



INTER-REGIONAL CONFERENCE ON
MALARIA FOR THE EASTERN MEDITERRANEAN
AND EUROPEAN REGIONS

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INFORMATION ON THE MALARIA CONTROL PROGRAMME
IN THE SUDAN¹

1. Present status of malaria control in the country
 - 1.1 Recently estimated population of the country: 9 754 000 (1953/1954 estimate)
 - 1.2 Number of inhabitants living in malarious regions: practically the whole population of the Sudan is seasonally exposed to risk of malaria.
 - 1.3 Malaria morbidity and mortality statistics: malaria is legally notifiable, but the only figures of any value are derived from returns from hospitals and dispensaries. Figures relating to the incidence of malaria for the past 15 years are:

Year	Malaria morbidity		Malaria mortality (Deaths in hospital)
	Admissions to hospitals	Out-patient attendances	
1939	9 393	139 921	88
1940	9 545	113 817	45
1941	8 551	100 979	60
1942	15 574	118 763	91
1943	14 241	153 551	117
1944	14 079	185 345	144
1945	14 007	213 606	195
1946	16 515	321 120	213
1947	13 910	251 688	253
1948	12 546	257 988	196
1949	14 360	219 226	210
1950/51 (18 months)	38 788	527 864	431
1951/52	16 016	245 049	289
1952/53	18 308	318 558	318
1953/54	16 153	336 230	294

¹ From the report submitted by the Ministry of Public Health in March 1955 to WHO, Regional Office for the Eastern Mediterranean.

In 1939 the total admissions to hospitals were 105 103

In 1939 the total out-patient attendances were 7 119 973

In 1953/54 the total admissions to hospitals were 172 675

In 1953/54 the total out-patient attendances were 14 483 366

The last quoted figures illustrate the expansion of medical services that has taken place and the increased demand for orthodox medical care that has arisen in recent years. In the light of this general expansion it is considered that any figures relating to a specific disease need extremely cautious interpretation.

1.4 Total population directly protected against malaria, by any method of control, in 1953: a rough estimate is 2 337 000.

1.5 Areas where the population was directly protected in 1953: protected areas are mainly in the Blue Nile Province (Gezira irrigated area, Fung district), in the Northern Province and in the Kordofan and Darfur provinces.

1.6 Data detailed in Annex I.

1.7 Information on the evaluation of the results of the campaign; see the note under 1.3. Malaria in the northern provinces of the Sudan, and to a less extent also in the southern provinces, is seasonal. There is a good deal of unprecise evidence that the incidence varies with the rainfall, but there are numbers of factors not easily calculable, such as the spacing of rainfall, nature of the Nile flood, cold weather possibly influencing overt relapses.

For reasons described under 1.3 it is difficult to make numerical measurement of the results of mosquito control measures on malaria incidence. It was not practicable to obtain basic data regarding spleen rates or parasite rates. The best numerical measurement available is the number of cases of malaria diagnosed over four years in the same 24 dispensaries in the Gezira irrigated area. In the 12 months, July 1950 to June 1951, adult control was not practised in the area covered by these dispensaries. It has been practised in subsequent years:

Year	No. of cases diagnosed as malaria	Recorded rainfall
1950/51	20 684	327.3 mm
1951/52	4 336	255.6 mm
1952/53	4 351	414.4 mm
1953/54	3 528	338.5 mm

1.8 Information available, if any, on general improvements that may have followed malaria control. It is submitted that the best evaluation available comes from reports of field inspectors in cotton growing districts. It is generally stated that before the use of insecticides for control of adult mosquitos, it was usually difficult to find adequate labour in the cotton fields after the rains. This difficulty has become considerably less since the use of residual spraying.

2. Organization, methods, and training facilities of the present programme

2.1 Organization

With the exception of a few large towns, malaria control is the responsibility of the central government and the cost is borne against the Ministry of Health budget. Decisions as to control measures to be adopted, type of imagocide or larvicide to be employed and use of drug prophylaxis, are made by the Director, Medical Services. Technical instructions as to mode of use of the various agents employed are issued by the Director. The directorate maintains a fairly close inspectorial supervision over antimalaria organizations.

In each province a Province Medical Officer of Health is responsible for the antimalaria organization. In practical charge is the Senior Public Health Inspector of the province. In each district the Province Medical Officer of Health exercises his control through the medical inspector, working with whom is a public health inspector.

Under the public health inspector are a number of sanitary foremen (overseers). These exercise direct supervision over the permanent staff employed in larval control and over the casual labour engaged for residual spraying operations.

The usual spraying team consists of three men. The senior public health inspector is responsible for their training. Frequently it is possible to allot an experienced employee from the permanent staff to each team. According to the size of the area to be covered, teams operate separately or squadded together. In a close-knit area such as the Gezira irrigated area, local inhabitants usually provide voluntarily the means of transport for the teams from one village to the next only at a short distance. In rural areas with a more scattered population it is necessary to provide mechanical transport. Under such conditions it is desirable that the teams work "squadded".

The underlying principle of adult mosquito control is that the whole area to be sprayed should be covered in the shortest possible time at the start of the appropriate season.

