaccessible for most of the year. Seasonal workers were closely followed at checkposts and by mobile teams. The border areas, particularly in those provinces adjoining Ethiopia received special attention. Close collaboration was developed with the Ethiopian SEP programmes and in several instances Sudan SEP Teams carried out investigations of rumours and containment activities across the border in concert with the Ethiopian SEP. Frequent pockmark surveys in children of pre-school age in border villages failed to find any with pockmarks originating after 1972.

E. Programme, Personnel and Finance

Sudan has maintained its SEP force at approximately the same level (500-600 personnel) from 1969 to 1978. The lion's share of the cost of the Sudan-WHO programme has been borne by the Sudan government.

CHAPTER (1)

COUNTRY AND PEOPLE OF THE SUDAN

1. Geography:

Sudan is a vast country occupying a great part of the heart of Africa with an area near to 2.6 million square kilometers. It is a completely inland country with the exception of small portion in the east which opens on the Red Sea. It has common borders with eight countries (Egypt, Libya, Chad, Central African Republic, Zaire, Uganda, Kenya and Ethiopia).

The nature of the terrain varies from desert in the extreme north through steppe and grassland in the centre to tropical jungle in the south. The River Nile traverses the country from south to north with a total length of 4160 miles with many tributaries and 80% of its water coming from the Ethiopian plateau.

The climate in the north is hot and dry during most of the year. The weather becomes cooler in December and January. Dust storms are frequent till rains begin towards the end of June, moving up from the south (tropical part). The hottest months are from April to June in the north when the rainy season starts and lasts till October. Rainfall varies from zero in the desert to heavy in the south.

2. Population:

The Sudanese nation has a multiplicity of ethnic origins. The main ones are: Arab, Nuba, Beja, Nubiyin, Nilotic and Nilohamatic. Although there is a degree of mixing, the distinction between them is clear in the formation of the tribes, of which there are hundreds. In spite of this mosaic picture, there are many common traditions and forms of behaviour. The predominant religion of the country is Islam with Christianity and pagan next. The main language is Arabic and, although some tribes have their own tongues, all use Arabic and, in some cases, English as a common language.

There are large number of immigrants from West or Central Africa. Most are of Nigerian origin and they are commonly called "Nigerians" or "Howsa" or "Fellata", after two of the large Nigerian tribes.

3. Provinces:

Sudan is now divided into 18 provinces according to the new administrative arrangements. This new number (18) of provinces is actually the result of dividing each of the previous provinces into two with exception of Khartoum province, which remained the same, and Blue Nile province, which was divided into 3 provinces. These provinces are organized into five geographical regions. The Smallpox Eradication Programme (SEP) was organized when there were 9 provinces and maintained that structure throughout the maintenance phase. The original and present provinces are listed in Table 1.

4. Census:

There have been two principal censuses. The first census was in 1956 when the total population was reported to be 10,263,000. The second and most recent census in 1973 showed the total population to be 14,902,894. (Table 2). Details about the population distribution and other information are available in the National Health Programme book prepared in 24 April 1975.

5. Urban, Rural and Nomadic Distribution of Population:

For the country as a whole approximately 18% of the population live in urban areas; 71% reside in rural areas and 11% lead a nomadic life. (Table 3). The main occupation of Sudanese is agriculture which depends on rain or on irrigation in big schemes. The second main occupation is animal breeding e.g., cattle, camels, sheep and goats. Industry and other trade is third in importance, although now steadily increasing.

The mode of life of Sudanese is shaped to a great extent by their main occupations i.e., agriculture and animal raising. This results in seasonal movements and activities. People move in certain seasons to big agricultural schemes. Tribal movement follows good rain and pasture. In addition there is an influx of population to big towns and industrial centers.

The Gazira cotton scheme is very illustrative of the seasonal movements. People in tens of thousands come and go at the time of cultivation and cotton-picking. The same happens on a smaller scale in sugar cane fields and factories.

These mass movements have in the past had a great impact in the spread of smallpox and also have had a great influence in helping its eradication. The concentration of masses of people in a limited area facilitated mass immunization and detection of cases. Other traditions also helped e.g., market days, tribal gatherings, religious gatherings.

6. Administrative Organization:

The country is administratively divided into provinces. Figure 1 shows the provinces as they existed in 1967 and in 1977

The province is a large administrative unit which is divided into smaller units called districts. The Commissioner, a politico-administrative figure, heads the Province. Under him are a group of Assistants, each responsible for a certain service such as health or agriculture. The Assistant Commissioner for Health (ACOH) is responsible for both curative and preventive services in the province.

The Assistant Commissioner for Health is responsible not only to the Commissioner of the province, but also to the Central Ministry of Health. Within the health structure there is a network of hospitals, health centers and a large number of dispensaries and dressing stations. There is also a complete staff for preventive and sanitation activities and sub-sections for such specialized divisions as Malaria, Bilharzia and the SEP unit. The SEP is unique in being a vertical programme from the outset. After the official declaration that the country is free from smallpox the organization will be continued as a horizontal programme, integrated into the existing health services in order to carry out the Expanded Immunization Programme.

Data on age and sex and on household size are presented in Tables 4 and 5 and in Figure 2 (Population Pyramid). Detailed information, including all facts and figures, is well documented in 3 books:-

1. National Health Programme (Blue Book)

2. Primary Health Programme for the North (Brown Book)

3. Primary Health Programme for the South (Green Book).

REGIONS AND PROVINCES OF SUDAN IN 1967 AND 1977 — Table (1)

1967		1977	
Region	Province	Region	Province
Northern	1. Northern	Northern	1. Northern
			2. Nile
	2. Kassala	Eastern	3. Kassala
			4. Red Sea
	3. Khartoum	Central	5. Khartoum
	4. Blue Nile		6. Blue Nile
			7. Gezira
			8. White Nile
	5. Kordofan	Western	9. Kordofan - North
			10. Kordofan - South
	6. Darfur		11. Darfur - North
			12. Darfur - South
Southern	7. Upper Nile	Southern	13. Upper Nile
			14. Junglei
	8. Bahr El Ghazal		15. Bahr El Ghazal
			16. El Buhayrat (Lakes)
	9. Equatoria		17. Eastern Equatoria
			18. Western Equatoria

Table (2)

Population, Area and Population Density by Province in 1973.

Province	Population	Area (x 1000) in sq. km.	Inhabitants per. sq. km.
1. Khartoum	1,168,000	21	55.6
2. Northern	999,000	271	3.7
3. Kordofan	2,202,000	381	5.8
4. Darfur	2,181,000	374	5.8
5. Bahr El Gasal	1,397,000	214	6.5
6. Upper Nile	756,000	236	3.2
7. Equatoria	798,000	214	6.5
8. Kassala (1,123,000) / Red Sea (468,000)	1,588,000	341	4.7
9. Blue Nile (1,964,000) / White Nile (998,000) / Gezira (1,851,000)	3,813,000	136	28.0
Total	14,902,000		

* Population of Kassala includes Red Sea.

** Population of Blue Nile includes White Nile and Gezira;

The 9 original provinces are underlined. The figures in brackets indicate the population of each new province.

Source : Department of statics, 1975.

Table (3)

URBAN, RURAL, NOMADIC DISTRIBUTION OF POPULATION BY PROVINCE IN 1973

PROVINCE	URBAN		RURAL		NOMADIC	
	No.	%	No.	%	No.	%
Khartoum	850,395	72.8	262,778	22.5	54,996	4.7
Blue Nile	141,020	14.5	718,348	74.1	110,106	11.4
White Nile	154,669	15.8	692,101	70.7	131,248	13.4
Gezira	213,430	11.4	1,644,984	88.2	7,085	0.4
Northern	169,199	16.9	736,519	73.7	93,165	9.3
Red Sea	169,083	36.4	129,722	27.9	166,238	35.7
Kassala	235,319	20.9	639,050	56.9	249,018	22.2
Kordofan	262,005	11.9	1,534,067	69.7	406,274	18.4
Darfur	210,420	9.6	1,566,174	71.8	404,567	18.5
Bahr El Ghazal	106,341	7.6	1,290,572	92.4	-	-
Upper Nile	57,147	4.7	761,104	95.3	-	-
Equatoria	148,631	19.7	607,119	80.3	-	-
TOTAL	2,697,659	18.1	10,582,538	71.0	1,622,697	10.9

Source : Department of Statistics, 1975. Estimates based on Preliminary 1973 Census results.

AVERAGE SIZE OF HOUSEHOLD ACCORDING TO PLACE OF RESIDENCE, Table (5)

Population Estimates 1973

PROVINCE	TOTAL	URBAN	RURAL	NOMADIC
Red Sea	4.132	4.657	2.642	5.480
Kassala	5.104	5.303	4.805	5.743
Northern	4.937	6.183	4.878	5.508
Khartoum	5.872	6.023	5.176	6.673
Gezira	5.454	6.219	5.358	5.260
Blue Nile	4.954	4.953	4.236	5.260
White Nile	4.881	5.467	4.734	5.260
Kordofan	4.738	5.230	4.664	7.451
Darfur	4.220	5.008	4.131	5.262
Bahr El Ghazal	6.245	5.311	6.342	-
Upper Nile	5.673	6.732	5.629	-
Equatoria	4.762	5.085	4.685	-
TOTAL	5.060	5.537	4.860	5.675

Source : Department of Statistics, 1973 Population Census, Population Census Technical Committee.

Figure I

MAP OF SUDAN SHOWING OLD AND NEW PROVINCES

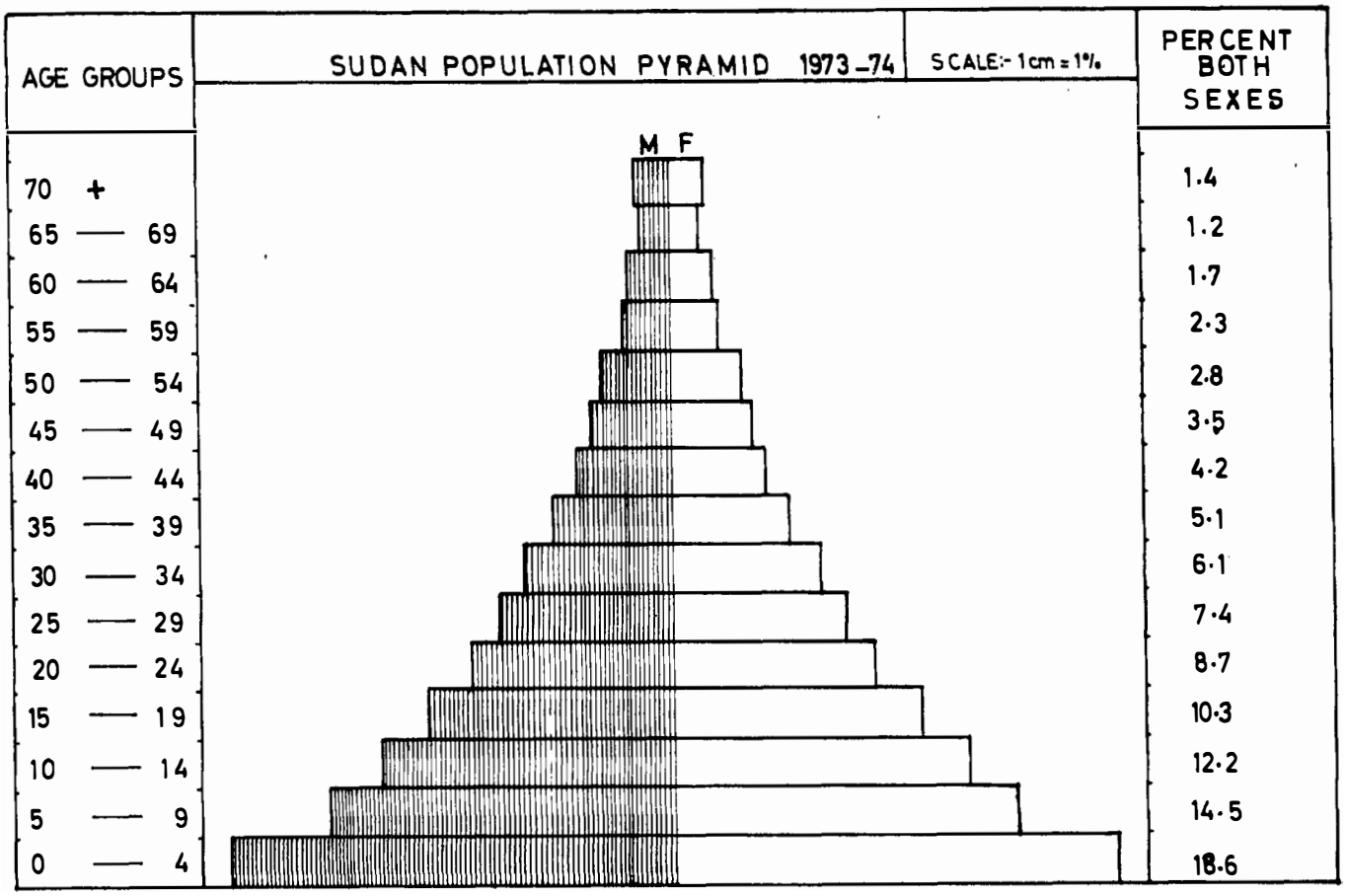
ESTIMATED POPULATION BY SEX AND AGE GROUPS IN 1973/74 Table (4)

AGE GROUP	TOTAL	Males	Females	% of both sexes
0 - 4	3,135,220	1,587,510	1,547,710	18.6
5 - 9	2,442,279	1,237,575	1,204,704	14.5
10 - 14	2,053,556	1,041,270	1,012,286	12.2
15 - 19	1,732,437	879,105	853,332	10.3
20 - 24	1,470,556	751,080	719,476	8.7
25 - 29	1,242,308	631,590	610,718	7.4
30 - 34	1,030,961	520,635	510,326	6.1
35 - 39	861,951	435,285	426,666	5.1
40 - 44	718,377	367,005	351,372	4.2
45 - 49	591,535	298,725	292,810	3.5
50 - 54	481,594	238,980	242,614	2.8
55 - 59	388,554	187,770	200,784	2.3
60 - 64	295,683	145,095	150,588	1.7
65 - 59	211,178	102,420	108,758	1.2
70 +	244,811	110,955	133,856	1.4
TOTAL	16,901,000	8,535,000	8,366,000	100.0

Source : Age distribution estimates based on United Nations Model for Stable Population. All total age figures are from the Sudan's Five Year Plan of Economic and Social Development (Amended) 1970/71 - 1974/75.

FIGURE II

SUDAN POPULATION PYRAMID 1973 - 1974



CHAPTER (2)

HISTORY OF SMALLPOX IN THE SUDAN UNTIL 1968

Sudan is located at a major crossroads of smallpox transmission. Travellers from the west brought the disease to Sudan as did those from the north-east, returning from Mecca. On the south and east smallpox was present in Zaire, Uganda and Ethiopia. In more recent times Sudan has known importations from Egypt in 1932, Ethiopia in 1939, Central African Republic in 1939 and Saudi Arabia in 1945. There have been many importations from Ethiopia subsequently.

Records of reported cases of smallpox go back to 1925. While they are undoubtedly incomplete, they show that all parts of the country were affected, some far more than others. They suggest that there were periods of endemic transmission, particularly in the south and east, where Sudan borders Zaire, Uganda and Ethiopia and probably repeated importations from the west, brought in by the large numbers of pilgrims and immigrants from West and Central African countries.

The number of cases and of deaths from 1925 to 1972 are presented in Table 6. From 1954 through 1960 the number of cases reported annually ranged from 25 to 4 200. This was followed by a period of low incidence from 1961 to 1967, perhaps as a result of the massive vaccination programme between 1961 and 1963 which was assisted by W.H.O. During this period more than 12,000,000 vaccinations were performed. At that time there was reason to believe that smallpox eradication was being approached. However, in 1969 the incidence again increased and reached 1 141 cases in 1971, just a year before eradication was accomplished. It is probable hat reporting was far from complete before the start of the eradication programme in 1969.

The case fatality figuresare presented because they show an interesting shift between the outbreaks in the 1950's and those which occurred after 1960, with the single exception of an outbreak in Darfur in 1965. During the earlier period fatality rates as high as 23.3% were reported, resembling those seen in Nigeria and elsewhere in West Africa. Later outbreaks, however, had the low fatality rates usually seen in Ethiopia and other East African countries. This raises interesting questions about the origin of Variola Major in Sudan and where it went. After 1965 it appears that only Variola Minor remained.

There is a suggestion in Table 7 that during the years between 1954 and 1965 the more severe smallpox came from the west, perhaps brought in by the very large influx of travellers or settlers from West and Central Africa. The three provinces on the western side of Sudan; Kordofan, Bahr El Ghazal and Darfur, reported fatality rates of 30.3%, 13.9% and 16.0% respectively. Kassala on the east had outbreaks with reported fatality rates of 21.8%. In the remaining provinces rates varied from 9% in Khartoum (based on 2 deaths) down to 0.0% in Northern Province. Thus, with the exception of the western provinces and Kassala, which also had a large West and Central African population, the prevalent type of smallpox during those years in most of the country appeared to have been associated with relatively low fatality rates.

The end of smallpox in Sudan came within 4 years after the eradication programme was launched in 1968. The planning, methods, work and dedication of the great number of smallpox workers who were responsible for this great achievement are the subject of the following report.

SMALLPOX CASES DEATHS AND VACCINATION
BY YEAR 1925 - 1973

Table (6)

Year	Cases	Deaths	Case fatality rate	Vaccinations
1925	147	13	8.8	-
1926	-	-	-	-
1927	207	83	40.1	-
1928	1976	357	18.1	368,978
1929	6467	885	13.7	255,000
1930	2179	343	15.7	33,730
1931	175	-	-	-
1932	47 *	-	-	-
1933	60	16	26.7	-
1934	197	1	0.5	-
1935	33	0	0.0	-
1936	577	132	22.8	-
1937	425	57	13.4	561,196
1938	527	158	30.0	1,347,258
1939	553	103	18.6	580,052
1940	515	104	20.2	446,155
1941	46	0	0.0	302,084
1942	12	0	0.0	448,176
1943	182	36	20.0	753,125
1944	242	51	21.1	1,274,897
1945	-	-	-	525,847
1946	63	1	1.6	528,394
1947	973	160	16.4	799,444
1948	1412	131	9.3	-
1949	246	13	5.2	524,693
1950	110	4	3.6	136,728
1951	346	40	11.6	593,372
1952	3653	578	15.8	1,124,260
1953	1767	221	17.7	431,554
1954	4200	584	13.9	1,203,673
1955	1427	284	19.9	1,748,190
1956	25	4	16.0	648,501
1957	295	23	7.8	2,678,223
1958	380	90	23.7	2,440,084
1959	336	9	2.7	633,275
1960	162	0	0.0	1,830,156
1961	8	0	0.0	3,418,539
1962	95	0	0.0	5,619,198
1963	0	0	0.0	3,220,953
1964	64	9	14.0	637,019
1965	5	0	0.0	286,481
1966	5	0	0.0	838,820
** 1968	112	0	0.0	1,967,450
1969	125	0	0.0	3,404,587
1970	1051	15	1.4	4,871,573
1971	1141	10	1.7	2,376,038
1972	787	10	1.7	2,268,142
1973	0	0	--	1,944,700

* Upper Nile is reported to have had " several thousand cases " during 1932.

** 1967 omitted because of change in recording interval

CASE FATALITY RATES BY PROVINCES, 1954- 1965

Table (7)

PROVINCE	NUMBER OF CASES	NUMBER OF DEATHS	FATALITY RATE (%)
Northern	43	0	0.0
Khartoum	22	2	9.0
Kassala	183	40	21.8
Blue Nile	955	68	7.1
Kordofan	761	231	30.3
Darfur	783	125	16.0
Upper Nile	225	15	6.7
Bahr El Ghazal	3390	473	13.9
Equatoria	660	48	8.2

CHAPTER (3)

EPIDEMIOLOGY AND EFFORTS TOWARD CONTROL OF SMALLPOX

Introduction:

Smallpox is a dreadful disease that kills many people and is well known to Sudanese since time immemorial. They call it by the Arabic name "Gadary" and differentiate it from chickenpox which they call "Burgum". The disease is so engraved in the memory of the public with a vivid picture that it is mentioned on uncountable occasions in their folklore and songs.

Although Sudan started to build its health services during the British occupation seventy years ago, the only sources available for information about smallpox are the Annual Reports of the Ministry of Health and a few other individual reports. From the Annual Reports one can collect information from as far back as 1925.

The information in these reports gives mainly the incidence and mortality by province. It is not possible to find data on age, sex or seasonal variations. In discussing the epidemiology of smallpox in Sudan it is convenient to speak of 2 important periods in the history of smallpox in this country. The first period was between 1925 and 1968, (the year of implementation of the SEP). The second period was from late 1968 until the last smallpox case in December 1972, (the period of SEP).

The period from 1925 to 1968:

From the data on the annual incidence of smallpox in different provinces for the period 1925 to 1968 (Table 8) one can notice at a glance that the greatest number of cases occurred in repeated outbreaks in Darfur Province. These outbreaks coincided with outbreaks in the neighbouring country of Chad (French Equatorial Africa). The next highest incidence was in Blue Nile and Bahr El Ghazal Provinces. This suggests that the disease was being introduced all the time into this country and into certain rural areas i.e., from the west through Darfur Province, the east through Blue Nile Province and in addition into the Red Sea and Kassala Provinces during the season of pilgrimage to Saudi Arabia. From these points of entry the disease spread to other provinces, mainly to Blue Nile because the large cotton fields there attracted seasonal labourers from all over the country. Also, as shown in Table I,it is obvious that the fatality rate was very high in Darfur and Kordofan Provinces, almost 'nil' in the 3 Southern Provinces, and intermediate in Blue Nile and Kassala Provinces. This suggests that Variola Major was present mainly in the Western Provinces and Variola Minor in the 3 Southern Provinces and mixture of both in the Blue Nile and some of the other provinces.

Effort toward Control:

Table 6 also shows the number of vaccinations done every year. As early as the 1920s vaccination campaigns were launched every year, usually after the outbreak had become evident. Notification may have taken place a bit earlier.

This reflects the time needed to prepare and organize a campaign. Smallpox incidence usually reached its highest limit during the dry season, the time of maximum mobility of the people. After the large campaigns of 1962-4 the number of cases declined sharply.

Vaccination campaigns had to be performed almost yearly in one or more provinces. This shows the importance of factors other than vaccination, however big the numbers.

SMALLPOX CASES AND DEATHS FROM 1925 TO 1968 BY PROVINCE

Table (8)

YEAR	B. NILE		DARFUR		KORDOFAN		KASSALA		NORTH		KHARTOUM		EQUATORIA		B. EL GHAZAL		UP. NILE	
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.
1925	147	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1926	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1927	183	74	Sporadic		-	-	-	-	-	-	-	-	-	-	-	-	-	-
1928	34	0	1942	357	Sporadic		-	-	-	-	-	-	-	-	-	-	-	-
1929	33	3	6187	798	31	0	Sporadic		13	-	Sporadic		-	-	-	-	Sporadic	
1930	-	-	941	138	-	-	-	-	-	-	-	-	-	-	-	-	1232	103
1931	-	-	97	0	32	0	10	-	-	-	-	-	-	-	-	-	13	-
1932	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	*	
1933	31	7	-	-	-	-	-	-	-	-	39	9	-	-	-	-	-	-
1934	Sporadic		-	-	-	-	64	1	Sporadic		-	-	-	-	167	24	-	-
1935	-	-	-	-	-	-	3	-	2	0	-	-	-	-	28	-	few	
1936	501	132	-	-	33	-	-	-	-	-	-	-	43	0	-	-	-	-
1937	231	41	1	0	103	10	50	6	-	-	3	0	28	0	-	-	-	-
1938	320	112	78	11	106	33	20	1	1	0	2	1	-	-	-	-	-	-
1939	7	0	502	98	5	1	-	-	-	-	5	1	1	0	-	-	-	-
1940	15	4	226	28	1	0	172	58	44	11	1	-	56	3	-	-	-	-
1941	1	-	-	-	-	-	-	-	1	-	2	-	40	-	-	-	2	-
1942	-	-	-	-	-	-	2	-	-	-	1	-	9	-	-	-	-	-
1943	-	-	-	-	55	22	1	-	112	10	1	-	12	-	-	-	-	-
1944	73	12	-	-	-	-	3	-	160	38	1	1	-	-	-	-	2	-

SMALLPOX CASES AND DEATHS FROM 1925 TO 1968 BY PROVINCE

Cont: Table (8)

YEAR	B. NILE		DARFUR		KORDOFAN		KASSALA		NORTH		KHARTOUM		EQUATORIA		B. EL GHAZAL		UP. NILE	
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	62	1	-	-	-	-
1947	139	3	-	-	90	19	299	51	-	-	-	-	425	87	-	-	20	3
1948	124	4	8	1	1052	99	152	20	3	-	3	1	10	-	27	3	33	3
1949	41	5	132	8	25	0	-	-	-	-	1	-	-	-	9	-	38	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71	-
1951	-	-	253	30	21	9	3	1	-	-	-	-	4	-	2	-	63	-
1952	-	-	3653	578	-	-	-	-	-	-	-	-	-	-	13	-	-	-
1953	-	-	1767	221	-	-	-	-	-	-	-	-	-	-	-	-	1013	172
1954	-	-	653	109	11	4	-	-	-	-	1	0	266	10	3307	461	2	-
1955	-	-	24	2	670	216	-	-	-	-	2	1	428	38	81	12	220	15
1956	4	-	8	-	-	-	2	-	-	-	-	-	3	-	1	-	7	-
1957	199	6	-	-	2	-	71	16	17	-	-	-	-	-	1	1	5	-
1958	260	59	15	1	37	11	45	18	10	0	13	1	-	-	-	-	-	-
1959	241	3	20	2	2	0	65	4	4	0	3	0	1	0	-	-	-	-
1960	146	-	-	-	-	-	-	-	12	-	3	-	-	-	-	-	-	-
1961	8	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1962	95	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1964	2	0	62	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	-	-	5	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	75	-
1968	18	0	-	-	1	-	9	0	-	-	9	-	-	-	-	-	-	-

* Thousands of cases but no deaths were reported with outbreak in Upper Nile in 1932.

The vaccine used before 1962 was glycerinated lymph vaccine which was imported every year and later during the war years, manufactured locally in the Stack Laboratory in Khartoum. Although it seems that it was a good vaccine there is doubt that it could stand the field conditions in this vast hot country.

The WHO assisted vaccination campaign was launched in February 1962. By the end of June 1964 a total of 8,840,152 vaccinations had been done. If it is assumed that no single person was vaccinated more than once during the period, 64% of the estimated population of 13 000 000 were vaccinated. The programme covered eight of the nine provinces. Equatoria Province could not be vaccinated because of violence resulting from political and social unrest. To a lesser extent the same problem was present in Upper Nile and Bahr El Ghazal Provinces.

Russian donated freeze dried vaccine was used during the WHO assisted(1962-4) campaign. The campaign was conducted by temporary staff and multiple puncture technique was employed using lancets or needles. Both house to house visits and focal collection of people for mass vaccination were adopted. Mobile teams were used for nomadic population.

As a result of these efforts, smallpox incidence dropped to nil in 1963 (Table 6) and the campaign appeared to have achieved its goal. While no effort was made to determine the vaccination coverage according to age group or to record primary and revaccinations, the achievement of nil incidence during the next 2 years created a wide feeling of complacency until the disease appeared again. Five cases were reported in 1965, 5 in 1966 and then incidence again began to climb.

Maintenance:

There had been little effort to maintain the level of immunity or to launch a similar campaign in Equatoria Province and this resulted in the appearance of outbreaks again in 1967/68. The incidence rose to 112 cases but no deaths. From this year onward and until the last case in 1972 very low mortality rate was reported in all the provinces. All the cases that happened during the attack phase of the SEP campaign from 1968 to 1972 were of the mild type. Variola Major had disappeared completely from the country. Most of the patients seen and investigated during SEP were very mildly affected by the disease. Pock marks could hardly be seen after a few years.

The continuity of transmission of smallpox for more than half a century (1925-1968) in spite of the notable efforts against it in the form of mass vaccination can be attributed to the following reasons:

1. The country is vast: 2.5 million square kilometers and sparesely populated.
2. Roads, as they are known in most countries, do not exist, making it difficult or impossible to reach the place of the notified case in reasonable time.
3. The climate most of the year is hot; therefore, the deterioration of the liquid vaccine was very likely.
4. There was no organized health structure such as SEP to plan, administer, and supervise a well planned vertical programme.
5. Vaccination campaigns were conducted usually after a lapse of time because of so many difficulties and shortages of transport.
6. The dry season in some provinces (Upper Nile) is very short (2-3 months) and during this time there is maximum mobility of the floating population.
7. Variolation: Although this practice had largely disappeared, there is a history of it occuring in the west having been practiced in the western part of Darfur Province and the eastern part of Kassala Province. There were no professional variolators. The practice was arm-to-arm among village people.

8. Refugees and security problems in the 3 Southern provinces (1956 to March 1972) and the problem of outlaws (Shifta) along the eastern borders with Ethiopia.

9. The nomadic population: Attempts were made to reach them by mobile teams but sometimes this could not be done due to shortage of transport.

Conclusion: - The efforts which were launched every year from 1925 to 1968 resulted in two achievements.

(a) Incidence was much reduced, especially after the WHO assisted campaign (1962-1964). The death rate declined very much.

(b) Variola Major disappeared, leaving only Variola Minor in all the country.

The period from 1968 to 1972:

This was the period of SEP with its present organization. The programme was a joint effort between WHO and the Sudanese Government. The programme was well organized and well managed from the beginning (Chapter 4). The real start of the programme was late in 1968 with the attack phase in the central area. In the period between 1963 and 1967, the incidence of smallpox was very low and it was thought that the disease was waning. But in March 1968, the incidence started to rise and notification came in succession as follows:-

- Upper Nile Province	75
- Kassala Province	9
- Blue Nile North	8
- Blue Nile South	10
Total	102

The first major outbreak of 1968 began in Renk, Upper Nile Province on 27 March. The index patient had arrived via Malakal from village Welding in Nassir District. The epidemiological investigation proved that smallpox cases had been occuring in the region along the Sudan-Ethiopia border at least two months before this first case came to the attention of Sudan health services. The importation of infection from Cambela, Illubabor Province in Ethiopia, in which smallpox cases had been reported in December 1967, was responsible for the 1968 Sudan outbreak. This outbreak ended in Upper Nile Province on 3 June and in Blue Nile Province (where there were 2 cases) on 16 June 1968.

The containment vaccination performed on a large scale during May 1968 amounted to:-

- Upper Nile Province	:	452 256 (61% primary)
- Blue Nile North	:	131 247 (12% primary)
- Blue Nile South	:	506 768 (19% primary)

This large containment vaccination together with isolation of patients and quarantine of contacts stopped the outbreak.

The distribution of cases by province from 1969 until the last case in 1972 is shown in Table (9). The highest incidence was reported from the 3 southern provinces and Kassala and Blue Nile Provinces. Both of latter provinces have common borders with Ethiopia. The incidence in Blue Nile was in most cases connected with seasonal workers coming for cotton picking. Most of the transmission was traced back either to the 3 southern provinces or to Ethiopia.

Northern Province for quite long time was smallpox free. But in 1970 it had an importation of 2 patients from Khartoum. A third case (also an importation) occurred in 1970 and since then, in spite of investigation of all rumours there has not been a single case of smallpox.

SMALLPOX CASES BY PROVINCE BY YEAR 1969 - 72 Table (9)

Province	1969	1970	1971	1972
Northern	-	2	1	-
Khartoum	7	261	22	7
Kassala and Red Sea	-	89	281	111
Blue Nile (South)	18	-	229	11
Blue Nile (North)	15	195	23	2
Kordofan	-	67	17	55
Darfur	-	-	17	5
Upper Nile	73	106	78	1
Equatoria	12	154	157	419
Bahr El Gazal	-	177	316	216
Total Cases	125	1051	1141	827
Number of Deaths *	33	15	10	10
Vaccinations	3,404,549	4,871,572	2,376,038	2,268,192

* The number of deaths was not reported from 551 cases in Equatoria in 1971 or from 205 cases in 1972.

