REPORT

OF THE

MEDICAL SERVICES, MINISTRY OF HEALTH
SUDAN GOVERNMENT

FOR THE YEAR

1951/52

(McC. 3933) S.G. 1974 M. of H. 350 Bks. 10/52.

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CONTENTS.

CHAPTER I.

INTRODUCTION.

This report refers to the twelve months period from 1st. July, 1951 to 30th. June, 1952.

Proposals submitted by the Ministry for the expansion and improvement of Health Services in the Sudan during the period 1951 to 1960 were passed by the Legislative Assembly. A major aspect of the programme was a greater emphasis on public health by appointing full time public health specialists in all provinces and a considerable increase in staff employed in public health. It was planned to provide the services of clinical specialists in all province hospitals.. Provision was made for a considerable extension of hospital and dispensary services both by building additional institutions and increasing accommodation and strengthening staff in established units.

Implementation of the projects in the first year of the programme went more slowly than planned. Limitations of building potential and rising costs enforced some lag in building construction. It was not possible to recruit all the additional staff required. Delivery of motor transport fell below demands.

The Kitchener School of Medicine was, in September, 1951, incorporated into the University College of Khartoum as a Faculty of Medicine.

There has been for many years an almost unbroken upward trend in the amount of work done in hospitals and dispensaries. It cannot be determined to what extent this trend is due to widened facilities, a greater public readiness to seek orthodox medical aid and an increased population. It is not believed to represent an increase in the real incidence of ill-health. It is certain that the Sudan is no nearer than other countries to a solution of the dual problem of an evergrowing demand for medical treatment and a progressive rise in the cost of treatment. Theoretically improvements in social and sanitary environment should be followed by lessened pressure on curative services. So far general experience has not borne out the theory.

The rains in many parts of the country were light. Food scarcity was reported from some parts. Crops in the Gezira Irrigated Area were below average. There was a general rise in the cost of living.

Epidemic cerebrospinal meningitis visited the northern provinces for the third successive season. The incidence was less than in 1951 and the outbreak waned early. The organisation for finding and treating cases worked well and the outcome of treatment was relatively good. The disease appeared in epidemic form in the Bahr el Ghazal in 1952.

Smallpox was introduced into Darfur early in 1952 by travellers from French Equatorial Africa. A troublesome epidemic resulted.

An extensive measure of adult mosquito control by residual sprays, using mainly *benzene hexachloride* (Gammexane), was initiated in rural areas. It was estimated that much increased protection against insect-borne disease was afforded to some two millions of the population.

A policy of substituting bucket closets and pit latrines by a flushless septic tank (Water Privy) was introduced.

Visits were received from representatives of the Eastern Mediterranean Region of the World Health Organisation and the Eastern Mediterranean Area of the United Nations Invalid Childrens' Emergency Fund. These visits were mainly to examine and discuss the problems of epidemic cerebrospinal meningitis and immunisation against tuberculosis by B.C.G. vaccine. The Government has formally requested assistance to start projects for control of the former and undertaking the latter.

CHAPTER II.

ADMINISTRATION.

(a) STAFF AND FUNCTIONS

Table I shows the strength of classified staff. It was not possible to bring the strength of all cadres of professional and technical staff up to the approved establishment. This shortage of staff is the most serious factor today. The table includes officials who were serving on secondment with local government authorities.

TABLE I.

	Establishment		
	British	Sudanese	Others
HEADQUARTERS.			
Director	1		
Deputy Director	1		
Asst. Director (Public Health)	1		
Asst. Director (Hospitals)	—	1	
D.A.D. (Quarantine)	—	1	
Inspector of Administration	1	—	
Controller, Medical Stores	1		
Establishment Officer		1	
Principal Matron	1		
Chief Public Health Inspector	1		
Principal School of Hygiene	1		
Labour Officer		1	
Head Staff Clerk		1	
Staff Clerk		2	
Clerk		29	
Head Accountant			1
Accountant		2	
Bookkeeper		25	
Superintendent of Stores		1	
Asst. Superintendent Stores			1
Stores Supervisors		6	
Storekeepers		16	
HOSPITALS AND DISPENSARIES.			
Director Khartoum Civil Hospital and Senior Physician	1		
Senior Surgeon	1		
Asst. Surgeon	1		
Senior Obstetrician and Gynaecologist	1		
Director, Omdurman Civil Hospital		1	
Medical Inspector	17	28	
Anaethetist	1		
Women Doctors	5		
Dental Surgeon	1		
Dental Officer		1	
Superintendent Radiographer	1		
Ophthalmologist		1	
Asst. Ophthalmologist		1	
Obstetrician and Gynaecologist, Omdurman		1	
Senior Medical Officer		5	
Surgeon, Omdurman Civil Hospital		1	

Category	Establishment		
	British	Sudanese	Others
Pharmaceutical Registrar			1
Medical Officer		47	
Asst. Registrar		4	
House Surgeon and Physician		10	
Hospital Superintendent		3	
Pharmacist, Omdurman Civil Hospital			1
Province Medical Assistant		10	
Medical Assistant		386	
Southern Medical Assistant		26	
Asst. Radiographer		14	
Dispenser		26	
Charge Nurse		5	
Nursing Instructor		10	
Matron	3		
Charge Sister	11		
Nursing Sister	17		
Theatre Attendant		39	
Bash-Mumarid		40	
Clerk		34	
Southern Clerk		1	
Ration Clerk		28	
Bookkeeper		54	
Southern Bookkeeper		1	
Storekeeper		18	
Telephone Operator		6	
Quarantine Overseer		1	
Southern Trainee..		10	
Staff Nurse		20	
Public Health.			
Medical Officer of Health Khartoum			1
Asst. Medical Officer of Health Khartoum			1
Senior Public Health Inspector	4		4
Public Health Inspector	1		7
Public Health Officer			29
Sanitary Overseer			151
Principal, Midwives Training School	1		
Charge Sister	1		
Supervisor, Health Visitor	1		
Clerk			5
Senior Staff Midwife			5
Staff Midwife			7
Staff Health Visitor			2
Health Visitor			15

Category	Establishment		
	British	Sudanese	Others
RESEARCH AND LABORATORY SERVICES.			
(i) *Stack Medical Research.*			
Asst. Director (Research)	1		
Bacteriolcgist		1	
Asst. Bacteriologist (Pathologist)	1		
Senior Laboratory Assistant	3		
Laboratory Assistant	1	48	
Southern Laboratory Assistant		2	
Head Laboratory Attendant		1	
Junior Technical Assistant		1	
Clerk		2	
(ii) *Medical Entomology.*			
Medical Entomologist	1		
Aedes Control Officer		1	
Technical Assistant		3	
Clerk		1	
(iii) *Wellcome Chemical Laboratories.*			
Senior Scientific Officer	1		
Scientific Officer	1		
Senior Technical Assistant		2	
Technical Assistant		5	
Junior Technical Assistant		3	
Clerk		1	
(iv) *Schistosomiasis Research (Gezira).*			
Fresh Water Biologist	1		
Senior Technical Assistant		1	
Technical Assistant		1	
Clerk		1	
Storekeeper		1	
GRAPHIC MUSEUM.			
Technical Assistant		1	
Museum Attendant		1	
SECONDED UNIVERSITY COLLEGE OF KHARTOUM.			
Dean, Kitchener School of Medicine	1		
TOTAL	86	1,122	4

The unclassified staff (*i.e.* employees not on establishment) number 4,300 approximately.

(b) LEGISLATION

The following legislation affecting public health was enacted during the year:—

Ordinances

Date	Short Title	Provision
15.7.1951	The Local Government Ordinance, 1951.	To define the powers of Local Government Authorities.

Regulations and Orders.

Date	Short Title	Provision
15.7.1951	The Quarantine Regulations, 1930 Amendment No. 1 Regulations.	Cancelling power to issue pilgrims passports under the regulations.
15.9.1951	Khartoum Province Minimum Area and Frontage (Shops and Markets Area) Order	To define minimum area and frontage of a plot on which a shop may be built.
15.10.1951	Khartoum and Khartoum North Building Plots Minimum Area Order.	To define minimum size of building plots on classified building land.
15.5.1952	The Quarantine (Smallpox) Regulations, 1952.	Measures to be enforced against introduction of smallpox from Egypt or French Equatorial Africa.

(c) FINANCE.

Table II (A)

Income and Expenditure of Medical Services over the past four years.

Item	1948	1949	1950/51	1951/52
	£E.	£E.	£E.	£E.
Revenue	54,393	42,279	61,845	40,418
Expenditure :				
Personnel and Personal Allowances ..	537,691	594,508	1,208,239	970,878
Services	348,891	414,245	926,374	684,580
Extraordinary	8,837	6,992	35,434	27,412
Total	895,419	1,015,745	2,170,047	1,682,870

Table II. (B)

Analysis of the Expenditure—1951/52.

Section	Personnel	Services	Extra-ordinary	Total
	£E.	£E.	£E.	£E.
Headquarters	66,976	197,322	—	264,298
Hospitals and Dispensaries	725,720	416,220	27,412	1,169,352
Hygiene and Public Health	140,664	67,229	—	207,893
Research	36,609	3,808	—	40,417
Graphic Museum	910	—	—	910
Total	970,879	684,579	27,412	1,682,870

CHAPTER III.

PUBLIC HEALTH.

(a) HEALTH OF OFFICIALS.

Table III.

NATIONALITY		Number of officials employed	Number * Placed on sick list	No. of days sick	Average days sickness		Died	Invalided
					For all officials	For those who were sick		
British	1950/51	1,004	361	2,850	2.83	7.89	4	4
	1951/52	1,028	553	1,573	1.53	2.85	0	6
Sudanese	1950/51	5,975	2,473	22,314	3.73	9.02	7	21
	1951/52	6,496	2,620	17,615	2.71	6.76	2	8
Others	1950/51	213	229	1,709	8.60	7.46	0	2
	1951/52	191	160	1,121	5.87	7.00	0	3

* The figures in Column 3 refer to the number of times an official of that category was placed on the sick list.

(b) GENERAL HEALTH.

Table IV illustrates an almost uninterrupted increase in work done in hospitals and dispensaries during the past ten years.

TABLE IV.

Work done in hospitals and dispensaries.

YEAR	Admissions	Attendances	Operations
1942	114,837	6,750,329	11,353
1943	112,275	6,795,372	12,726
1944	131,077	7,077,919	13,796
1945	131,571	7,897,148	15,455
1946	126,586	8,474,874	15,509
1947	142,294	9,253,251	16,785
1948	140,511	9,820,304	17,573
1949	151,011	10,186,668	21,327
1950/51 (18 months)	302,526	16,503,371	31,459
1951/52	168,251	12,181,931	26,021

There were 51 licensed private medical practitioners in June 1952. This number has steadily increased since the war. No figures are available of the number of patients attended by them, but it must add appreciably to the sum total of medical work done.