2.2 Methods of malaria control

2.2.1 (a) In large towns larval control is generally adopted. Residual spraying may be used in the face of exceptional epidemic risk. Perimeter spraying of towns is widely adopted.

(b) On account of population density and economic importance, combined adult and larval control is practised in the major cotton cultivations.

(c) In other rural areas and in small towns residual spraying is solely employed.

2.2.2 The use of antimalarial drugs is limited to certain disciplined communities, such as schools, army, police, prisons, under conditions of special risk.

2.3 Training facilities

Training of public health inspectors and sanitary foremen is done at the School of Hygiene, Khartoum. Training of sanitary foremen for the southern provinces is done by the senior public health inspector, Juba. Senior public health inspectors are responsible for training field staff.

3. Plans for the future

Since malaria control extends already to some degree over much of the accessible areas of the Sudan, it is not possible to indicate on a sketch map plans for extension of the areas to be protected. In brief, future plans include:

(a) the extension of adult control to the whole loop of the Nile from Wadi Halfa to Merowe. At present a system of combined larval and adult control is practised in this area. The population involved is 351 000.

(b) The extension of residual spraying operations in the Fung district of Blue Nile Province. At present it is restricted to larger villages. The population involved is 283 000.

Year 1953

1. Area of operations. Residual spraying as a means of adult mosquito control was first introduced in 1946. Initially the insecticide employed was a solution of DDT in kerosene and operations were restricted largely to perimeter spraying in certain urban areas. Following apparently successful pilot schemes in 1949 and 1950, residual spraying as a widespread means of malaria control in rural areas was introduced in 1951.

It is considered that an attempt to give with precision the area of operations as required in Annex I, would be misleading owing to the large area of the Sudan and the variation in population density. For example, in the Gezira irrigated area population is dense and inhabited centres are close together. It may be claimed that the whole of this area, approximately 1500 square miles, is included in the area of operations. On the other hand, in the southern part of the northern province (area approximately 43 000 square miles) practically the whole of the settled population has been afforded the protection of residual spraying through operations, confined only to the riverain area of the province. In these riverside strips, villages may be almost contiguous, followed by stretches of several miles between villages.

An estimation is even more difficult in areas such as Fung district (26 000 square miles), Kordofan Province (147 000 square miles) or Darfur Province (192 000 square miles). In those areas residual spraying has been applied to a number of the settled villages, but these centres may be many miles separated.

2. Number of houses and all other structures sprayed. It has been the general practice to keep record of the number of rooms sprayed. A "room" may vary from the mosque to the lowliest out-house of a village dwelling. When spraying of an inhabited centre is undertaken, all "rooms" so defined in which Anopheles might harbour, are included. It has been calculated that the mean area sprayed of a "room" so defined is 600 square feet.

Annex I

Owing to the decentralization necessitated by the large areas covered by spraying operations, it is not claimed that an accurate record of all rooms sprayed, is obtainable. The scope of residual spray operations in the Sudan has been successively described in the Reports of the Medical Services, Ministry of Health 1950/51, 1951/52 and 1952/53.

The following table gives the approximate number of rooms sprayed in successive years. However, a great deal of spraying operations undertaken in the more distant rural Sudan are not included in these figures.

Year	Number of rooms sprayed		
	1st cycle	2nd cycle	3rd cycle
1949	20 000	-	-
1950	40 000	-	-
1951	584 000	584 000	99 000
1952	640 000	640 000	41 000
1953	746 000	739 000	25 000

3. Population directly protected (i.e. living in sprayed structures). It is considered that this information cannot be given with sufficient approximation.

4. Population protected by other methods of control. It is not considered that this information can be rendered sufficiently nearly.

5. Number of sprayings in the year. The incidence of malaria in the northern provinces is thought to be much influenced by climate, particularly rainfall. Breeding of A. gambiae rarely becomes marked until after onset of rains. The usual plan of residual spray operations includes a first spraying cycle about July and a second in October. (This interval between cycles is necessitated by the impracticability of transport during the rains.) In certain districts it is

Annex I

thought that a single spray cycle at the onset of Anopheles breeding is all that is economically practicable. In other districts it is considered that a third spray cycle about January may offset the risk of Anopheles breeding in river pools.

6. Insecticides and formulations used: total annual consumption:

	DDT Wettable Powder 50%		BHC (Gammexane P. 520 at 6.5% gamma isomer)	
		kg		kg
1949	19 500 lbs	8 775	2 200 lbs	990
1950	18 500 "	8 325	40 000 "	18 000
1951	27 000 "	12 150	240 000 "	108 000
1952 (? Ed)	166 000 "		250 000 "	112 500
1953	20 200 "	9 090	570 000 "	256 500

7. Average dose of insecticide per square foot, for each spraying: DDT, approx. 185 mg/sq. ft: BHC, not less than 10 mg/sq. ft.

8. Types of sprayers used: Mysto hand sprayer tried and discarded.
Knapsack sprayer tried and discarded.
Compression sprayers tried and discarded.
Stirrup pump sprayers are now standard.

9.)
10.)
11.) no data
12.)
13.)