INCIDENCE OF SMALLPOX PER 100,000 BY PROVINCE BY YEAR 1969 - 72. Table (10)

Ser.	Province	1969	1970	1971	1972
1.	Northern	-	.22	.1	-
2.	Khartoum	.66	24.17	1.98	.61
3.	Kassala & Red Sea	-	6.06	18.68	7.2
4.	Blue Nile (South)	1.5	-	18.27	.85
5.	Blue Nile (North)	.66	8.41	.96	.08
6.	Kordofan	-	3.27	.80	2.55
7.	Darfur	-	-	.82	.23
8.	Upper Nile	10.01	14.18	10.18	.12
9.	Equatoria	1.74	21.81	21.7	56.5
10.	Bahr El Gazal	-	13.6	23.69	15.8
	All Sudan	.92	7.59	8.04	5.68

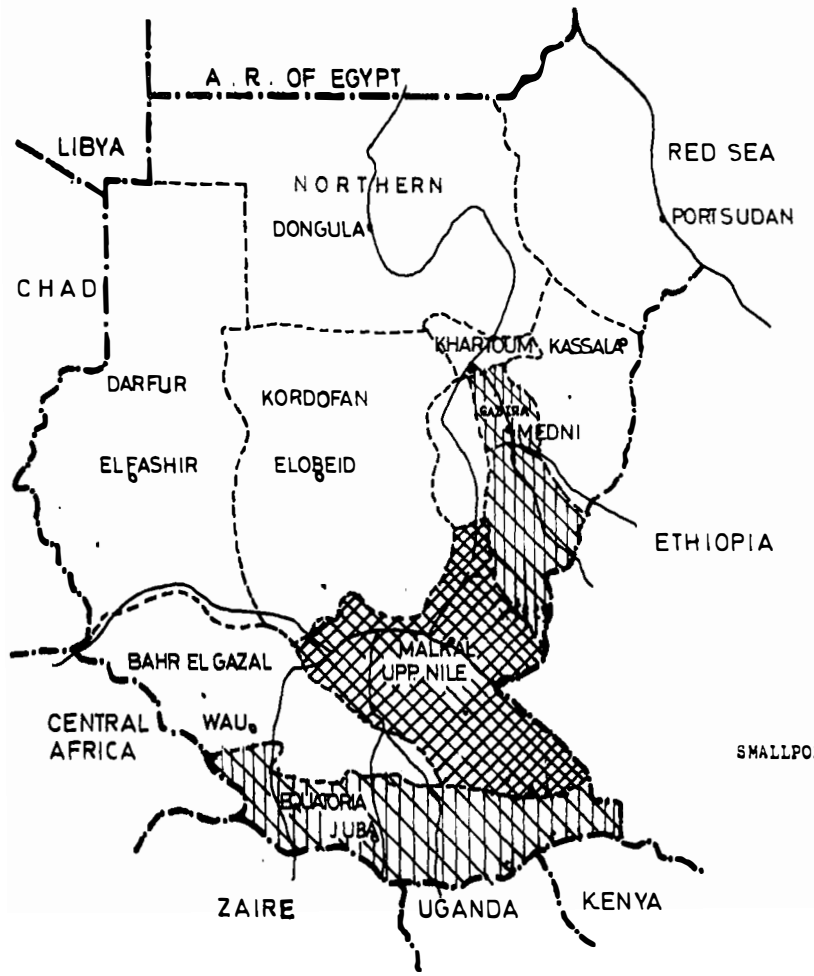
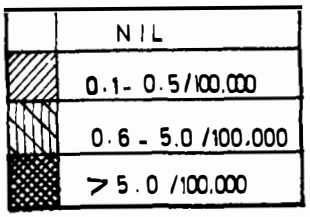


FIGURE III

SMALLPOX INCIDENCE BY PROVINCES - 1969



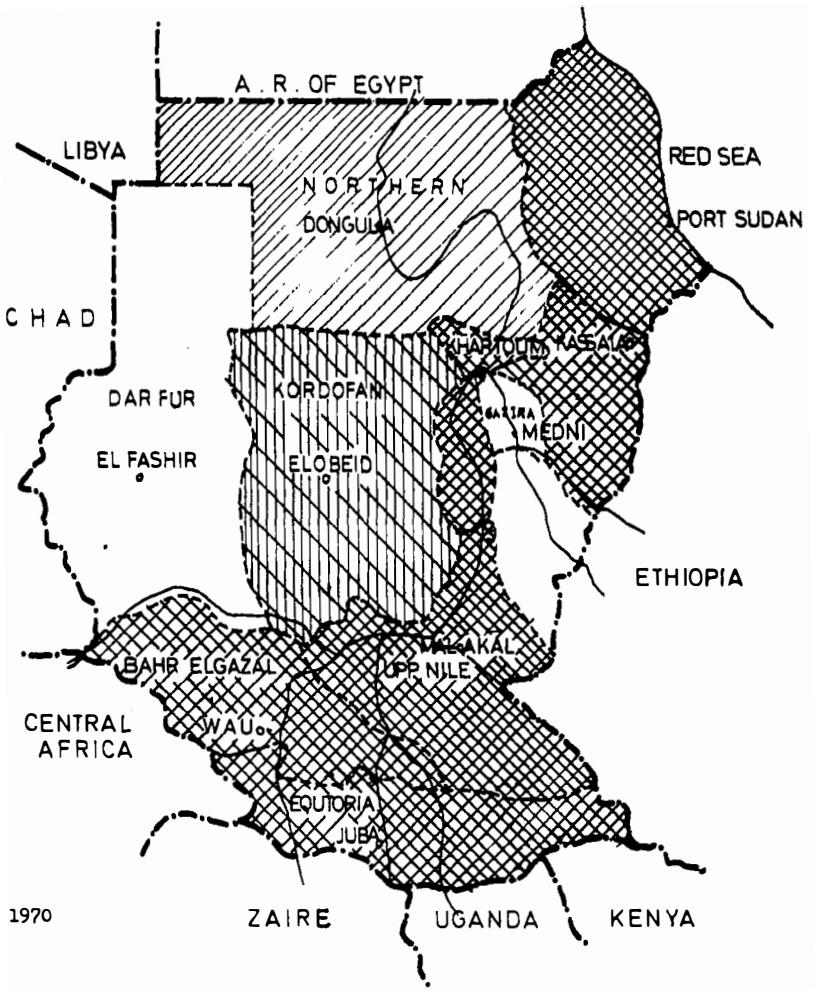


FIGURE IV

SMALLPOX INCIDENCE BY PROVINCE - 1970

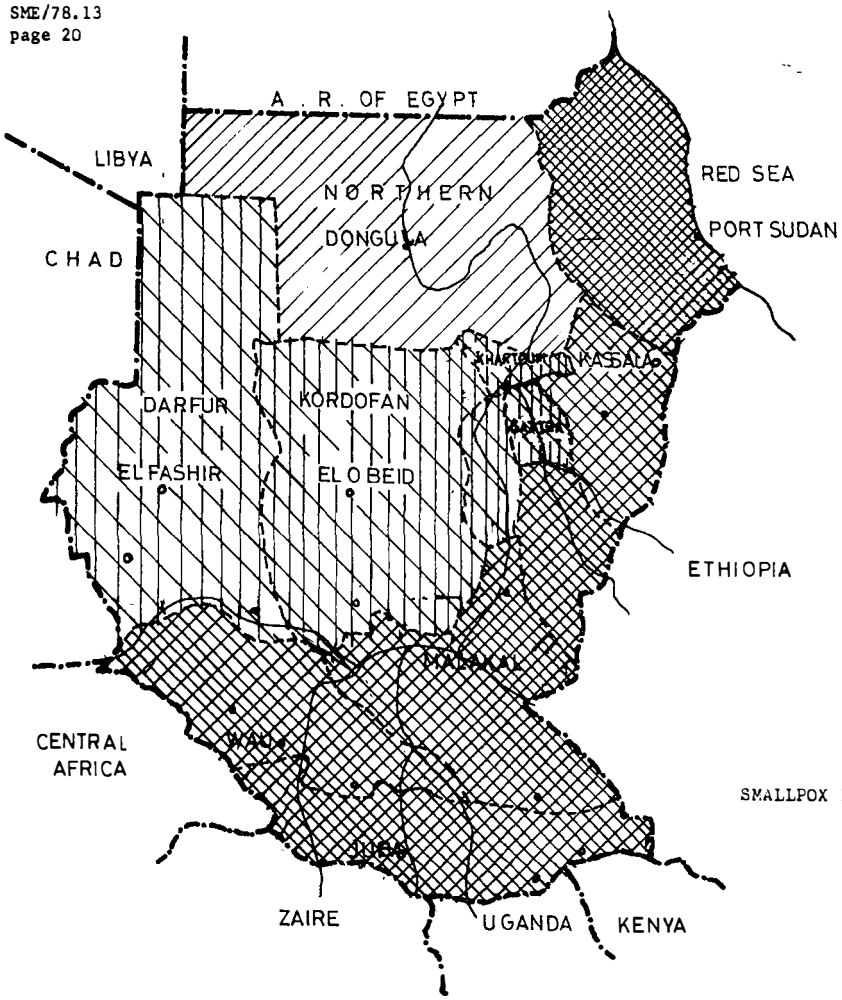
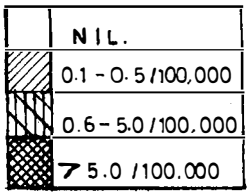


FIGURE V

SMALLPOX INCIDENCE BY PROVINCE 1971



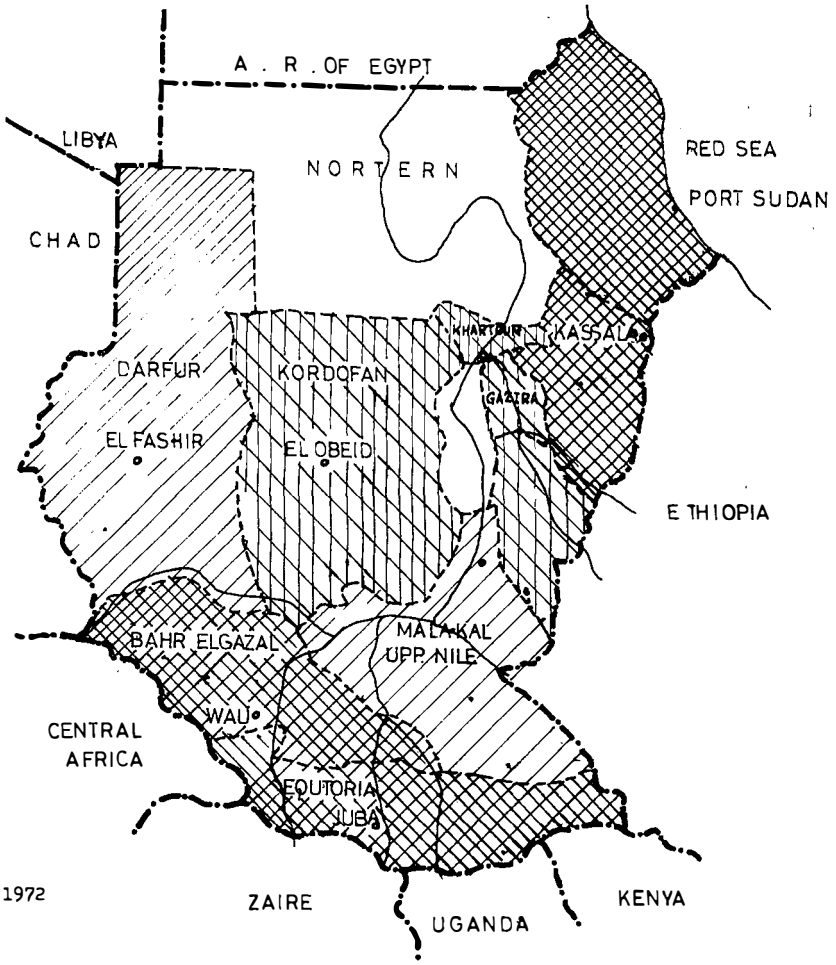


FIGURE VI

SMALLPOX INCIDENCE BY PROVINCES 1972

The provinces of Kordofan and Darfur experienced a rather low incidence of smallpox during the whole period of the programme. The source of infection in these provinces could usually be traced to southerners who came during the incubation period. In only a few instances mainly in Darfur Province, did investigation show that the cases were indigenous. The incidence of smallpox was usually of its maximum between January and March. This period coincides with the dry season when maximum mobility, especially of the floating population, was greatest.

Khartoum Province reported few or no cases from 1939 to 1969. In 1970, however, 261 cases were notified from various parts of the city, with 166 in Khartoum North, 64 in Khartoum, 16 in Omdurman and 15 in rural areas. One index case was traced to Aweil in Bahr El Ghazal Province. In 1971 and 1972 the number of cases fell sharply. Outbreaks in those years were traced to 4 provinces, Bahr El Ghazal (2), Blue Nile, Upper Nile and Kordofan. The majority of cases were discovered in the residential quarters predominantly inhabited by people coming from the three southern provinces or by Fellata, who usually came in contact with seasonal cotton picking workers in Blue Nile North Province.

The incidence by province from 1968 to 1972 is shown in Table 10 and in Figures 3,4, 5 and 6. The relatively low figures in 1968 probably reflect incomplete reporting. In the following 2 years rates are higher. This is due to the fact that the attack phase was going on in Region 1. The SEP staff was active in mass vaccination by the house-to-house method and was, therefore, discovering cases in addition to those being reported by routine notification. The highest incidence was found in the South, notably in Equatoria, in 1972 when teams were for the first time able to do a complete search.

The monthly incidence from 1969-72 is shown in Figure 7. There was little evidence of a definite seasonal pattern.

The high incidence from January to August 1972 was due to the adoption of active case searches in Regions II and III, which led to the discovery of most of the cases. After August 1972, the incidence started to come down until the last case occurred in Aluet village of Aweil Rural Council in Bahr El Ghazal Province in December 1972 (Chapter 19). Table (11) shows the cases distributed according to age group. The largest number of cases was in the age group 15-44 , the earning population. There were more cases in males than in females. This reflects the fact that men of this age group are more on the move, looking for work, and get the infection during their travel (railways, steamers), in the camps of seasonal workers in agricultural fields or in the residential areas of people of the same tribe in big towns.

The vaccination status of the cases is shown in Table 12 . With the exception of 1969, when 26% of 52 cases were reported to have scars, it was uncommon to see smallpox in a vaccinated person. This was seen in 10% of cases in 1970, 7% in 1972 and 2.2% in 1971.

The death rate reported during the programme period was very low and the disease was usually mild. Death occurred mainly in cases also having other diseases (e.g., malaria, malnutrition). This indicates that the smallpox strain was of the alastrin type. Variola major seems to have disappeared from the country well before the implementation of the programme.

SMALLPOX CASES BY AGE AND SEX - 1969 - 1972 Table (11)

Age	1969			1970			1971			1972			Males		Females		Total	
	M	F	Total	M	F	Total	M	F	Tot.	M	F	Tot.	Cases	%	Cases	%	Cases	%
0 - 1	2	1	3	8	8	16	22	12	34	11	14	25	43	1.6	35	1.3	78	2.9
1 - 4	14	13	27	77	64	141	116	90	206	45	11	56	252	4.5	178	6.7	430	16.2
5 -14	12	14	26	112	140	252	206	174	380	174	91	265	504	19.0	419	15.8	923	34.8
15-44	38	21	59	297	150	447	228	171	399	102	80	182	748	28.1	479	18.0	227	46.1
44 +				40	28	68	31	17	48	12	12	24						
Total	66	49	115	534	390	924	603	464	1067	344	208	552	1547	58.2	1111	41.8	2658	100.0

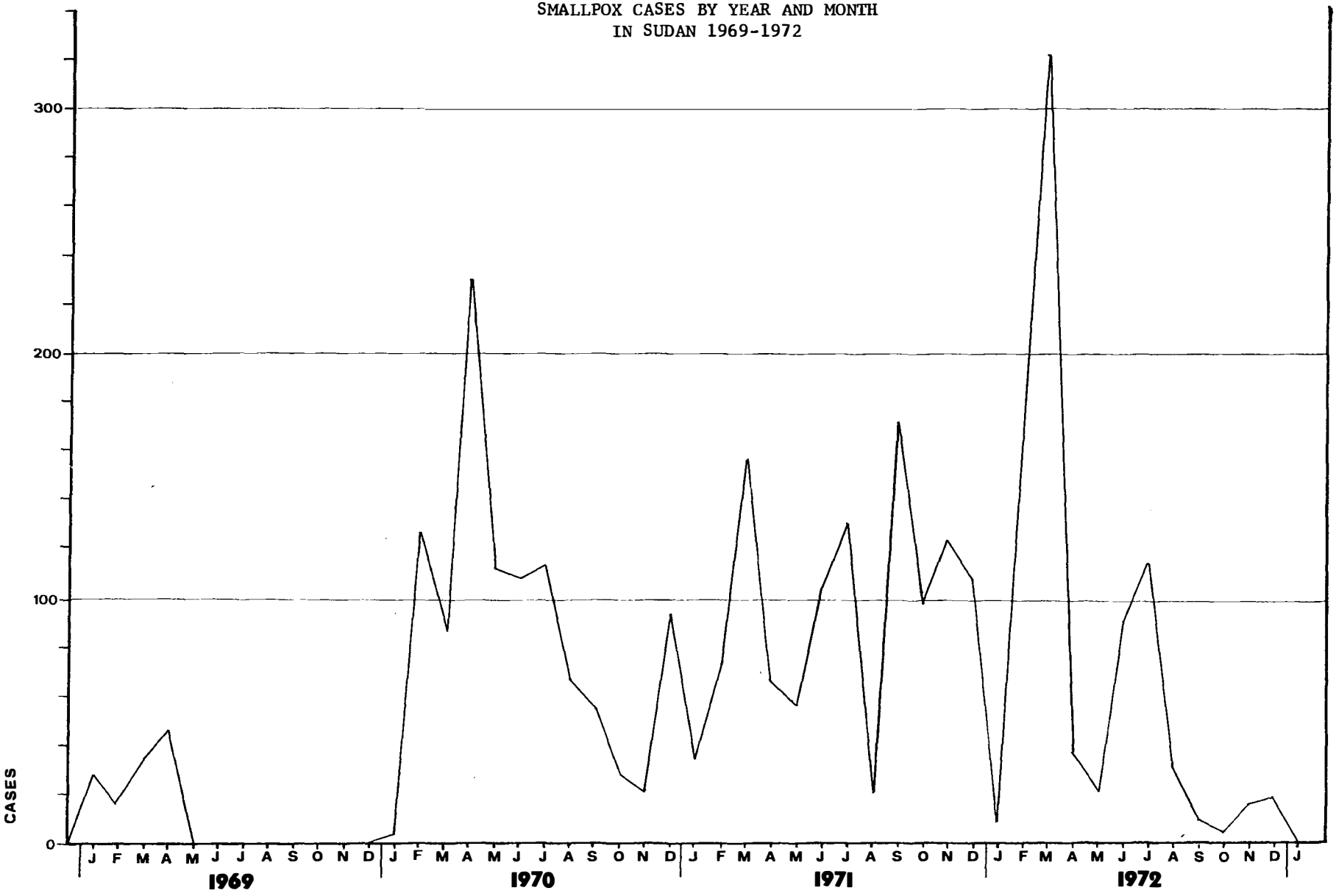
SMALLPOX CASES BY VACCINATION SCAR STATUS Table (12)

1969 - 1972

Year	Registered Cases	Case Sheet Available +	Scar Present	Scar Not Certain	% With Scar
1969	125	52	14	3	26
1970	1051	708	72	9	10
1971	1141	1025	23	193	2.2
1972	827	538	38	6	7
	3144	2323	147	211	6.3

FIGURE VII

SMALLPOX CASES BY YEAR AND MONTH
IN SUDAN 1969-1972



CHAPTER (4)

THE PREPARATORY PHASE OF THE SMALLPOX ERADICATION PROGRAMME

In view of the unanimous decision of the WHO Assembly in the year 1966 declaring world-wide eradication of smallpox to be one of the major objectives of the Organization, and the WHO resolution stating that the Organization would provide any endemic country with necessary technical and material assistance to help get rid of this devastating disease, the Sudan Government seized this golden chance and contacted the Organization at once, supporting the idea and requesting international help.

Pre-planning Reconnaissance:

The Under Secretary, Ministry of Health, called a departmental meeting with the WHO Advisor to discuss the situation. It was then decided that a tour should be made of the provinces, particularly those known to have smallpox during the past two years (1965-66), and that the purpose of this tour should be to collect information regarding the population census; social, economic and cultural standards; the expected level of cooperation, and any local difficulty likely to be encountered. Having finished this task successfully a proper plan of action was made which was agreed upon and signed by both the Sudan Government and the WHO on April 1967.

The programme for smallpox eradication was based on 3 distinct phases: the Preparatory Phase, the Attack Phase and the Maintenance Phase.

The Preparatory Phase:

This phase was totally devoted to the following:

1. Establishment of a National SEP Headquarters and Provincial Offices in Region I. (Figures 8,9)
2. Summing up and evaluating information already obtained.
3. Planning field activities.
4. Recruiting the required number of personnel and giving them adequate theoretical instruction and practical training (Table 13).
5. Collecting and distributing the necessary means for operation, such as vehicles, refrigerators, vaccines, needles, etc.
6. Deciding where and when to start the attack phase.

The plan of action provided for mass vaccination campaigns to be carried out stepwise in the different parts of the country. The country would be divided into 3 regions which would be placed under attack one after the other. All resources would be used in the region chosen for attack. The 3 regions with their estimated populations would be:- (Figures 10,11)

FIGURE VIII

TABLE OF ORGANIZATION - SUDAN MINISTRY OF HEALTH

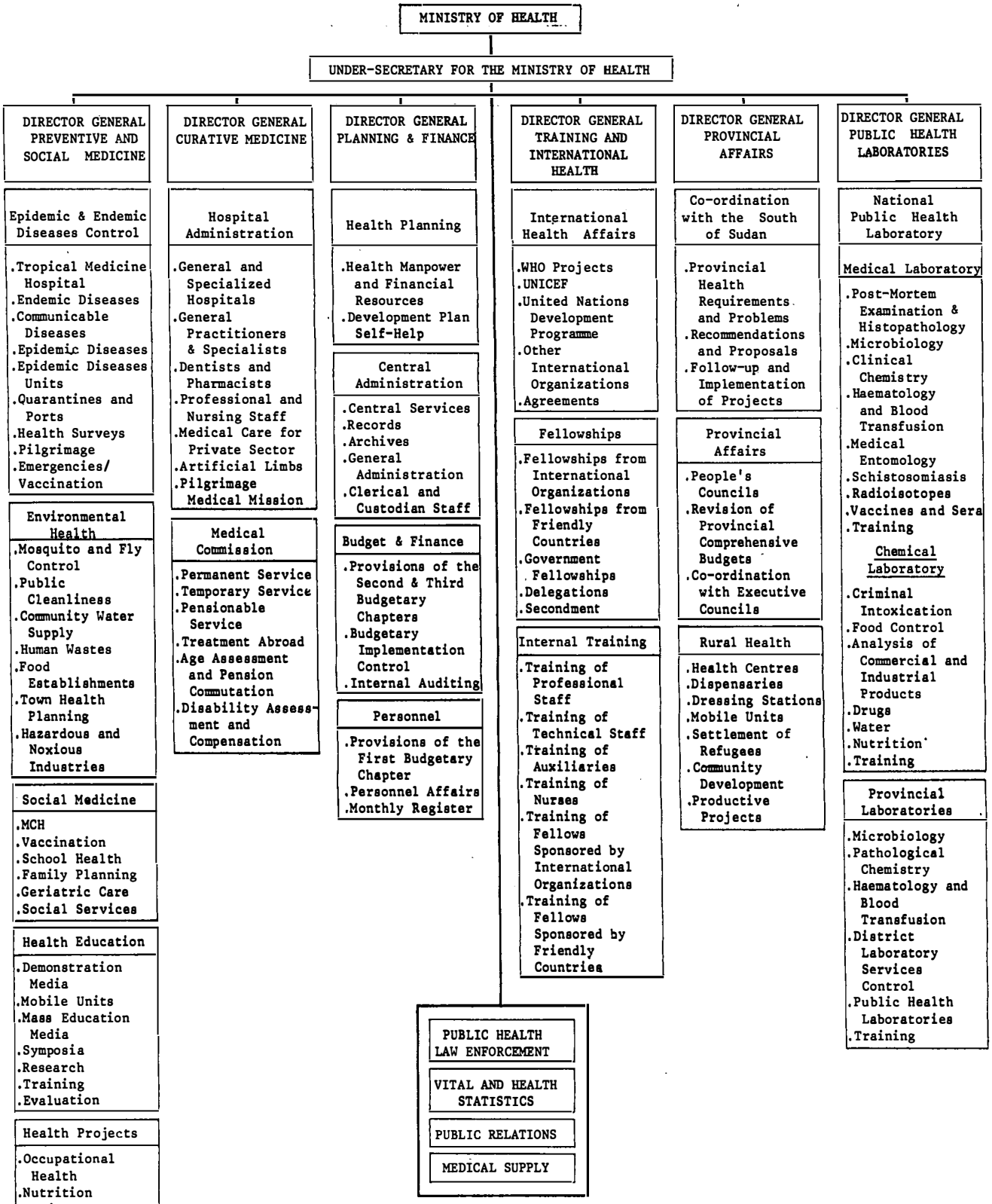
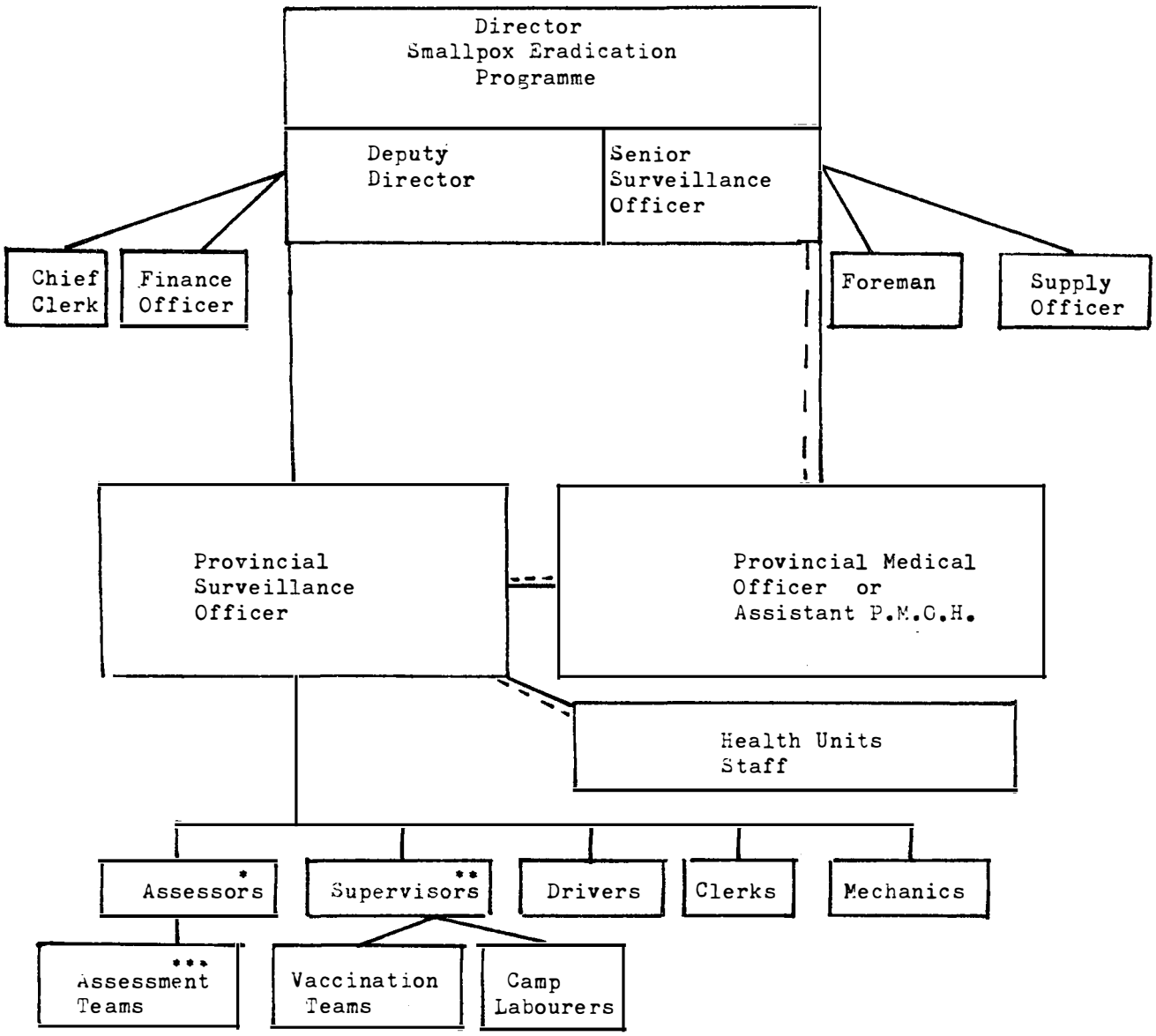


FIGURE IX

TABLE OF ORGANISATION SMALLPOX ERADICATION PROGRAMME



* 2 - 4 Assessors in every Province
** 4 - 8 Supervisors in every Province
*** 6 - 8 Vaccinators

——— Direct Technical and Administrative Responsibility

– – – – – – Cooperation and Technical Advice

Staff of SE/BCG Programme at the start of Activities
in the year 1968/1969

Table (13)

Stations	Khartoum	B. Nile N.	B. Nile S.	Kordofan	S. Darfur	Total
Nat. Director	1	-	-	-	-	1
HQ. Sr. Staff	3	-	-	-	-	3
A/PMOH R. Director	-	1	1	1	1	4
PHI R. O. Off	-	1	1	1	1	4
PHO Surv. Off	-	1	1	1	1	4
MA Ass. Off	-	1	1	1	1	4
Admin. Staff	5	-	-	-	-	5
Typist	2	-	-	-	-	2
Store-Keeper	1	1	1	1	1	5
Assessor	-	4	4	7	5	20
Supervis.	1	8	8	14	10	41
Vaccinators	12	75	75	120	90	372
Mechanics	1	1	1	1	1	5
Drivers	3	7	7	9	8	34
Messengers	4	1	1	1	1	8
Guards	2	4	4	8	6	24
Others	2	-	-	-	-	2
Total	37	105	105	165	126	538

Region I : The Central Region
Blue Nile North, Blue Nile South, Kordofan, Darfur
(population 6,462,000)

Region II : The Northern Region
Kassala, Red Sea, Khartoum, Northern
(population 3,211,000)

Region III : The Southern Region
Upper Nile, Bahr El Ghazal, Equatoria
(population 4,500,000)

Background for Decision:

The grouping of Sudan's provinces into these regions was based on geographic, demographic, epidemiologic and administrative reasons. Some specific considerations are listed below:

Geographic Factors: The climate and terrain of the country were always a consideration in terms of accessibility of the population to be reached.

Demographic Factors: Movements of people both within Sudan and across its borders provided special problems in terms of importations, exportations and spread of disease. These movements are dealt with in later chapters but the major ones can be mentioned here. (Fig. 12)

1. From the West, some 30 000 to 40 000 people crossed from West and Central Africa in Darfur and Kordofan Provinces every year on Pilgrimage to Mecca. With them the Pilgrims brought smallpox.

2. From the East. Through Port Sudan smallpox entered Sudan from the east, from Mecca. Smallpox also came to Kassala and Blue Nile Province from Ethiopia.

3. From the North. Some smallpox had entered Sudan from Egypt long ago.

4. From the South. Across the border contact between tribes of the same origin facilitated the importation of smallpox from Kenya, Uganda and, to a lesser extent, Zaire and the Central African Republic.

Epidemiological Factors: The central or "Epidemic Belt" (see Fig. 13) across Darfur, Kordofan, Blue Nile and Kassala Provinces has historically been the primary area of infectious disease transmission in Sudan. In this area occurred the great migrations of seasonal agricultural workers, coming to and returning from large projects such as the Gezira Sheme. Many Ethiopian workers crossed the border to find work there.

Administrative Factors: At the time of implementation of the Smallpox Eradication Programme and for the next 3 years, administrative difficulties prevented activities in the 3 southern provinces even though it was known that the incidence of smallpox there was high. Therefore, the attack phase started in the Central zone (Darfur, Kordofan and Blue Nile).

Reasons for Beginning Attack Phase in Region I:

The selection of Region I was based on the following reasons:

1. To provide a buffer zone to prevent, or at least minimize the spread of the disease from the endemic area in the South to other regions.