(c) VITAL STATISTICS.

No accurate census of the population of the whole country has been taken. The estimated population figures for the provinces as given in Table V must be accepted with some reserve.

TABLE V.

Estimated population of provinces

Province	Population			
	Men	Women	Children	Total
Bahr El Ghazal	220,345	206,340	397,736	804,321
Blue Nile	464,487	551,950	770,765	1,787,202
Darfur	226,204	356,389	448,367	1,030,960
Equatoria	170,576	185,103	296,865	652,544
Kassala	231,732	237,687	356,268	825,687
Khartoum	143,393	133,855	217,784	495,032
Kordofan	408,339	506,662	802,255	1,717,256
Northern	189,625	256,529	331,594	777,748
Upper Nile	201,480	252,537	407,013	861,030
TOTAL	2,236,181	2,686,952	4,028,647	8,951,780

TABLE VI.

Estimated population of the towns of Khartoum, Omdurman and Khartoum North.

Town	Estimated population.			Total
	Men	Women	Children	
Khartoum	30,952	24,905	26,816	82,673
Omdurman	34,686	43,907	51,824	130,417
Khartoum North	13,714	12,107	18,389	44,210
TOTAL	79,352	80,919	97,029	257,300

Registration of births is believed to be fairly complete in the Three Towns. Registration of deaths is probably nowhere complete.

TABLE VII.

Number of registered births and crude birth rate. Khartoum, Omdurman and Khartoum North.

Town	No. of Births	Birth rate per 1000.
Khartoum	1,949	23.6
Omdurmen	3,409	26.1
Khartoum North	1,064	24.1

(d) PREVENTIVE MEDICINE.

1. Insect-borne Diseases.

(a) *Malaria.* The incidence of malaria in many parts of the Sudan tends to vary with the amount of the rainfall.

The rains of 1951 were generally moderate and, in consequence, it was anticipated that the incidence of malaria would be relatively low.

In rural areas emphasis in malaria prevention was largely shifted to control of adult mosquitoes by means of insecticidal residual sprays in place of traditional measures of larval control. The gamma Isomer of benzene hexachloride (Gammexane Dispersible Powder, P.520) was the insecticide mainly used, applied as a suspension in water by means of Vermoral stirrup pumps, at a rate calculated to leave a deposit of not less than 10 mgms. of gamma B H C per sq. foot of surface sprayed.

An ambitious project to spray all buildings in the Gezira Irrigated Area was twice carried through successfully, in June- July and September—October. The work was done economically with staff consisting of mosquito men and casual labour. The spraying unit was a team of three men. Teams were squadded and one or more squads were allotted to each of the five public health districts of the Irrigated Area. Within the districts the squads worked systematically through each block and its contained villages. Squads were lifted from village to village in the vehicles of the inspecting officials or, more usually, on donkeys lent by the populace. About 6 weeks were necessary to cover the whole area. The success of the undertaking was due to :—

(i) Careful estimation of the number of rooms to be sprayed made by the public health inspectorate and local government staff.

(ii) A well contrived plan for dumping supplies of insecticide in villages before the rains.

(iii) Efficient supervision by the public health inspectorate.

(iv) Hearty co-operation and assistance from the populace.

1,452 villages and cantonments, a total of 194,981 rooms, were sprayed twice. The total amount of B H C used was 101,797 lbs.

All villages in the Rural District of Khartoum Province, a total of 99,264 rooms, were sprayed on three occasions with Gammexane P.520. The work was done by lorry-transported squads. A single spraying occupied 6 weeks to cover the district.

Spraying in the riverain area of Northern Province, comprising about 158,119 rooms, was carried out twice in the period mid-July to mid-March. 52 men in two parties, one on each bank, were transported in two lorries.

Residual spraying was also done in Kosti, Ed Dueim and Sennar districts of Blue Nile Province ; in El Fasher; Nyala and Geneina of Darfur ; in Kassala and adjacent villages, Gedaref and Aroma of Kassala Province ; round the perimeter of El Obeid town and suburban villages, Nahud, Dilling, Kadugli, Talodi and Rashad in Kordofan; Malakal in the Upper Nile ; Wau in the Bahr-el-Ghazal ; and Juba with other towns of Equatoria. All out-stations of the Sudan Railways were sprayed by teams carried by train from station to station.

As anticipated from the climatic conditions the general incidence of malaria was relatively low. On the other hand the result of favourable weather may have in part been offset by the occurrence of a large number of relapsed cases of fever following the epidemic state of 1950. These natural factors make it difficult to assess the value of residual insecticide adult control. It is considered that it will be possible to draw final conclusions as to its effectiveness only after the experience of a succession of seasons.

The method is not likely to be more expensive than traditional larval control in that the number of mosquito-men permanently employed is much reduced. Such mosquito-men were, in many areas, largely unnecessary for 9 months of the year while, during the rains conditions were wont to become beyond control by larvicidal precautions.

It is not likely to be economically or administratively practicable in the Sudan to estimate the efficacy of mosquito control measures by means of parasite rates, splenic indices or comprehensive observations on mosquito density. Reliance must be placed on such cruder standards as returns from dispensaries, reports of field inspectors on the labour state, common report and sample entomological inspections.

1949 in the Gezira was a year of light rains and comparable to 1951. Only traditional larvicidal measures were undertaken in 1949 in the area covered by the Medani district dispensaries. The following figures of cases of malaria reported by these dispensaries in 1949/50 and 1951/52 suggest that some factor was responsible for a lessened incidence of malaria in this district of the Gezira during the second season.

	July 1949—June 1950 Cases of malaria	July 1951—June 1952 Cases of malaria
July	650	653
August	800	317
September	1,000	614
October	1,100	787
November	1,150	632
December	850	425
January	1,372	489
February	1,417	598
March	1,300	628
April	1,305	458
May	1,025	563
June	890	320
TOTAL	12,859	6,586

There was no doubt that Gammexane caught public imagination and was accorded full credit for the lessened malaria incidence in 1951/52. Additional to its probable value in the reduction of malaria it may be surmised that residual spraying contributed to the reduction of other insect-borne disease and to the comfort of life by lessening the number of insect nuisances in the home. The lethal. action of B.H.C. on scorpions was most useful propaganda.

The Medical Entomologist reported that during the usual breeding season the larvae of *Anopheles gambiae* were so scarce in the Gezira that it was difficult to obtain enough for experimental purposes. It could not be said whether this unusual phenomenon was due to the adult control measures or the light rains.

Throughout the country 16,016 cases of malaria were admitted to hospital 289 deaths were attributed to the di ase.

Table VIII shows the total attendances diagnosed as malaria in out-patient departments compared with two-thirds of such total for the eighteen months January 1950—June 1951. The value of such comparison is partly impaired by the largely seasonal incidence of malaria in the Sudan. Moreover, recorded attendances for treatment give a very incomplete representation of the real incidence. Particularly in an epidemic season as during the latter period a large number of cases were treated in their homes by peripatetic therapeutic teams and by self-medication using drugs distributed through local authorities. In a normal year following an epidemic year the occurrence of relapsed cases may prejudice the picture.

TABLE VIII.

Outpatient cases of malaria—1950/51 and 1951/52.

PROVINCE	2/3 Attendances for Malaria 1950/51	Attendances for Malaria 1951/52
Bahr El Ghazal	4,144	7,442
Blue Nile	129,326	85,727
Darfur	18,848	17,987
Equatoria	24,140	26,052
Kassala	38,272	22,169
Khartoum	21,638	13,679
Kordofan	56,270	41,612
Northern	47,840	18,884
Upper Nile	11,550	11,497
TOTAL	352,028	245,049

TABLE IX.

Species of parasite in 9,446 positive slides

Province.	*P. falciparum*	*P. vivax*	*P. malariae*	Total
Bahr El Ghazal	1,202	19	2	1,223
Blue Nile	1,794	221	9	2,024
Darfur	422	80	0	502
Equatoria	2,376	69	21	2,466
Kassala	564	19	0	583
Khartoum	596	46	1	643
Kordofan	1,110	80	4	1,194
Northern	625	56	0	681
Upper Nile	130	0	0	130
TOTAL .. .	8,819	590	37	9,446

(b) *Blackwater fever.* 9 cases with one death were reported.

(c) *Relapsing fever.* The reported incidence of this disease was the lowest on recent record. Only 12 cases were notified. There were no deaths.

Relapsing fever in the early years of the present century was regarded as a rare condition in the Sudan. In 1926 Darfur was attacked by a very severe epidemic. The infection was believed to have spread from West Africa. The outbreak was not brought under control until 1928. In 1930 and 1931 the disease became established in mildly endemic form in the Gezira Irrigated Area and then practically disappeared until 1937. From this year the condition again became endemo-epidemic in most of the central provinces and reached peaks of 22,672 cases in 1944 and 17,392 cases in 1945. The Gezira Area of the Blue Nile Province was the major focus of infection. Darfur and Kassala provinces were seriously involved. There were considerable outbreaks in Kordofan Province in 1943, 1944 and 1945 ; in Khartoum Province in 1943 and 1944 ; in the Upper Nile Province in 1944, 1945 and 1946. Since 1946 the disease has subsided to insignificant proportions.

It has been tempting to attribute the decline of the disease since 1946 to the introduction of D.D.T. anti-louse powder as a control measure. The earlier history of the condition suggests that there may be unexplained natural factors involved.

Table X.

Relapsing fever : Cases and deaths over ten years.

Year	Cases	Deaths
1942	5,287	559
1943	10,505	668
1944	22,672	310
1945	17,392	444
1946	1,952	65
1947	568	67
1948	287	8
1949	376	3
1950	36	2
1951/52	12	0

Table XI.

Relapsing fever 1951/52. *Distribution of cases in provinces.*

Province	Cases.
Blue Nile	0
Darfur	2
Equatoria	3
Khartoum	2
Kordofan	2
Upper Nile	3
	12

Relapsing fever has not in late years been reported from the two southern provinces. Some doubt exists as to the accuracy of diagnosis in three cases reported from Meridi district of Equatoria Province.

(d) *Leishmaniasis.* The recorded incidence of kala-azar showed a considerable increase. The main distribution of the disease retained its oddly patchy character. Singa district is the main focus in the Blue Nile Province. In Equatoria the infection exists almost exclusively around Kapoeta. Gedaref district produced the great majority of the cases notified in Kassala Province. Most or all of the cases diagnosed in Khartoum were probably introduced from other localities.

There was a considerable epidemic in Melut—Paloic area of the Upper Nile Province. It was difficult to estimate incidence as the outbreak started in the rains and touring was restricted. Local report attributed 112 deaths to the disease up to the end of December, 1951. A laboratory assistant undertaking a survey found 34 positive cases on spleen or gland puncture. From September, 1951 to February, 1952 a total of 205 cases, of which 54 died, was admitted to hospital. Cases were also reported from Fashoda, Kodok, Abwong, Kaka, Lul, Renk and Bor in the Upper Nile Province and from Gambela in Ethiopia.

Five cases were reported from Meridi, in Equatoria, a district where the disease has not before been known to occur.

Residual insecticide spraying campaigns have been undertaken with the aim of reducing the incidence of infection.

TABLE XII.

Leishmaniasis : reported incidence over 10 years.

YEAR	Cases
1942	432
1943	225
1944	205
1945	192
1946	246
1947	327
1948	460
1949	523
1950/51	638
1951/52	1,063

TABLE XIII.

Leishmaniasis 1951/52 : *distribution in provinces.*

Province	Cases	Deaths
Bahr el Ghazal	1	0
Blue Nile	207	21
Darfur	8	0
Equatoria	122	11
Kassala	154	27
Khartoum	173	0
Upper Nile	390	76
TOTAL	1,063	136

(Note : The record from the Upper Nile Province may be very incomplete).

Pentostam (sodium stibogluconate) was widely held to be of great value in treatment.

(e) *Trypanosomiasis.* This disease was only reported in Equatoria Province. 122 new cases notified represented a somewhat disquieting rise in incidence. The increase was mainly in Li Rangu area where the notifications rose from 26 in the period ending June 1951 to 93 in the year under review.

Resettlement of the population has increased the risk of " fly-man contact ". Movement to and fro across the Congo frontier was believed to be of importance. The Belgian authorities claimed that cases were introduced into the Congo from the Sudan. Attempts were made to tighten frontier control.

Sleeping sickness had apparently been almost absent from Meridi district for 10 years until 26 new cases were discovered in 1951/52. It is possible that improved methods of inspection in part explained the re-appearance of the disease.

No new cases were reported in Li Yubu area for the first time in many years. 84 old cases remained under observation. The system of inspection and re-checking was considered satisfactory in districts that have been re-settled, but in the small unsettled area cases may have been missed.

TABLE XIV.

Sleeping Sickness : distribution of cases over 10 *years.*

YEAR	S. Yubu	Yambio	Yei	Kajo-Kaji	Meridi	Imported	Other Localities	TOTAL
1942 ..	42	—	—	2	25	—	—	69
1943 ..	60	—	8	1	9	3	—	81
1944 ..	37	—	35	—	4	—	4	80
1945 ..	16	1	19	—	—	—	3	39
1946 ..	21	19	16	—	—	—	—	56
1947 ..	18	6	21	—	2	—	—	47
1948 ..	32	23	20	—	—	—	—	75
1949 ..	5	12	17	—	—	—	—	34
1950/51	15	33	12	—	—	—	1	61
1951/52	0	93	3	—	26	—	—	122

(f) *Filariasis.* 287 cases were reported, of which 226 were in Equatoria Province.

(g) *Typhus fever.* No case was reported.

(h) *Yellow fever.* No case was reported.

2. EPIDEMIC AND ENDEMIC DISEASES.

(a) *Cerebrospinal meningitis.* Following the epidemic of 1950/51 cerebro spinal meningitis was still smouldering at the end of June, 1951. At no time did infection fully subside and sporadic cases were reported during and after the rains. Incidence took a sharp upward peak in Kordofan in November, 1951 and epidemic conditions were re-established in that province by December, 1951. The Nuba area was again the district most heavily attacked and, as has been frequently noted in the past, the infection seemed to spread from the periphry of zones mainly attacked in the previous year into zones which had been relatively lightly affected in 1950/51. There was also a serious outbreak in Western Kordofan. Incidence was comparatively small in other districts of the province. The epidemic had waned by the middle of May, though sporadic cases continued to occur up to the end of June.

Table XV.

Cerebrospinal meningitis. Recorded incidence and fatality in Kordofan, 1951/52.

Province	Cases	Deaths	Fatality Rate
Nuba	4,441	580	13.1
Western Kordofan	1,346	143	10.6
Eastern Kordofan	111	22	19.8
Northern Kordofan	198	37	18.7
Central District	314	46	14.6
	6,410	828	12.9

The disease again occurred in epidemic form in Darfur. Southern Darfur District was the major focus. There were but few cases in this district during the epidemic of the previous year. Districts which bore the brunt of the 1950/51 outbreak had comparatively few cases in 1951/52.

Most of the cases in the Blue Nile Province were in the southern part of Singa district and Roseires district. Infection was slight here the year before. Serious epidemic conditions did not occur in the Gezira or northern Fung in 1951/52. These areas were heavily infected in 1950/51.

Epidemic cerebrospinal meningitis had not been present in the Bahr el Ghazal from 1947 to 1951, though the disease was moderately endemic during this period. There was a cycle of considerable epidemics each year from 1938 to 1947. Mainly in the Aweil and Raga districts a sharp epidemic broke out in January, 1952.

Table XVI.

Cerebrospinal meningitis. Recorded incidence and fatality in the Sudan 1951/52.

Province	Cases	Deaths	Fatality Rate
Blue Nile	2,324	341	14.2
Darfur	2,374	379	16.0
Kassala	380	94	24.7
Khartoum	499	16	3.2
Kordofan	6,410	828	12.9
Northern	563	90	16.0
Total Northern Provinces	12,550	1,748	13.9
Bahr el Ghazal	1,431	238	15.9
Equatoria	6	4	66.6
Upper Nile	540	41	7.6
Total Southern Provinces	1,977	283	14.3
Overall Total	14,527	2,031	14.0

The pattern of the epidemic presented some notable characteristics. Initially the rise of the curve of incidence was steep. By the second half of February the total of recorded cases was about three times greater than that at the same date in the previous year. Thereafter the rate of increase was checked. The disease had largely disappeared from many zones before the start of the rains. By the time abatement of the outbreak became general the total incidence reported was about-one-quarter of the total cases in 1950/51. It is possible that the marked slackening of the steepness of ascent of the curve of recorded incidence was due to a relative group immunity resulting from the visitations of the two previous seasons.

TABLE XVII.

Cerebrospinal meningitis 1951/52. *Monthly incidence.*

Month	Cases
July 1951	305
August 1951	64
September 1951	62
October 1951	39
November 1951	56
December 1951	318
January 1952	1,648
February 1952	2,655
March 1952	3,798
April 1952	3,151
May 1952	2,008
June 1952	423
TOTAL	14,527

Emphasis in control was again put on provision of an organisation for early detection and treatment of cases. Few restrictive measures were enforced. Treatment with sulphonamide drugs seemed to give satisfactory results. It is the firmly held opinion of all field observers that the main factor adversely affecting the mortality rate was delay in obtaining treatment.

Treatment with Terramycin was undertaken experimentally at the suggestion of the World Health Organisation. The results, in a limited number of cases, were unsatisfactory.

Representatives of the World Health Organisation carried out a limited field trial of the value of sulphonamides and penicillin as chemoprophylactics. Taken at their face value the results were encouraging, and indicated further trials on a larger scale, but there were in the conditions of the trial so many possible sources of statistical error that it was thought impossible to evaluate the outcome with any precision.

Table XVIII.

Cerebrospinal meningitis. Recorded incidence and fatality over 10 years.

Year	Recorded cases	Recorded deaths	Case fatality rate %
1942	2,787	1,027	36.8
1943	3,526	765	21.7
1944	2,346	405	17.3
1945	6,166	666	10.8
1946	730	155	21.2
1947	443	159	35.9
1948	170	59	34.7
1949	353	102	28.9
1950/51	57,575	7,710	13.4
1951/52	14,527	2,031	14.0

(b) *Diphtheria.* This disease remained moderately endemic and there was no significant change in recorded incidence. The disease was mainly diagnosed in urban districts and in the Gezira Irrigated Area.

Table XIX.

Diphtheria. Recorded incidence and fatality, 1951/52.

Province	Cases	Deaths
Bahr el Ghazal	1	1
Blue Nile	98	10
Darfur	9	1
Kassala	35	4
Khartoum	82	6
Kordofan	6	0
Northern	28	8
Upper Nile	21	0
	280	30

Table XX.

Diphtheria. Recorded incidence and deaths over 10 years.

Year	Cases	Deaths
1942	207	33
1943	309	45
1944	270	61
1945	389	54
1946	390	61
1947	319	37
1948	326	27
1949	264	36
1950/51	573	77
1951/52	280	30

(c) *Dysentery.* No attempt was made to differentiate statistically between amoebic and bacillary infections. The circumstances under which many cases were treated prevented precise diagnosis. 4,046 cases were admitted to hospital and 72,172 were treated.

These figures represent a disquieting rise in the number of outpatient cases. The numbers of in-patients and out-patients for the 18-month period 1950/51 were respectively 6,261 and 67,053.

(d) *Enteric Fever.* The mean of the recorded annual incidence during 10 years ending 1949 is 195.6, with 116 cases in 1946 and 336 cases in 1940 as the extreme figures. 560 cases were notified in the 18-month 1950-51, the relative increase being largely-due to an epidemic in Katire, Equatoria Province.

The serious increase in 1951/52 was entirely due to a greater number of cases in Khartoum Province. The totals in all other provinces are less than in 1950/51.

TABLE XXI.

Enteric Fever. Distribution of cases 1951/52.

Province	Cases	Deaths
Bahr el Ghazal	1	0
Blue Nile	82	4
Darfur	2	0
Equatoria	15	0
Kassala	17	0
Khartoum	391	45
Northern	50	2
Upper Nile	20	1
	578	52

(e) *Leprosy.* No change was introduced in methods of control. It is possible that better results might be obtained by a system of domiciliary supervision of cases, but the staff problems involved are formidable. A second B.E.L.R.A. lay worker was appointed in Equatoria Province, but the first worker went on prolonged leave in the second part of the year. Results of sulphone therapy were encouraging.

TABLE XXII.

Leprosy, 1951/52.