2. To immunize the densely populated areas, particularly the children.

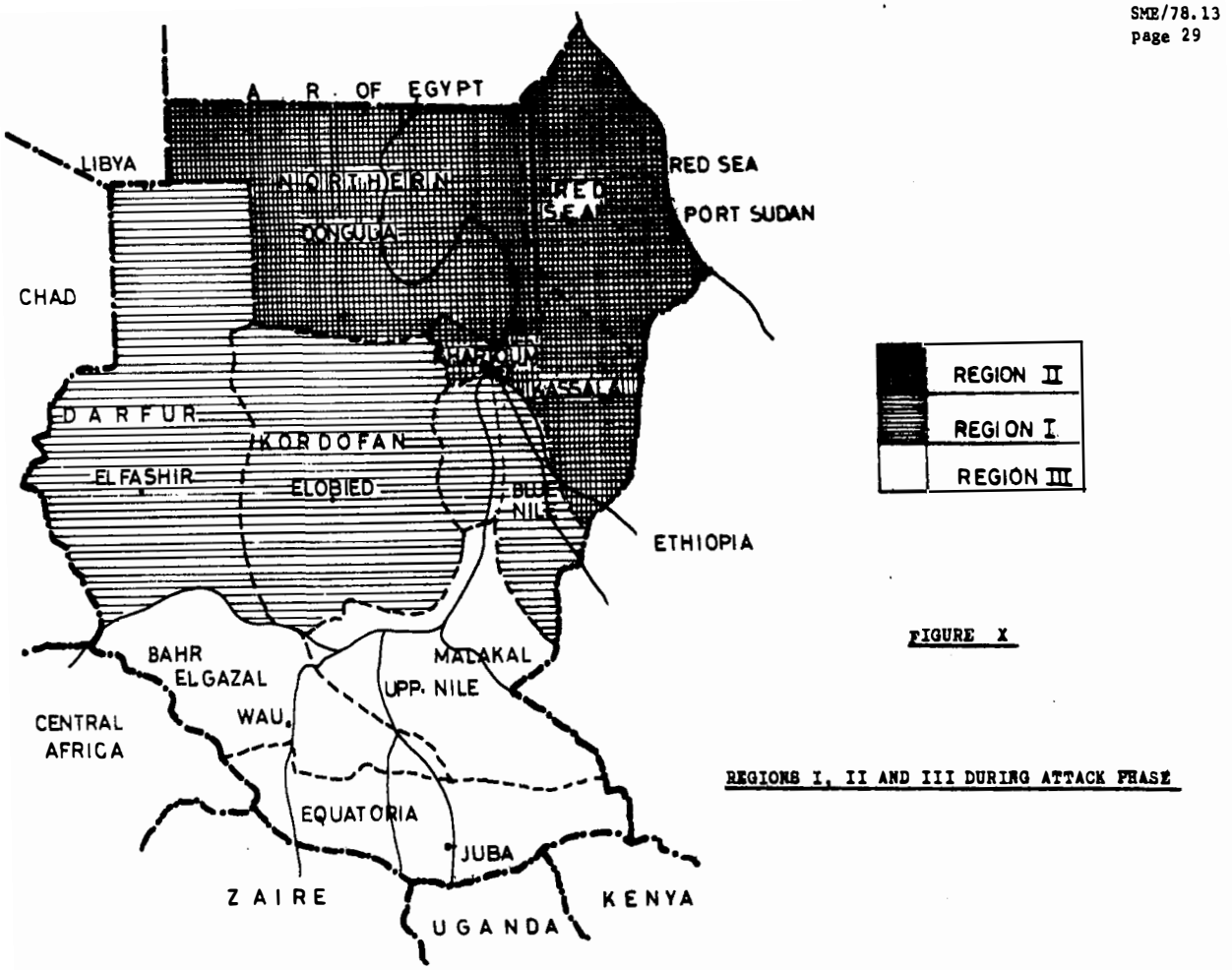


FIGURE X

REGIONS I, II AND III DURING ATTACK PHASE

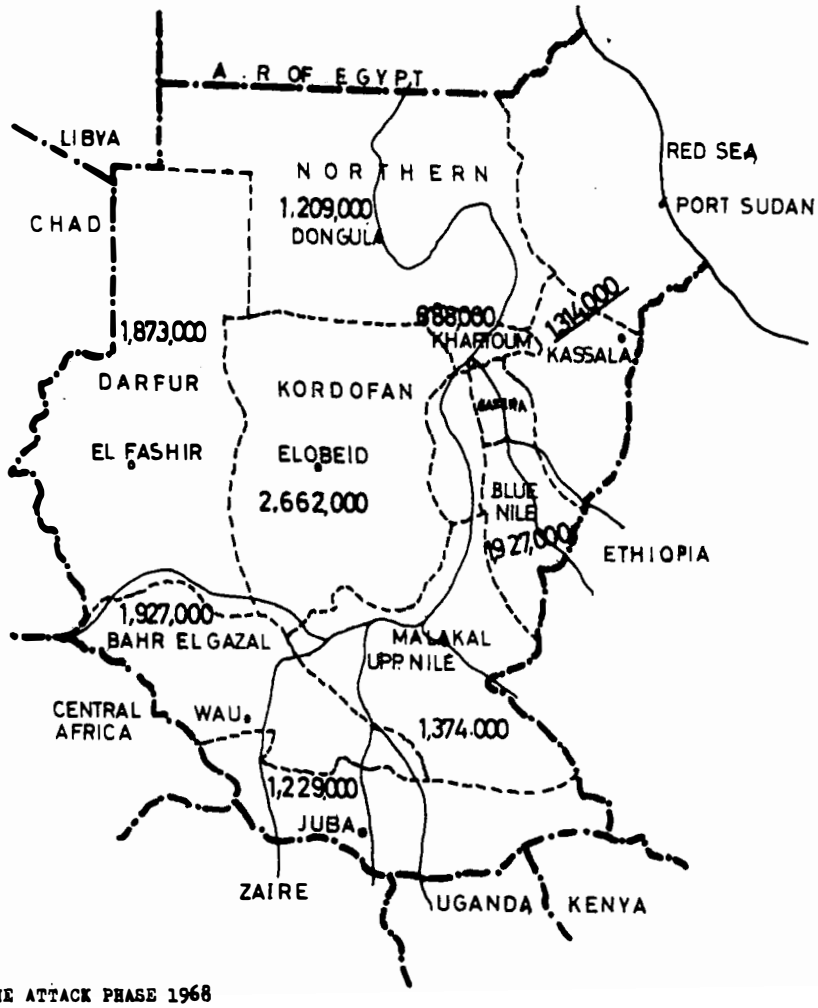


FIGURE XI

POPULATION BY PROVINCES AT START OF THE ATTACK PHASE 1968

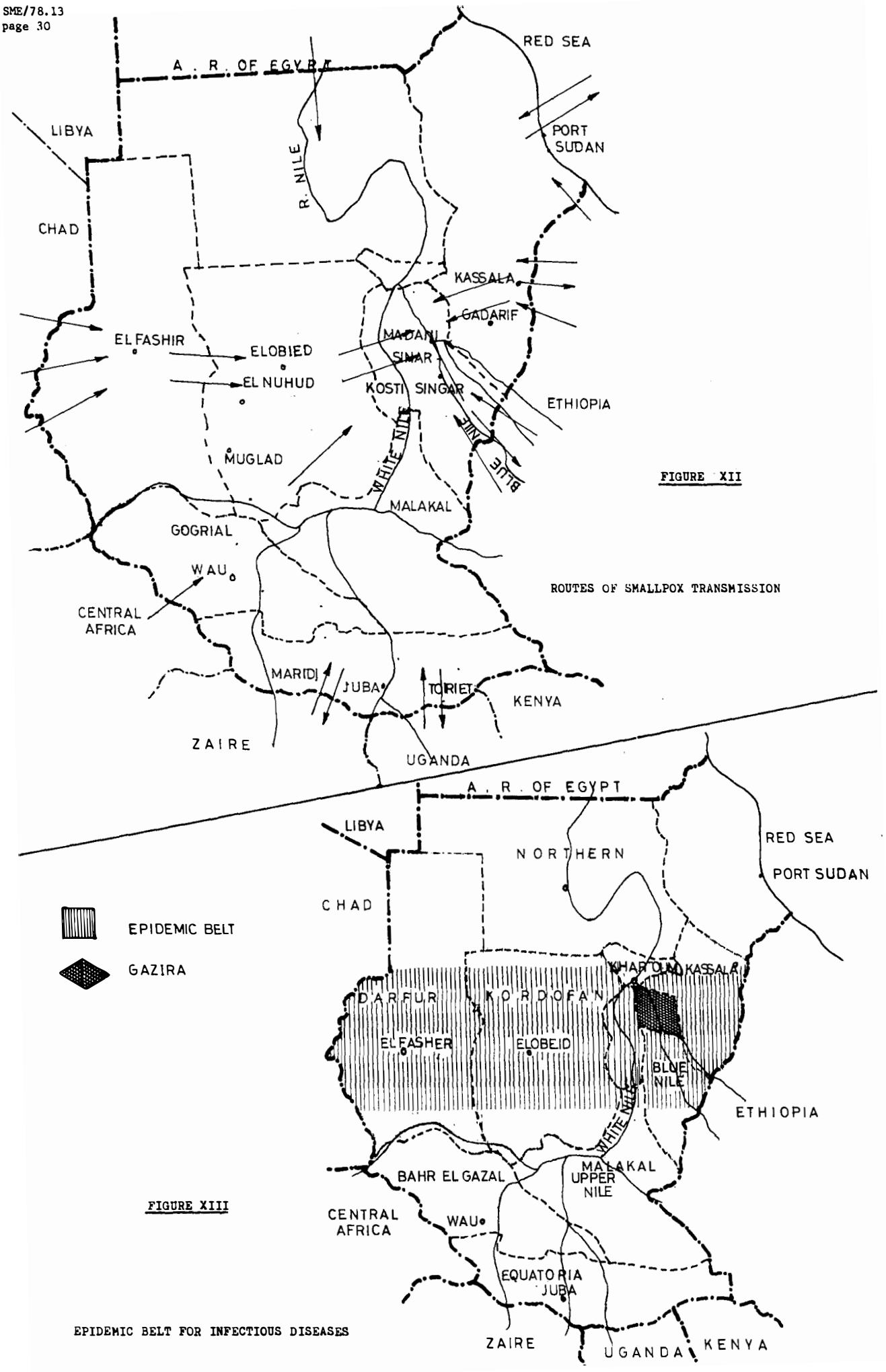


FIGURE XII

ROUTES OF SMALLPOX TRANSMISSION

FIGURE XIII

EPIDEMIC BELT FOR INFECTIOUS DISEASES

3. To keep this sector practically free from smallpox, since it was the main area for national agricultural products such as cotton and grains.

4. Region II, with the exception of Kassala Province had had little smallpox for many years.

5. Region III was inaccessible. It was known that smallpox was occurring in that region, but it was impossible to conduct a campaign there.

Delay due to Closing of Suez Canal:

According to the Plan of Action, it was expected that work would start in September 1967. With the sudden flaring of the Middle East War in 1967, came the closure of the Suez Canal, which compelled sea traffic to come around the "Cape". This delayed the beginning of January 1969, when the first attack was launched in Region I.

Constraints: The following is a list of constraints that hampered attack phase activities, but which were overcome:

1. The general state of the roads was extremely poor. Some were traversed with deep grooves and some were blocked with rocks and bushy undergrowth or surrounded with swamps that rendered crossing by car a foolhardy undertaking.

2. Under such conditions, the teams often had to walk for several miles to reach some infected or suspected village.

3. Environmental conditions were difficult and varied from the dreary and stormy desert in the North to the bushy and humid nature in the South, where the rainy season extends for 8-9 months in some areas.

4. The fear of reactions to vaccination deterred some people from co-operating. They tried to evade vaccination in many clever ways. The elderly rolled themselves in straw mats. Some people hid in domestic grainaries or burned false fire scars on their arms, then claiming that they were vaccinated recently. Youngsters were covered by mattresses, hidden in boxes and cupboards or put in straw baskets and hung down wells and pit latrines. Great efforts were made to convince them of the benefits of vaccination and to dispel their magnified and unfounded fears and to get their full cooperation.

CHAPTER (5)

STRATEGY OF THE CAMPAIGN

Introduction:

The objective of the programme was to eliminate smallpox, once and for all, from Sudan. Following the agreement between the Sudan Government and the WHO, the programme was rapidly developed and implemented and subsequently went through a series of modifications in order to meet changing situations. The programme evolved through the following stages:

1. Preparatory Phase (1967 - 68): This is the subject of Chapter 4.
2. Attack Phase (1969 - 72): Mass vaccination, passive surveillance and containment.
3. Attack Phase (1972): Active surveillance and containment, with emphasis on primary vaccination.
4. Maintenance Phase (1973 - 76). Improvement of notification system, chickenpox surveillance, specimens for laboratory diagnosis and reward.
5. Preparation for Review by International Commission (1977 - 78): Increased chickenpox surveillance and specimen collection, preparation of documentation.

Attack Phase in Region I (1969-72):

The objective of the first Plan of Action was to eradicate smallpox from Sudan by vaccinating the entire population, if possible, in less than 3 years. This effort was to be accompanied by case investigation, passive surveillance through health units, and containment vaccination. Upon completion of this plan, a maintenance phase was to follow for as long as might be necessary.

The first Plan of Action took into account the following considerations:

1. The time schedule with respect to the total population to be covered in each province.
2. The number of teams (supervisor, vaccinators and assessors) required to meet the time schedule. The daily norm of vaccinator output was used to calculate the number of vaccinators needed for each province.
3. The number of vehicles required. This was calculated on the basis of the number of teams for each province.
4. The design of the system and frequency for reporting smallpox cases.
5. Surveillance depended on notification by existing health facilities.
6. Assessment: Concurrent assessment of vaccination coverage and "take rates" was built into vaccination activities from beginning.
7. Containment vaccination and epidemiological investigation of reported cases. From the beginning a system was established for having trained teams respond immediately to notifications of smallpox outbreaks and to uncover the chain of transmission, to find the source of infection, to isolate the active cases and contacts, and to carry out containment vaccination in as big a circle around the outbreak as possible.

Time Required for Completion:

According to the Plan of Action, it was expected that work would start in September 1967. With the sudden flaring of the Middle East war in 1967, came the closure of the Suez Canal, which compelled sea traffic to come around the "Cape". This delayed the arrival of the project equipment, so that work could not be started before the beginning of January 1969, when the first attack was launched in Region I, the central section.

To set in motion the Attack Phase in Region I, an administrative directive defining field operations was prepared and distributed to all those concerned. The plan was to finish mass vaccination of Region I in 18 months, but owing to several local handicaps, it took about 30 months. After completion of mass vaccination, Region I was put under surveillance with the necessary staff and equipment. (Tables 14,15,16).

Attack Phase in Region II (1972) - Change in Strategy:

When Region I was put under maintenance activities, the Attack Phase was carried to Region II. Because of observed shortcomings of the mass vaccination strategy, the strategy was changed to one emphasizing active surveillance and containment vaccination. Mass vaccination was continued but it was aimed at covering primary vaccinations. This new strategy stressed the following points:

1. Active efforts to discover any hidden or imported outbreak anywhere in Sudan.

2. Regular active surveillance through visits to all villages in the country at least once each year. Villages of old known foci were to be visited more frequently.

3. Encouragement of responsible officials to report any suspected cases. Identification cards to be used. Smallpox-chickenpox differential diagnosis charts to be distributed to all health facilities.

4. Establishment of routine vaccinations and notifications by existing health facilities.

5. Mass vaccination to be restricted to primary vaccinations and to vaccination of contacts of infected persons.

6. The need to keep accurate and comprehensive records. Four types of records served this need:

   a) Provincial SEP units and SEP HQ in Khartoum should be notified by telegramme or telephone of smallpox cases. These units must keep records of such notifications.

   b) Monthly smallpox vaccination reports.

   c) Smallpox active case search reports

   d) Field assessment forms for active surveillance activities.

Special Procedures in High Risk Areas:

Certain areas in the country were identified as having a high risk of being infected by smallpox. The following special procedures were followed for such areas:

1. All towns and villages having any history of smallpox in the 2 years prior to the date of starting the Attack Phase were thoroughly inspected and vaccinated.

2. All major towns and villages lying on main routes of communications were surveyed and vaccinated.

PRIMARY AND RE-VACCINATIONS GIVEN DURING THE ATTACK PHASE 1969 - 1970 BY PROVINCE. Table (14)

PROVINCE	1969			1970		
	PRI	RE.V	TOTAL	PRI	RE.V	TOTAL
Blue Nile N.	178359	497685	676044	80587	272348	352935
Blue Nile S.	77103	181945	259048	94057	242750	336807
Darfur	294715	417350	712065	214914	393625	608539
Kordofan	228271	538071	766342	222001	665777	887778
Northern	5149	127	5276	142898	56317	199215
Kassala N	914	1995	2909	192603	96561	289164
Kassala S	1260	8730	9990	5919	19538	25457
Upper Nile	381277	290437	671714	60607	87997	148604
Bahr El Ghazal	39281	28315	67596	93986	154493	248479
Equatoria	67976	50434	118410	96582	102612	199194
Khartoum	42339	72864	115203	567	1788	2355
Sub- total	1316644	2087953	3404597	1204721	2093806	3298527
Unspecified	-	-	-	-	-	1573046
Grand Total	1316644	2087953	3404597	1204721	2093806	4871573

PRIMARY VACCINATION AND RE-VACCINATIONS GIVEN DURING THE ATTACK PHASE 1971 - 1972 BY PROVINCE. Table (15)

PROVINCE	1971			1972		
	PRI	RE.V	TOTAL	PRI	RE.V	TOTAL
Blue Nile N.	43257	302671	345928	44124	113705	157829
Blue Nile S.	68989	163973	232959	39972	72475	112447
Darfur	109924	191487	301411	53312	183543	236855
Kordofan	56287	217056	273343	19471	111835	131306
Northern	2143	16134	18277	10020	11445	21465
Kassala N.	11725	100223	111948	6150	92344	98494
Kassala S.	92774	351888	444662	57347	233972	291319
Upper Nile	11480	61865	73345	25491	128640	154131
Bahr El Ghazal	221092	241684	462776	68497	275102	343599
Equatoria	17990	64420	82410	65385	170584	235969
Khartoum	-	28979	28979	50645	154633	205278
Sub-total	635658	1740380	2376038	440414	1548278	1988692
Unspecified	-	-	-	-	-	1852496
Grand Total	635658	1740380	2376038	440414	1548278	2268142

Unspecified figures were given as total vaccinated.

TOTAL PRIMARY VACCINATIONS AND RE-VACCINATIONS GIVEN DURING THE ATTACK PHASE 1969 - 1972 BY PROVINCE. Table (16)

PROVINCE	TOTAL		
	PRI	RE.V	TOTAL
Blue Nile N.	346327	1186409	1532736
Blue Nile S.	280118	661143	941261
Darfur	672865	1186005	1858870
Kordofan	526020	1532739	2058759
Northern	160210	84023	244233
Kassala N	211392	291123	502515
Kassala S	157300	614128	771428
Upper Nile	478855	568939	1047794
Bahr El Ghasal	422856	699594	1122450
Equatoria	247933	388050	635983
Khartoum	93551	258264	351815
Sub- total	3597427	7470417	11067844
Unspecified	-	-	1852496
Grand Total	3597427	7470417	12920340

Unspecified figures were given as total vaccinated.

NUMBER OF CASES BY PROVINCE
1969 - 1972 Table (17)

YEAR	BLUE NILE S.	DARFUR	KORDOFAN	KASSALA (+)	NORTH	KHARTOUM	GEZIRA B.N.N.	EQUATORIA	B. EL GHAZAL	UPPER NILE	VACCINATIONS DURING YEAR
1969	18	-	-	-	-	7	15	12	-	73	3,404,549
1970	-	-	67	89	2	261	195	154	177	106	4,871,572
1971	229	17	17	281	1	22	23	157	316	78	2,376,038
1972	11	5	55	111	-	7	2	419	216	1	2,268,192
	258	22	139	481	3	297	235	742	709	258	

(+) Red Sea Province was included in Kassala during the attack phase.

3. Towns and villages bordering infected or suspected villages were checked and vaccinated.

4. Special care was taken with refugees, labour camps, nomads and transit camps.

The operation in Region II covered Kassala and Red Sea Provinces only as Khartoum and Northern Provinces had been practically free from indigenous infections for a very long time. When operations were finished in Kassala and Red Sea, these areas were put under surveillance, as were Khartoum and Northern Provinces. All 4 provinces were provided with the staff and other resources required to carry on the work.

Attack Phase in Region III (1972)

The Attack Phase was started in this region in July 1972, following the Addis Ababa Agreement, signed in March 1972. This agreement ended the national war, bringing unity, peace and tranquility to the South. Trained personnel were moved to the South from provinces which had entered the maintenance phase. These ersonnel remained in the South until the job was finished. Operations were completed in December 1974 after which the region was put under surveillance with the staff and equipment required to carry on the work. (Table 17).

Maintenance Phase 1973 - 76:

In 1976, about 4 years after the last case, a further improvement was made by introduction of the following:

1. Establishment of a notification system by all health units using the weekly infections disease telegrams to include nil smallpox reports.
2. Establishment of a monitoring system using a special chart at the provincial capital to check on sending the weekly telegrammes by the health units so as to stimulate the units which were not doing so.
3. Health education using every possible means available to propagate the importance of reporting of smallpox cases by officials and the public.
4. The reward, a financial reward, which at the beginning was 10 Sudanese pounds, then 20, later 50 and finally 100 pounds for every health official including SEP personnel or a member of the public who reported a case proved to be a true case of smallpox.
5. Chickenpox surveillance: This was introduced and instructions were given for laboratory specimens to be taken in the following situations:

    1. Severe chickenpox
    2. Death in chickenpox outbreak
    3. Chickenpox in patients without a vaccination scar
    4. Whenever there was doubt or difference of opinion

Preparation for Certification by International Commission:

Terminal activities, in addition to preparation of documents, were to concentrate the field activities on a special active search by mobile teams during October, November and December 1977 to ensure that there was no silent transmission anywhere in the country.

The plan of this terminal strategy was as follows:

1. A visit by mobile teams to as many villages as possible within this period.

2. Villages to be visited were those not visited in 1977. The remote and difficult to reach villages were to be given preference.

3. The target was to visit 50% of the villages in the border areas and 25% of the inland villages.

4. While in the village, the teams should concentrate on the following:

   a) Asking about presence of smallpox or rumours and investigating these.

   b) Asking about chickenpox cases, investigating and taking specimens according to instructions.

   c) Spreading the word about the reward and how and where to notify.

   d) Certification of village visits. The team leader was to obtain a special certificate signed by the village leader or school master that the team had visited their village.

CHAPTER (6)

VACCINATION ACTIVITIES AND ASSESSMENTS

Plan of Action:

In the plan of action for each province, the province was divided into operational areas. Each council was considered as an independent operational area. A time table was laid for each council, stating the date of start of operations and date expected to finish. The team was supposed to cover the whole population of the operational area before shifting to another area. In each operational area all towns, villages and nomadic areas were visited. Every house and every hut was visited. The team leader on visiting every house will use the daily vaccination form. In that form he will first record the name of the household, all residents of the house by age group, and whether present or not at the time of the visit. He will then vaccinate all present household members. Previous vaccination must be checked first to differentiate between primary and revaccination. For those absent and expected to come back at the end of the day another visit must be paid to the house to vaccinate them. The team must not leave the village unless convinced that a high percentage of coverage was achieved. Every week the supervisor of the unit will complete SP/BCG form No. 1 - A. From these weekly reports the public health officer in charge of the campaign will prepare monthly reports and complete SE/BCG form 1 - B and forward to the provincial level HQ. From the province the report will be raised to the central level.

Method of Vaccination:

Before the start of the campaign all vaccinators were well trained on how to perform proper vaccinations. The important points were properly explained to them. Then they passed a period of practical training in the field and became qualified for the job.

Site: The outer side of the area over the insertion of the deltoid muscle was chosen as a convenient site.

Preparation of the site: The best is none at all. If the skin is obviously dirty it can be cleaned with a moistened piece of cotton.

Technique: The entire operation was done in shade. Exposure to sunlight was always avoided. A clean sterile bifurcated needle is dipped into the vaccine, and on withdrawal a droplet of vaccine sufficient for vaccination may be seen between the two prongs of the needle. Every vaccinator was supplied with two plastic containers, one filled with 100 bifurcated needles (sterile) and the other empty for the used needles. Every needle is used once and then placed in the container. The vaccinator holds the needle perpendicularly to the skin, his wrist resting against the arm of the person to be vaccinated. Fifteen perpendicular strokes (up and down) of the needle are made rapidly in an area about 5 mm. in diameter. The strokes must be sufficiently vigorous to induce a trace of blood at the vaccination site.

Assessment: Evaluation of the extent of coverage and success of vaccination are fundamental for determining the progress of the activity. Knowledge on the part of vaccinators that their work is being constantly checked and, perhaps, compared with the work of others introduces an element of motivation and indirectly also plays a disciplinary role.

The operation of assessment used to start seven days after the end of vaccination activities in the area to be assessed. An assessment team led by

an assessment agent (pensionable M.A.) and well trained for the job was appointed for this purpose. (Table 18).

Assessment was done both for coverage and potency of vaccine used.

Potency of vaccine used was checked in primary vaccinations in the age group 0-4 only.

Coverage was checked in all those vaccinated in all age groups. The samples chosen for assessment (both potency and coverage) were supposed to be between 5 and 10%.

Villages to be assessed were chosen on a random basis and also the houses in each village. A table of random numbers was used for this purpose.

The assessment officer at the end of the day completed the daily assessment tally sheet and raised it to the Public Health Officer in charge of the campaign. The PHO then completed the weekly assessment return SE/Form No. 11A. from the daily tally sheets. The monthly assessment return in SE/Form No. 11B. was also completed by the PHO from the weekly returns. The monthly report was prepared by the PHI of the province and raised to the central level at the end of the month.

Results:

Assessment: Instructions fixed the size of the sample of the assessed population between 5 and 10% with selection on random sampling. The method to achieve this 10% was as follows:

Firstly, to select at random 40% of the villages vaccinated
Secondly, in each of these villages the number of houses to be assessed in:

a) villages with less than 20 houses ..... 3 houses
b) villages with 20 houses and less than 100.... 10%
c) villages with 100 houses and over ..... 5 to 7% of houses

This method failed to give the required size of sample (between 5 and 10%). The size of assessed sample according to this method was between 2 and 3% only.

The other alternative was to choose 50% of the village vaccinated by random sampling. In each village chosen for assessment 25% of the population of that village chosen for assessment 25% of the population of that village (registered in the vaccination records) should be assessed. This method gave the required 10% size of sample.

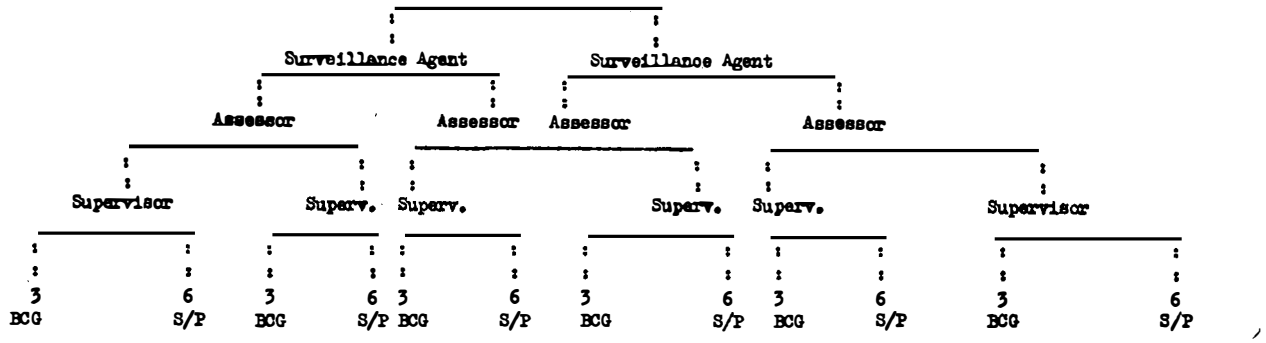
Potency: Potency was checked in primary vaccinations in the age group 0-4 years only. The percentage of takes usually ranged between 93% and 95% and continued thus to the end of the attack phase. At the beginning of the attack phase it dropped to 88% in Blue Nile North. Reasons for this were attributed to mothers using lemon juice, cow dung and mud on the vaccinated part of the skin to prevent takes. This reason was rejected. This would not interfere with takes if vaccinia virus has been inoculated deep enough into the skin layers with a bifurcated needle. Specimens of vaccine incriminated for poor take rates were withdrawn from the field.

Coverage: It was noticed during the start of the attack phase that the assessed coverage was in all provinces larger than the coverage calculated on basis of the monthly vaccination returns. This was attributed to the fact that assessment was done in villages considered well covered and not randomly selected villages as requested.

PROVINCIAL STAFF ORGANIZATION

Table (18)

Provincial Medical Officer of Health
Medical Officer (Full Time)
Public Health Inspector
Public Health Officer



COVERAGE AND TAKE RATES BY AGE GROUP AND BY PROVINCE

Table (19)

1969

PROVINCE	TAKE RATE 0 - 4		COVERAGE 0 - 4		5 - 14		15 - 19		20 +		TOTAL	
	No. SEEN	% TAKE	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR
BLUE NILE NORTH	1630	95	1777	95	3433	94	571	91	3203	95	8984	93
BLUE NILE SOUTH	2930	88	3405	95	5504	92	997	88	4068	86	13974	90
DARFUR	2718	95	45063	90	79752	92	128258	93	2990	92	256063	92
KORDOFAN	9936	96	34570	99	42331	91	21505	91	74790	87	173196	92
TOTAL	17234	93	84815	94	131020	92	151331	91	85051	90	452217	92

1970

PROVINCE	TAKE RATE 0 - 4		COVERAGE 0 - 4		5 - 14		15 - 19		20+		TOTAL	
	No. SEEN	% TAKE	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR
BLUE NILE NORTH	3585	98	3888	92	5273	67	1121	95	4874	93	15156	84
BLUE NILE SOUTH	24001	92	19755	66	26959	94	18170	95	20188	89	85072	87
DARFUR	3331	95	3513	96	3527	94	1288	92	7631	91	15959	94
KORDOFAN	11311	98	14685	98	9621	97	8628	97	17194	97	50128	97
TOTAL	42228	95	41841	88	45380	88	29207	95	49887	93	166315	91

Table (20)

COVERAGE AND TAKE RATES BY AGE GROUP AND PROVINCE 1971 - 1972

PROVINCE 1971	TAKE RATE 0 - 4		COVERAGE 0 - 4		5 - 14		15 - 19		20 +		TOTAL	
	No. SEEN	% TAKE	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR
BLUE NILE NORTH	2928	99	3963	92	5777	80	1940	65	6345	90	18025	85
BLUE NILE SOUTH	8919	96	24886	63	51347	86	11861	90	39947	92	108041	84
DARFUR	1202	95	2910	72	2934	90	1269	93	5716	91	12829	86
KORDOFAN	477	97	834	99	731	97	593	97	948	97	3106	98
TOTAL	13526	97	32593	82	60789	88	15663	86	52956	93	142001	88

PROVINCE 1972	TAKE RATE 0 - 4		COVERAGE 0 - 4		5 - 14		15 - 19		20 +		TOTAL	
	No. SEEN	% TAKE	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR	No. SEEN	% WITH SCAR
KASSALA			7145	82	8694	95	8569	98	3951	93	28139	91
RED SEA			2735	88	4549	95	8451	91			15735	91
EQUATORIA			20	100	15	93	3	100	25	76	63	92
KORDOFAN			3177	79	4516	92	2089	96	3435	94	13017	90
TOTAL			13077	87	17574	94	18912	95	7391	88	56954	91

Table (21)

VACCINATION COVERAGE BY GROUP AND BY PROVINCE - 1973 - 1975

PROVINCE 1973	COVERAGE 0 - 4		5 - 14		15 - 19		20 +		TOTAL	
	No. seen	% with scar	No. seen	% with scar	No. seen	% with scar	No seen	% with scar	No seen	% with scar
Blue Nile N.	348	87	254	95	257	98			859	93
Blue Nile S.	8,803	30	12,960	84	10,911	84			38,819	76
Darfur	1,600	98	1,600	97					3,200	98
Kordofan	4,900	46	4,900	91					9,800	69
Kassala	Survey was given as totals								58,657	89
Equatoria	396	55	502	83					898	70
Upper Nile	1,301	90	1,317	99					2,618	95
Total	17,348	68	21,533	92	11,168	91			114,851	84

PROVINCE 1974	COVERAGE 0 - 4		5 - 14		15 - 19		20 +		TOTAL	
	No. seen	% with scar	No. seen	% with scar	No. seen	% with scar	No. seen	% with scar	No. seen	% with scar
Darfur	1,000	98	1,000	98					2,000	98
Kordofan	5,500	66	5,500	96					11,000	81
Equatoria	2,950	67	2,874	69					5,824	68
Upper Nile	2,929	85	3,201	97					6,130	90
Bahar El Gasal	4,041	86	4,029	92					8,070	89
Kassala	Age group distribution not given								13,538	75
Total	18,846	76	18,887	92					46,562	82

PROVINCE 1975	COVERAGE 0 - 4		5 - 14		15 - 19		20 +		TOTAL	
	No. seen	% with scar	No. seen	% with scar	No. seen	% with scar	No. seen	% with scar	No. seen	% with scar
Equatoria	1,516	88	692	92	180	92			2,388	90
Upper Nile	1,297	70	1,107	91	1,997	93			4,401	85
Darfur	1,697	85	2,331	98					4,028	92
Kordofan	700	97	700	100					1,400	98
Kassala	3,079	95	2,864	97	2,227	95			8,170	95
Total	8,289	87	7,694	96	4,404	95			20,387	92

It was also noticed that there was great difference between the estimated number of population in Region I in 1968 (7 203 000) by official sources and the actual number of inhabitants having been already under attack (3 918 952). This difference was blamed for the low coverage when calculated on basis of estimated population by official sources.

The following summary on accomplished SP vaccinations in 1969 and the 1st two quarters of 1970 in Region I is a very good example:-

No. of Population		No. Accomplished Vaccinations			Coverage based on	
Official Estimate	S.E.P. Estimate	Total 1969	1 & 11 quarters .70	Grand Total	Official Estimate	S.E.P. Estimate
7 203 300	3 918 952	2 127 136	1 478 721	3 605 857	50	92

Assessment of take rates and coverage by age groups and by province is shown in Table 19 for the period 1969-70 and in Table 20 for 1971-72. Take rates were uniformly, exceeding 92% in all but one province. Most were between 95% and 98%.

Coverage rates in 1969 and 1970 were determined in Region I, which was at that time in the attack phase. Very high coverage rates, almost always above 90% was reported in all age groups. As the attack phase moved on into Region II (Kassala) and Region III, the southern provinces in 1971-72 coverage remained at the same high level.

Daily Output of Vaccinators: The requested daily output was 100 vaccinations per vaccinator per day. Actual average daily output per vaccinator ranged between 25 and 35 vaccinations per day. Explanations given for this were as follows:

a) The actual number of working days was less than 25 - 26 days per month.

b) Camps were shifted on average once a month. Five to 6 days were lost in this operation. Vaccinators were engaged in packing and shifting of camping commodities.

c) In performing house to house vaccinations, vaccinators lost time in waiting outside the house to get permission to enter the house. Inside the house vaccinators worked as health educators and thus, much time was taken inside every house.