Province	Total known cases	Total in Settlements		Bacteriologically positive new cases found in the year.
		Government	Missions	
Bahr El Ghazal	174	153	—	14
Blue Nile	294	39	—	29
Darfur	74	64	—	25
Equatoria	7,164	615	317	264
Kassala	37	33	—	37
Khartoum	59	—	16	29
Kordofan	2,097	81	—	13
Northern	15	—	—	11
Upper Nile	32	20	—	12
TOTAL	9,946	1,005	333	434

It is not possible to decide what relationship the total of known cases bears to the actual prevalence of the disease in the country.

(f) *Poliomyelitis.* 19 acute cases were admitted to hospital. Of these 1 was in the Bahr el Ghazal, 7 in Equatoria and 11 in Khartoum. There was some evidence that the condition may be more prevalent in the country than was indicated by the records.

(g) *Smallpox.*

TABLE XXIII.

Smallpox 1951/52.

Province	Cases	Deaths
Bahr el Ghazal	2	0
Darfur	253	30
Equatoria	4	0
Kassala	3	1
Kordofan	21	9
Upper Nile	63	0
	346	40

It appeared that infection was introduced into Darfur by travellers who had passed through French Equatorial Africa and had evaded frontier quarantine. An immigrant with the disease was found at Um Kedada, between El Fasher and El Obeid, in September, 1951. A second case followed here in the same month. Two immigrants with smallpox were found in El Fasher also in September.

The disease broke out in the Northern District in November. 24 cases were notified.

In February 1952, five cases of smallpox were found in a party of 36 pilgrims in Disa quarantine station. Individual cases were discovered in Geneina Town in immigrants who had evaded quarantine. Infection was brought into Kadaldol village, near Geneina, by a resident of the village who returned from a visit to French Equatoria with smallpox. An outbreak of 51 cases followed. Immigrants arrived in El Fasher in May without passing through quarantine. One of them had smallpox and caused an outbreak of 13 cases in the Fellata quarter of El Fasher. Isolated cases were found in several villages of the Dar Masalit, the patients being immigrants who had crossed the frontier by other than the recognised routes.

A total of 72 cases were found in immigrants in Disa quarantine station.

18 of the 21 cases in Kordofan were immigrants. The remaining 3 cases were directly infected from imported cases.

It is difficult to enforce quarantine restrictions against immigrants throughout the length of the frontier between Darfur and French Equatorial Africa. During the rains, when water is plentiful, travellers pass the frontier at many places and often aim to evade quarantine stations. Difficulty is added by the tendency to conceal cases of smallpox. One case was found wrapped in a bundle of grass matting packed in a lorry about to leave Geneina for El Fasher. This difficulty is rarely found in Sudanese who appreciate and often demand vaccination.

The cases reported in the Upper Nile Province were all diagnosed alastrim. This condition has been endemic in the province for some years, has a negligible death rate and is lightly regarded by the public. It does not seem to demand intensive control measures. The cases in Equatoria were also regarded as variola minor.

Table XXIV.

Vaccinations done: 1951/1952.

Province	No. of vaccination
Bahr el Ghazal	1,608
Blue Nile	7,061
Darfur	120,152
Equatoria	11,965
Kassala	116,009
Khartoum	39,756
Kordofan	292,034
Northern	3,911
Upper Nile	876
	593,372

An extensive vaccination campaign was in progress in Darfur at the end of June, 1952.

Table XXV.

Smallpox. Cases and deaths over 10 *years.*

Year	Cases	Deaths
1942	12	0
1943	182	36
1944	242	51
1945	0	0
1946	0	0
1947	807	160
1948	1,412	131
1949	246	13
1950/51	110	4
1951/52	346	40

(h) *Tuberculosis.*

TABLE XXVI.

Tuberculosis. Admissions to hospital and dispensaries over the last 10 years.

YEAR	Pulmonary	Non-Pulmonary	Total
1942	671	505	1,176
1943	593	529	1,122
1944	796	632	1,428
1945	957	643	1,600
1946	888	613	1,501
1947	877	599	1,476
1948	1,019	604	1,623
1949	1,176	650	1,826
1950/51	1,611	883	2,494
1951/52	1,325	747	2,072

Admissions to hospital and dispensaries do not represent the full diagnosed incidence of tuberculosis since a number of cases are treated under domiciliary supervision in their homes.

The general trend of increase in admissions for tuberculosis is paralleled by the general increase in work done in hospitals over the same period.

It is difficult to decide if the increase in hospital admissions represents a real increase in incidence of tuberculosis.

TABLE XXVII.

Tuberculosis : distribution of admissions to hospital and dispensaries 1951/52.

Province	Pulmonary	Non-Pulmonary	Total
Bahr El Ghazal	96	28	124
Blue Nile	283	163	446
Darfur	46	22	68
Equatoria	60	45	105
Kassala	179	146	325
Khartoum	343	121	464
Kordofan	82	106	188
Northern	164	78	242
Upper Nile	72	38	110
TOTAL	1,325	747	2,072

(Note : The figures for Khartoum may be weighted by the addition of cases from other provinces coming to the capital for specialist treatment).

Table XXVIII.

Tuberculosis 1951/52. *Incidence of all cases diagnosed per* 10,000 *of estimated population.*

Province	Total cases of tuberculosis diagnosed.	Incidence per 10,000 estimated population.
Bahr el Ghazal	175	2.17
Blue Nile	534	2.99
Darfur	88	0.85
Equatoria	134	1.05
Kassala	617	7.47
Khartoum	957	19.33
Kordofan	354	2.06
Northern	440	5.66
Upper Nile	138	1.60
	3,437	3.84

(Note : It is improbable that full reliance can be put in some of the diagnoses made in outpatient units).

Tuberculosis of cattle is very rare in the Sudan. Probably all forms of tuberculosis in man were always due to the human type of organism. The source of infection in both pulmonary and non-pulmonary tuberculosis was probably almost exclusively an open case of human tuberculosis.

Both pulmonary and non-pulmonary tuberculosis were predominantly diagnosed in early and middle adult life. Cases in infancy and youth were comparatively rarely recorded. No explanation of this phenomenon is attempted.

Table XXIX.

Tuberculosis : Age distribution of cases admitted to hospital.

	Age Periods.								
	0-1	1-5	6-15	16-25	26-35	36-45	46-65	Over 65	Undefined
Northern Province.									
Pulmonary	0	12	22	243	320	181	68	15	0
Non-Pulmonary ..	4	15	81	121	153	82	41	11	0
Southern Province. ..									
Pulmonary	0	0	18	72	104	50	9	0	7
Non-Pulmonary ..	1	4	17	40	51	26	12	1	0
Non-Sudanese. ..									
Pulmonary ..	0	0	6	5	16	13	8	1	0
Non-Pulmonary ..	0	2	4	14	12	6	1	1	0

Table XXX.

Site of Main lesion in 700 cases of non-pulmonary tuberculosis admitted to hospital.

Site of Lesion	Northern Provinces	Southern Provinces	Non-Sudanese	Total
Gland	181	66	10	257
Bone	213	56	19	288
Joint	47	16	3	66
Abdomen	37	5	1	43
Skin	17	5	5	27
Genito-urinary	15	1	2	18
Meninges	1	0	0	1
Total	511	149	40	700

The pilot Tuberculosis Service in the Three Towns was expanded. A house physician and a medical assistant were appointed to the unit and the staff of tuberculosis visitors was increased from 3 to 7.

The following beds, under the Chest Physician, were available for cases of tuberculosis in the Three Towns :—

River Hospital	62
Khartoum Hospital	15
Omdurman Hospital	13
Khartoum North Hospital	15
Hamad el Nil Isolation Hospital	63
Total	168

902 cases of pulmonary tuberculosis were diagnosed in the unit during the year, compared with 570 in the previous year. 261 cases were admitted for residential treatment. The remainder was kept under domiciliary care or referred back to homes away from Khartoum.

The following is a summary of the work done by the Chest Unit :—

Cases under domiciliary care at 30.6.1952	174
Admissions to hospital	261
Discharged	161
(a) Quiescent and fit for light work	125
(b) Unimproved	36
Died	42
Outpatients seen	3,020
(a) Pulmonary tuberculosis	902
(b) Non-pulmonary tuberculosis	71
(c) Non-tuberculous chest conditions and suspects under surveillance	2,047
New contacts examined	280
Total contacts under observation at 30.6.1952	696
Home visits by tuberculosis visitors	785
Screening examinations	2,886

The Sudan Association for the Prevention of Tuberculosis, a voluntary body, was in a thriving state. It afforded useful material assistance to patients under domiciliary care and to dependents of patients in hospital.

A World Health Organisation advisor on vaccination with B.C.G. visited the Sudan. Agreement was reached as to the principles of a project to undertake this form of immunisation in the Sudan. It was anticipated that the project might be initiated early in 1953.

(*j*) *Undulant Fever.*

TABLE XXXI.

Undulant Fever, 1951/52. *Distribution.*

Province	Cases	Deaths
Blue Nile	15	0
Equatoria	6	0
Kassala	9	1
Khartoum	9	0
Kordofan	3	0
Northern	2	0
Upper Nile	1	0
	45	1

The patchy distribution and low incidence of this disease suggested that there was a high level of immunity in the population at risk. The habit of boiling milk before use is common and often milk is allowed to sour before it is consumed.

3. HELMINTHIC DISEASES.

(a) *Ancylostomiasis.* 7,993 of 8,669 cases treated were in the two southern provinces. There remained a focus of infection in Northern Province.

(b) *Dracontiasis.* 2,586 cases were reported. The condition occurred predominantly in the southern and western provinces.

(c) *Schistosomiasis.* This disease has a firm hold on the people of the Gezira Irrigated Area and the White Nile District. Bilharzia control work in the Gezira was concentrated in an area of about one-fifth of the whole. Certain information has emerged as to the value of the control measures and the number of control teams necessary to cover a given area.

Destruction of snails in the canals of the controlled area was undertaken using copper sulphate. 105 canals, of a total length of just over 327 miles, were sulphated once. Copper sulphate in a concentration of 30 parts per million effectively killed snails in the canals, but the supply of snails was constantly replenished by the water entering the canals and no canal remained free of snails for more than two months after sulphation.

The pods of the tree, *Acacia arabica*, were found under experimental conditions to have a lethal effect on snails.

Laboratory teams did surveys of villages in the controlled area. These were followed up by treatment teams undertaking treatment of persons found infected in the survey.

18 villages were surveyed and treated in 1949. These villages were re-surveyed in 1950/51 and the total villages was increased to 35. The same 35 villages were again surveyed in 1951/52. The results of these surveys are summarised in Table XXXII.

TABLE XXXII.

Bilharzia Survey, 1949–1952.

	1949	1950/51	1951/52
No. of villages	18	35	35
No. of persons examined	5,549	12,376	13,107
Per cent infected *S. mansoni*	19.5	12.9	8.3
Per cent infected *S. haematobium*	12.3	2.8	2.0

The results of a general survey of random samples of the population of the Gezira Irrigated Area are shewn in Table XXXIII.

TABLE XXXIII.

Bilharzia Survey. Gezira Irrigated Area, 1951-52.

	Number examined			Percentage infected		
	Men	Women	Children	Men	Women	Children
S. mansoni	4,586	4,465	3,958	12.9	2.5	6.2
S. haematobium ..	12,605	5,647	7,684	4.0	5.2	8.3

A research programme formulated in the previous year was delayed owing to lack of staff and material.

A large number of those infected with schistosomiasis do not suffer from symptoms sufficiently severe to cause them to seek treatment. In only a minority of those infected does schistosomiasis produce grave disability.

There are many cases of splenic enlargement, ascites and paraplegia of idiopathic origin in areas where the disease is endemic. If and when critical autopsy becomes possible on a larger scale schistosomiasis may be found to be not completely guiltless in these conditions.

The figures in Table XXXIV are made up of those who attended for treatment and those diagnosed by routine examination.

Not until four conditions are fulfilled will this disease come under any measure of control.

(1) Alternative domestic water supplies other than the irrigation canals;

(2) A comprehensive conservancy system throughout the area;

(3) A complete drying out of all canals during the closure period (April to July);

(4) The night watering of cultivations instead of night storage of water in the canals.

TABLE XXXIV.

Schistosomiasis 1951/52. *Distribution.*

Province	Cases
Bahr el Ghazal	336
Blue Nile	14,869
Darfur	3,205
Equatoria	3,121
Kassala	389
Khartoum	710
Kordofan	4,793
Northern	2,550
Upper Nile	14
TOTAL	29,987

In the Bahr el Ghazal and Equatoria *S. mansoni* is the predominant infection and *S. haematobium* is rarely seen in these provinces.

4. OTHER DISEASES.

(a) *Neoplasms.* Cases admitted to hospital were classified as follows:—

Carcinoma	160
Sarcoma	105
Undefined	86
Benign tumours	507
TOTAL	858

(b) *Venereal diseases.* These conditions remained a major course of invalidism, being sixth in order of frequency of attendance for treatment. They were reported in the Bahr el Ghazal to have constituted an increasing social and economic problem. They comprised about 11 percent of the new cases that attended treatment centres in that province.

(c) *Yaws.* The infection remained endemic in the three southern provinces.

E. SANITARY CIRCUMSTANCES.

The policy of devolving an increasing responsibility for sanitation on to local government authorities was maintained.

Water supplies. Completion of the purified water supply in Wau was delayed.

Work was in progress for extension of the piped supply in Wad Medani. Provision of deep bore wells was a hopeful sanitary advance in the Gezira.

The Wadi Golo pipe line was sealed and made ready for use. So was the holding reservoir. Mellit dam held water throughout the year. 2 new water yards and 3 hafirs were made in Southern Darfur.

The new mains system and holding tanks were nearly completed in Juba. After an initial adverse report the results of bacteriological examination of the water were satisfactory. Water supplies were barely adequate at Li Yubu, Li Rangu, Yei and Meridi. Plans were advanced for making a storage dam in the latter town.

Water supplies in El Obeid were sufficient. Further progress was made on El Ein dam.

A piped supply with seven public water points was provided in the north of Halfa Degheim. Supply in the southern part of this suburb was poor.

Disposal of waste Matter.

(i) *Refuse.* Tipping and open burning continued the method generally used. Some composting was done in Khartoum. The extended growth of Khartoum posed collection and disposal problems which were not always completely solved and the condition of the streets often left much to be desired. The inveterately untidy habits of some of the population did not aid town and village cleansing.

(ii) *Conservancy.* A number of local government authorities undertook clearance of buckets by motor transport. The innovation was not always an unmixed advantage. It was often expensive and the organisation was sometimes dislocated by mechanical defects, particularly in districts where there was no good vehicle maintenance service. The Kosti Town Council experimented unsuccessfully with tractor-drawn bucket-carrier trailers.

Ten 8-seater public latrines were installed in Wau.

A system of public pit latrines was provided at Katire, in Equatoria.

The policy of converting bucket closets in Port Sudan to domestic water carriage plants made steady progress. The Town Council raised a loan to accelerate the work.

Khartoum Municipal Council secured a loan to meet the cost of construction of a main water carriage disposal system.

The water privy latrine if properly made and maintained, has been successful. A large number of such flushless septic tanks were built in the Three Towns and in Port Sudan. The Atbara Town Council initiated a plan for conversion, over a term of years, of all bucket latrines to water privies. A number of experimental water privies were built in El Obeid.

Housing. There was extensive residential and market building in Ed Dueim. Clearance and re-development of the Medinine quarter in Wad Medani progressed.

Re-development of the Mirghania quarter of Kassala has much improved the layout of this part of the town. It was reported that overcrowding has increased in Port Sudan. It was estimated that the average number of occupants per house had risen from 8.5 in 1949 to 9.5. Most of the insanitary sleeper-built houses in Deim Tigani were replaced by stone houses. A municipal housing plan in Port Sudan was begun with the erection of 24 council houses, for renting. In Port Sudan only about one house in three had any form of latrine accommodation.

The Deims slum clearance and re-planning scheme in Khartoum neared completion. 653 new premises were approved in the Three Towns, but shortage of materials and rising costs called a halt to first class building towards the end of the year. The Government made a large new housing estate adjacent to the airport. A widespread plan for bettering the housing of police and prison warders was undertaken.

There was a large amount of first class building in El Obeid. Many houses were destroyed or damaged by a severe flood in Nahud. The opportunity to improve building in this town layout has been taken.

Food in relation to health. Food scarcity was reported from the Bahr el Ghazal and Abeyei area in Kordofan. Import of grain was necessary. There was some evidence of malnutrition in the Butana.

New meat and vegetable markets were completed in Juba.

The Minister of Education appointed a committee to enquire into diets in secondary schools. The committee reported that the diets were adequate in quantity and balance, but were monotonous and generally ill-dressed, ill-cooked and ill-served. The committee made certain recommendations designed to remedy these defects.

Industrial hygiene. It was expected that the meat preservation factory in Kosti would be in operation by the end of 1952. The factory is of modern design and may well serve as an industrial model. An agricultural research station was established at Wad el Nayyal in the Fung District.

No problems were raised by the industrialisation of Nzara as a part of the Zande Scheme.

Plans were advanced for building a brewery in Khartoum North. There was a heavy demand for sites in the industrial area of Khartoum.

Progress was made in the development of an industrial area in El Obeid. The Sudan Railway gum cleaning sheds in El Obeid were condemned as insanitary.

CHAPTER IV.

SOCIAL HYGIENE.

Midwifery. 32 midwives were trained in the Omdurman School, 4 in the El Obeid School and 3 in the Juba School.

One sister of the Verona Fathers Mission practised as a midwife in Wau, undertaking mainly deliveries in hospital. The mission established a lying-in centre at Kuajok in charge of a second sister.

Including hospital midwives and health visitors 474 trained licensed midwives were in practise at the end of the year. Health visitors only undertook midwifery when called to aid district midwives.

TABLE XXXV.

Distribution of trained licensed midwives 30.6.1952.

Province	District Midwives	Trained nurse midwives	Health Visitors	Total
Bahr El Ghazal	—	2	—	2
Blue Nile	101	6	4	111
Darfur	27	1	1	29
Equatoria	—	3	—	3
Kassala North	13	1	1	15
Kassala South	23	—	—	23
Khartoum	96	25	8	129
Kordofan	46	2	2	50
Northern	103	2	1	106
Upper Nile	4	2	—	6
TOTAL	413	44	17	474

Maternity and Child Welfare. 15 Sudanese health visitors were employed by the Ministry of Health on 30.6. 1952. Two health visitors were seconded to the Ministry of Education for work in connection with the Gezira Adult Education Scheme. Distribution of health visitors was :—

Khartoum	2
Omdurman	3
Khartoum North	1
Wad Medani	2
Kosti	2
El Fasher	1
Port Sudan	1
El Obeid	2
Atbara	1
Seconded	2

Women doctors were engaged in welfare services in Khartoum, Wad Medani and Atbara. At most other provincial centres, where health visitors were not available, welfare sessions were supervised by British nursing staff.

Ante natal services were generally better understood and better attended than child welfare centres.

An ante-natal centre was established in Wau.

In Wad Medani both ante-natal and child welfare services were fully appreciated. A follow-up service of children discharged from hospital was arranged. Work in Kosti welfare centres showed a steady increase.

Ante-natal and child welfare sessions were held weekly in El Fasher. An ante-natal centre was formed in Nyala.

Weekly ante-natal and child welfare services were held in Juba. The Save the Children Fund team did valuable and uphill pioneer work in Torit and four adjacent villages. It is believed that the infant mortality rate is abnormally high in this neighbourhood. The team formed a conclusion that much infant ill-health is due to failure to supplement breast feeding sufficiently early. The C.M.S. hospital held maternal and child welfare sessions in Lui.

Five ante-natal centres in Port Sudan were well attended, but attendances at child welfare centres was disappointing. Ante-natal centres were working in Kassala and Gedaref.

There were 25,901 attendances at 13 ante-natal centres in Khartoum and 11,147 attendances at 12 child welfare centres. 5,033 homes were visited.

Omdurman Municipal Council were enabled by a charitable bequest to build a new welfare centre and a second financed from the same source was nearly finished.

There were 3681 attendances at the ante-natal centre in El Obeid and 407 at the centre in Nahud. A staff midwife from El Obeid held a weekly ante-natal session at Rahad.

The child welfare centre in El Obeid had 1,255 attendances; 778 home visits were made.

In Atbara there were 6,674 attendances at the ante-natal centre and 7,238 at the child welfare centre. In Merowe and Dongola there were 491 and 368 attendances respectively at the ante-natal centres.

Two ante-natal centres in Malakal had a total of 1,345 attendances.

School Medical Service. This service was handicapped by scarcity of staff and the necessity to divert medical staff to epidemic control. The number of pupils inspected was: —

Bahr el Ghazal	351
Blue Nile	12,953
Darfur	3,141
Equatoria	2,202
Kassala	5,940
Khartoum	9,524
Northern	13,722
Upper Nile	882
	55,792

Health Education.

A steady flow of visitors from the public continued to visit the Graphic Museum.