Vaccinations Accomplished: Since the start of the campaign in February 1969 and up to the year 1972 in which the last case of smallpox was reported. The following vaccinations were performed.

Year	Primary Vaccination	Re-vaccination	Not Specified	Total
1969	1 316 634	2 087 953	-	3 404 587
1970	1 204 721	2 093 806	1 573 046	4 871 573
1971	635 658	1 740 380	-	2 376 038
1972	440 414	1 548 278	279 450	2 268 142
	3 597 427	7 470 417	1 852 496	12 920 340

Tables 19-20 show primary vaccination and re-vaccinations given during the attack phase (1969 - 72) by age - group and by province.

Obstacles and Difficulties:

Due to the fact that the programme was hurriedly started, no surveys were made of areas to be covered in Region I. The plan of action was based on information and statistical figures taken from the files. On implementation of the plan of action all estimations were not correct and what was supposed to finish in only 18 months took 32 months.

In the plan of action natural conditions which would affect the continuation of the campaign were not considered (rain, for example) and also other occasions like Ramadan during which people rejected vaccinations because it might break their fasting.

Rejections of vaccination were not considered. Rejections took much time and were one of the reasons for the poor daily output of vaccinators. This was discussed in a meeting held in the School of Medicine in 1971. A recommendation was raised to declare the area in which the campaign is working an epidemic area, so that vaccination would be compulsory. This was done whenever it was needed.

Movement of Population:

Internal migration was not fully considered. In Blue Nile Province for example, the campaign was for this reason shifted from Shokreya R.C. to Managil R.C Later an outbreak of smallpox occurred in Shokreya R.C. and the campaign therefore interrupted work in Managil and shifted to Shokreya R.C. to control the outbreak. This time almost all inhabitants of Shokreya R.C. were in Managil working as cotton pickers. The campaign had to wait until they came back and it took double the time estimated to cover the area.

The campaign once started should continue until the area is covered or the work will be very much affected. This happened in the period between September and November 1970 when all vaccination activities were stopped to engage the whole campaign in Cholera vaccination. This resulted in the following:

a) In Blue Nile North, and in the same period (Sept. - Nov. 1970) the campaign was supposed to cover the population of the eastern area of White Nile. This was the most suitable time to find them settled in their villages because they are semi-nomads.

b) The campaign started to cover the area in December 1970 when the population started to leave to the Gezira for cotton picking.

c) Many villages were found empty or with very little population.

d) Time consumed in travelling was very much more than time actually consumed in vaccination operations. This resulted in very poor vaccination figures accomplished in a very long period of time.

Final Remarks:

By the end of the attack phase in Region I the programme strategy was converted from mass vaccination to surveillance and containment activities. The high coverage achieved in potentially dangerous areas gave protection to the population and with proper surveillance activities contributed in a major way to maintaining the country free of smallpox.

CHAPTER (7)

SURVEILLANCE AND CONTAINMENT

Introduction:

The Smallpox Eradication Programme started its activities early in 1969 with a strategy based on mass vaccination. This strategy was followed until July 1972 when the attack phase was nearing completion in Region I (Darfur, Kordofan and Blue Nile Provinces). Before starting operations in Region II (Kassala Province) a meeting was held to review what had been accomplished since the eradication activities began. A decision was reached to change the strategy to surveillance and containment.

Reasons for shift to surveillance and containment strategy:

1. In spite of very high coverage, cases of smallpox were still being reported in Region I.
2. The process of mass vaccination proved to be very time-consuming and expensive. For example, teams used to travel for more than 24 hours in some instances to cover very small villages in the northern desert even though these villages are very isolated and presented no danger.
3. Epidemiological features of smallpox were not taken into consideration. All areas whether more crowded or sparsely populated, whether along roads or far from roads, whether endemic or free, were treated the same way.
4. Surveillance, which could be the most valuable technique, was not fully appreciated.

Surveillance and Containment Activities in 1971 - 72:

To perform surveillance activities properly and efficiently, training the staff was essential. Two seminars were held in December 1971 (10 days each). The first one was in English for senior supervisory staff and the second in Arabic for surveillance agents. The Seminars were arranged by WHO. Senior staff from EMRO participated.

After the end of the seminars, proper surveillance systems were established in the provinces. Surveillance teams were formed and team members were trained for the job by surveillance officers and surveillance agents who attended the seminar.

The suggested plan of action was to use surveillance activities to cover all villages on main roads and on border areas, all villages with schools, all risky areas and areas with previous history of smallpox, all labour attracting areas, all major points of entry from neighbouring countries, all refugee camps, and all nomad areas and interrelated tribes.

Methods adopted in surveillance and containment activities were investigation of all reported cases, confirmation of the diagnosis, determination of the source of infection, backward tracing of the chain of transmission, detection of other cases in the immediate area, and containment of the outbreak. Outbreak containment involved isolation of the patient at home or in an isolation hospital, quarantine and vaccination of close contacts, and vaccination of other residents in the area as well as special groups at risk.

Epidemiological Investigation:

The epidemiological investigation following discovery of a smallpox case can be generally divided into two parts: talking to the patient and tracing persons whom the patient may have infected.

Talk with the Patient: This is done when the patient is discovered, to collect basic information. This basic information includes basic biographical information about the patient (name, age, sex, place of residence), date of onset of disease, the patient's vaccination history (whether vaccination scar is present or not), the patient's source of infection and possible contacts during the time he has been infective (i.e., since the beginning of rash).

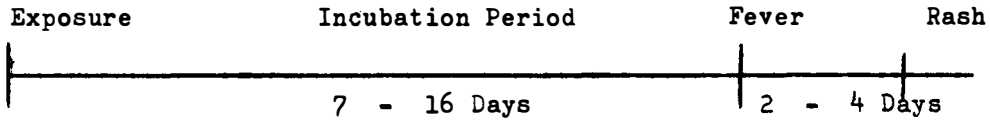
Sometimes the smallpox patient is not co-operative and does not supply true information. In such cases, members of the surveillance team are well trained to collect information from members of the patient's family or relatives either at home or in quarantine.

Tracing Contacts: All places the patient has been since he has been infective must be visited and attempts must be made to trace and vaccinate all persons who have come in contact with him during this time. This activity has two main objectives: One is to continue and expand the epidemiological investigation. The other is to implement containment measures without delay for all people who may have been infected.

When visiting the patient's residence all family members are examined to detect recovered smallpox cases or even fresh cases. Visits may be extended to other places from which infection could have been contacted such as the patient's place of work and households of neighbours or friends who have had a similar disease. A visit should also be paid to the health unit and the sheikh of the village to collect more information.

To determine the source of infection and trace the chain of transmission two questions must be answered: "How and from where did the patient contract the infection? "; and "To whom (or where) has the patient already spread the infection? ".

The following figure illustrates how to calculate the approximate date of the patient's infection so that the source can be traced.



Containment measures:

These must go in hand with the epidemiological investigations. Containment measures are always in competition with infection which is already going on, so containment must start immediately if it is to control the outbreak.

The objectives of containment measures are to prevent infection and to increase the immunity level in the community.

Measures to prevent infection include isolation of the patient at home or in quarantine, quarantine and vaccination of all close contacts, vaccination of other residents in the area and special groups at risk. Residents and special groups who may have been infected should be kept under daily surveillance for 16 days. Two other measures are detection of other cases by house to house searching, and by making a return visit to the area 2 to 4 weeks later to make sure no cases were missed.

After being properly trained, surveillance teams started active surveillance in Kassala Province in March 1972. All this time Kassala Province was still in the attack phase. The teams detected many outbreaks and contained them properly. The spread of infection was greatly minimized by quick reporting by the medical services through: (1) their establishments and staff; (2) proper investigations of each reported case by surveillance agents; (3) the implementation of immediate containment measures, and (4) epidemiological investigations. Kassala Province reported its last case in July 1972.

In the southern provinces the campaign began in July 1972. The Addis Ababa Agreement restored peace in the South and made it easier for the surveillance teams to visit parts of these provinces which were inaccessible before. These activities were very important because the three southern provinces were the main hyper-endemic area of the country at this time.

An intensive search was made in the South by all personnel, including vaccinators, before vaccination activities were begun. Ten outbreaks were discovered in Equatoria, 17 in Bahr El Ghazal and 1 in Upper Nile. A second search disclosed only 6 new outbreaks and after November 1972, no new outbreaks could be found. Thus, under a proper surveillance system the South reached zero smallpox level only 6 months after the campaign started.

Surveillance Activities 1973 - 1978:

After the last case of confirmed smallpox in Sudan was reported in December 1972, surveillance activities continued and several forms of operations were implemented aiming at one target, to prove beyond doubt, that smallpox no longer existed in the country.

Priorities for 1973 were: (1) to discover any hidden or imported cases anywhere in Sudan; (2) to establish routine vaccination programmes by regular visits; (3) to integrate routine vaccinations into local health unit activities, and (4) to establish case search activities in villages which must be visited twice each year. Such villages included border villages, old foci villages, and villages in risky areas. In such villages case searching must be done on a house to house basis.

Two main kinds of surveillance activities were carried out: (1) active surveillance, which includes the activities carried out by surveillance teams in the provinces; and (2) passive surveillance, which depends mainly upon reports received from health establishments in the provinces.

The plan of action for active surveillance has two forms of operations. One is case search and the other is combined surveillance and immunization activities. Vaccination coverage was maintained at a high level (Table 21).

Under case search operations, villages with old outbreaks, border villages and villages in risk areas were searched house to house twice a year. Special teams were formed for this type of operation. No vaccination activities were performed.

Under combined surveillance and immunization activities, special teams were formed to carry out both surveillance and immunization activities. The WHO identification card was used by the teams in their case search activities. When visiting the village the team leader inquired about the presence of smallpox while the team members were performing vaccinations. He contacted the village leaders, health personnel, school pupils and teachers. All suspected cases were investigated immediately. All smallpox rumours were also investigated.

Later on, vaccination surveys were introduced as part of the surveillance activities. Another method, pockmark surveys was also introduced. Two age

groups were subject to pockmark survey. Those under 6 years and those 6 years and above. All children with pockmarks dating to an illness occurring since December 1972, were reported and investigated immediately.

Seventy one months (up to November 1978) has passed now since the last smallpox case in the country. In spite of active surveillance and vigilant case searches which covered the whole country, no evidence of smallpox has been found in Sudan during this time.

CHAPTER (8)

THE ROLE OF HEALTH UNITS IN REPORTING SMALLPOX

Introduction:

The key to smallpox eradication is surveillance; the detection of smallpox cases. Surveillance can consist of any method used to detect cases. Surveillance methods can be divided into two broad categories: active surveillance and passive surveillance.

Active Surveillance:

Active surveillance means aggressive village by village and house to house searching for cases by teams specially trained for that purpose.

Passive surveillance:

Passive surveillance means the system whereby reports of cases are delivered to static health facilities. A purely passive surveillance system is one in which health personnel sit in their offices and wait for reports to be brought to them. Successful smallpox programmes have utilized systems combining both active and passive surveillance. The Sudan SEP used such a combined system. (Table 22).

Types of Passive Surveillance:

There were two types of passive surveillance that reported smallpox cases to the Sudan SEP. One type was through workers of the health system. The other type was through private citizens of the community.

The private citizens of the community normally have no regular system of reporting infectious diseases like smallpox. Whether the private citizen is a villager, a teacher, or a village chief, smallpox reports will depend on how educated he is about the disease. If he knows how to recognize smallpox and the benefits of reporting it, he will most likely report cases to the proper officials. This latter point concerning being educated about the disease also applies to workers of the health system.

A first priority for the Sudan SEP was to give much attention to the health education of the community with especial stress to the widespread network of static health units. As these health units had a definite system for reporting smallpox and other diseases, the Sudan SEP wanted to utilize it to the fullest advantage.

Infectious Disease Reporting in the Sudan:

Dressing stations and dispensaries are required to report certain infectious diseases monthly to the local or district hospital. The hospitals send weekly reports to the Provincial Medical Officer of Health (PMOH) who in turn sends weekly reports to the Ministry of Health in Khartoum.

Cases of smallpox are to be included in the reports sent to hospitals, but they must also be reported immediately by the most expedient means, whether this is a telegram or a five-day walk on foot. (Table 22).

Health Facilities in Operation By Each Province as on December 1976

Table (22)

Province	Hospitals	Health Centres	Dispensaries	Dressing Stations	Total
Khartoum	14	33	36	90	173
Red Sea	4	5	14	37	60
Kassala	7	13	43	82	145
Blue Nile	9	4	35	144	192
Gezira	16	31	94	202	343
White Nile	8	7	26	93	134
Upper Nile	8	3	28	23	62
Equatoria	9	2	29	90	130
Bahr El Gasal	7	1	23	76	107
South Darfur	6	3	26	28	63
North Darfur	5	10	38	38	91
N. & S. Kordofan	15	12	76	153	256
Nile & Northern	19	35	122	158	334
Total	127	159	590	1,214	2,090

Percent of Expected Communicable Diseases Reports Actually Received, by month, Jan. - Dec. 1977

Table (25)

Province	No. of Hospitals or Health Centres	Percent of Expected Reports Received											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Khartoum	42	86	79	86	90	79	64	48	38	69	83	69	64
Red Sea	5	80	80	80	- *	100	100	100	100	100	100	100	100
Kassala	7	100	100	100	100	100	100	100	100	100	100	100	100
Blue Nile	11	27	82	82	45	45	55	55	73	18	91	91	82
Gezira	18	67	67	44	50	50	56	-	39	56	-	-	-
W. Nile	8	100	100	100	88	100	75	88	100	25	50	88	88
S. Darfur	6	17	34	17	67	77	-	17	34	34	17	34	34
N. Darfur	5	100	80	100	100	60	40	80	20	60	20	20	60
Kordofan	7	43	57	43	43	-	57	57	-	71	-	-	-
Northern	19	20	100	100	30	20	60	40	90	90	90	90	90
Upper Nile	12	42	42	-	33	50	42	42	42	42	42	42	42
Equatoria	10	-	-	40	50	-	50	60	70	70	-	70	-
Bahar El Gasal	7	57	43	43	5	43	57	43	43	43	57	43	43
Total	148	62%	72%	70%	58%	60%	63%	61%	62%	60%	65%	68%	70%

* (-) indicates information not available.

Comparison of Reporting of Cases by Active and Passive Surveillance

Table (23)

Province	Total Forms	Passive Surveillance				Active Surveillance	
		Health unit: Reports	%	Private Citizen	%	Reports	%
Kordofan	93	32	35	3	3	58	62
Darfur	5	1	20	1	20	3	60
Blue Nile	208	40	19	5	3	163	78
Northern	2	2	100	-	-	-	-
Kassala	188	65	34	7	4	116	62
Equatoria	612	112	18	382	63	118	19
Bahr El Ghazal	50	20	0	7	14	23	46
Upper Nile	66	43	65	8	12	15	23
	1224	315	26	413	33	496	

Percent of Expected Communicable Diseases Reports Actually Received, by month, April - December 1976

Table (24)

Province	No. of Hospitals	Per cent of Expected Reports Received								
	Health Centres	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
Khartoum	10	80	60	60	60	68	68	88	88	- *
Red Sea	5	100	100	80	100	60	60	60	80	80
Kassala	6	100	100	83	83	83	83	100	100	100
Blue Nile	11	64	81	64	-	73	73	73	-	73
Gazira	17	94	11	88	82	76	76	82	82	76
W. Nile	8	-	-	-	75	50	50	-	100	25
S. Darfur	6	33	50	33	17	17	-	-	17	17
N. Darfur	5	50	40	40	40	40	40	-	40	40
Kordofan	7	57	57	57	71	42	72	-	72	71
Northern	10	60	60	-	70	50	70	70	100	-
Upper Nile	12	17	50	33	42	42	42	42	42	42
Equatoria	10	70	80	70	80	80	-	70	-	70
Bahar El Gazal	7	100	100	100	100	65	-	100	100	57
Total	114	69%	66%	64%	68%	59%	63%	76%	75%	58%

Evaluation of Passive and Active Surveillance Reporting of Smallpox:

Case investigation froms are available only for 1224 of the 3144 smallpox cases reported in Sudan from 1969 to 1972. Table 23 shows how these 1 224 cases were brought to the attention of the Sudan SEP: by case search (active surveillance) or by reports of health units and private citizens (passive surveillance). This table shows that 59% of the 1 224 cases came to the attention of the Sudan SEP through passive surveillance means (26% by health units and 33% by private citizens) while the other 41% were found through active surveillance. It should be noted that the cases brought to SEP attention by private citizens is much higher for Equatoria Province than it is for any of the other provinces. This can be explained by the fact that until the end of 1972, active surveillance was not possible in many parts of Equatoria, especially eastern Equatoria where most of the smallpox was. The data from Equatoria overstates the contribution made by private citizens for Sudan as a whole. Indeed, if the data for Equatoria is excluded, the percentage of cases reported by private citizens drops to 5%.

Changes in Reporting System:

After 1972, as it became more and more certain that Sudan was no longer smallpox endemic, the SEP felt an increasing need to have an effective reporting system (passive surveillance) throughout the country. A reliable national reporting system was needed that could be supplemented by the active searching of SEP teams. Positive action was taken on 27 January 1976, in a meeting between SEP staff and the Director of Epidemiology and Infectious Diseases, during which guidelines for an improved national infectious disease reporting system were established.

The implementation of the improved reporting system started in April 1976. Table 24 shows the reporting effeciency of 114 district hospitals in Sudan for the period April - December 1976. Table 25 shows the same information for all of 1977.

CHAPTER (9)

HEALTH EDUCATION AND COMMUNITY ROLE IN SMALLPOX ERADICATION PROGRAMME

It is now recognised that education in matters of health and the control of disease is essential for the promotion of healthier ways of living. It is of vital importance to gain the cooperation of people affected by the health measures, and this can only be achieved by a process of education which leads the people to understand the reasons for the sanitary measures. It is well known that health education is the cornerstone in the success of any health programme by means of which the public can be convinced of the benefits they can gain from cooperation with the authorities conducting any health activities in their area.

Smallpox is a deeply rooted disease in the Sudan and the vaccination campaigns and all the complications caused by vaccination were known since 1925. In order to gain public support for the eradication programme health education through mass media was adopted on a large scale. However, the most important approach was through personal contact by the vaccination teams who were going from house to house.

Health Education Among Health Staff:

Frequent meetings were held during the preparatory phase and attack phase. Pamphlets, posters and leaflets were also sent to the provincial health leaders. Training seminars were held for provincial health leaders through W.H.O. coordination.

Check-posts:

These were set up on almost all the main roads, in railway stations, border villages and markets. The main purpose was to check for smallpox cases and pockmarks and to tell about SEP. The same procedures were followed through the maintenance phase. The location of these checkposts is shown in Fig 14 .

Special Activities at the National Level:

During the attack phase and after the reward was established loud speakers were adjusted to Land Rovers to use during their tour round the villages to diffuse health education. Mass media were used as follows:

1. Letters and posters were sent to all medical and environmental health departments and to the Army Medical Corps, religious leaders, members of rural councils, political and social leaders and sport clubs. (Fig.15,16)

2. It was also made possible for the health education section of the Ministry of Health to give many talks to the public on the radio.

3. Some of the most widely circulated newspapaers held sessions with the SEP Director about SEP.

Provincial Activities:

Each Ministry of Health made its plan to contact the public to have their trust and cooperation. The following were the main methods:-

Provincial council members were told about the plan. Meetings for health staff were called for and guidelines and posters were distributed. Lectures were printed to be distributed to the

FIGURE XIV

LOCATION OF CHECKPOSTS

public in markets, gathering areas, schools and clubs, district towns and villages.

SEP teams were well trained on the subject matter. In communicating with minorities, where Arabic is not easily understood, people from such groups were appointed as vaccinators and educators.

World Health Organization Day 7th April 1975

All provinces and districts throughout the country participated in the World Health Organization anniversary in April 1975. The main subject was "Smallpox, Point of No Return", with lectures, group discussions, posters, films, exhibitions showing activities of smallpox control.

Generally, health education efforts were very successful and the people were very cooperative. Many suspected cases were reported by the public seeking the reward.

FIGURE XV

REWARD POSTER (ARABIC)

See Annex VI (page 114)

FIGURE XVI

REWARD POSTER (ENGLISH)

See Annex VI (page 115)

CHAPTER (10)

SURVEILLANCE ACTIVITIES DURING MAINTENANCE PHASE PERIOD 1973 - 1976

Introduction:

During the 1969 - 72 "attack phase" of the Sudan SEP, programmes strategy gradually shifted from one of mass vaccination to one of surveillance and containment. By the end of 1972, Sudan had experienced its last smallpox case. By mid - 1973 the Sudan SEP staff were becoming increasingly confident that there was no more smallpox in the country. With this realization came the need to change the programme strategy again; this time to one of thorough and methodical, rural council by rural council searches of every province that could be documented and held up as evidence of Sudan's smallpox free status. Thus the maintenance phase period of 1973 - 1976 was begun.

Maintenance Phase Activities:

Maintenance phase activities required that all areas of the country be searched by SEP teams on at least an annual basis. Certain areas, such as the areas of last known foci and areas felt to be at highest risk of smallpox importations were to be searched on a more frequent basis. In addition to activities by SEP personnel, cooperation from the public and from static health facilities was actively encouraged.

Maintenance phase activities can be divided into those performed by SEP personnel and those performed by non-SEP personnel.

SEP Personnel

SEP personnel were responsible for smallpox surveillance. The Sudan SEP surveillance methods were active surveillance methods, which took several forms and which were carried out by mobile and non-mobile teams.

Mobile Team Activities: (Table 26)

Intensive Searches: Along the areas bordering Ethiopia in Upper Nile and eastern Equatoria Provinces, SEP mobile teams conducted thorough and methodical intensive searches. These searches were special efforts which utilized SEP personnel from several provinces so that a large area could be covered in a short period of time. During the searches traditional and village leaders, health facilities, other government facilities (such as schools and police stations) and major markets were visited. Suspected cases that came to the attention of the teams were investigated immediately and specimens were taken whenever the diagnosis was in question. These searches served the dual purpose of uncovering and diagnosing all suspicious rash illnesses for entire geographical areas while at the same time documenting the absence of smallpox.

House to House Searches: Routine surveillance by provincial smallpox units involved house to house searches. During each year the teams visited as many towns and villages in the province as possible, carrying out house to house searches for smallpox in each town or village. During 1973 and 1974, house to house searches were carried out at least twice each year in areas known to have had smallpox in 1972.

NUMBER OF PLACES SEARCHED FOR SMALLPOX BY PROVINCE BY YEAR (1973-1976) Table (26)

PROVINCE	YEARS	VILLAGE/ CAMP	CHIEFS	HEALTH ESTABLISH.	SCHOOLS	POLICE STATIONS	MARKETS	RASH DISEASES SEEN		
								Chicken-pox	Measles	Skin Diseases
KHARTOUM	1973*									
	1974*									
	1975	99	26	65	121	22	33	20	6	-
	1976	279	399	159	215	29	52	2	-	-
RED SEA	1973	-	53	70	75	14	47	-	-	-
	1974*									
	1975	3	-	-	38	-	-	-	-	-
	1976	143	245	112	59	42	51	-	-	-
KASSALA	1973	385	365	163	123	116	97	9	112	3
	1974	211	210	125	139	88	51	74	82	3
	1975	61	4	8	12	5	3	4	-	-
	1976	272	307	118	112	56	46	-	-	-
BLUE NILE	1973	154	118	99	-	6	12	1	19	-
	1974*									
	1975	52	44	23	13	9	7	1	-	-
	1976	141	155	50	42	18	13	1	-	-
GEZIRA	1973	33	40	36	78	6	14	-	24	-
	1974	11	19	11	13	-	1	-	2	-
	1975	62	112	48	102	6	4	-	105	190
	1976	433	649	147	291	12	13	7	80	14
WHITE NILE	1973*									
	1974*									
	1975	17	23	16	12	7	10	-	-	-
	1976	65	14	52	39	19	16	-	53	-
KORDOFAN	1973	239	591	122	304	55	93	-	76	-
	1974	125	318	96	202	44	87	-	-	-
	1975	13	62	6	26	3	6	-	-	-
	1976	178	338	68	153	23	65	144	-	-
DARFUR	1973	61	40	24	12	4	16	-	-	-
	1974	80	100	35	52	16	45	39	10	5
	1975	80	126	44	77	25	41	-	-	-
	1976	293	529	44	104	16	69	52	41	-
UPPER NILE	1973	259	304	42	53	42	50	11	32	66
	1974	440	666	83	75	79	55	23	32	74
	1975	13	13	4	-	4	-	-	-	-
	1976	33	83	7	7	13	7	2	-	2
BAHR EL GHAZAL	1973	62	34	17	8	17	39	14	-	-
	1974	74	172	42	27	25	26	58	27	-
	1975	33	56	4	24	9	6	15	-	-
	1976	63	61	51	15	13	-	-	-	-
EQUATORIA	1973	175	159	100	35	41	14	33	3	25
	1974	234	-	117	92	40	36	60	4	49
	1975	17	15	7	2	-	-	-	-	-
	1976	62	38	44	24	27	20	-	-	-
NORTHERN	1973*									
	1974*									
	1975	75	9	11	7	8	-	-	-	-
	1976	92	167	35	45	7	13	-	-	-

* CASE SEARCH ACTIVITIES CARRIED OUT BUT NUMERICAL DATA NOT AVAILABLE

Ref : Monthly Reports (1973/76)

Pockmark Surveys: Headquarters and provincial SEP personnel have periodically carried out pockmark surveys in selected areas of the country. Pockmark surveys provide useful surveillance information: children born after the last known smallpox case who have pockmarks indicate that undetected foci have existed, while no pockmarks among these same children indicate that the last cases occurred when the SEP says they did (Chapter 14).

Chickenpox Outbreaks: During the time that Sudan was smallpox endemic, mild smallpox cases were often reported as chickenpox cases (Chapter 15). For this reason, SEP surveillance of chickenpox outbreaks was an important part of maintenance phase activities. SEP personnel visited as many reported chickenpox cases as possible. Specimens were collected from serious cases. All reported chickenpox deaths were investigated.

Non-Mobile Team Activities:

Check-Posts. SEP personnel were assigned to various check-posts, which were established on heavily travelled roads around the country for smallpox surveillance purposes. These personnel screened travellers for smallpox cases and questioned them about news of smallpox in their home areas. Vaccinations (mostly primary) were also given, but fewer re-vaccinations were done each year. (Table 27).

Stationary Health Facilities: SEP personnel were also assigned to certain stationary health facilities to ensure that proper smallpox surveillance was being carried out at the facility. Because of limited staff, it was only possible to assign such staff at those facilities where the danger of smallpox was felt to be greatest; near last known foci or near areas where importations were most likely.

Non-SEP Personnel:

The Sudan SEP was not large enough to do the entire job of smallpox surveillance using only its own personnel. Non-SEP personnel were needed to supplement the efforts of the SEP so that there could be an effective surveillance system for the entire country.

Static Health Facility Surveillance: Those static health facilities to which the SEP could not assign personnel were visited and asked to carry out smallpox surveillance as part of its regular duties. The staff were given instructions on how to recognize smallpox and what to do if suspected cases were encountered. Visual aids and vaccine were also given to the facilities.

Static Health Facility Reporting: Static health facilities were enlisted as reporting points. The public was instructed to report suspected smallpox cases to the nearest health facility. Facility staff were instructed to forward such reports to the nearest hospital or SEP office by the quickest means available.

Reporting by the Public: Traditional and local leaders, school teachers, police, other government officials and the public as a whole were urged by various means to be on the look-out for smallpox and to report suspected cases to the nearest health facility or to the nearest SEP office. This effort was stimulated by a reward incentive which was first introduced in November 1975.

The first reward offered was for ten Sudanese pounds. Anyone reporting a smallpox case (if confirmed) would receive ten pounds from the SEP. Announcement of the reward caused many reports at first but none of the reported cases turned out to be smallpox. In May 1976 the reward was increased to 50 Sudanese pounds. Again many reports were received, but again none of the reports turned out to be smallpox. In July 1977 the reward was increased to 100 Sudanese pounds, but up to the present not a single report has turned out to be smallpox. News of the reward has been spread by means of radio, newspapers, posters and by SEP personnel and other public health workers.

Conclusion:

During the maintenance phase period of 1973 - 1976, smallpox surveillance activities have been carried to every area of Sudan, and repeatedly to those areas (last known foci and certain border areas) where it was thought most likely for smallpox to be present. Despite these strenuous and comprehensive activities, no cases of smallpox have been found since the last case occurred in Bahr El Ghazal Province in December 1972. Table 28 indicates the comprehensive nature of the surveillance activities of 1973-76.

PRIMARY VACCINATIONS AND RE-VACCINATIONS 1973 - 1977 Table (27)

PROVINCE	1973			1974			1975		
	PRI	RE-V	TOTAL	PRI	RE-V	TOTAL	PRI	RE-V	TOTAL
Blue Nile N.	120,499	132,039	252,538	86,206	137,584	223,790	91,653	46,598	138,251
Blue Nile S.	57,054	31,170	88,224	27,206	4,196	31,402	39,000	-	39,000
White Nile									
Darfur	51,363	187,221	238,584	36,392	206,620	243,012	74,295	127,606	201,901
Kordofan	34,873	138,204	173,077	29,442	95,084	124,526	46,931	13,510	60,450
Kassala	33,317	78,954	112,271	26,380	79,379	105,759	70,395	81,854	152,249
Red Sea	3,674	67,592	71,266	2,044	18,671	20,715	12,632	2,601	15,233
Equatoria	94,506	307,274	401,780	19,168	73,202	92,370	31,936	57,523	89,459
Upper Nile	44,911	302,477	347,388	32,360	150,181	182,541	25,484	99,664	125,148
Bahr El Ghazal	42,483	144,503	186,986	9,251	16,666	25,917	9,146	3,261	12,107
Khartoum	13,164	56,307	69,471	14,916	53,568	68,484	39,528	66,593	106,121
Nile & Northern Lakes	2,786	329	3,115	3,122	55	3,177	1,625	233	1,858
	498,630	1,446,070	1,944,700	286,487	835,206	1,121,693	442,625	499,443	942,068

PROVINCE	1976			1977			TOTAL		
	PRI	RE-V	TOTAL	PRI	RE-V	TOTAL	PRI	RE-V	TOTAL
Blue Nile N.	74,525	7,020	75,227	30,683	3,972	34,655	403,566	320,895	724,461
Blue Nile S.	61,287		61,287	47,335	1,850	49,185	231,882	37,216	269,098
White Nile	38,739		38,739	56,565		56,565	95,304		95,304
Darfur	82,422	129,009	211,431	91,794	95,463	187,257	336,266	745,919	1,082,185
Kordofan	79,707	13,636	93,343	41,645	9,721	51,366	232,598	270,155	502,753
Kassala	32,534	34,537	67,071	36,018	14,698	50,717	198,644	289,422	488,066
Red Sea	16,873		16,873	9,467		9,467	44,690	88,864	133,554
Equatoria	22,357	130	22,487	10,855		10,855	178,822	438,129	616,951
Upper Nile	19,850	42,306	57,156	9,210	46,295	55,505	126,815	640,923	767,738
Bahr El Ghazal	42,471	7,430	49,901	31,342	649	31,991	134,693	172,509	307,202
Khartoum	182,897	35,957	138,854	49,058		49,058	219,563	212,425	431,988
Nile & Northern Lakes	58,972	21,455	80,429	51,241	9,661	60,902	117,746	31,733	149,479
				16,404		16,404	16,404		16,404
	527,634	285,162	912,796	481,617	182,309	663,926	2,336,993	3,240,190	5,985,183

SUSPECTED CASES INVESTIGATED AT PROVINCIAL LEVEL- 1973 to APRIL 1978 Table (28)

Province	1973		1974		1975		1976		1977		1978(April)		Total	
	Local[1]	WHO Lab[2]	Local	WHO Lab.	Local	WHO Lab.	Local	WHO Lab.	Local	WHO Lab.	Local	WHO Lab.	Local	WHO Lab.
Northern	-	-	-	-	-	1	5	-	41	2	-	-	46	3
Khartoum	-	-	-	2	1		24	1	7	3	6	2	38	8
Red Sea	-	-	-	1	-		6	1	30	1	4	-	40	3
Kassala	-	-	-	1	-		4	2	7	-	-	-	11	3
Blue Nile	-	1	-	3	-		1	3	34	2	-	-	35	9
Gezira	-	-	-	-	1		3	-	4	2	1	1	9	3
White Nile	-	-	-	-	-		9	1	11	-	43	1	63	2
Kordofan	-	-	-	1	-		3	-	2	1	1	1	6	3
Darfur	-	-	-	-	-		3	1	17	-	-	-	20	1
Upper Nile	2	1	1	2	4		6	-	19	-	-	-	32	3
Bahr El Ghazal	1	2	1	7	2	1	2	1	105	2	30	1	141	14
Equatoria	1	2	2	3	3		11	5	3	3	4	1	24	14
Total	4	6	4	20	11	2	77	15	280	16	89	7	465	66[3]

1. Local = Suspected cases investigated by physicians and/or local SEP staff diagnosed as definitely not smallpox.
2. WHO Lab. = Specimen taken and sent to WHO and notification by WHO of a negative lab result.
3. An additional 15 specimens were sent to WHO and found negative, but the forms are missing so the province cannot be identified. Five of these 15 were sent in 1973, 9 in 1975 and 1 in 1976.

CHAPTER (11)

REPORTING AND RECORDING PROCEDURES

Introduction:

Since the beginning of modern medical services in Sudan, the routine method of reporting has been by weekly telegramme. This telegramme is officially called the Infectious Diseases Weekly Telegramme. Each province must send this weekly telegramme to the Ministry of Health in Khartoum.