Health exhibitions were arranged at agricultural shows and other gatherings. Much of the material for such exhibitions was furnished by the Graphic Museum which maintained a regular service to this end.

A Sudanese "radio doctor" twice weekly broadcast health talks. Special broadcasts on subjects of topical interest were interpolated.

Numerous articles on health were published by the press. Editors were generally anxious to include material of this nature.

Two films on health subjects were made and shown by the Public Relations Office. Throughout the season slides illustrating precautions to be taken against cerebrospinal meningitis were exhibited in public cinemas.

Mental Health.

4,654 cases were received for treatment in the Nervous Diseases Centre, Khartoum North. Diagnostic range included psychoses of constitutional and organic reaction types, neuroses, psychopathies and a large number of cases of psychosomatic manifestations. Treatment was invariably on an outpatient basis and included such techniques as electronarcosis, modified insulin treatment and abreactions enhanced by pharmacological methods. It was considered that satisfactory results were obtained.

There were 120 inmates in the Criminal Lunatic Asylum on 30.6.1952. Dangerous cases are kept in cells and the relatively harmless in association of groups under direct supervision. Therapeutic planning involving the use of physical methods of treatment, group therapies, occupational and recreational methods is being worked out.

The Mental Diseases Board held 47 examinations on 45 patients, classified as follows :—

Schizophrenia	9
Delusional insanity	5
Alcoholism with delirium tremens	4
Senile dementia	4
Epilepsy	3
Hypomania	1
Mentally defective	12
Mentally sub-normal	7

CHAPTER V.

PORT HEALTH. QUARANTINE.

No seaport or airport was declared infected.

Disinfection of aircraft and quarantine control of air travellers was carried out at Wadi Halfa, Port Sudan, Khartoum, Juba, Malakal, Geneina and El Fasher airports.

The *Aedes aegypti* index was calculated on an inspection of all habitations within an area. Table XXXVI shows the *Aedes aegypti* index throughout the year at certain stations on international air routes.

Table XXXVI.

Aedes aegypti index 1951—1952.

Month 1951/52	Juba	Malakal	El Obeid	El Fasher	Kassala	Port Sudan	Wadi Seidna and Khar-toum.	Wadi Halfa
July	—	0.09	0.06	0. 6	—	—	--	—
August	—	0.40	0.01	0. 1	0. 01	—	—	—
September ..	—	0.16	0.02	0. 2	0. 02	—	—	—
October	—	0. 1	—	0.03	0. 01	—	—	—
November ..	—	—	—	0.03	0.001	—	—	—
December ..	—	—	—	0.07	—	—	—	—
January ..	—	—	—	—	—	—	—	—
February ..	—	—	—	—	—	—	—	—
March	—	—	—	—	—	—	—	—
April	0.05	—	—	—	—	—	—	—
May	0.03	—	—	—	—	—	—	—
June	0.03	—	—	—	—	—	—	—

Port Sudan Quarantine. 1,008 ships entered Port Sudan harbour, 385 sambuks entered Flamingo Bay. The figures during eighteen months ending June, 1951 were 1,271 and 596 respectively.

On January, 1st. 1952 it was made permissible to issue radio pratique for all ships. Previously it was only authorised for ships carrying a doctor. Requests for radio pratique have now been adopted by all shipping lines using the port regularly.

4,367 rats were trapped in the port.

Suakin Quarantine. The number of pilgrims that has left Suakin for Jeddah in the past ten seasons has been :—

1942/43	7,670
1943/44	17,818
1944/45	6,999
1945/46	6,214
1946/47	8,404
1947/48	12,020
1948/49	11,105
1949/50	5,091
1950/51	4,374
1951/52	6,047

In addition, during 1951/52, 135 pilgrims left Port Sudan for the Hedjaz by air.

The pilgrimage was declared clean. Returning pilgrims were detained in quarantine only long enough for medical formalities to be undertaken.

Wadi Halfa Quarantine. 25,138 persons were inspected, of whom 1,998 were admitted to quarantine, mainly on account of schistosomiasis.

418 vessels were inspected by the staff of the quarantine station.

Geneina Quarantine. 7,629 persons passed through the station. 72 cases of smallpox were detected. Vaccination and fourteen days observation were imposed on entrants from French Equatorial Africa.

Medical Mission to the Hedjaz. The mission consisted of two doctors with ancillary staff. Treatment centres were formed at Jeddah, Medina, Muna and Mecca. Treatment was afforded to many nationalities including pilgrims and local inhabitants. The number of persons treated was :—

Jeddah	3,011
Medina	1,208
Muna	556
Mecca	1,595

26 persons were treated as inpatients, mainly suffering from heat exhaustion syndrome.

CHAPTER VI.

HOSPITALS, DISPENSARIES, OTHER UNITS.

TABLE XXXVII.

Number of hospitals and beds available.

Province	Number of hospitals	Beds in hospitals	Beds in dispensaries	Total beds	Beds per 1000 population
Bahr El Ghazal ..	2	364	293	657	0.8
Blue Nile	7	1,141	71	1,212	0.7
Darfur	3	400	178	578	0.6
Equatoria	8	1,023	541	1,564	2.4
Kassala	3	665	246	911	1.1
Khartoum	7	1,019	24	1,043	2.1
Kordofan	5	678	477	1,155	0.7
Northern..	6	684	7	691	0.9
Upper Nile	1	275	144	427	0.5
TOTALS ..	42	6,249	1,981	8,254	0.9

(Note : The foregoing includes beds in mission hospitals).

Building operations in all provinces resulted in improvements in medical accommodation and staff quarters.

Province	Locality	Buildings constructed.
Bahr el Ghazal ..	Wau	Paying ward. Lecture room for staff. Quarters for nursing sisters. Quarters for dressers.
Bahr el Ghazal ..	Besselia	2 wards.
Bahr el Ghazal ..	Akon	1 ward.
Blue Nile	W/Medani	3 houses for doctors. Hospital boundary wall.
Blue Nile	Ed Dueim	House for doctor.
Darfur	Nyala	Male ward. House for Bash mumarid.
Equatoria	Li Rangu	Quarters for dressers.
,, ...	Li Yubu	House for laboratory assistant.
,, ...	Torit	Quarters for dressers.
,, ...	Kapoeta	Male ward.
Kassala	Port Sudan	Laundry block. Quarters for dressers. House for medical assistant.
,, ...	Kassala	Conversion of female ward to 2nd class. Kitchen.
,, ...	Gedaref	Male ward. O.P. department. Equipment store.
Khartoum	Omdurman	Enlargement of doctors' mess. X-Ray department.
Kordofan	El Obeid	Gynaecological ward. Quarters for dressers.
,, ...	Nahud	Maternity block. Quarters for dressers.
,, ...	Kadugli	Maternity block. O.P. department.
,, ...	Um Ruaba	Ward.
Northern	Merowe	Ward. Quarters for staff.
,, ...	Dongola	Lecture room. Equipment store.
,, ...	Shendi	Hospital re-built.
Upper Nile	Malakal	Ward.
,, ,, ...	Bor	First stage of new hospital.

The following new dispensaries and dressing stations were opened :—

Province	Dispensaries	Dressing Stations
Bahr el Ghazal	0	0
Blue Nile	2	6
Darfur	3	3
Equatoria	1	0
Kassala	1	4
Khartoum	0	0
Kordofan	0	0
Northern	3	1
Upper Nile	2	0
	12	14

The following dispensaries were re-built, enlarged, or otherwise improved :—

Province	Improvements to dispensaries
Bahr el Ghazal	7
Blue Nile	6
Darfur	2
Equatoria	1
Kassala	4
Khartoum	1
Kordofan	4
Northern	5
Upper Nile	3
	33

Dental Service.

Two dental surgeons and a dental mechanic were stationed in Khartoum. A third dental surgeon was employed part time in the School Dental Service in Khartoum. The pupils of 40 schools were inspected. 7,089 children were examined and 2,491 advised treatment. Of the latter number 2,164 attended for treatment.

CHAPTER VII.

MEDICAL MISSIONS.

Medical work by Missionary Societies.

The following shows the work done by medical missions :—

	Inpatients	Outpatient attendances	Operations
Church Missionary Society.			
Omdurman (Khartoum Province)	1,572	47,215	199
Salara (Kordofan Province)	240	25,332	—
Katcha (Kordofan Province)	478	11,813	—
Lui (Equatoria)	723	42,649	320
American Mission.			
Nasir (Upper Nile)	—	61,343	—
Akobo (Upper Nile)	—	4,103	—
Sudan United Mission.			
Abri (Kordofan)	247	20,187	—
Heiban (Kordofan)	218	13,021	—
Moro (Kordofan)	—	2,118	—
Kauda (Kordofan)	239	6,123	—
Sudan Interior Mission.			
Abayath (Upper Nile)	—	3,791	—
Banjang (Upper Nile)	—	368	—
	3,717	238,063	519

CHAPTER VIII.

MEDICAL TRAINING.

(i) *Kitchener School of Medicine.*

This school was incorporated as a Faculty of Medicine of the University College of Khartoum from the 1st. September, 1951.

(ii) *School of Hygiene.*

Number of students :

1st. year	9
2nd. year	7
3rd. year	4

Four candidates entered for the examination for the Certificate of the Royal Sanitary Institute in December, 1951. All were successful.

Sanitary Overseers. Ten candidates passed their proficiency test.

Assistant Sanitary Overseers. A course of instruction was prepared and notes distributed to all public health sections in which this class of employee is engaged.

(iii) *Medical Assistants Training School, Omdurman.*

20 candidates entered and successfully passed the qualifying test in May 1952. The number included two candidates sent by the Government of Tripolitania.

(iv) *Laboratory Assistants Training.*

6 laboratory assistants were trained during the year in Khartoum.

(v) *Juba Training Centre.*

Medical Assistants.

The number of students in the centre was :—

First year	11
Second year	6
Third year	6

Three students were discharged at the end of the first year, having failed to reach a satisfactory standard.

Sanitary Overseers.

Six candidates successfully passed their proficiency test.

Laboratory Assistants.

Three candidates successfully completed their training.

(vi) *Nurses Training Schools.*

The Central Nursing Council has recognised the following schools as capable of undertaking the full course of nurses ' training.

Omdurman Nurses Training School.

Omdurman Hospital.

Khartoum Hospital.

It is considered that a probationer who passes the examination after three years training in one of the foregoing schools may be regarded as approximately equivalent in nursing skill to a S.R.N. of Britain.