The medical services in each province are headed by a Provincial Medical Officer of Health (PMOH). The PMOH has his headquarters in the capital of the province. He is directly responsible to the Ministry of Health in Khartoum, for both curative and preventive medical services.

Each province has a provincial hospital. This hospital is located in the capital, usually has specialists on its staff and is the hospital to which other provincial health units refer patients they cannot treat themselves. Each province is sub-divided into rural councils. Each rural council has a hospital and a number of dispensaries and dressing stations.

The Present Reporting System:

Every dispensary and dressing station in a rural council must submit a monthly report to the rural council hospital. The rural council hospital consolidates all such reports into a single report which is forwarded to the PMOH. In addition the rural council hospital must send weekly telegrammes to the PMOH. These telegrammes report all cases of specified "notifiable diseases". Smallpox is one of these. The PMOH submits his weekly telegramme to the Ministry of Health in Khartoum. If there is a serious epidemic of any kind, he will send a special telegramme or he may contact the Ministry of Health by any other means. The incidence of all such reported infectious diseases will be compiled by the Ministry of Health in its annual report.

The arrangement described above existed when the SEP was established. Only one modification was made to accomodate the SEP. This was that the Ministry of Health must immediately pass to SEP HQ in Khartoum any notification about smallpox received from the provinces. Later on, this became a secondary method of providing information to SEP HQ. The main one became direct contact by telegramme or telephone from provincial SEP offices or from the PMOH. This method provided very prompt and regular reports of smallpox or suspected smallpox cases.

In March 1976, an important change occurred in the weekly infectious diseases telegramme system. All health facilities were required to begin negative smallpox reporting i.e., weekly reports from rural council and provincial hospitals should show "nil" smallpox if no cases were being reported. A monitoring chart to follow up this kind of reporting from rural council hospitals was to be kept in each provincial hospital and each PMOH's office. The SEP operations officer for the province was made responsible for checking this chart regularly and contacting any facility not submitting "nil" smallpox reports. Assessments of this reporting monitoring system were to be included in SEP monthly reports submitted from the provinces to SEP HQ in Khartoum.

The smallpox reporting system now in use can be summarized as follows:

- Public Reporting:

  Many real or suspected cases of smallpox are reported by the public. The number of suspected cases reported increased significantly after the announcement of the reward for reporting a true case of smallpox.

  Village heads and sheikhs also play an important role in reporting cases of smallpox, as it is obligatory for them as part of their duty towards their community. The public reports to the nearest health facility or SEP team. From there the reports follow the normal channels.

- SEP Units:

  Before the last smallpox case, many cases were reported by SEP units. This has continued to be the case. Suspected cases found by SEP teams during active surveillance are reported to SEP HQ in Khartoum through provincial SEP offices or the PMOH.

- Provincial Health Facilities to PMOH:

  All health facilities in the province must report immediately,by any means, any case of smallpox. Cases reported in this way should be included in the weekly infectious disease telegramme from the rural council hospital if the case has been confirmed. In this case of very remote dressing stations, reporting is done by using a police radio telephone or by a runner to the nearest station where good communication is available.

Records of Reported Smallpox Cases:

Records of notification: Any weekly telegramme containing a report of smallpox is kept by SEP HQ in a special file for reference. Such telegrammes are also recorded on a special roster together with other notifications received.

Records of investigation: Results of case investigations are written on case investigation forms. There are two copies of the case investigation form. One copy is filed by the investigator and one copy is sent to SEP HQ. This form is then filed so that it is available for future reference.

Monthly reports: Every province prepares monthly reports. These reports include the monthly incidence of suspected cases of smallpox. Copies of these reports are kept in the SEP provincial offices and at SEP HQ in Khartoum.

SEP reports: The monthly reports from provinces are summarised monthly by SEP HQ in a report which is sent to EMRO. Up to late 1975, these reports were sent to EMRO quarterly.

Special reports: Special reports are prepared by SEP personnel (usually provincial operations officers) at the request of SEP HQ when

circumstances require more complete information than is usually included in the monthly reports. Some examples of such special reports are listed in Annex III. Other types of special reports include tour reports and special papers written for seminars.

Specimen collection forms and results: Two specimen collection forms are completed for every specimen collected. One is sent to Geneva together with the specimen and the other is kept at SEP HQ. The telegramme from WHO indicating the laboratory result is received by SEP HQ. Notification of the result is sent by telegramme to the SEP office in the province where the specimen was collected. The original telegramme is retained by SEP HQ.

Assignment reports: Assignment reports are written by long-term WHO staff at the end of their assignment to Sudan. Copies of these reports are kept in the WR's office.

CHAPTER (12)

SUSPECTED CASE REPORTING AND INVESTIGATION DURING MAINTENANCE PHASE (1973-78)

Introduction:

A suspected case means any rash illness with or without fever that is considered to be a possible smallpox case and that is brought to the attention of the Sudan SEP. Some of the ways that reports of suspected cases could be received by SEP personnel were:

1. From mass or containment vaccination activities
2. From a case investigation of a previously notified suspected case
3. From active case searching activities; either routine surveillance activities or intensified activities such as searches of previous foci, border areas, or wide-scale crash programmes
4. From special surveys such as pockmark or vaccination scar surveys
5. As a result of voluntary information supplied by other government officials or by the public
6. By means of passive surveillance, either by telegramme or through the weekly report of notifiable diseases. More expedient means, such as hand carried reports, were used when necessary. Reports of health units were channelled officially to provincial headquarters' and from there to the Ministry of Health in Khartoum.

Method of Reporting:

During the attack phase, most suspected cases came to the attention of the SEP while mass or containment vaccination activities were in progress. For the maintenance phase a comprehensive strategy for reporting and investigating suspected cases was established. This resulted in reports coming from several important sources. The most important source was active surveillance and thorough investigations of previous reports. Passive surveillance also provided numerous reports. There were two main reasons for this. One was that a more efficient infectious disease reporting system was in operation and the other was that the reward for reporting smallpox cases encouraged greater public interest. When chickenpox surveillance activities were began, the opportunities for detecting suspected cases were further expanded.

Method of Investigation:

To ensure that investigation of suspected cases was prompt and thorough, the following practices were adopted by the SEP:

Administrative:

1. Formation of a surveillance team for each province, to be headed by the operations officer of the province

2. A new or dependable vehicle to be assigned to each surveillance team.
3. The drawing up of monthly plans for provincial surveillance activities.
4. Designing and using practical forms for recording surveillance activities.
5. Assuring the availability of adequate supplies of specimen containers in the SEP office and at hospitals in each province.
6. Providing payment of per diem for operations officers and overtime for other members of the surveillance teams.
7. Deciding that the reward for reporting a confirmed smallpox case would also be paid to SEP personnel.
8. Requiring all chickenpox outbreaks to be investigated and specimens to be collected to confirm the diagnosis.
9. Monitoring of weekly infectious disease reports from hospitals and prompt action with any hospital defaulting on its report
10. Requiring the weekly infectious disease telegramme to include "nil" reporting of smallpox cases when there are no cases to report.

Professional:

1. Suspected cases should be investigated by the most responsible SEP person available and specimens should be collected as indicated.
2. A second opinion on the diagnosis of the suspected case should be obtained whenever possible.
3. Active case searching and health education should be given the highest priority.

Table 28 shows the number of suspected smallpox cases, by province, that were investigated by headquarters or provincial SEP personnel from 1973 to April 1978. No specimens were collected from suspected cases that were investigated and found clearly to not be smallpox. Specimens were collected from suspected cases for which there remained even the slightest possibility of a smallpox diagnosis. These specimens were forwarded to WHO for laboratory determination of the diagnosis. In these cases containment was began and maintained until notification was received from WHO that the diagnosis was not smallpox. (Annex IV).

CHAPTER (13)

POCKMARK SURVEYS

Pockmark surveys have been used as a surveillance tool since the beginning of the SEP. Initially these surveys were informal, so records were not kept and results were not reported. Later, several large and more formal surveys were conducted in the border areas as part of the continuing surveillance against importation. Results of these surveys were reported (see Chapter 18). In late 1975, pockmark surveys were began as a special programme aimed at uncovering any silent transmission. Originally they were conducted in only 6 provinces (Khartoum, Kassala, Kordofan, Darfur, Bahr El Ghazal and Equatoria) but in 1976, the programme was extended to all provinces and continued until the middle of 1977.

The purpose of the pockmark surveys was to learn whether any pockmarked person could be found whose illness had occurred after the beginning of 1973, i.e., after the last case. Checkposts located at numerous points in the country along communication routes and in border areas were used to screen very large numbers of persons, but the reports from the units did not record the ages of persons with pockmarks. Since it was of special importance to show whether anyone born after the last case had pockmarks, special teams in 1976 and 1977 concentrated on children of the appropriate ages.

Results are shown in Table 29 . Over the period of the special surveys, which included all provinces except Blue Nile, White Nile and Equatoria, 253 692 children 0 to 6 years of age were examined and none was pockmarked. Among 208 364 school age children (6-14) 21 were pockmarked (0.01%). Of the 1,651,291 people of all ages who were examined, 188 were pockmarked (0.01%). All persons with pockmarks said they had had smallpox before 1972. These observations are considered evidence that smallpox cases have not occurred since 1972.

Special investigation of persistence of pockmarks:

Because several observers had noted that many smallpox patients had only a few or no pockmarks, a special study was done in 5 formerly infected villages in Kassala and Gezira Provinces to determine if this was generally true. In 1976 it was possible to find 55 of the 147 patients who had had smallpox in 1971 or 1972. Most were children. About half were of Arab and half of West African origin.

Nineteen of the 55 cases showed no scars and 15 more showed less than 5 pockmarks. According to WHO guidelines, which call for 5 or more pockmarks, the latter would be considered negative. Thus, 34 of 55 or 62% of documented cases would be called negative. The children under 4 years of age at the time of their illness showed even less scarring. Only 1 of 11 in this age group had more than 5 pockmarks. Persons of Arab origin tended to have pockmarks more than those of West African origin, and females more than males, but the numbers are too small to be considered significant. (Table 30).

The criteria for using pockmarks as a marker for an earlier smallpox infection are based on careful studies in West Africa and the Indian subcontinent in patients with Variola Major. They appear to have been useful in those areas in field studies. However, the observations made here raise serious doubt about the sensitivity of pockmark surveys as a method of screening for cases of Variola Minor.

Table (29)

NUMBER OF PERSONS EXAMINED FOR FACIAL POCK-MARKS BY AGE GROUP & PROVINCE

Province	1975						1976						1977					
	Pre-School	+	School 6-14	+	Check-Post All Ages	+	Pre-school	+	School 6-14	+	Check-post All Ages	+	Pre-school	+	School 6-14	+	Check-post All Ages	+
Khartoum	268	0	3 860	0	3 434	0	10 060	0	14 468	0	49 468	7	91 602	0				
Red Sea		0							16 077	20	126 269	0	38 353	0				
Kassala	2 895	0	6 187	17	4 315	38	664	0	17 793	1	88 900	154	10 265	0	16 279		23 487	0
B. Nile S.											44 300	7					94 180	0
W. Nile											110 865	13					48 405	0
Gezira									10 860	0	181 415	7	30 626	0			81 793	0
Kordofan	600	0	600	0			15 739	0	29 934	0	110 734		3 611	0	2 759		74 609	0
Darfur	1 517	0	1 468	0	380	0			1 276	0	108 423	175					108 022	185
North, Nile									3 822	0	14 414	1	34 312	0	78 004			
Upper Nile									3 100	0	80 014	20	314	0	373		1 473	5
Equatoria	1 892	0	856	0	180	0					6 219	14	4 778	0				
B. El Gasal	16 461	0	16 419	0					144	0	72 800	15					17 010	0
Total	23 633	0	12 971	17	24 728	38	26 463	0	97 978	21	993 821	413	203 596	0	97 415		448 980	188

Combined data from check-posts, dispensaries and mobile teams.
\+ Indicates number of persons with pockmarks.

Table (30)

FACIAL POCKMARK SURVEY OF OLD SMALLPOX CASES

AGE AT TIME OF ILLNESS	NUMBER OF FACIAL POCKMARKS				
	NONE	1 - 4	5 - 10	OVER 10	TOTAL
0 - 1	1	-	-	-	1
1 - 4	7	2	-	1	10
5 - 9	5	5	6	1	17
10 - 14	4	2	1	2	9
OVER 15	2	6	1	8	17
TOTAL	19	15	8	12	54

CHAPTER (14)

CHICKENPOX SURVEILLANCE

Chickenpox as a disease is known in Sudan by two local names "Burgom" and "Gadary El Kazib". "Gadary El Kazib" means "Liar smallpox". Since 1912 chickenpox was considered a disease to be notifiable throughout Sudan.

The mortality rate for chickenpox has been very low in Sudan. The population generally considers it to be a safe disease among children, but more serious with adults. Deaths occur as a result of other diseases like anaemia, malaria or septicemia from secondary infection.

During its first years, the SEP was faced by the fact that many smallpox cases were being diagnosed as severe chickenpox. After consultation, some diagnoses were changed to smallpox. It was often necessary to have two quarantines, 200 metres apart, one for smallpox and the other for chickenpox.

Public Health Ordinance 1939:

Title XXI, Sub-Title I, Section 18, Sub-Section I defined smallpox, chickenpox and fifteen other diseases as Communicable Diseases, Class A. Section 19 makes them notifiable throughout the Sudan.

Section 20 makes compulsory notification to the nearest representative of the medical service or to the local government authorities. Section 21 defined persons responsible for sending a notice to the Provincial Medical Officer of Health:

a) The medical practitioner, if any, or official or employee of the medical service attending the person so suffering.

b) The head of the family with whom such person is residing.

c) The owner of or the principal resident in the house within which such person is residing.

d) The chief of the quarter or the village.

e) If such person is living on any vessel or is being carried on any public vehicle, the chief or other person in charge of such vessel or vehicle.

The above Sections in addition to other local orders made the reporting of chickenpox known to the general public and health staff.

Records of chickenpox on monthly and annual bases are available for many years back in the annual reports of the Ministry of Health.

Chickenpox Cases 1968 - 1972:

During this period, chickenpox was a common disease over all the country. Cases were reported on a monthly basis from dressing stations and dispensaries to the rural council hospitals. From rural council hospitals the reports were forwarded to the Provincial Medical Officer of Health (PMOH) and from the PMOH to the Ministry of Health in Khartoum.

A total of 140,295 cases with 118 deaths were reported during the five years before the last case of smallpox in 1972 (see Table 31).

The mortality rate was 0.03% for 1968 and 1969, 0.25% for 1970, unknown for 1971 and 0.20% for 1972. A somewhat higher mortality rate of 1.35% was recorded for Bahr El Ghazal province in 1972. This is perhaps explained by the fact that there were large numbers of cases of smallpox in Bahr El Ghazal in 1972.

Chickenpox Cases 1973 - 1977:

During this period a total of 17 690 cases with 10 deaths were reported. This was a drop of 122 602 cases from the number reported between 1968 and 1972. (Table 32).

The chickenpox mortality rate for first period (1968 - 72) was 0.08%. For the second period (1973 - 1977) the mortality rate was 0.05%.

Investigation of Chickenpox Cases During the SEP:

It was the strategy of the smallpox eradication programme to investigate any suspected skin disease. When cases were reported they were visited by a SEP surveillance officer accompanied by one of the senior staff at the provincial level. If both agreed on the diagnosis and that it was not smallpox, no action was taken. In case of doubt or disagreement on the diagnosis, specimens were taken and containment measures were started immediately. Then SEP HQ was informed so that instructions for further action could be given.

Because of this strategy and because chickenpox is most of the time easily diagnosed by experienced health staff and field workers, suspected cases of smallpox reported by SEP units numbered only 105 in 1976, and 241 in 1977. Thirty-two specimens were collected from these suspected cases and sent to WHO laboratories for confirmation of the diagnosis. (Table 33).

In 1977 a new plan of action was developed to obtain more specimens for laboratory diagnosis. This plan required that specimens be collected from every chickenpox outbreak.

Summary:

The fact that during the programme mild smallpox cases were sometimes reported as chickenpox cannot be denied. The drop in reported chickenpox cases after the country was free of smallpox supports this statement.

During 1973 and 1974 no deaths occurred among chickenpox cases. The 8 reported deaths in 1975 occurred in Northern (5) and Equatoria (3) Provinces, neither of which was at risk of importation of smallpox.

The proper investigation of 345 cases during 1976 - 77 and the submission of 32 specimens for laboratory diagnosis (all negative) provides evidence that smallpox is no longer hiding under the cover of chickenpox.

CHICKENPOX CASES AND DEATHS REPORTED BY PROVINCES 1968 - 1972 Table (31)

PROVINCE	1967/68		1968/69		1970		1971		1972		TOTAL	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Khartoum	2,633	-	2,755	-	2,548	-	827	N	3,881	-	12,644	-
North	22,317	1	25,433	1	276	-	679	O	3,609	6	52,314	8
Blue Nile	7,601	10	2,868	1	588	-	1,471	T	8,676	1	21,204	12
Kassala	3,344	-	3,511	-	961	9	733		2,592	4	11,141	13
Darfur	3,825	4	1,705	9	666	6	579	R	2,687	3	9,462	22
Kordofan	863	1	906	0	963	1	985	E	3,125	-	6,842	2
Equatoria	2,694	-	3,709	2	202	1	432	P	4,932	-	11,969	4
Upper Nile	1,203	1	1,263	1	97	-	375	O	3,716	5	6,654	7
Bahr El Ghasal	2,445	-	1,205	-	301	-	422	R	3,692	50	8,065	50
								T				
	46,925	17	43,355	14	6,602	17	6,503	+	36,910	70	140,295	118

CHICKENPOX CASES AND DEATHS REPORTED BY PROVINCES 1973/1977 Table (32)

PROVINCE	1973		1974		1975		1976		1977		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Khartoum	346	-	3,958	-	653	-	591	-	635	-	6,183	-
Blue Nile	2,751	-	1,909	-	236	-	138	-	64	-	5,098	-
Northern	546	-	511	-	245	5	43	-	5	-	1,150	5
Kassala	242	-	1,534	-	56	-	82	1	-	-	1,914	1
Red Sea	257	-	228	-	68	-	75	-	3	-	629	-
Kordofan	265	-	195	-	237	-	85	1	40	-	822	1
Darfur	135	-	163	-	88	-	2	-	8	-	396	-
Equatoria	228	-	253	-	67	3	25	-	-	-	553	3
Upper Nile	235	-	241	-	124	-	39	-	-	-	639	-
Bahr El Gamal	118	-	123	-	58	-	4	-	3	-	306	-
	5,123	-	8,895	-	1,832	8	1,082	2	758	-	17,690	10

CHICKENPOX CASES REPORTED BY SEP STAFF BY PROVINCE 1976 - 1977

Table (33)

Province	1976				1977			
	Jan.-Mar.	Apr.-Jun.	Jul- Sep.	Oct. - Dec.	Jan.- Mar.	Apr.-Jun.	Jul.-Sep.	Oct.- Dec.
Khartoum	6	18	1	0	12	0	0	1
Red Sea	1	2	0	1	1	1	20	9
Kassala	0	3	0	0	0	3	4	0
Blue Nile	1	0	2	0	32	1	0	0
Gazira	1	3	0	0	1	1	0	0
W. Nile	0	0	3	7	1	5	2	1
Upper Nile	0	0	0	4	10	4	0	1
Equatoria	1	2	2	3	15	17	5	3
Bahr El Gazal	0	0	0	2	31	27	5	1
Darfur	2	1	0	0	11	0	5	0
Kordofan	28	1	2	1	1	0	0	0
Northern	0	1	2	3	1	19	0	0
Total	41	31	12	21	116	78	41	16

CHAPTER (15)

MAINTENANCE OPERATIONS IN 1977

Introduction:

The year 1977 can be divided into two period, from January to July, and from August to December. Surveillance activities continued to be the main activities during the first period of 1977. The objective was to confirm the absence of smallpox. Four forms of operations were implemented. They are summarised below:

Active case search: Surveillance teams visited all villages in risky areas, border villages, and areas where outbreaks had occurred in 1971 and 1972. Village leaders and elders, health establishments, schools, police stations, markets and government officials were contacted during these visits. All data obtained were registered on a Smallpox Active Case Report Form. Results of this operation from January to July 1977 are shown in Table 34.

During the active case search, information about the reward for the reporter of a case of smallpox (laboratory confirmed) was widely circulated to everybody in the village. People were also told where to report a suspected case of smallpox. The teams used the WHO identification card while inquiring about smallpox cases. After the end of the visit a certificate stating that the village had been smallpox free since July 1972, had to be obtained from the village leader, and signed and stamped by him. These certificates are kept in special files in provincial SEP offices.

Pockmark surveys: These operations were conducted by mobile teams and by teams assigned to static centres or check posts. As explained in Chapter 13, the purpose of pockmark surveys was to see if pockmarked persons could be found whose illness had occurred after the last known smallpox case.

Investigations of Suspected Cases of Smallpox and Smallpox Rumours:

Full investigations were made of all reports of suspected cases. Circulars were passed from HQ to all provincial units to pay more attention to cases and epidemics of chickenpox, especially those with deaths. Collection of specimens for further confirmation of diagnoses was given high importance.

Weekly Communicable Disease Reporting: Measures were taken to improve the weekly infectious disease reports by requiring "nil" reports of smallpox. A chart was established in each province to monitor the reporting efficiency of district hospitals. Table 34 presents a summary of searches. by province for the period April to December 1976.

During the second period of 1977 (August - December), new operational guidelines were followed. These new guidelines emphasized five forms of operations.

Special Village Search by Mobile Teams:

Teams should visit all rural councils of each province. A map was to be prepared showing all villages of each rural council. The team would then have to visit as many villages as possible, but a minimum of 25% in each rural council and 50% in rural councils bordering Ethiopia. In the village the teams were required to contact schools, markets, health units

and village leaders. Three questions were to be asked:

(1) "Are there any cases of smallpox or rumours of smallpox in this or neighbouring villages?" If the answer was "yes", an investigation was began immediately.

(2) "Are there any chickenpox cases in this or neighbouring villages?" If the answer was "yes", the cases had to be investigated and specimens taken.

(3) "Do you know about the reward for reporting a true case of smallpox?"

At the end of each visit a certificate was to be obtained from the village leader. Certificates obtained from villages had to be stamped by the official stamp of the rural council.

Special Search of Large Towns and Cities:

This was a health education activity combined with case searching. The search was to be conducted by teams assigned to SEP units in big towns. The same procedure used in the villages was to be followed in towns and cities. The same three questions were to be asked. A special form was designed for the registration of data. The teams were no supposed to do house to house case searches or perform vaccinations.

Reporting by Primary Health Units:

Increased efforts were to be made to improve the reporting efficiency, including 'nil' reports, by dressing stations, dispensaries, and rural council hospitals. These facilities were to be visited during the special searches and personal contact made with the person responsible for reporting.

Surveillance of Nomads, Migrating Labourers and Refugees:

Surveillance of these groups was to be continued in those provinces where they were present.

Collection of Specimens for Laboratory Diagnosis:

Specimens were to be collected from all suspected smallpox cases and from all chickenpox cases discovered by the SEP teams during the maintenance operations.

Implementation:

For the implementation of this Plan of Action all SEP provincial leaders were called for a meeting at SEP HQ in Khartoum in early October, 1977. The Plan of Action was fully discussed. The three months of October November and December 1977 were the period agreed upon to complete the special activities. The time when activities were began varied in different provinces. Some started immediately in October, others in November and some failed.

Many reasons were given for the lack of action. Vehicles were in poor repair or were not useable. Petrol was in short supply in many provinces. Not mentioned, but probably an important factor, was the difficulty in stirring up enthusiasm in the workers for yet another search in a country which had not seen a case of smallpox for almost 6 years.

RESULTS OF ACTIVE CASE SEARCH JANUARY - JULY 1977 Table (34)

MONTH	VILLAGES/ CAMPS	CHIEFS/ SUB-CHIEFS	HEALTH ESTABLISH-MENTS	SCHOOLS	POLICE STATIONS	MARKETS	GOVT. FIELD WORKERS	RESULTS OF CASE SEARCH	
								CHICKEN-POX	SKIN DISEASES
January	293	404	659	59	15	51	36	27	-
February	280	398	81	108	23	43	30	20	4
March	199	251	75	116	24	25	-	37	13
April	301	321	215	77	23	44	49	48	101
May	91	137	44	26	16	14	9	4	83
June	195	217	58	76	23	23	9	20	261
July	385	150	145	50	30	49	132	-	71
Total	1,744	1,878	1,277	512	154	249	265	156	533

Awareness of Reward by Province 1978 Table (35)

Province	No. of localities	Total persons questioned	Reply to Questions							
			HAD SEEN				KNEW ABOUT			
			Smallpox teams	%	Posters	%	Reward	%	Where to report	%
Kassala	54	9,694	2,594	34.8	2,594	26.7	2,396	24.7	2,425	25.0
Kordofan	16	9,121	3,274	35.8	2,771	30.3	2,156	23.6	2,614	28.8
Nile	9	20,014	18,805	93.9	19,285	96.3	18,829	94.0	18,829	94.0
White Nile	12	1,362	739	54.2	661	48.5	594	43.6	645	47.3
Khartoum	22	821	444	54.0	266	32.3	305	37.1	457	55.6
Gesira	23	655	462	70.5	487	74.3	462	70.5	305	46.5
Bahr El Gasal	10	22,710	1,938	8.5	1,968	8.6	739	3.2	365	1.6

Visits were made between October 1977 and June, 1978, assessments were done between April and June, 1978.

In the 9 Provinces where there were searches, 1 892 villages were visited. Four chickenpox outbreaks were found and 5 specimens were collected. Forty-eight towns were visited and one chickenpox outbreak was found. Nowhere were there rumours of smallpox. Of particular interest is the fact that a very thorough search was made in Kassala Province, where all rural councils were visited, including refugee camps, and nothing was found, except one chickenpox outbreak.

The replies to questions asked during these searches varied greatly from one province to another, and it is possible that procedures in questioning and reporting may have been different. Nile Province reported the highest figure (over 90%) for having seen smallpox workers and posters and for knowing about the reward. Next highest was Gezira, then Khartoum, followed by Kassala and Kordofan at about 25%. The figures from Bahr El Ghazal were very low (only 3.2% knew about the reward).

During the special searches, information about the reward was widely circulated. Pamphlets, posters and other publications all publicizing the Ls.100 reward for the reporter of a smallpox case were prepared and widely distributed to cover the whole country. The following is a list of the material distributed. Office calendars: 6 000; posters in Arabic: 9 000; posters in English: 3 000; folded pamphlets: 4 000; and timetables for students: 20 000.

CHAPTER (16)

CRASH PROGRAMME IN UPPER NILE PROVINCE (1972-74)

Introduction

Upper Nile Province lies between latitudes 12° and 6° North and longitude 28° and 36°, sharing an international border with Ethiopia to the East. The terrain is flat, but interrupted by many rivers, streams, plenty of Toges (low land full of water and grass) and a single mountainous area in the far south-east corner of the province (see Figure 17).

The soil is "cotton soil", a type of soil that becomes very sticky during the rainy season. The climate is sub-tropical with heavy rainy seasons and dry winter seasons. Land transportation is very difficult. There are no paved roads and no motor roads to villages not lying on the main roads. Roads are motorable only during the dry season (November - April). River transport is insufficient and not regular.

Population of Upper Nile Province is 798,251 (1973). The population density is 3.5 per square kilometre. Inhabitants live in distantly scattered huts, breed cattle and goats, and cultivate grain on very small pieces of land near their huts, i.e. subsistence farming.

Background

Smallpox is a disease well known among people of the Province. Among local people it has the names "Akwak", (Nuer tribe) and "Komkom" (Dinka tribe) in their local dialects.

During the civil disturbances (1955-1972) smallpox control was a difficult task because smallpox teams could not move safely and freely from one place to another. Smallpox was endemic in the whole of the province until 1971. The only reliable data available are for the years 1970 and 1971. These data show smallpox occurring in five of the province's nine rural councils (see Figure 18).

With the launching of the Smallpox Eradication Programme in Sudan (1969), it was noticed that 80% of the smallpox cases reported in the Northern provinces were traced back to the Southern provinces of Upper Nile, Bahr El Gazal and Equatoria. This underscored the need for greater expanded programme activities in the Southern provinces.

During 1970 and 1971, personnel, transport and vaccines from SEP HQ in Khartoum were sent to Upper Nile to assist with smallpox activities. These activities resulted in the interruption of disease transmission in December 1971. Later on only one case of smallpox was detected, in August 1972. This was an imported case from Juba, Equatoria Province. No secondary cases resulted.

What is a Crash Programme and Why?

In Upper Nile Province a crash programme consisted of activities aimed at covering the whole province in a short period of time, using all available resources. Crash programmes were designed for Upper Nile Province because of the terrain, shortness of the dry season (November - April) and the vastness of the province.

First Crash Programme (November 1972 - April 1973)

The first crash programme was conducted in the province during the first dry season after the peace settlement in the Southern provinces (The Addis Ababa Agreement, March 1972).

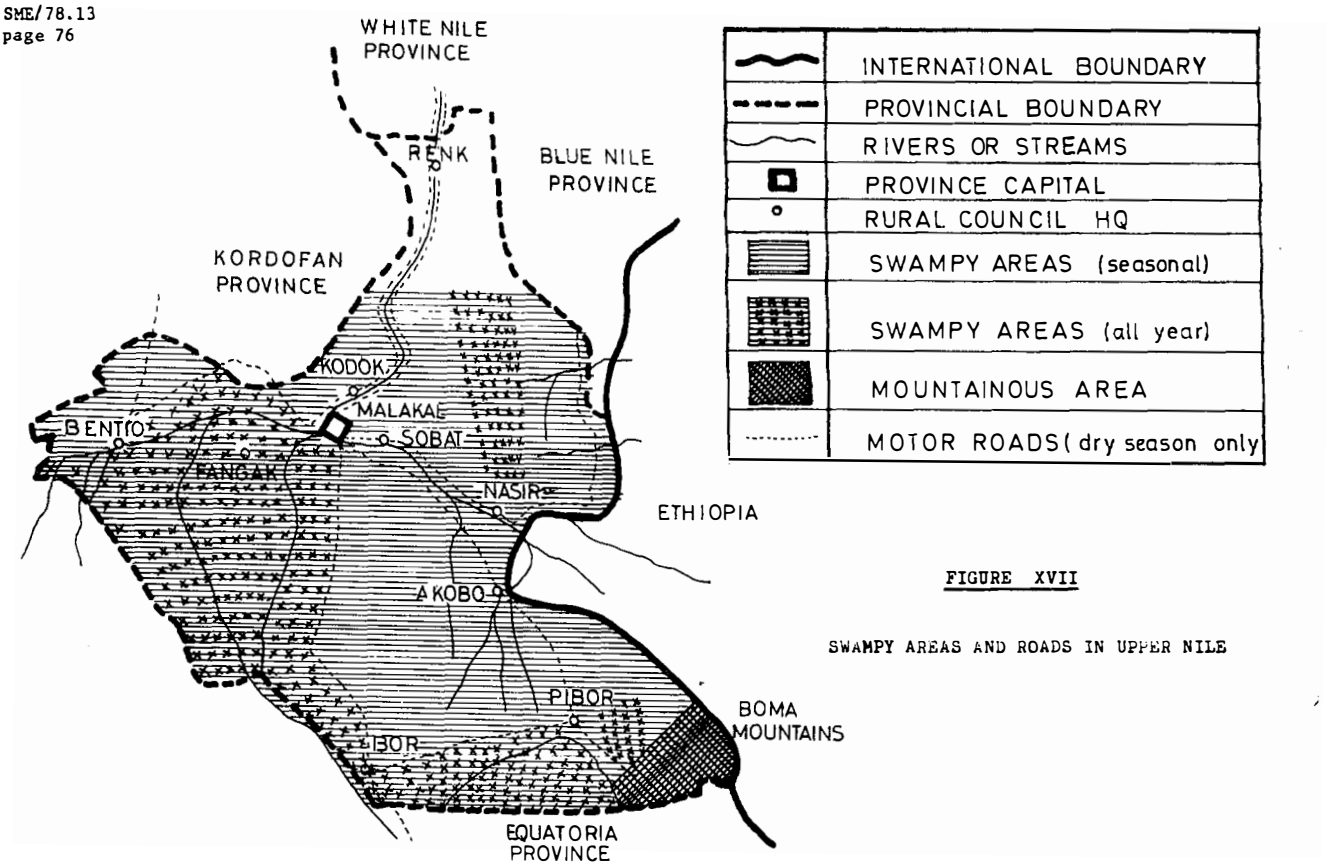


FIGURE XVII

SWAMPY AREAS AND ROADS IN UPPER NILE

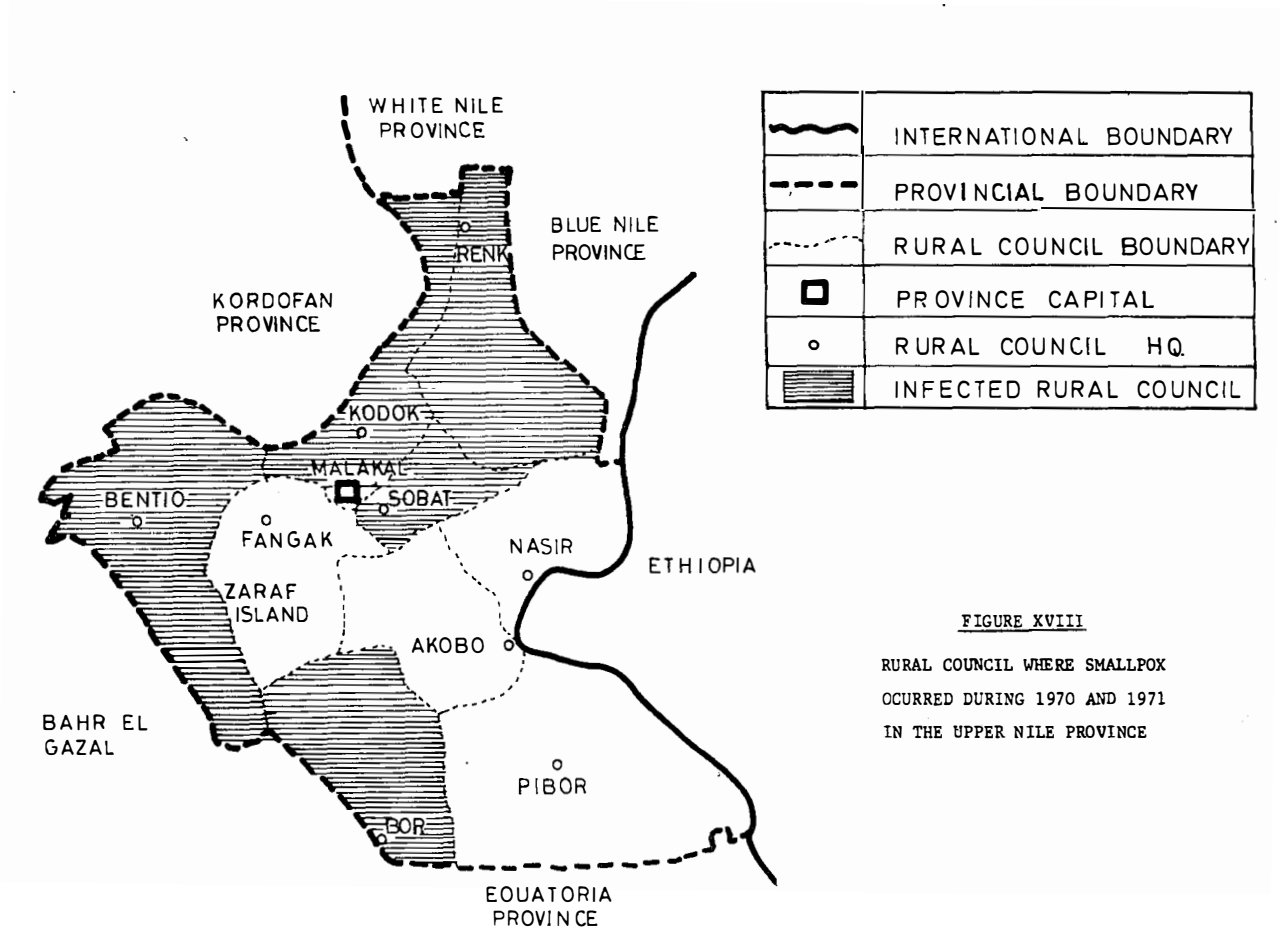


FIGURE XVIII

RURAL COUNCIL WHERE SMALLPOX OCURRED DURING 1970 AND 1971 IN THE UPPER NILE PROVINCE

After the settlement people began to move freely within the province and to other provinces, a fact which increased the threat of extending the chain of transmission of the disease to the maintenance phase areas in the Northern provinces. The first crash programme was rather a small-scale programme to combat smallpox outbreaks through case search and containment vaccination activities. Accessible and previous foci areas in Bentio, Bor, Akobo, Nasir, Fangak and Pibor Rural Councils were visited.

Situation of Smallpox after First Crash Programme

The limited objectives of the first crash programme were carried out successfully. No new cases of smallpox were found. Because the first crash programme did not reach all areas of Upper Nile Province, a more thorough crash programme to reach all areas of the province was required to make sure beyond doubt that no undetected smallpox foci remained. So the second crash programme (November 1973 - April 1974) was planned.

Second Crash Programme (November 1973 - April 1974)

Objectives

1. To make an all-out search for smallpox cases in all areas of the province that it was possible to reach during the dry season.

2. To maintain a high level of immunity to smallpox in the provinces through vaccination.

Preparations

1. Up-dating of lists to include the chiefs, village schools, health establishments, police stations, markets of each rural council.

2. Preparing a map of each rural council showing locations of village schools, health establishments, police stations and markets.

3. Stock-piling of vaccines and related equipment.

4. Stock-piling of Benzine, Diesel oil and lubricants for vehicles.

5. Acquisition of empty fuel drums for drinking water.

6. Stock-piling of food stuffs.

7. Stock-piling of needed spare parts.

8. Maintenance and repair of project vehicles in the province.

9. Personnel who want to take their leave should do so before October 1973. No leave to be granted during the period November 1973 - April 1974.

10. Acquisition of additional personnel:
    (a) 2 surveillance officers
    (b) 2 assessors
    (c) 4 supervisors
    (d) 1 mechanic

All to be instructed by SEP Directorate in Khartoum to leave their provinces and be present in Malakal by the end of October 1973.

11. Availability and cooperation of WHO Operations Officer to help with the preparation and implementation of the programme.

12. Eight reliable Land Rovers and two Toyota trucks to be sent to Malakal from HQ and different provinces.

13. Administrative officers, government officials, health authorities and chiefs throughout the province to be informed of the crash programme and its objectives and request their cooperation.

14. To search and vaccinate in Malakal Town Council and all rural council HQ towns, except Pibor, during rainy season prior to second crash programme. Pibor not accessible during rainy season.

Methodology

1. Four teams were appointed: three for surveillance and mass vaccination, and one for assessment and supply. Each surveillance and vaccination team consisted of a surveillance officer as leader, three supervisors, three drivers, nine vaccinators and three camp labourers. Each team had the use of three Land Rovers. The assessment and supply team was headed by the Upper Nile Provincial SEP Team Leader as an overall supervisor for the whole programme, assisted by three assessors, three drivers, six vaccinators and seven camp labourers. This team had the use of one Land Rover for assessment and two Toyota trucks for supply.

2. The three surveillance and vaccination teams should go at the same time to cover three rural councils in a period of 15-21 days.

3. Each surveillance and vaccination team leader should divide the rural councils for which he is responsible into three areas. Each of these areas should then be covered by a supervisor and three vaccinators, using one Land Rover.

4. After covering each rural council, each surveillance and vaccination team must return to Malakal to deliver its report and then prepare for second trip to another rural council.

5. The assessment team should enter a rural council 10-20 days after the surveillance and vaccination team has left the area.

6. The assessment team had to take randomly selected villages to do vaccination scar and pockmark surveys.

7. As Bentio Rural Council is most easily approached from Kordofan Province, it was arranged to have the surveillance officer of SEP Kordofan Province to be responsible for covering the Bentio area during January 1974.

Summary of Achievements (Table 36)

1. During the second crash programme, all areas of the province were covered except:

   (a) Area of Boma Mountains in Pibor Rural Council. Only the police station was visited. Due to insecurity reasons the police advised the surveillance unit accompanied by the WHO Operations Officer, February 1974, not to go to

the villages. A second visit was made by the assessment unit during March 1974. The police gave the same advice, but with all cooperation they summoned the chiefs of the area's villages, who were then questioned about the smallpox situation. The chiefs gave their assurances that there was no smallpox in their villages.

(b) Southern part of Zaraf Island (Fangak Rural Council). Due to floods this area had been deserted and the people had moved to the area around Fangak (see Figure 19).

2. During the second crash programme almost all chiefs were contacted. All health establishments, schools, police stations and markets were visited.

3. No evidence was found of smallpox in the province since the last confirmed case of August 1972. Suspected cases found by units were investigated with the following results:

19 chickenpox cases

59 skin diseases

4 scabies

8 measles

7 pockmarks - previous history of smallpox outbreaks of 1970 and 1971

4. The total number of smallpox vaccinations given in the province in the period January 1971 to April 1974 was 718,036, of which 169,478 were given during the first crash programme and 219,193 were given during the second crash programme (see Table 37).

5. Vaccination scar surveys conducted 10 to 20 days after the vaccination teams left the area revealed maintenance of high level of vaccination immunity among the province population (see Table 38).

SUMMARY OF ACTIVITIES DURING SECOND CRASH PROGRAMME

Table (36)

RURAL COUNCIL	NO. OF LOCALITIES VISITED *	NO. OF CHIEFS CONTACTED	HEALTH FACILITIES.	SCHOOLS	POLICE STATIONS	MARKETS	GOV. FIELD WORKERS & OTHERS	RESULTS OF THE SURVEILLANCE
KODOK	169	168	3	18	5	4	34	(13) Chickenpox, (2) Scabies (44) Skin disease, (6) Measles (2) Pockmarks (1970).
SOBAT	78	95	3	5	3	2	72	(1) Chickenpox (2) Skin diseases (2) Scabies
BENTIO	40	84	4	8	6	6	30	(1) Measles
RENK	64	45	13	6	11	4	8	
NASIR	91	97	8	13	9	3	28	(7) Skin disease, (1) Chickenpox (1) Measles (5) Pockmarks (1970)
BOR	59	105	7	1	8	5	-	(6) Skin disease, (1) Chickenpox
FANGAK	51	63	4	2	3	3	6	(3) Chickenpox
AKOBO	28	33	7	4	5	2	5	
PIBOR	18	63	3	1	8	1	24	
ALL	598	753	52	58	58	30	207	(19) Chickenpox (59) Skin disease, (4) Scabies (8) Measles, (7) Pockmarks (1970).

* Villages and Camps.

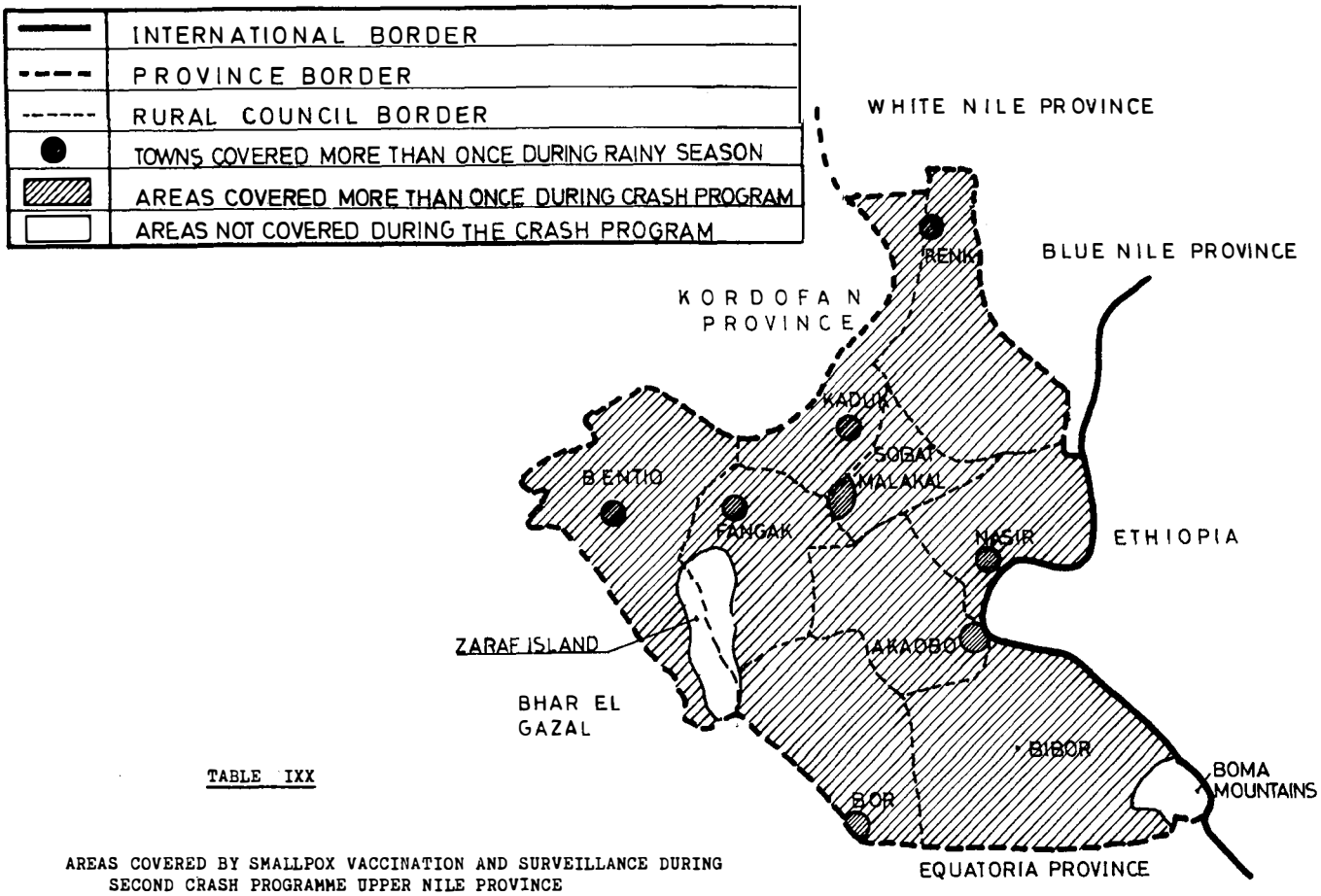


TABLE IXX

AREAS COVERED BY SMALLPOX VACCINATION AND SURVEILLANCE DURING SECOND CRASH PROGRAMME UPPER NILE PROVINCE

TOTAL SMALLPOX VACCINATIONS PERFORMED IN UPPER NILE PROVINCE
MARCH 1971 - OCTOBER 1973

Table (37)

MONTH	Y E A R			TOTAL
	1971	1972	1973	
January	8 658	3 349	37 043 *	49 050
February	2 865	11 359	27 534 *	41 758
March	3 400	8 499	82 631 *	94 530
April	nil	4 075	23 125 **	27 200
May	8 828	3 057	23 388 **	35 273
June	2 740	7 395	15 234 **	25 369
July	5 036	27 974	22 972 **	55 982
August	12 337	17 661	10 764 **	40 762
September	10 504	10 807	12 624 **	33 935
October	3 546	18 990	16 052 **	38 588
November	10 113	18 695	-	28 808
December	5 318	22 270 *	-	27 588
ALL	73 345	154 131	271 367	498 843

* Smallpox vaccinations carried out during First Crash Programme (November 1972- April 1973)
** Smallpox vaccination performed in Malakal (Province capital) and Rural Council capital towns except PIBOR

VACCINATION SCAR AND POCKMARK SURVEYS DURING SECOND CRASH PROGRAMME

Table (38)

RURAL COUNCIL	NO. OF VILLAGES SURVEILLED	0 - 4 YEARS				5 - 14			
		Total seen	Scar present	% with scar	No. with pockmarks	Total seen	Scar present	% with scar	No. with pockmarks
SOBAT	4	403	371	92	nil	404	404	100	nil
FANGAK	4	379	365	96	nil	494	495	99	nil
KODOK	3	377	342	90	nil	386	386	100	nil
BOR	6	616	556	90	nil	396	596	100	nil
RENTIO	9	900	570	63	nil	900	840	93	nil
PIBOR	2	80	69	86	nil	65	64	98	nil
AKOBO	3	255	246	96	nil	314	314	100	nil
NASIR	9	689	637	92	nil	808	789	97	nil
RENK	6	531	465	87	nil	551	547	99	nil
MALAKAL	-	-	-	-	-	-	-	-	-
ALL	46	4230	3621	85	nil	4518	4435	98	nil

CHAPTER (17)

SEASONAL WORKERS

Seasonal workers are people who normally live in one area, but who travel to other areas at certain times of year to provide labour for seasonal activities such as crop harvesting or crop processing. When this temporary work is finished they return to their original areas.

In Sudan, seasonal labourers are attracted to three main areas: (Figure 20).

1. To the Gezira, for cotton picking, from mid-December to late May.
2. To the sugar factories in the Gezira and Kassala Province, from July to August (for planting), and from December to May (for the harvest).
3. To the border districts of Blue Nile and Kassala Province, for the harvest of dura (sorghum), from May to December.

For the first and second areas, the workers come mostly from other areas of Sudan. For cotton picking, they come from Darfur, Kordofan, Blue Nile, Upper Nile and Kassala Provinces. Seasonal workers for the sugar factories come from these same provinces as well as from Bahr El Ghazal and Equatoria. Workers in the dura harvest come mainly from Ethiopia, although Sudanese workers do come from Kassala and surrounding provinces (Table 39).

Cotton Harvesting:

The main cotton growing area in Sudan is in the Gezira. Since 1936, workers from different parts of Sudan have been attracted to this area from December to May. The Gezira Administrative Committee is responsible for gathering people in their original provinces, transporting them to the Gezira, providing them with temporary shelters while they are employed, and transporting them back to their original provinces when the work is finished.

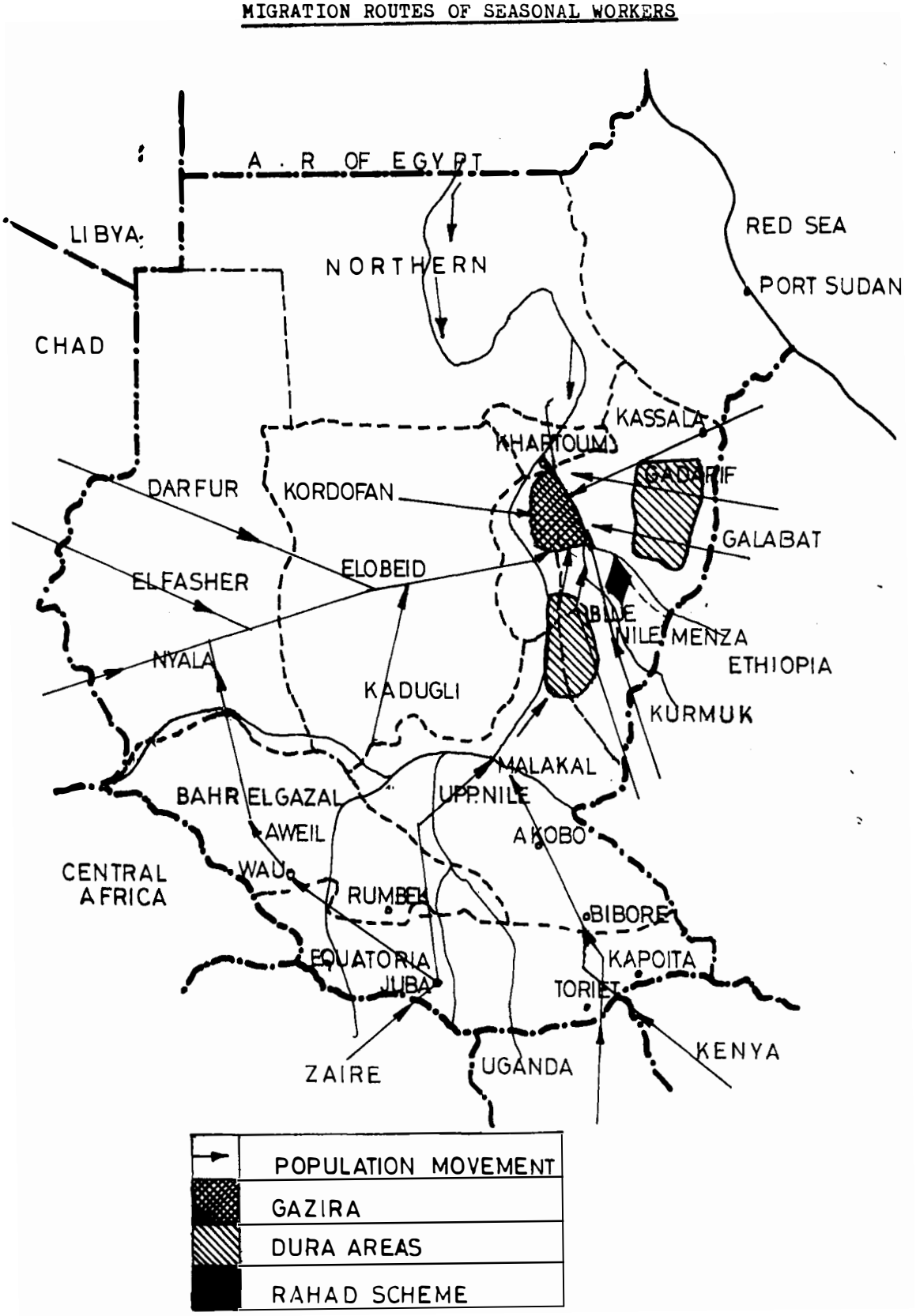
Gathering centres in the province of origin are either in the capital city or at railway stations. People from different villages are grouped together and then transported together. Several hundred thousand labourers are transported to the Gezira annually in this way. Of the 359,000 labourers engaged in the Gezira in 1973, about 60% were employed as cotton pickers while the rest were engaged in ginning and other crop harvesting.

With the start of the Gezira Irrigation Scheme in 1936, special efforts were made to provide health care to seasonal workers so as to reduce the transmission of communicable diseases. Early on, smallpox and relapsing fever were given top priority. De-lousing and vaccination centres were established at gathering areas in the provinces of origin. In the case of smallpox, these efforts were not completely successful, and in succeeding years it became clear that the Gezira was becoming responsible for attracting smallpox cases and then dispersing smallpox to many parts of Sudan at the end of each harvesting season. For example, of the 125 cases of smallpox reported in Sudan during 1969, 33 occurred among seasonal workers. The seven cases reported for Khartoum in that year were traced to a seasonal worker who travelled to Khartoum from Gezira.

When the SEP began its activities, it recognized the need to make the Gezira one of its first areas of priority. The number of check-posts was increased and check-post activities were expanded and intensified. Additional checks were made at river crossings and main roads. These checks were made by SEP and other trained health personnel located in temporary camps. Additional personnel were assigned to travel on trains to screen labourers using that mode of transportation.

FIGURE XX

MIGRATION ROUTES OF SEASONAL WORKERS



SPECIAL PROGRAMMES FOR SEASONAL WORKERS

Table (39)

A. GATHERING POINTS FOR COTTON PICKERS.

PROVINCE	GATHERING CENTRE
Darfur	Nyala
Kordofan	El Obeid, Rahad, Um Ruwaba, Abasiya and Um Jarfa
White Nile	Tendelti, Kosti, Ed Dueim
Blue Nile	Kurmuk, Roseires
Kassala	Kassala, Gedaref
Khartoum	include nomadic pastoralists
Estimated number in 1973	359,000

Date of Entry 15 December. Date of return 30 May.
Estimated Number 359,000 (1973)

B. LOCATION OF CHECKPOSTS AND VACCINATION CENTERS.

Blue Nile	Kordofan	Darfur	Kassala	Khartoum	Gezira	Up. Nile
Dinder	Obeid	Fasher	Kassala	Jebel Aulia Bus station	Medani	Renk
Suki	Rahad	Geneina	Gedaref		Hag Abdalla.	Steamer
Sennar	Um Ruwaba	Babanoussa	Hawata	Suk Shaabi	El Hosh	
Sennar (Railway)	Abasiya	Kabkabya	Train	Trains	Managil	
Guiessam	Galesha	Nyala	Aien		Hantoub	
Kurmuk	Train	Train			Abu Haraz	
Roseires					Hassa Heisa	
Mozmum					Rufaa	
Jabalin					Wad Rawa	
Kosti					Kamlin	
Aba					Gineid	
Gully					Mereehla	
Tendelti					Diriera	
Train					Kawa	

By 1973, when Sudan was no longer reporting smallpox cases, it was realized that the seasonal labourers attracted to the Gezira from all over Sudan would provide a good means of smallpox surveillance. Since 1973, the Sudan SEP has spent much time questioning seasonal workers in the Gezira about news of smallpox cases. Several pock-mark surveys have also been carried out.

Sugar Factories:

In the late 1960's a sugar factory was established in Geneid, Blue Nile Province (Gezira area). About a thousand seasonal workers were attracted to this factory from the beginning, most of them coming from the southern provinces. The planting season, beginning in July, would attract a few hundred seasonal workers with the majority of the seasonal workers arriving for the harvest, which began in November or December, and sometimes lasted until May.

In 1969, SEP teams were informed of a smallpox outbreak among workers in the sugar factory. Seven cases occurred in Geneid and persons infected in Geneid contributed to several other outbreaks in Blue Nile Province. The index case was found to have come from near Aweil, in Bahr El Ghazal Province.

In 1970, another smallpox outbreak occurred among sugar workers in Geneid. This outbreak was initially mistaken for chickenpox and thus continued to smolder for several months. Eventually the outbreak spread into the Gezira in late 1970 and early 1971, when the sugar harvest was completed and some workers moved on to the cotton harvest.

From 1971, the Sudan SEP established a permanent unit at the Geneid Sugar Factory. This unit was responsible for questioning and screening workers for smallpox and for vaccinating and conducting periodic surveys. Up to the present time, no more smallpox outbreaks have occurred among workers at the Geneid Sugar Factory. These same surveillance techniques have been applied with the same success at two new sugar factories established (one each) in Kassala and Blue Nile Provinces.

Harvest of Dura:

The harvest of dura (sorghum) is concentrated along the Kassala Province border with Ethiopia from just south of the city of Kassala to the Dinder Game Park. Another dura area is concentrated in the area stretching from the south-west part of Blue Nile Province to the extreme northern part of Upper Nile Province. These began emerging as large scale cultivation areas in the early 1960's. Seasonal labourers are attracted to this area from July to February, with the greatest number being present during the harvest months (December to February). Some 400,000 seasonal labourers are attracted annually for the dura harvest. Less than 10% of this number are present during the planting season.

About half of the seasonal labourers come from Ethiopia. These come from the Ethiopian provinces of Wollega (via Kurmuk), Gojjam (via Mensa and Geissan), Begemdir (via Gallabat) and Eritrea. They travel to Sudan along known roads and settle in certain areas, usually production areas, where they stay for 3 to 4 months. They travel mainly by foot. Some journey for as many as 7 days inside Ethiopia and then another 7 to 15 days inside Sudan.

Because the Ethiopians travel along known routes and because they settle in established production areas and remain there for several months, it has been a relatively easy task for the Sudan SEP to set up and maintain good smallpox surveillance. Checkposts have been maintained along all the main routes of their travel. All persons using these routes are screened and questioned for cases of smallpox and vaccinated.

The Sudanese seasonal labourers journey to the dura schemes in much the same way as to the Gezira cotton harvest. The only difference is that a greater proportion seem to come from the southern provinces. The SEP teams keep these seasonal workers under surveillance in much the same way as the seasonal cotton workers.

The Sudan SEP has also maintained active surveillance within the dura schemes during the harvest season. Three permanent mobile units, consisting of three vehicles and about 20 staff constantly move through the dura scheme area doing surveillance (including surveys) and vaccinations. Another 50 or so temporary staff are posted at nearby checkposts, health units and other static positions (Table 40).

These activities have been carried out since 1969. The success of these efforts is highlighted by the last imported case in Sudan. This case was discovered in a dura scheme area in the second day of rash. No secondary cases resulted (Chapter 20).

POCKMARK SURVEY OF SEASONAL WORKERS BY PROVINCE OR COUNTRY OF ORIGIN. FEBRUARY 1976.

Table(40)

Province of origin	No. of Councils	No. of Villages	No. of Families	Age Group 0-1	1 - 4	5 - 14	15 +	Total
Blue Nile	7	55	683	187	479	883	1,451	3,000
White Nile	5	107	1,148	953	990	1,597	2,739 (4)	5,779 (4)
Kassala	8	46	132	27	74	141	382 (3)	624 (3)
Kordofan	11	84	545	178	386	729	1,386	2,678
Darfur	9	116	484	88	255	419 (2)	1,289 (10)	2,051 (12)
Khartoum	3	12	118	78	121	216	377	792
B. El Ghazal	2	3	4	0	0	0	4	4
Total	38	368	3,114	1,011		3,985 (2)	7,628 (17)	14,929 (19)
Country								
Chad	Unknown	20	59	9	51	67	163 (1)	290 (1)
Ethiopia		4	4	0	0	0	12	12
Nigeria		6	33	0	11	41	88 (2)	140 (2)

( ) Number with pockmarks. All had onset before 1972.

CHAPTER (18)

CASE SEARCH AND SURVEILLANCE ACTIVITIES ALONG BORDERS

Because Sudan has borders with eight other countries and because it has historically been a country through which pilgrims from many countries have travelled on their way to Mecca, there have always been large scale movements of people across Sudan's borders. The danger of smallpox importations and exportations existed as long as endemic smallpox was present in any part of Sudan or its neighbouring countries. For this reason border surveillance has been a most important part of Sudan SEP's activities since they began in 1968. (Figure 21).

By 1973, when Sudan was no longer smallpox endemic, border surveillance and case searching was intensified, as it was recognized that importations posed the only remaining smallpox threat. Activities were concentrated on Ethiopian border areas as Ethiopia was the only neighbouring country that was still reporting smallpox cases after 1972.

Cooperation Between Sudan and Ethiopia SEP's:

During 1969 and 1970, there were known smallpox importations from Ethiopia into Sudan's Blue Nile and Kassala Provinces. During that time it was not possible for Sudan SEP personnel to cross into Ethiopia, so containment measures could only take place on the Sudan side of the border. By mid 1972, Blue Nile and Kassala Provinces were free of endemic smallpox, but the danger of importations from Ethiopia was still present. There was need for strong cooperation between Sudan and Ethiopia SEP's but at this time cooperation consisted only of local arrangements made by Sudan SEP personnel with neighbouring Ethiopian villages. In December 1971, after a case of smallpox imported from Ethiopia was discovered in Blue Nile Province, Sudan SEP notified the Ethiopia SEP via EMRO, and the Ethiopia follow-up of this notification led to the discovery of an outbreak of 165 smallpox cases. This episode was the beginning of a good and fruitful cooperation between Sudan and Ethiopia SEP's.

From 18 - 23 September, 1972, an international WHO Smallpox Eradication Programme Seminar was held in Addis Ababa. This seminar provided the chance to remove all obstacles and achieve the goal of cooperation. The seminar produced two main understandings in connection with border cooperation between the Sudan and Ethiopia SEP's.

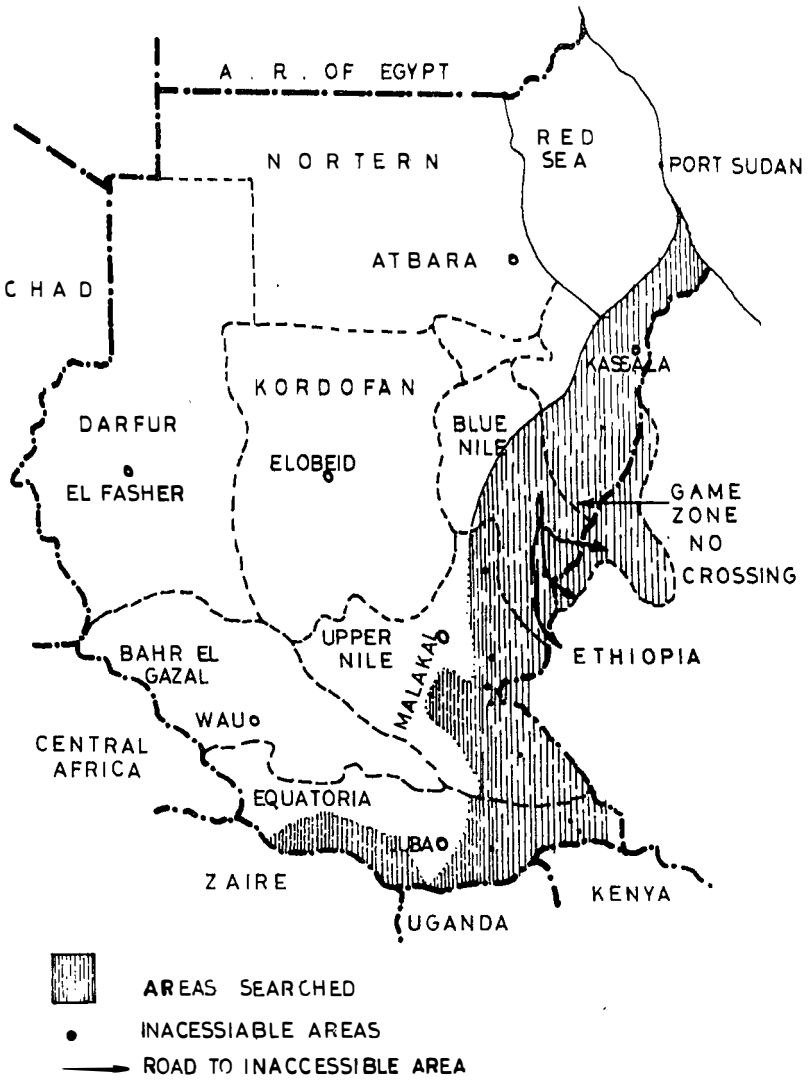
1. Appropriate administrative measures may be taken to permit the health staff in border areas to perform field vaccinations and case investigations across the national borders.
2. When a smallpox outbreak occurs in a border area or when rumours of smallpox in the neighbouring country are uncovered, this information should be communicated by cable to the national smallpox eradication officials of the neighbouring country. If possible, the information should also be communicated to the appropriate health units situated near the border of the adjoining country.

Governments were also requested to work out ways and means to facilitate inter-country travel to the neighbouring country.