The following hospitals are recognised as elementary training schools in which a course of one year's instruction in nursing duties is given :—

Wad Medani Hospital

Abu Usher Hospital

El Fasher Hospital

Juba Hospital

Port Sudan Hospital

Kassala Hospital

Khartoum North Hospital

El Obeid Hospital

Atbara Hospital

Malakal Hospital

102 male nurses and 19 female nurses were certificated in 1951 52 on successful completion of a three year course of training.

CHAPTER IX.

LABORATORY SERVICES.

STACK MEDICAL RESEARCH LABORATORIES.

By Dr. R. Kirk.

Owing to a recent decision to change the end of the Sudan Government's financial year to June 30th. the last Annual Report covered a period of eighteen months, from 1.1.1950 to 30.6.1951, whereas the present report covers twelve months only from July 1st. to June 30th. as will be the case in future reports. During this period *ad hoc* investigations have been carried out in connection with schistosomiasis, onchocerciasis, *Phlebotomus*, kala azar, Chironomidae, the effects of antibiotics in rabies, cerebrospinal meningitis, a systemic mycosis of obscure origin, and an epidemic of jaundice in Malakal. Summaries of these and other research activities will be found under the appropriate headings.

The dark room and other facilities of the laboratories were placed at the disposal of Dr. G. van Biesbroeck of the Yorkes Observatory, Chicago, for his attempts to measure the "Einstein shift" at the time of the total eclipse of the sun in February, 1952.

Other visitors to the Laboratories included Drs. Clark, Machiavello and Omer of the World Health Organisation who had come to study cerebrospinal meningitis in the Sudan; Dr. Logan of the International Health Division of the Rockefeller Foundation; and Mr. Harry Hoogstraal of the United States Naval Medical Research Unit in Cairo. Although the Sudan substation of this Unit was closed in 1950, material obtained there is still being studied. Professor Garnham of London (*J. Parasitology*, Dec. 1951, vol 37, p.528) has recently described a new species of piroplasm from the rock hyrax in Torit, and other references will be found in the report of the Medical Entomologist.

At the invitation of the Societa Italiana di Medicina et Igiene Tropicale, Dr. Mohammed Sati and the writer attended the First East African Medical Congress, in Asmara in April 1952 and read a paper before the Congress.

ROUTINE AND EDUCATIONAL ACTIVITIES.

A summary of the routine work and examinations carried out during the period under review is appended to this report. The total number of examinations was 24,032. The volume of work remains practically constant. The Central Laboratories are working to maximum capacity and no extra work can now be undertaken, although there is an increasing demand particularly for biochemistry.

As in previous years teaching duties in the Kitchener School of Medicine have made heavy demands on the time and energy of the Laboratory staff, who have undertaken also the teaching of Medico-Legal subjects in the Sudan Police College. The appointment of new staff to the Kitchener School of Medicine, now incorporated in University College, Khartoum, should help to relieve the position in the future as regards teaching.

Hospital Laboratory Services. I would again pay tribute to the loyal and diligent services rendered by the former Scale K and J members of the Laboratory service posted to the various hospitals throughout the Sudan. Their figures are not included in this report; to include them would raise the number of routine examinations to astronomical figures. But they play a vital part in maintaining the efficiency of the medical and health services throughout the Sudan.

12 new Laboratory Assistants were appointed during the period under review, 6 after completion of training in Khartoum, 3 after completion of training in Juba, the remaining 3 being ex-Laboratory Assistants who had resigned to seek their fortunes elsewhere and later became applicants for re-employment. The establishment is now 1 scale H. and 58 scale K/J Laboratory Assistants, two of the latter being at present under special training for promotion to Scale H. posts. New hospital laboratories have been opened at Shendi and Nyala, bringing the total of hospital laboratories to 30. It has been possible to second Laboratory Assistants for special duties in connection with kala azar in the Upper Nile, tuberculosis and bilharzia.

POST MORTEM EXAMINATIONS.

25 post mortem examinations were carried out in Khartoum Civil Hospital during the period under review. Of these 19 were medico-legal. As regards the practical instruction of medical students the position remains deplorable.

PATHOLOGICAL SPECIMENS.

The total was 474, excluding brains for rabies.

NEOPLASMS.

128 malignant neoplasms were received, of which the following table is a summary : —

Site	Carcinoma	Sarcoma	Melanoma	Mixed Tumour	Total
Scalp	1	2	—	1	4
Face	6	—	—	—	6
Tongue	1	—	—	—	1
Mouth	5	—	1	—	6
Jaw	3	—	—	—	3
Eye	5	2	2	—	9
Neck	2	2	—	—	4
Parotid	—	—	—	6	6
Chest	1	—	—	—	1
Hand	1	2	—	—	3
Arm	—	2	—	—	2
Leg	6	1	—	—	7
Foot	—	—	4	—	4
Rectum, anal canal	2	—	—	—	22
Abdomen	3	4	—	—	7
Bladder	4	—	—	—	4
Groin	22	1	—	—	3
Ovary	1	—	—	—	1
Uterus	12	—	—	—	12
Breast	12	—	—	—	12
Lymphatic glands	5	6	—	—	11
Skin	1	—	—	—	1
Thigh	2	2	1	—	5
Buttocks	1	—	—	—	1
Penis	1	—	—	—	1
Prostate	2	—	—	—	2
Testicle	1	—	—	—	1
Liver	4	—	—	—	4
Kidney	1	—	—	—	1
Vagina	2	—	—	—	2
Unspecified	2	—	—	—	2
TOTAL	89	24	8	7	128

RABIES.

256 brains were received, of which 26 were decomposed and useless for examination. 47 of the remaining 229 were positive for Negri bodies. The species distribution of positives and negatives in this series is shown in the following table :

Animal	Positive	Negative
Human	1	—
Dog	38	147
Donkey	3	10
Horse	—	9
Cat	1	8
Calf	3	1
Cow	1	1
Gazelle	—	1
Sheep	—	3
Goat	—	1
Monkey	—	1
TOTAL	47	182

Antibiotics in rabies. Two further antibiotics became available during the period under review, terramycin and aureomycin, and their effect in experimental rabies in rabbits was tested. Like all the drugs and antibiotics previously tested in these Laboratories, they were found to have no influence on the course of the infection.

Rabies vaccine. 170,250 ml. were issued, sufficient to treat 2,270 cases.

VACCINE LYMPH.

44 sheep were used for the production of 2390 grams of pulp with an average yield of 54.3 grams per sheep.

SCHISTOSOMIASIS

Approval has been obtained for the formation of a schistosomiasis research unit as recommended in the report of Professors Gordon and Davey last year.

A supply of the schistosome antigen described in the annual report of these Laboratories for 1949 was sent to Professor G. Ferro-Luzzi, in Asmara, for clinical testing in cases of bilharziasis and cases of obscure splenomegaly. According to his report the antigen is highly specific in cases of *S. mansoni* infection, and more sensitive than one rectal biopsy in cases with negative stool examination. If these results are confirmed the antigen may be a useful tool for eliminating, or establishing the presence of schistosome infection in those cases of obscure hepato-splenomegaly which are so common in most parts of Africa and which require, more than anything else, methods of clearing up the differential diagnosis.

On the instigation of Professors Gordon and Davey, random specimens of serum were collected from children under six years of age in foci of (according to our records) pure *haematobium* and pure *mansoni* infection. These were tested in Hamburg by the C.H.R. reaction of Professor Vogel and complement fixation test of Dr. Minning, and in London by the precipitin reaction of Dr. Standen. The results are extremely interesting, and show clearly :

(1) that infection with bilharzia of both types, is commonly contracted in endemic areas by children under the age of six years. This is a valuable and important observation.

(2) the percentage of positives under six years of age is much higher in *haematobium* infected villages than *mansoni* infected villages. This opens all kinds of possibilities for debate and discussion. Experience in the Sudan indicates that *haematobium* infection is essentially a disease of childhood and youth, and tends to disappear from the adult population, whereas *mansoni* infection becomes progressively more serious in the older age-groups.

ONCHOCERCIASIS.

The work on onchocerciasis started in 1946 has been largely brought to a conclusion this year. The results, which are now in progess of publication, are on the whole disappointing. A great mass of interesting parasitological data has been accumulated by Mr. Lewis from which it appears that infection occurs mainly in the rainy season. But his conclusions about the possibility of controlling *Simulium damnosum*, the vector of onchocerciasis in the Sudan, are not encouraging. Dr. Sati's conclusions on the subject of chemotherapy are also rather disappointing, but similar to those which have been reported independently from other countries. Pentostam appears to have little or no effect on the infection. Hetrazan produces rapid disappearance of the microfilariae, often with severe allergic symptoms, but does not appear to affect the adults, so that microfilariae re-appear soon after the cessation of treatment. Antrypol is undoubtedly effective and kills both microfilariae and adult worms. A constant feature in cases treated with this drug and receiving more than 5 grams was the complete disappearance of the onchocercal nodules after the completion of treatment as observed in follow up examinations. But antrypol is too toxic ever to become an acceptable remedy for onchocerciasis. It is difficult to estimate how much of the toxicity is due simply to the drug and how much is the result of a Herxhiemer like reaction following destruction of the worms in a person who is already sensitized to them.

EPIDEMIC JAUNDICE IN MALAKAL.

An epidemic of jaundice in the Malakal area was investigated in some detail owing to the possibility of yellow fever and its implications in Malakal, which has always been a problem spot on the yellow fever map. By a process of exclusion it was decided that the epidemic was one of the obscure jaundice syndromes so often mentioned in previous annual reports of these laboratories (1935, 1937, 1939) and possibly identical with infective (Virus) hepatitis.

Relapsing fever was excluded by the examination of blood films. Leptospirosis was excluded by dark ground examination of centrifuged urine (20 cases), inoculation of blood into guinea pigs (two cases) and agglutination tests kindly carried out in London by Dr. J. C. Broom, of the Wellcome Laboratories of Tropical

Medicine to whom our thanks are due. Dr. Broom reported that sera of eight cases sent to him were tested against the following strains of *Leptospira* : *L. icterohaemorrhagiae*, *L canicola*, *L. bovis*, *L. grippotyphosa*, *L. hebdo madis*, and *L. autumnalis*, with completely negative results in all cases. Yellow fever was excluded by mouse protection tests, carried out in the Virus Research Institute, Entebbe, for which thanks are due to Dr. Horgan. Of 25 sera submitted six were positive and the remainder negative. This is approximately the percentage of positives that would be found in random sample of the Malakal population : a much higher percentage would be expected from cases and recent convalescents from yellow fever. Moreover, several cases were bled at the beginning of the illness and later during convalescence, but in none of them did the test change from negative to positive as a result of the illness.