Following the seminar, a lot of fantastic work was achieved. The Ethiopian Government was the first to give permission, allowing Sudan SEP teams to cross the border whenever necessary. The Sudan Government issued orders to all police stations

FIGURE XXI

SPECIAL SURVEYS ALONG BORDERS



Pockmark Surveys in Kassala Province 1977 Table (41)

Rural Council	Localities	Age Group 1	1 - 2	3 - 5	Total	Remarks
Kassala	11 villages	1 268	1 581	2 040	4 889	No pockmarks
Dok-Bamunda (Gedarif)	18 villages	180	459	661	1 300	" "
Wad El Hillowe	3 Displaced persons camps	861	2 023	2 963	5 847	" "
Border R.C (Kassala)	1 Nomadic camp	389	359	470	1 218	" "
Wad El Hillowe	32 villages	835	2 069	2 659	5 560	" "
		3 333	6 491	8 790	18 814	" "

on the border to facilitate the needs of the Ethiopian SEP teams. The Ethiopians were permitted to enter Sudan to reach part of their own country which is inaccessible from within. It was also possible for the malaria teams to use the same agreement. On many occasions the Ethiopian teams were supplied with petrol from Sudan when they needed it.

On 24 November, 1973, at the request of the Ethiopia SEP, a Sudan SEP team crossed the Ethiopian border to help in Gabba, an area inaccessible to Ethiopian teams from within. In 13 days the Sudan team covered 34 villages and gave 3,822 vaccinations. A second visit of a similar nature was made from 10 January to 16 February 1974. During this time, the whole of Metakel Awraja, Gojjam Province was searched and 12,625 persons were vaccinated.

These two attempts were appreciated by Geneva; Dr Henderson, Chief of the WHO SEP Unit wrote: "I believe this story especially should and will be recorded in the annals of smallpox programmes as an outstanding example of true devotion to duty and of the best in international cooperation. Assistance to the Ethiopian programme could not come at a better time." Dr Weithaler, Director SEP, Ethiopia also expressed his thanks for the efforts of the Sudan team.

In August, 1975, and again in August, 1976, Sudan teams crossed the Ethiopia border to investigate suspected cases in Guessan and Ayonsa (Gojjam Province). Both of these journeys were made during the rainy season, under the worst field conditions, and during Ramadan. For these investigations all types of transport were used: helicopter, army vehicles, tractors, river boats, mules and foot.

Blue Nile Province:

Blue Nile Province shares borders with Gojjam and Wollega Provinces in Ethiopia. For the past several decades there has been large-scale movement of seasonal workers across these borders from Ethiopia into Sudan. Additional workers crossed from Ethiopia into other Sudan provinces and then made their way into Blue Nile Province. Since the 1930's efforts have been made to avoid the transmission of communicable disease imported into Sudan in this way. By 1969 Sudan SEP personnel had established strict and comprehensive methods of surveillance to detect any imported smallpox case immediately (Chapter 17). Chiefs of villages, health units, police and schools were all aware of the situation and were reporting any suspected cases of smallpox. Five border checkposts were established to screen people at major crossing points. In addition, SEP personnel at these checkposts gave primary vaccinations and asked for news of smallpox cases. From time to time, pockmark and vacccination scar surveys were carried out.

Kassala Province:

Kassala Province shares borders with the Ethiopian Provinces of Eritrea and Begemdir. Most of the border area is easily traversed. For this reason the establishment of border checkposts could not be as effective as in Blue Nile Province. But something had to be done and with the end of endemic smallpox in Sudan, increased attention was given to the border areas. Beginning in 1972, SEP teams were carrying out active searches, vaccinations, and when necessary, containment activities along the border areas. Checkposts were established at major crossing points and teams also maintained surveillance at railroad stations and big markets. Ethiopian SEP teams were met at different points and combined surveillance plans were put into operation. After the Addis Ababa Seminar, some border meetings were arranged. Beginning in 1976, further information was provided by pockmark surveys, which gave a good picture of the situation inside the unreachable Eritrean Province of Ethiopia. When suspect smallpox cases were reported during 1976 and 1977, the rumours were investigated with success on both sides of the border. (Table 41).

Upper Nile Province:

Upper Nile Province shares borders with the Ethiopian Provinces of Illubabor, Wollega and Kaffa. Unlike Kassala, in Upper Nile there is limited crossing of borders due to natural barriers such as mountains, swampy areas, heavy rainfall for up to 10 months of the year and there is no regular transportation.

Since the 1972 start of SEP in Upper Nile, SEP teams have taken advantage of the short dry season to cover border areas. The crash programmes of 1973 and 1974 (Chapter 16) emphasized active searching, pockmark surveys and investigation of suspect cases. The report of a suspect case at Khigle post in November 1974 is a good example of the programme efforts in Upper Nile.

Transportation difficulties in Upper Nile are greater than in any other province of Sudan, with the possible exception of southern Blue Nile. Surveillance Officers have expressed their difficulties in this way: "Had our motor cars had their own tongues they would definitely express the horror of the roads to the Mechanical Transport Department. Land Rovers damaged beyond repair are lying aside in front of SEP offices in Malakal, like so much useless war material left to rust after a fierce military battle. But the proud SEP soldiers are still manning the checkposts of Nasir, Akobo and Renk."

Equatoria Province:

In addition to bordering the Ethiopian province of Kaffa, Equatoria Province has common borders with four other countries: Central African Empire, Zaire, Uganda and Kenya. The border area with Ethiopia is sparsely populated and has not posed a major threat for importation or exportation of smallpox. To a lesser extent, this is also true of the border area with Kenya and the Central African Empire. The border areas with Uganda and Zaire were more heavily populated and posed a much greater potential threat of smallpox importation and exportation.

No smallpox cases were reported in Equatoria Province from 1960 to 1968. For security reasons, good surveillance was not possible during this time, however. In 1969, some smallpox cases appeared among Dinka tribesmen travelling up the Nile to Juba from Upper Nile Province. This highlighted two dangers:

(1) the possibility of endemic smallpox in Equatoria Province, and
(2) the possibility that smallpox could be exported from Equatoria into neighbouring countries.

During 1973 and 1972, Uganda reported 16 and 19 cases respectively, imported from Equatoria. In retrospect, this is not surprising as subsequent surveillance efforts in late 1972 and 1973 indicated that several smallpox foci had existed in western Equatoria during the last few years of civil disturbances, up until late 1971 and early 1972.

With the signing of the Addis Ababa Agreement in March 1972 and the subsequent end of civil disturbances, it became possible to undertake effective surveillance and containment measures throughout the province. At this time it was decided that SEP activities would be started in Equatoria Province. By November 1973, full-scale activities were in operation. The last smallpox case was found in November 1972. During 1973 and 1974 SEP teams searched the entire province thoroughly. This included reported visits to all international border areas of the province, and maintenance of checkposts at major border crossings. The only evidence of smallpox found at this time was of foci existing in 1972 or before.

During 1975, reports were received of smallpox cases along the border with Zaire. SEP personnel responded to these reports by thoroughly re-searching the border areas. The rumours were proved to be false.

CHAPTER (19)

THE LAST SMALLPOX OUTBREAK IN SUDAN DUE TO ENDEMIC DISEASE

I Introduction

On 31 December 1972, a telegramme was received at SEP Headquarters, Khartoum, from Wau, Bahr El Ghazal Province. The telegramme stated cases had been detected in Aweil Rural Council. At the time the telegramme was received it was not known nor thought that these cases would be the last to occur in the Sudan and a detailed investigation of the outbreak was not undertaken. However, some information was gathered during containment activities.

II Background

Up to August 1972, the southern provinces were not entirely accessible because of civil disturbances. During this time it was known that smallpox cases were occurring in many eastern rural councils of Bahr El Ghazal Province, including Aweil, but the problem could not be adequately dealt with because only limited SEP activities were possible. The SEP Headquarters in Bahr El Ghazal was established in Wau in May 1972. Two smallpox vaccination teams were assigned to Aweil R.C. in August 1972. In late December 1972, the last indigenous cases were discovered during vaccination activities in Aweil R.C.

Aweil Rural Council is north-west of Wau and had a population of 418,966 in 1973. The people are mainly members of the Dinka tribe, but the Jur tribe is present in the southern part of the rural council. Villages in Aweil R.C. usually contain less than 350 persons, living in households scattered over a wide area. Cattle are the main occupation of the inhabitants. Grazing takes the people up to 50 km from their homes, depending on rainfall.

III Epidemiologic Features

A. Source of the Outbreak:

The last case occurred in Aluet village, Malek sub-council, about 50 miles east of Aweil (Figure 22). The patient claimed to have been infected in nearby Magok village. A visit to all nearby villages revealed that smallpox had been present in the area throughout most of the latter half of the year. The first case in this outbreak, occurring in September 1972, could be traced to Bul-Umm village. This patient was infected in Wun-Kir village in Gogrial Rural Council, to the east of Aweil.

B. The Epidemic Curve:

The epidemic curve of the outbreak is shown in Figure 23. At the time the epidemic was discovered the dry season was beginning and people were beginning to search for pastureland.

C. Age and Vaccination Status

The line listing of 12 cases discovered in this outbreak is shown in Table 42. One child died. One person had a vaccination scar.

D. Transmission

All cases occurred in a localized endemic area within a 100 km radius of Aweil. Person to person transmission was traced back to September 1972.

FIGURE XXII

THE LAST SMALLPOX FOCUS IN THE SUDAN

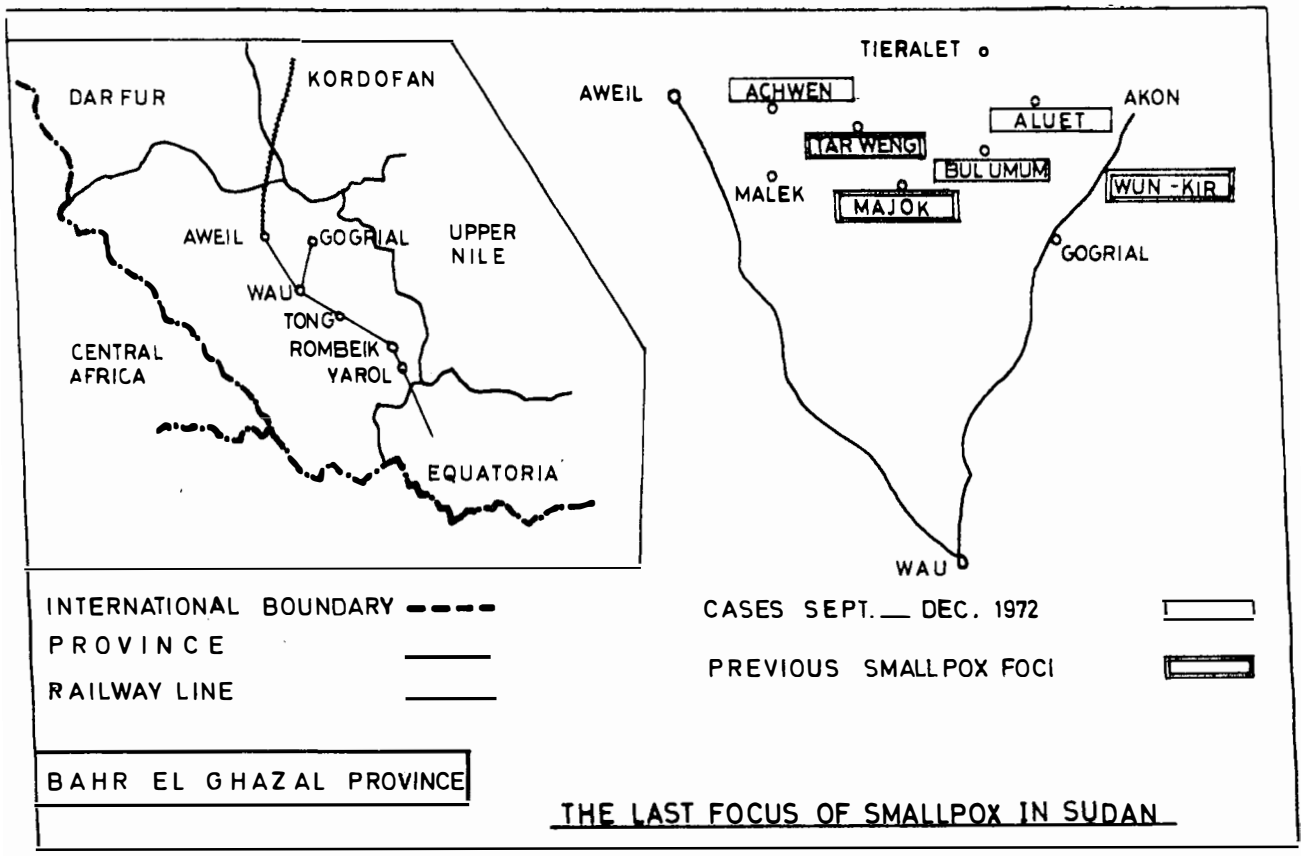
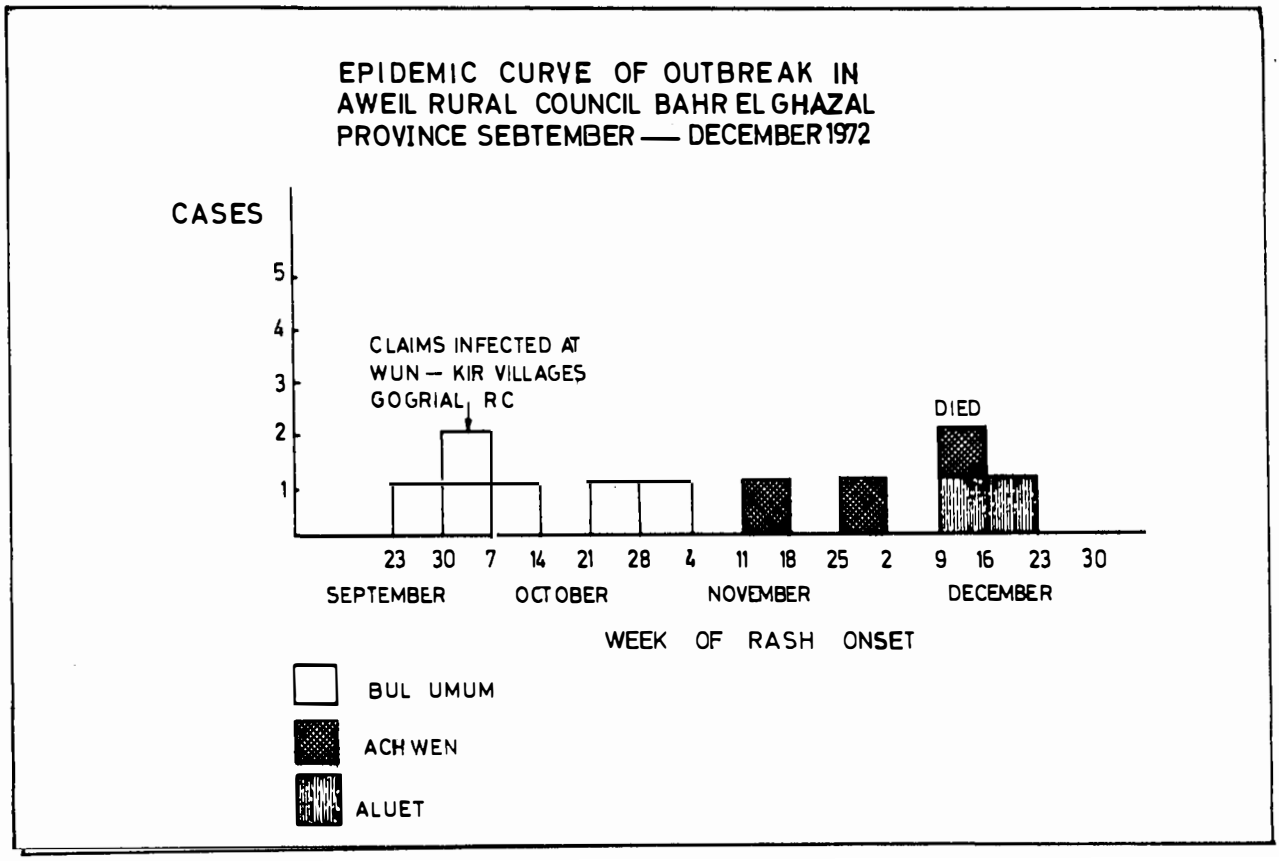


FIGURE XXIII

EPIDEMIC CURVE OF OUTBREAK IN AWEIL RURAL COUNCIL
BAHR EL GHAZAL PROVINCE SEPTEMBER - DECEMBER 1972



IV Control Measures:

All villages in Aweil Rural Council and several areas in Gogrial Rural Council were visited. House to house searching was done from December 1972 through April 1973. After April 1973, periodic searches in the area were carried out frequently and failed to detect new foci.

From October 1972 to April 1973 the following number of vaccinations were given in Aweil and Gogrial Rural Councils.

	Primary	Re-vaccinations	Total	
Aweil	12,286	35,860	48,146	A
Gogrial	8,155	14,963	23,188	B

A January 1973 missing
B No record of vaccination from January - April 1973

Twenty-nine per cent of the total vaccinations were primary vaccinations indicating a relatively unprotected population.

Special surveillance was carried out in May 1973 at which time the following places and persons were visited: villages (65), houses (4,768), health units (20), schools (4), markets (29), labour camps (11), tribal sub-chiefs (40), police stations (10), tea and coffee shops (15), relgious places (2), lorry and ferry stops (5). Fifteen suspect cases were found but none were smallpox. Periodic visits to the area have occurred from 1973 to 1978 to confirm that the area has maintained freedom from smallpox.

Summary:

A cluster of villages in Aweil and Gogrial Rural Councils, Bahr El Ghazal Province, were found to have endemic smallpox cases up through December 1972. Cases had been occurring in the eastern part of the province throughout the year. Containment relied on vaccination of neighbouring villages. Active searching throughout the area failed to detect other cases. It is believed this was the last endemic focus in Sudan.

Line Listing of Cases from outbreak in Aweil Rural Council, Bahr El Ghazal Province : September - December 1972.

Table (42)

	Village	Patients Name	Age	sex	Date of rash onset	Vaccination scar status	Outcome	Source of Infection
1.	Bul. Umum	Athong Ateim Deing	12	F	28.9.72	No	Recovered	Wun-Kir village, Grogrial rural council
2.	" "	Deng Ateim	1	M	5.10.72	No	"	Contact with patient 1
3.	" "	Ashwel Akol	3	M	5.10.72	No	"	" " "
4.	" "	Deing Ateim Aleim	11	M	13.10.72	No	"	" " "
5.	" "	Ateim Ateim Dung	30	M	23.10.72	Yes	"	" " " 1,4
6.	" "	Majok Atein	15	M	29.10.72	No	"	" " " 1,2,4
7.	Achwen	Athian Ruac	30	F	17.11.72	No	"	At Buo-Umum village
8.	Bul-Umum	Mel Ateim	7	M	19.11.72	No	"	Contact with 5,6
9.	Achwen	Agan Sigom	4	M	26.11.72	No	"	From grandmother infected at Bul-Umum
10.	Achwen		11	M	About 10.12.72.	Un-known	Died	Unknown
11.	Aluet	Athok Macuay	$3\frac{1}{2}$	F	14.12.72	No	Recovered	At Majok village
12.	Aluet	Arek Ature	30	F	17.12.72	No	"	" " "

CHAPTER (20)

THE LAST CASE OF SMALLPOX IMPORTED INTO SUDAN

Introduction:

The last case of smallpox to be imported into Sudan came from Ethiopia. The patient was a seasonal labourer who had come to the Abo Agla dura scheme in Kassala Province to work with the harvest. The case was detected through the surveillance efforts of SEP staff in Kassala Province, who were acting on information provided by a surveillance officer with the Ethiopia SEP, based in Asamara.

Background:

In early December, 1972, the Public Health Inspector (PHI) in charge of SEP activities in Kassala Province received a letter from the Ethiopia SEP Surveillance Officer based in Asmara, Eritrea. The letter was to inform the Kassala SEP that the Ethiopia SEP had discovered smallpox in the Eritrean village of Ali Ghider, a village not far from the Sudan border. The letter advised the Sudan SEP to keep to a close watch on the border area near Ali Ghider.

On 11 December, the Sudan SEP PHI proceeded with a surveillance team to the Gargif area of Kassala Province. This was the area nearest Ali Ghider. The entire area was surveyed and all dura scheme owners were instructed to inform the surveillance team of any labourers that have come from Ali Ghider so that the team could question and vaccinate them and put them under surveillance. Arrangements were made to station the surveillance team at the Gargif police station, and the PHI returned to Kassala on 14 December.

The PHI returned to the Gargif area on 21 December, to visit the surveillance team. No cases had been found at that time, but surveillance activities were being maintained throughout the entire area.

On 23 December, the PHI and members of his surveillance team were visiting the Abo Agla scheme when a young man was seen who had a very clear rash typical of smallpox on his face. The man was a 21 year old Eritrean who had come to work at the Abo Agla scheme. At the time he was found, he was living with 5 other persons in a small camp.

Epidemiologic Features:

The epidemiological investigation revealed that the 6 men all came from Ali Ghider. The patient and his 5 friends had left Ali Ghider on 9 December, accompanied by a Sudanese agent for the owner of the Abo Agla scheme. The group spent the night in the Ethiopian village of El Shokeriaya in the home of a man named Hamid Ibrahim. On the 10th, they continued their journey, passing through Burma police station before arriving at Abo Agla that same day. On 18 December, the patient felt feverish and on 21 December a rash began to appear.

Of the 5 people travelling with the patient, 2 had recently been vaccinated in Ali Ghider. One showed clear smallpox scars on his face. This man said he was infected in the Keren (Eritrea) area 3 months before. The other two men had never been vaccinated.

Containment Measures Taken:

All five of the patient's fellow travellers were vaccinated and the entire camp was put under quarantine. Five other labourers found nearby were also vaccinated. All labourers in nearby camps were visited, examined and vaccinated.

On that same day (23 December) the PHI and some members of his surveillance team proceeded to Um Hagar, which is located inside Ethiopia. The health authorities there were asked to give the Health Officer in Tessenei (the district HQ) full information about the case found at Abo Agla, so that he could take the necessary action. The team spent the night at Gargif police station and the next day (24 December) the PHI returned to Kassala.

From Kassala, the SEP HQ in Khartoum was informed of details of the case. On 26 December, a Senior Public Health Inspector (SPHI) from Khartoum came to Kassala to confirm the diagnosis. On 27 December he and the PHI visited Gargif for this purpose. The confirmation was made and both men returned to Kassala that same day. Arrangements were then made for a journey to Tessenei and Ali Ghider to confirm the epidemiological history and to see what measures the Heatlh Officer in Tessenei was initiating.

The PHI and the SPHI left Kassala on the 28th. They arrived in Tessenei that same day and met with the Health Officer. Although the Health Officer had received the message sent from Um Hagar, he had done no more than forward the same message to SEP in Asmara. The Health Officer was asked to accompany the Sudanese personnel to Ali Ghider, which he agreed to do.

At Ali Ghider, Hamid Ibrahim, the man with whom the patient had been staying, denied that he even knew the patient, but it was clear that he was lying. Health authorities in Ali Ghider were met and convinced that it was important to search the town thoroughly as it was likely that more cases were in the town. After receiving assurances that thorough searching would be done, the Sudanese personnel and the Ethiopian Health Officer returned to Tessenei.

On the 29th, the Sudanese personnel returned to Kassala. On 3 January, they again returned to the Gargif area and visited the patient. By this time the patient was beginning to scab. Another check of the area was carried out but nothing suspicious was found. After making arrangements to have SEP personnel remain in the area until all danger of smallpox was over, the PHI and SPHI returned to Kassala and Khartoum, respectively.

Summary:

Acting on information received from the Ethiopian SEP office in Asmara, Ethiopia, Sudan SEP personnel in Kassala Province were alerted to the possibility of a smallpox importation. Intensified surveillance was undertaken in the areas thought to be most vulnerable. This intensified surveillance was responsible for the detection of a case of smallpox only two days after the patient began to develop a rash. Containment measures were begun immediately and no secondary cases occurred.

CHAPTER (21)

LAFIT OUTBREAK

Introduction:

During an active search for smallpox cases undertaken during January 1974, a Sudan SEP surveillance officer discovered evidence of smallpox cases that possibly had occurred as recently as November 1973. This discovery was in the Lafit mountains of eastern Equatoria Province. This discovery caused great concern among Sudan SEP staff because, if the preliminary information was confirmed, the last case would have occurred 11 months after the last reported smallpox case in Sudan (for reference, see WHO/SE/74.67, "The Mystery of the Smallpox Cases in the Lafit Mountains, Equatoria Province, Sudan").

Background:

Smallpox is known to have been endemic in many areas of eastern Equatoria Province as recently as 1972. It was not possible to intensify smallpox eradication activities until after the Addis Ababa Agreement of March, 1972, which brought an end to civil disturbances in southern Sudan. By June, 1972, smallpox eradication efforts in Equatoria Province were in full operation. The last confirmed case of smallpox in Equatoria Province had an onset of rash in November 1972 and occurred in eastern Equatoria.

During the 1973 rainy season, plans and arrangements were made for extensive smallpox surveillance activities to be carried out in eastern Equatoria during the 1973-74 dry season. The purpose of these activities was to make sure that no smallpox foci remained in the area. In December 1973, special surveillance teams thoroughly searched Kapoeta District, the eastern-most district. During the search reports were received of current and recent smallpox cases, but investigations of these reports proved that they were groundless in every instance.

During January 1974, the special surveillance teams began active searching of Torit District. This district is particularly difficult because it contains a number of high and rugged mountain ranges. All are inhabited and most are known to have experienced smallpox epidemics as recently as 1972. In mid-January the teams uncovered evidence of a smallpox chain of transmission that may have continued as late as October or November 1973. This was in the Mura and Dorik areas of the Lafit Mountains.

The Lafit Mountains:

The Lafit Mountains are a narrow range of mountains about 45 miles long, that run south-east to north-west. The mountains are not exceptionally high (highest peak: 1,939 metres), but they are very rugged. There were exactly 40 villages in the Lafit Mountains at the time of the search, with 38 of them located on the mountains themselves. A 30 minute climb was required to reach most of these villages. While the population of other mountains in Equatoria are scattered randomly in small settlements, almost all the total population of the Lafit Mountains could be found in its 40 villages. The mountains are accessible by road only during the period December to April (Figures 24, 25).

The Population:

The Lafit Mountains are populated almost exclusively by the Lafit tribe. The Lotuka people to the west and the Taposa to the east are traditional enemies and so, historically, the Lafit have not normally ventured far from their mountain homes.

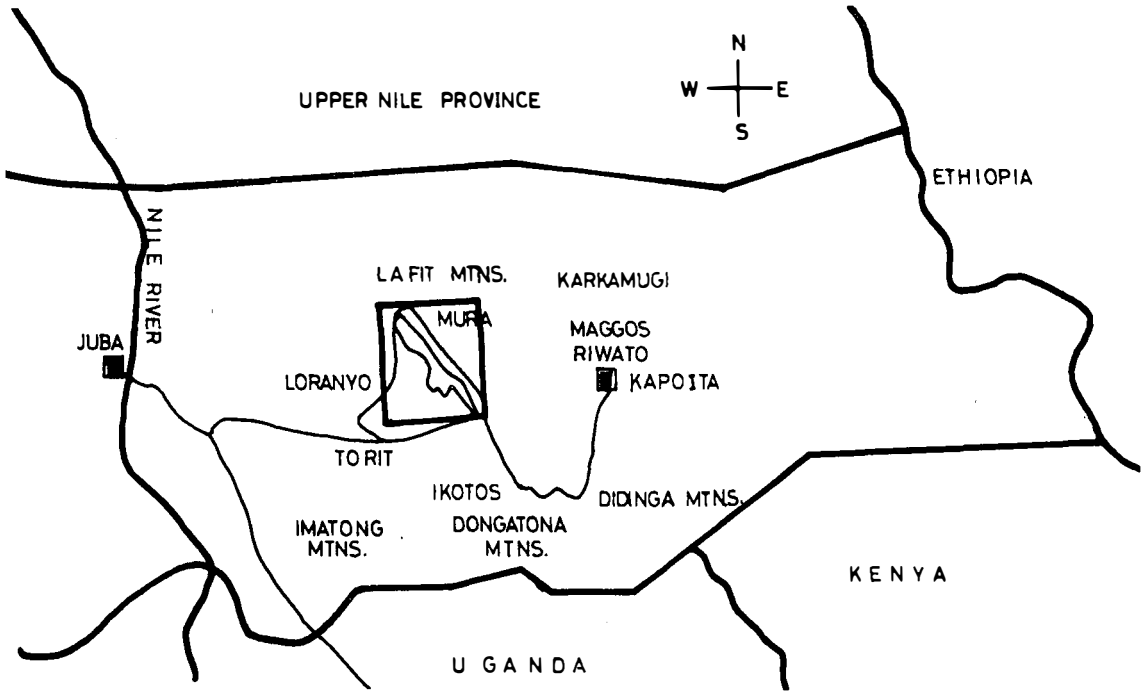


FIGURE XXIV

EASTERN EQUATORIA PROVINCE

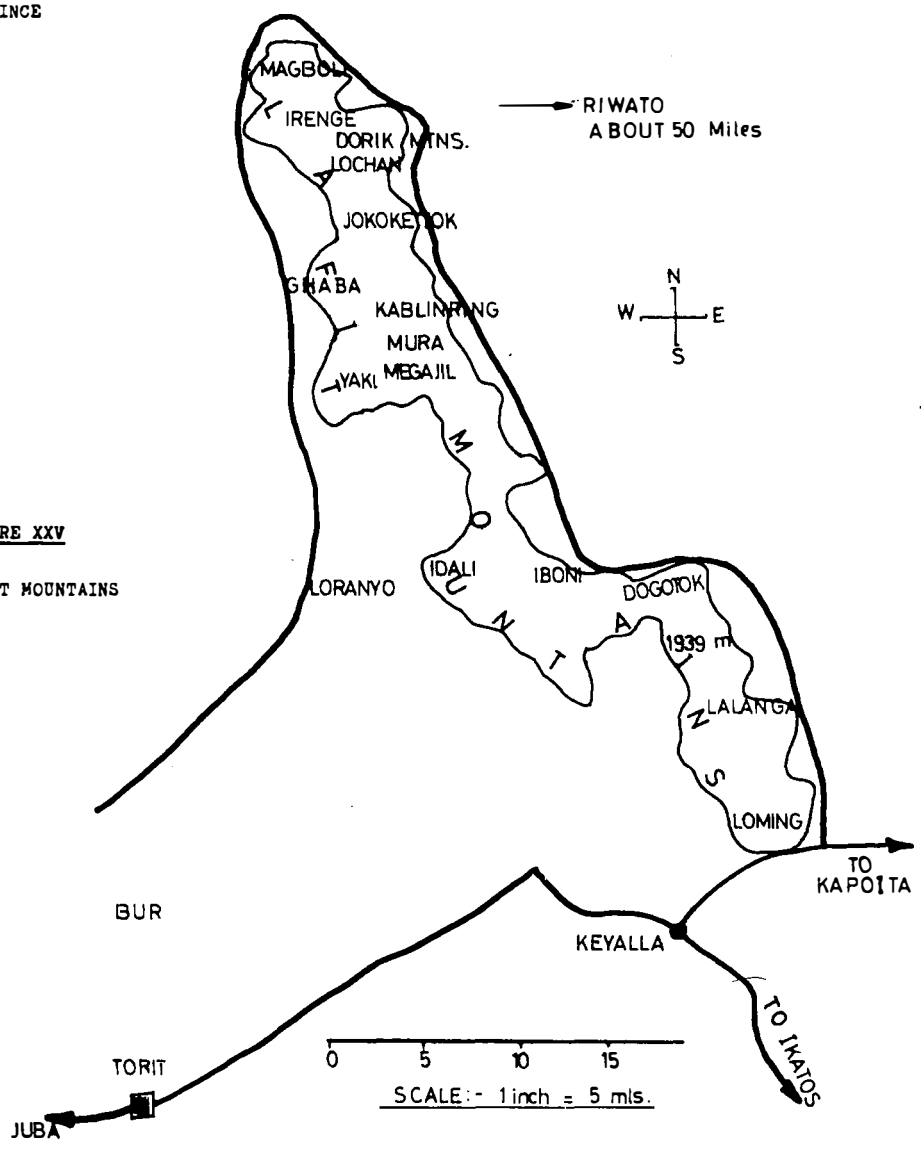


FIGURE XXV

THE LAFIT MOUNTAINS

During the disturbances, most of the people became refugees. Many settled in Kapoeta town, some stayed in Torit and Juba and some travelled as far as Uganda. At the end of the disturbances, the Lafit refugees returned and most of the population at the time of the search consisted of returnees.

Recent History of Smallpox in Lafit Mountains:

According to the information gathered from villagers in the Lafit Mountains, smallpox cases occurred during 1971 at Loming and Lalanga, in the south-eastern section of the mountains. During 1972, there were smallpox cases in the area from Logotok to Megajik on the eastern side of the mountains and from Ngaboli to Ikoli on the western side. The reported smallpox cases in 1973 were apparently confined to the Mura area, but may have included the villages of Dorik Mountain (Irenge and Locharo).

It would seem that, if cases of smallpox occurred in the Mura area in 1973, they might have represented a progressive spread of an existing smallpox outbreak from other parts of the mountain range. It is equally possible that smallpox was imported into the Lafit Mountains during 1972 from Kapoeta District, or that both occurred.

The last confirmed smallpox case in Equatoria Province was in November 1972, at Karkamugi in Kapoeta District where many cases of smallpox are known to have occurred that year. Karkamugi, Riwato and Maggos, the most densely populated part of Kapoeta District, are only about 50 to 70 miles from the Lafit Mountains. Taposa tribesmen frequently travel from the Riwato area to the Lafit Mountains with their cattle. In fact, during the active search some Taposa tribesmen were encountered. They said that they could walk to Riwato from Lafit in two days.

Smallpox could also have been imported to Lafit when the refugees returned from the Kapoeta area. It was not until June 1972 that SEP personnel were able to begin work in the Kapoeta area and by that time, refugees were already being taken back to Torit District by lorry. It is worth noting that a SEP surveillance officer who helped with vaccination efforts in the Lafit Mountains after the Mura focus was discovered, claimed that some of the persons seen with old pock-marks were persons he had seen in quarantine in Kapoeta when he was working there in 1972.

Previous Surveillance Work:

Surveillance activities were not possible in eastern Equatoria until after 1972 rainy season. Surveillance activities were not extended to the Lafit Mountains until February 1973. A surveillance team accompanied by a WHO Adviser visited the area at that time. The team drove completely around the mountains, and vaccinated many of the villages. No active smallpox was seen or reported at that time.

The Mura Focus:

A guide engaged by the surveillance team when it visited the Lafit Mountains in January 1974, said that there had been smallpox in the Mura area the previous year, that in fact he could reliably date the last surviving case to have been in the scabbing stage in early November 1973. The area was visited. The alleged last surviving case (a boy of 15 months) was found and confirmed to have the scars of smallpox. Eight other persons having the scars of smallpox were found in the area. All these people placed their time of infection one or two months before the alleged last surviving case. Another 25 people without scars claimed to have had smallpox and a list was developed of 25 people said to have died from smallpox between Christmas 1972 and Christmas 1973. An additional two people in a neighbouring village were found to have smallpox scars, but these cases could not be epidemiologically related to the Mura cases.

The development of case histories for the Mura outbreak indicated that these cases may well have occurred during 1972 rather than 1973. In fact, most of the evidence supported that view. The only problem was the alleged last surviving case. The guide insisted that this case was in the scabbing stage in early November 1973, and the other old cases in Mura said that they were infected one to two months prior to the alleged last surviving case. These people were less sure that their infection had occurred in 1973, however.

At the time, it was not possible to positively determine that the chain of transmission had occurred in 1972 rather than 1973. A complete search and mass vaccination of the entire area was carried out. All 40 villages were reached. Since some 90% of the population lived in the villages, the search was considered thorough and complete. A total of 3,924 vaccinations were given of which 1,586 were primary. No evidence of fresh smallpox cases was found.

Post Script:

The Lafit Mountains were visited two more times during 1974 by SEP surveillance teams. Since that time, repeated visits have been made. No smallpox was ever found. It is interesting to note that a visit in 1976 by a Surveillance Officer, accompanied by a WHO Adviser, determined that the alleged last surviving case of the focus was infected in late 1972 and not late 1973 (see extract from March 1976 Monthly Report).

CHAPTER 22

AYENSA: THE STORY OF A BORDER RUMOUR, 1976

On 23 August, 1976, the Sudan SEP HQ's received a telephone call from Sennar. The Assistant Commissioner of Health, Blue Nile Province reported that a message had been received from Geissan checkpost by the Medical Inspector at Roserires that there was a suspected case of smallpox in Ayensa Village, Wollega Province, of Ethiopia. This village is in Mange Woreda, Asosa Awraja, and is located 1 1/2 hours by foot from Geissan.

Response:

The Sudan SEP response was immediate.

1. The Ethiopia SEP was informed through the Sudan WHO Representative.
2. The Bue Nile Province SEP Public Health Inspector, who was on marriage leave, was instructed to report immediately to Geissan.
3. Sudan Airways was contacted to reserve 2 seats on the first available fight to Rosieres.
4. As the WHO Epidemiologist was on leave, the WHO SEP Administrative Assistant prepared to accompany the Bue Nile PHI.
5. The Assistant Commissioner of Health was asked to contact the Commissioner of Blue Nile Province. This contact was made and the following points were agreed upon:

   (a) The Assistant Commissioner of Health should contact His Excellency, the Minister of Health, to see if a helicopter could be made available.

   (b) Army cars would be the alternative in case of failure to arrange for a helicopter.

   (c) The borders at Geissan should be closed to prevent smallpox from entering Sudan.

On 25 August, the Under-Secretary for the Ministry of Health personally contacted the SEP office to learn what measures had been taken so far. He was informed that the Blue Nile PHI and the WHO SEP Administrative Assistant would be leaving on that day's flight and that if a helicopter was not available in Rosieres they would proceed by tractors from there.

The SEP HQ team arrived at Damazin (Rosieres aerodrome) at 1230 on August 25, by a regular flight and contacted the Commissioner immediately. The Commissioner explained that the effort to get the helicopter had failed. He suggested an army car as an alternative, but the team said it preferred to have two tractors. The Commissioner contacted the Mechanical Agricultural Department, which promised to have the tractors ready by the next day.

The team then contacted Geissan by radio-telephone and asked for details concerning the suspected case. It was learned that one of the vaccinators had left Geissan on the 23rd by donkey to deliver a specimen from the suspected case to Damazin (5 days travel).

On the 26th, while the team was waiting for the tractors the helicopter arrived at Damazin from Khartoum. The HQ team was contacted and they left for Geissan (45 minutes, 117 miles by helicopter). As the village of Avensa was inside Ethiopia and as the helicopter could neither wait nor cross the border, it returned to Khartoum. The HQ team was left to determine the best way to reach Ayensa and then return to Dmazin. The team met the Geissan health unit Medical Assistant and his vaccinators.

Events in Geissan Before the Arrival of the SEP HQ Team:

1. On 21 August, the Ethiopian Medical Assistant at Geissan Dispensary contacted the Sudan unit for vaccine as he said there was a smallpox case in Ayensa village.

2. In a joint effort, both Sudan and Ethiopian personnel visited the patient and diagnosed the illness as a highly suspected smallpox case. A specimen was taken and all villages were vaccinated. It was agreed that the Ethiopian medical assistant would come to Geissan the next day to take more vaccine for vaccinating nearby villages.

3. The Sudan unit contacted the Sudan police station to insure that everybody crossing the border should pass the vaccination station and be checked.

4. After receiving a message from the Assistant Commissioner of Health, Blue Nile Province, the borders were closed. To the astonishment of the Sudan unit, the Ethiopian MA did not come on the 22nd or 23rd to collect the vaccine.

5. The unit, accompanied by a translator, then visited Geissan Dispensary to know the reason for the delay. They learned the Ethiopian police had heard of the border closing and had refused to allow the MA to visit Sudan for the vaccine. Moreover, the Ethiopian MA had sent a message to his HQ asking for supplies from Assosa because Sudan would not allow people to visit the market in Sudan. Despite all explanations the MA refused strongly to accept the vaccine offered to him and said that Addis Ababa had been contacted and that he would get his own vaccine.

Events in Geissan after the Arrival of the SEP HQ Team:

On the 26th, a letter was sent to the MA requesting a meeting. On the 27th the MA reported and everything was explained, especially that the vaccine belongs to nobody because it is from WHO and for the whole world.

The Ethiopian MA agreed to cooperate and in a joint effort, all visited the suspected case. After two hours of walking on a rough mountainous road, while the Sudan team was fasting (Ramadan), all reached Ayensa.

Findings:

1. The patient, Hamid El Toum, male, 42 years of age, was in the scab stage.
2. While most of the rash was in the scab stage, there were still lesions in the pustular stage. Specimens were taken from both scabs and pustules.
3. Lesions were most numerous on the trunk. There were few on the peripheryes with very few on the face.
4. There was one pock on the left palm.
5. The patient had no vaccination scar, but there was a variolation mark on his left arm. He said that this had been done in early childhood. Elders were asked and all agreed that it was so and that this practice had been stopped for more than 30 years when vaccine was introduced by the British in Sudan.
6. The fallen scabs left superficial pockmarks.

The Patient's Movement During Incubation Period:

The patient left Ayensa on 12 July to attend a wedding party. He passed Abongo, Abaley and Delhi villages, and crossed F. Dabus River on the 17th. He spent nights in Mali, Gadarif Omer, Tedasa and reached Mendi on the 21st. He stayed more than a week at Mendi, and then started his return journey. reaching Ayense on 5 August.

He stayed in that village until the 16th when he travelled to Geissan market in Sudan. On that same day he felt fever. On the 17th the rash appeared. On the 20th, he visited the dispensary at Geissan.

Containment:

The patient appeared to have severe chickenpox but since smallpox was still suspected, containment measures were carried out. All Sudan border villages near Ayensa were vaccinated. The Ethiopian MA was asked to visit 14 Ethiopian villages near Ayensa and give primary vaccinations.

The people were willing to participate and gather in each of the 14 Ethiopian villages. A donkey or mule was arranged to take the MA to each village from his dispensary.

It was agreed that vaccine would be supplied by Sudan at any time from the permanent checkpost. It was also agreed that the Sudan HQ team would stay in Geissan so that a meeting with the SEP team coming from Addis Ababa could be arranged.

On 29 August it was learned that the Ethiopian team could not leave Addis Ababa because of bad weather. A meeting was held with the Assosa District Administrator and the Assosa police officer, who came to settle troubles that broke out after the closing of the border.

The situation was well explained and a good agreement was was reached. The District Adminstrator welcomed any visit of Sudan SEP to Assosa and any effort on the borders. It was also agreed that since the Sudan team felt the suspected case was not smallpox, a message to that effect should be sent to Addis Ababa. On 3 September the Sudan team left Geissan.

Back to Khartoum:

The Commissioner of Blue Nile contacted the army for a reliable car to accompany the tractor to help the team to return. The team, hearing this good news, decided to wait in Geissan for the transport to arrive. After five days it was learned that the car was deeply stuck in Khor Tomat and that the helicopter was not available. The team decided to take the most reliable transport facilities for crossing Tomat waters and climbing mountains without getting stuck and thus mules were the choice.

The team spent two days travelling by mule, covering eighty miles. On the 3rd day a tractor was met at Abu Shasuna village and Damazin was reached at 1730 hours on 5 September. Two more days were spent waiting for a flight to Khartoum. On 8 September the team reached Khartoum.

Specimen Result:

On 29 September, the laboratory result for the specimen taken from Hamid El Toum was received from Geneva. Electron microscopy revealed Herpes Varicella particles.

CHAPTER (23)

PROGRAMME PERSONNEL AND FINANCES

In 1968, when Sudan committed itself to the goal of smallpox eradication, the obstacles to success were formidable. Among the obstacles were the limited resources available.

Sudan asked for and received assistance from the World Health Organization, but this assistance, while important, should not be overemphasized. The Sudan Smallpox Eradication Programme was a programme implemented, maintained and sustained by Sudanese. WHO personnel made important contributions and WHO and UNICEF equipment and supplies were crucial to programme success, but the final credit for the success of the programme should go to those Sudanese who participated in the programme, to the Government of Sudan which supported it, and to the people of Sudan, without whose cooperation success could not have been achieved.

Tables 13 and 43 show the number of SEP personnel, by province, for the 1968/69 and 1976/77 Financial Years. It is noteworthy that the total personnel during these two financial years is not greatly different, even though the programme in 1968/69 was not fully implemented. The explanation for this is that the Sudan SEP tried to engage its full complement of personnel from the beginning, so that they could be put to work in priority areas. Later, when the programme was expanded to the South and other areas, these personnel were transferred to those provinces where they were needed most. All personnel except the Operations Officers, who were transferred from other Ministry of Health programmes, were recruited locally and had not had previous experience as health workers.

SEP personnel were often asked to move to areas far from their homes and to stay in these areas for as long as several years. That they did so and continued to put forth high quality efforts is to their credit.

Tables 1 and 2 also make the point that the level of SEP personnel has been maintained at about 600 for the entire life of the programme, even though the last smallpox case occurred in December, 1972. This was essential because Sudan had to amintain a vigilant posture against importations from Ethiopia, where smallpox outbreaks continued to occur until August 1976. It is a credit to the Sudan Government that it has maintained its commitment to SEP at this same level during the almost 6 years that have passed since the last smallpox case in Sudan.

Table 44 shows the total annual expenditures for SEP activities by the Government of Sudan and by WHO from Financial Year 1967/68 to Financial Year 1976/77. It is clear from this table that expenditures on smallpox eradication in Sudan have been relatively modest. It is also clear that the great majority of these expenditures have been borne by the Government of Sudan itself.

STAFF OF SE/BCG PROGRAMME AT THE END OF FINANCIAL YEAR 1976/1977

Table (43)

Station	Nat. Director	H.Q. Sr. staff	PHI/PHO Op. & Maint.	Surv. Off.	Administr-ative staff	Store Keepers	Sec/Typists	Assessors	Supervisors	Vaccinators	Mechanics	Drivers	Refriger-ator Tech.	Messengers	Guard	Labourer	A/Cook	Total
Khartoum H.Q.	1	4	-	-	7	2	3	-	-	-	2	7	1	4	2	15	-	48
Khartoum Province	-	-	1	2	-	-	-	5	17	78	-	3	-	1	-	-	-	107
Gezira	-	-	1	1	1	-	-	2	4	35	1	3	-	-	-	-	-	48
Blue Nile	-	-	1	-	1	-	-	3	3	30	-	4	-	-	1	-	-	43
White Nile	-	-	1	-	-	-	-	2	3	21	-	4	-	-	-	1	-	32
Red Sea	-	-	1	-	-	-	-	1	2	12	-	3	-	-	-	1	-	20
Kassala & Gedaref	-	-	1	-	1	-	-	2	4	27	-	7	-	1	1	-	-	44
Nile	-	-	-	1	2	1	-	-	7	42	1	5	1	-	-	7	2	69
Kordofan	-	-	1	-	1	-	-	1	2	50	1	8	-	1	2	3	-	70
S. Darfur	-	-	1	-	-	-	-	-	2	18	-	4	-	-	1	-	-	26
N. Darfur	-	-	1	1	-	-	-	1	1	8	-	3	-	1	-	-	-	16
Upper Nile	-	-	1	1	3	-	-	1	1	15	-	5	-	1	1	8	1	38
Bahr El Ghazal	-	-	-	1	1	1	-	-	2	22	-	4	-	1	1	4	1	38
Equatoria	-	-	1	-	-	-	-	-	-	11	-	4	-	1	1	5	1	24
Total	1	4	11	7	17	4	3	18	48	369	5	64	2	11	10	44	5	623

N.B.:-

1) DEP. DIRECTOR)
2) C. ASS. OFFICER) Were not available at the time mentioned.
3) Posts of 10 labourers &, Refrig. Technician, in Khartoum were then vacant.

FINANCIAL CONTRIBUTION

Table 44

Budgetary funds of Government and WHO for Smallpox Eradication

Sources	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	Total
1. Central Government	LS.	LS.	LS.	LS.	LS.	LS.	LS.	LS.	LS.	LS.	LS.
a) Chapter 1	70 000	120 000	140 000	150 000	150 000	150 000	180 000	180 000	180 000	215 000	1 535 000
b) Chapter 11	25 000	40 000	120 000	250 000	200 000	225 000	215 000	170 000	130 000	135 000	1 510 000
2- Local Government	-	-	-	-	-	-	-	-	220 000	220 000	440 000
Total	95 000	160 000	260 000	400 000	350 000	375 000	395 000	350 000	530 000	570 000	3 485 000

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	Total
3. WHO	$	$	$	$	$	$	$	$	$	$	$
a) Staff costs (salaries & travel expenses)	18 160	20 028	20 309	38 580	39 720	31 672	16 300	23 532	26 174	17 500	251 975
B) Supplies & Equipment	74 400	21 000	20 000	10 000	14 000	5 000	12 000	20 000	20 000	20 000	216 400
c) Local costs	-	-	-	-	-	-	13 800	13 800	14 000	14 000	55 600
Total	92 560	41 028	40 309	48 580	53 720	36 672	42 100	57 332	60 174	51 500	523 975

A N N E X I

LIST OF TABLES

ANNEX II

LIST OF FIGURES

A N N E X III

LIST OF SPECIAL REPORTS

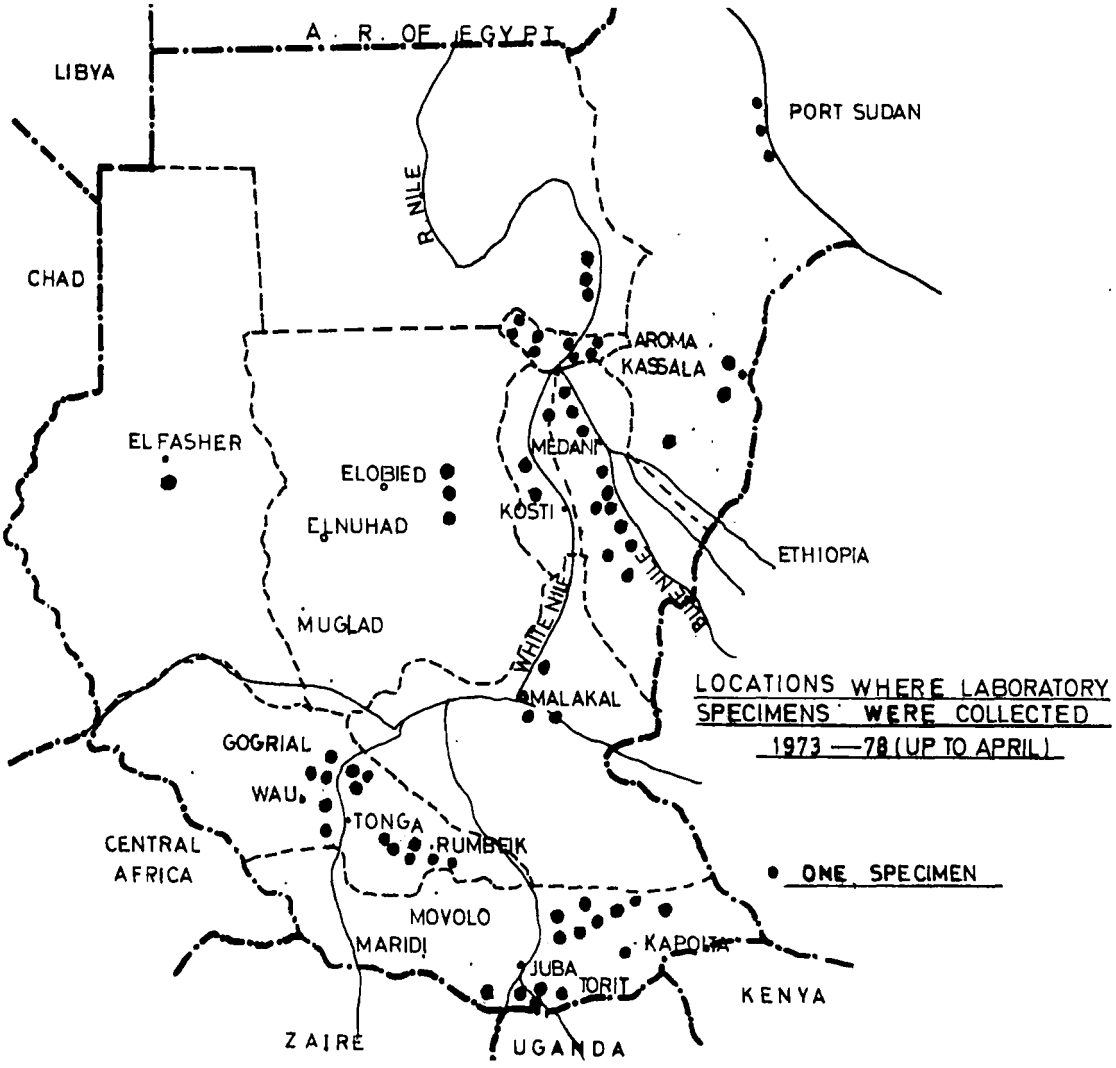
This list is by no means complete, but is representative of staff and consultant activities during and after eradication. Much of the information contained in the documents, particularly in the section on "Special Field Activities" comes from these reports:-

1.	Smallpox Outbreak in Sudan in 1969	G. Nikolaevski and S. Kalcic
2.	Report of Suki Outbreak in Blue Nile Province 1971	A. Q. B. Rahman
3.	Present Situation in the South and Plan of Action for the Three Provinces 1972	Omer El Hag Suleiman
4.	Imported Cases from Ethiopia 1972	F.Y. Khalifa
5.	Crash Programme in Upper Nile Province 1973	Moh. Abbas Idris
6.	The Smallpox Situation along the Ethiopian Sudan Border 1973	D.I. Francis
7.	Assignment Report 1973	J. Lepkowski
8.	Gobba Area in Gojjam Province, Ethiopia 1973	A. Gadir el Sid
9.	Metekal Awraja in Gojjam Province, Ethiopia, 1974	A. Gadir el Sid
10.		
10.	The Lafit Outbreak 1974	D. Bassett and G. Kebieda
11.	Brief Notes on Smallpox (Arabic) 1974	A. N. Ghanin
12.	Equatoria - Zaire Border Activites 1975	Hassen Babiker
13.	Khigle, the Unreachable Area 1975	S. Singh
14.	Cotton - Picking Camp Survey 1976	Hamad El Nil
15.	Ayensa. Suspected Smallpox Case Investigation (Ethiopia) 1976	A. Gadir el Sid and G. Kebieda
16.	Pockmark Surveys in Border Area with Ethiopia 1977	F. Y. Khalifa
17.	Facial Pockmark Survey in Old Smallpox Cases 1977	F. Y. Khalifa
18.	Surveillance Activities in Upper Nile Province 1977	D.O.F. Daniel
19.	Documents for Nairobi Meeting 1977	Abdel Hamid el Sayed
20.	Investigation of Rumour in Eritrean Refugee Camp, August 1978	A. Gadir el Sid

ANNEX IV

SPECIMENS TESTED FOR SMALLPOX BY WHO LABORATORIES BY PROVINCE 1972 - MAY 1978

Province	1972	1973	1974	1975	1976	1977	1978 up to May	Total
B. El Ghazal (includes Lakes)	0	3	7	1	1	2	1	15
Upper Nile	0	1	2	0	0	0	0	3
Equatoria	0	2	3	0	5	3	1	14
Kordofan	0	0	1	0	0	1	1	3
Khartoum	0	0	2	0	1	3	2	8
Kassala	0	0	1	0	2	0	0	3
Blue Nile (includes White Nile)	0	0	3	0	4	2	3	12
Red Sea	0	0	1	0	1	1	0	3
Nile	0	0	0	1	0	2	0	3
Darfur	0	0	0	0	1	0	0	1
Gezira	0	0	0	0	0	2	2	4
Unknown	2	5	0	9	1	0	0	17
Total	2	11	20	11	16	16	10	86



ANNEX V

REPORT OF SMALLPOX IN KASSALA PROVINCE[1]

Background:

The Sudan SEP HQ in Khartoum learned on 3 August 1978 that a Reuters correspondent had reported smallpox cases in an Eritrean refugee camp in Kassala Province and that this report had been released over the Reuters wire service.

Action by Sudan SEP:

Telegraph messages were sent immediately from SEP HQ to SEP Surveillance Officers in Red Sea, Kassala and Blue Nile Provinces, asking about any rumours of smallpox among Eritrean refugees or immigrants. Replies were received that there was no smallpox in any of these provinces.

From a telephone conversation with the SEP Surveillance Officer for Kassala Province it was learned that an Eritrean Medical Assistant had mentioned smallpox cases he had been treating to the Commissioner of Kassala Province when the Commissioner visited El Lafa camp (near Kassala) on 25 July, saying the cases had moved on to Khaam El Girba (2 hours distance by road). The Commissioner reported this to the Surveillance Officer when he returned to Kassala. Even though he had just returned from both camps himself, the Surveillance Officer agreed to re-visit the camps and investigate the rumour. This he did and the investigation determined that there was no smallpox in either camp or in the area. In fact, the Medical Assistant was contacted and he denied that he had ever said there was smallpox.

The Reuters correspondent and Representative of the United Nations High Commission for Refugees (UNHCR) for Sudan were met in Khartoum on 4 August. It was learned that the Reuters correspondent had not seen cases of smallpox but had been told of smallpox cases in El Lafa and Khaam El Girba Refugee Camps, near the Eritrean border. Without verifying this report he included the information in his next dispatch to London without being aware of the significance of such a report.

Both the Reuters correspondent and the UNHCR Representative agreed to accompany the WHO SEP Operations Officer to the border area in question so that a definitive statement could be made on the presence or absence of smallpox. The UNHCR Representative agreed to arrange for transportation to the border area. This proved to be difficult due to recent heavy rains, which have affected road, railroad, and scheduled air traffic to the area. These difficulties led to the intervention of the Under Secretary, Ministry of Health, who contacted the Minister. The Minister offered his services to arrange for transportation. In spite of the difficulties the Minister was finally able to secure the services of a single engine aircraft on 13 August.

Results of the Investigation:

1. The events described above were confirmed; i.e.,

   (a) During a visit to the El Lafa Refugee Camp just outside Kassala on 25 July, the Kassala Province Commissioner had learned of smallpox patients who had since moved to the Khaam El Girba Refugee Camp. This information was supplied by an Eritrean Medical Assistant working at the camp.

[1] Investigation by a WHO Operations Officer of report made by Reuters.

(b) The information was passed by the Commissioner to the Kassala Province SEP Surveillance Officer that same day.

(c) The Surveillance Officer visited both El Lafa and Khaam El Girba to investigate the rumour. No smallpox was found. During this investigation the Eritrean Medical Assistant was questioned, but he denied ever saying there was smallpox.

(d) The Reuters correspondent heard hearsay repetition of the Medical Assistant's statement about smallpox. Without verification, this hearsay information was included in a dispatch to London which was later repeated on the wire service.

2. On 13 August, the Reuters correspondent, the UNHCR representative and the WHO Operations Officer met with the Commissioner of Kassala Province, all other provincial leaders and all senior health staff. It was learned that very extensive searching for smallpox had been carried out since the rumour was first mentioned on 25 July, but that no evidence of even suspected smallpox had been found.

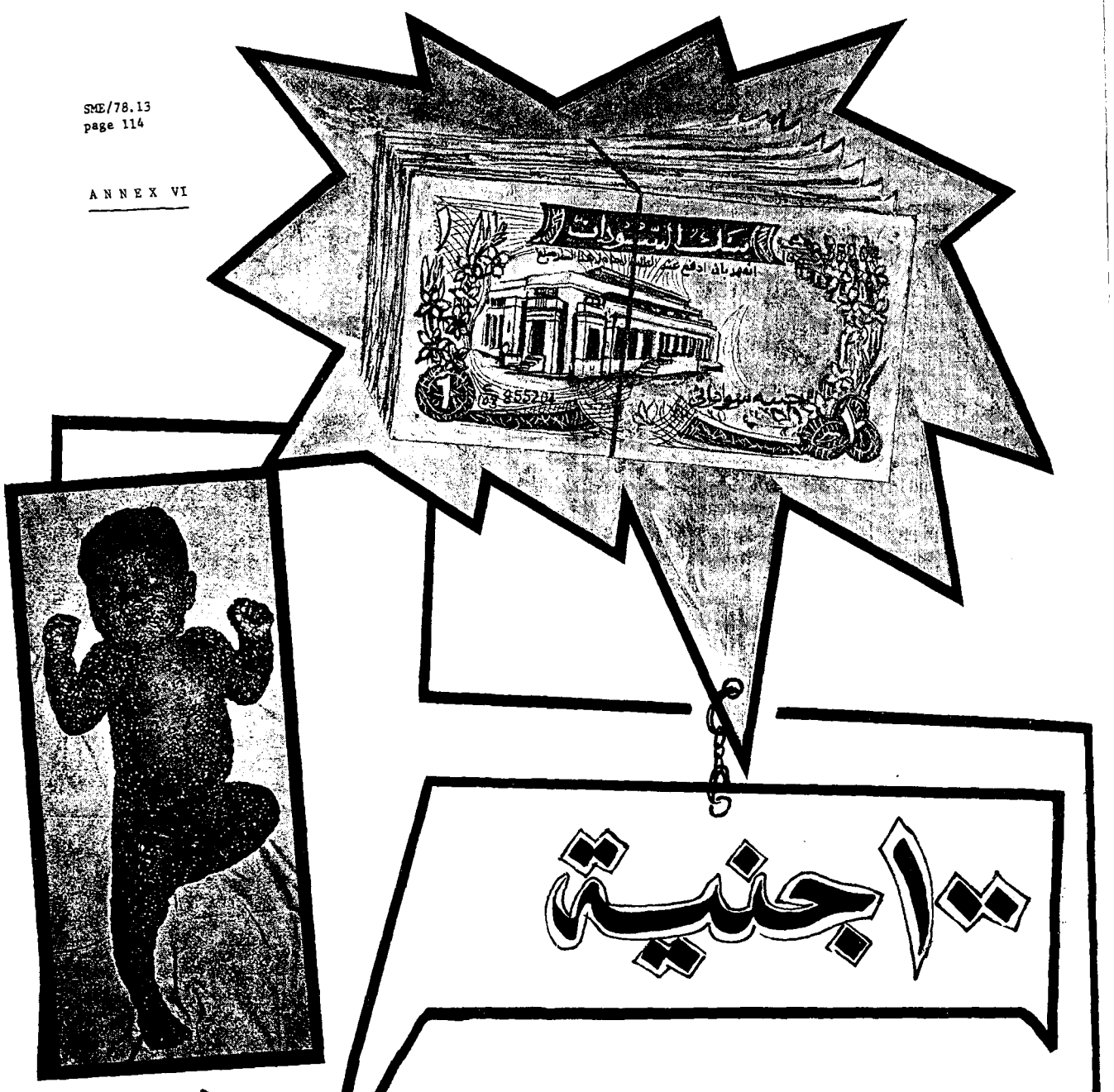
3. During the meeting it was learned that two chickenpox cases had been detected in Khaam El Girba camp on 7 August. It was decided that a visit should be made to the camp to see these cases.

The visit was made and the cases were found already recovered. Both cases had successful smallpox vaccinations. They could not be considered suspect smallpox cases. A specimen was collected.

Summary:

The report of smallpox in refugee camps just inside the Sudan border, Kassala Province, stimulated immediate action on the part of Sudan SEP. It has been determined that the report was based on unverified and unfounded hearsay. Nevertheless, thorough searching was conducted in the two refugee camps in question and in the surrounding area. No evidence of even suspected cases of smallpox was found.

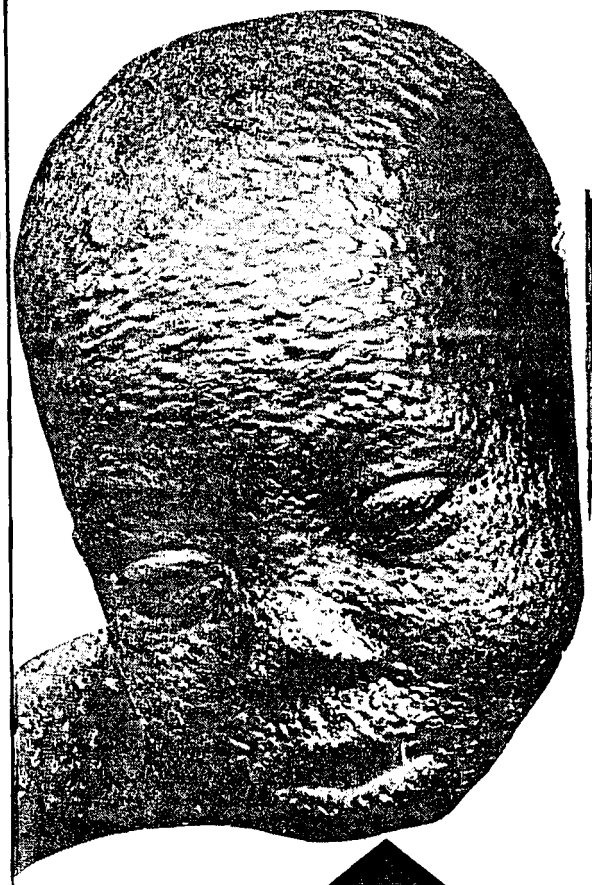
ANNEX VI

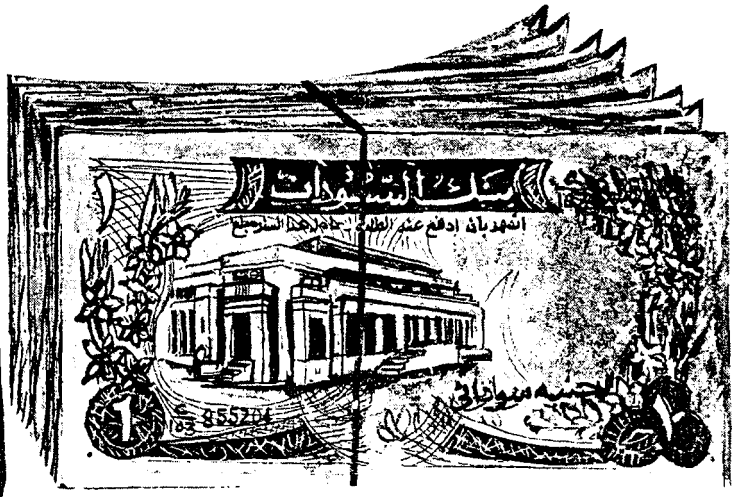


١ جنيه

لمن يبلغ عن حمالة

جدري حقيقي





100 LS POUNDS REWARD FOR THE REPORTER OF A SMALLPOX CASE

SMALLPOX ERADICATION PROGRAMME

MINISTRY OF HEALTH