The blood picture showed the relative lymphocytosis typically found in infectious jaundice. An attempt was made by Dr. G. W. M. Findlay in London to isolate the virus in baby mice from the stools of five early cases sent to him by air, but was not successful. The disease was comparatively mild, with a very low mortality rate, and no liver sections were available for examination. Serum protein estimations were done by the Van Slyke copper sulphate method with serum from 96 persons. The results did not reveal any evidence of gross protein deficiency which is an interesting observation itself and also in relation to the comparative mildness of the disease as a whole in the Malakal population.

SALMONELLAS IN SUDAN LIZARDS.

Dr. R. A. Neal of the Wellcome Laboratories of Tropical Medicine, London, spent some time in the Sudan with Veterinary Research Department during the period under review.

Among other activities he collected and examined numerous lizards from Khartoum and Malakal in an attempt to identify the Entamoeba recorded by Wenyon in these reptiles. As other observers in Africa have reported the occurrence of salmonellas in lizards, Dr. Neal, at the writer's request, kindly inoculated gut contents from each lizard into selenite broth which was passed to the bacteriological section of these Laboratories for further examination. An interesting find was the isolation of *Salmonella paratyphi* C (Hirschfield's organism) from some of the lizards. This organism has not been isolated from man in the Sudan although it is a well recognized human pathogen. It is a popular Sudanese belief that lizards can poison one's food by going across it, and this may very well be the case if the lizards harbour salmonella organisms.

CHIRONOMIDAE

All sections of the Research Laboratories have been occupied to some extent with chironomidae during the period under review, and comments will be found in the Reports of the Government Analyst and of the Medical Entomologist. On the purely medical side the main object has been to confirm the strong circumstantial evidence that these insects are a common cause of hay fever, asthma and other allergic complaints by collecting illustrative case histories, and testing sensitivity either directly or by means of skin tests with antigens mentioned in the last report.

VISCERAL TORULOSIS (BLASTOMYCOSIS)

During the past six years occasional cases of a curious fungus infection have been observed in lymph glands sent for histological examination from such widely separated localities as Khartoum, Juba, El Obeid and Wad Medani (see Reports for 1946, 1950-1951 ; also Jelliffe, J. Trop. Med. & Hyg., 1949, vol 52, p.177). The condition has been variously reported as histoplasmosis or torulosis, but it does not conform strictly with either of these conditions. It has not yet been possible to isolate the causal organism for further study, so its nature is still uncertain, but the histological picture in the infected lymph glands is very characteristic. On the basis of histological appearance only, Dr. J. S. Duncan, of the London School of Tropical Medicine, provisonally suggested that the infection was possibly a torulosis, due to an organism resembling *Cryptococcus neoformans.*

Mr. Fleming has this year drawn the writer's attention to a clinical syndrome which appears to be not uncommon in Khartoum, at all ages and in all races. The patient is usually admitted to hospital as a case of acute abdomen with signs and symptoms of appendicitis. The findings at operation are usually a normal-looking appendix with a line of enlarged lymph glands running upwards in the nesentery from the ileo-caecal region and some free fluid in the abdominal cavity. In paraffin sections these mesenteric glands and the lymphoid tissue of the appendix show similar changes, with an apparently similar type of organism, to those found in the glands previously regarded as histoplasmosis or torulosis.

The cases of this pseudo-appendicitis syndrome have a slight leucocytosis with relative eosinophilia of variable degree.

VIRUS INFECTIONS OF THE NERVOUS SYSTEM.

Previous studies have shown that humoral immunity to West Nile virus, Japanese B encephalitis and St. Louis encephalitis are widely distributed in the Sudan, and in some places on the White Nile the percentage of donors immune to West Nile virus is very high (Smithburn and Jacobs, 1942, *J. Immunology*, vol. 44, p.9) ; but studies undertaken during the last ten years have failed to identify the clinical features of the immunizing infections.

During the period under review sera from various obscure neurological cases in Khartoum and from 15 normal monkeys in the Stack Laboratories were, at his suggestion, sent to the late Dr. G. M. Findlay for testing against encephalmyocarditis virus. The results were completely negative. One cannot say this virus is absent from Khartoum, but these tests suggest that it is not being actively transmitted as it was recently in Uganda.

Some attention is being given to the subject of poliomyelitis in the Sudan. In 1951 sera were collected by Dr. Bates from donors in remote localities in the Upper Nile, off the main lines of communication. These sera were collected at the request of Dr. G.W.A. Dick, who took them to the John Hopkins University, Baltimore, where they are being tested as part of a wide survey of poliomyelitis. The results have not yet been communicated. Studies in Khartoum have been mainly clinical. It is very noticeable that paralysis of a leg often seems to follow a quinine injection whereas it is really due to poliomyelitis. A series of cases being published by Dr. Coles bring out this point clearly, which is of some interest in view of the alleged association between poliomyelitis and inoculation against diphtheria and pertussis in Great Britain.

PUBLICATIONS.

As in previous years a bibliography on medical matters relating to the Sudan has been prepared for the Editorial Secretary of *Sudan Notes and Records*. The following papers have been published by members of the staff, either separately or in collaboration since the last report.

KIRK, R. and LEWIS, D.J. (1951). The Phlebotominae of the Ethiopian Region *Trans. R. Ent. Soc. Lond.*, 102, 383.

HASEEB, M. A. (1951). A scorpion in captivity. *Sudan Notes and Records*, 32, 338.

KIRK, R. and HASEEB, M. A. (1952). Epidermolysis bullosa in the Sudan. *J. Trop. Med. & Hyg.*, 55, 26.

DRYSDALE, A.D. and KIRK, R. (1952) Typhus fever in the Anglo-Egyptian Sudan, II. *J. Trop. Med. & Hyg.*, 55, 49.

HENRY, A. J., MANSOUR, R., WATSON, A. G. and ZAKI, A. H. (1952).

Storage of stilbamidine in the animal body. (Correspondence). *Nature*, 169, 835.

HASEEB, M. A. (1952). "Nilodin" in treatment of *Schistosoma haematobium*. *Brit. Med. J.*, *i*, 1331.

Summary of Routine Examinations.

From: 1*st July* 1951 *To*: 30*th June*, 1952.

Kahn Tests	14,656
Widal Reactions	1,568
Weil Felix Reactions	1
Heterophile agglutination tests (Paul—Bunnell)	3
Blood Cultures	914
Blood Films	5,942
Blood Counts	42
Cerebro-Spinal Fluids	201
Medico-legal Specimens (Blood and Seminal Stains)	50
Biochemical Tests	264
Autogenous Vaccines	1
Pathological Histology (including brains for rabies)	703
Faeces	1,480
Urines	1,055
Throat and Nasal Swabs for *C. diphtheriae* Positive	115
,, ,, ,, ,, ,, ,, Negative	1,689
Sputa for *Myco. tuberculosis* Positive	11
,, ,, ,, Negative	82
Spleen Smears (Kala-azar Positive)	3
General Bacteriological Examinations	454
Water Examinations	152
TOTAL EXAMINATIONS	24,032

Summary of Faeces Examinations.

Shigella flexneri, V—Z types	57
Shigella shigae	7
Salm typhi	84
Entamoeba histolytica	8
Ova present	12
Negative	1,309

Summary of Urine Examinations.

Salm, typhi	40
Ova present	14
Negative	1,001

Summary of Kahn Tests.

Positive	3,300
Negative	11,350

Summary of Blood Films.

Benign tertian malaria	4
Subtertian malaria	32
Negative	558

Summary of Widal Reactions.

Salm typhi	241
Salm paratyphi A.	1
Salm paratyphi B.	9
Br. melitensis	65
Negative	1,252

Summary of Blood Cultures.

Salm. typhi isolated	88
Salm. paratyphi A isolated	2
Salm. paratyphi B isolated	1
Streptococcus pyogenes isolated	9
Other organisms	19
Negative	795

Summary of Heterophile Agglutination Tests.

Negative	3

Summary of Vaccines Issued.

T.A.B. vaccine	16,500	ml.
Antirabic vaccine	170,250	ml.
Cholera vaccine	19,800	ml.
Vaccine lymph	968,640	doses

WELLCOME CHEMICAL LABORATORIES.

By Mr. D. N. Grindley.

Owing to the recent decision to change the end of the Sudan Government's financial year to June 30th., the previous Annual Report covered a period of eighteen months, from 1.1.1950 to 30. 6. 1951, whereas the present report covers twelve months only, as will be the case in the future. This fact must be taken into consideration in assessing the volume of work recorded herein in relation to that recorded in the last report.

During the period under review, the number of samples examined was seventeen hundred and thirty five, as compared with an average of eleven hundred and forty two per year for the previous eighteen months period, and seven hundred and sixty three in 1949, representing increases of approximately 50 percent and 250 percent over these respective periods. Although the laboratory facilities are very good, the time has come when further expansion such as seems likely to be required can only be considered when the staff can also be materially increased at all levels

The year under review saw the retirement of Dr. A. J. Henry, the former Government Analyst, after twenty five years service, who is leaving the department to take up the newly created Chair in Chemistry at the University College of Khartoum. The general distribution of samples amongst the various categories was not vastly different from that of recent years, again a high proportion of the routine work being of a medical or semi-medical nature. In addition, a large number of samples of gum arabic have been submitted by the Chief Conservator of Forests, and also the work for private firms continues to increase steadily as the industry of the country develops.

The research work has consisted of an investigation as to the cause of spoilage of sugar stored at Port Sudan; the effect of temperature on the composition of sunflower seed oil ; further extension of the survey of Sudan seed oils ; examination of Red Sea seaweed ; and endeavour to find the cause of " stringiness " in gum arabic ; further work on the incidence of nimitti ; and a continuation of the investigation of the basic constituents of *Courbonia virgata*, *Datura* species and other plants.

During the period under review, three original papers and the Report of the Government Analyst for 1.1.1950 to 30.6. 1951 were published or prepared for publication.

The routine samples examined were classified as follows, the corresponding figures for the previous eighteen months being given : —

	1.7.1951 to 30.6.1952	1.1.1950 to 30.6.1951
Waters	134	177
Foodstuffs	200	479
Medico-legal and miscellaneous drugs	182	279
Mineralogical	120	191
Miscellaneous	1,099	589

Waters.

The majority of the samples submitted were from the Geological Survey, principally from new bores in various parts of the country. A very extensive programme of well-boring is about to be embarked upon in an endeavour to improve the rural water-supplies of the country, and it is anticipated that heavy demands will be made on these laboratories for their analysis. Of the one hundred and thirty four samples submitted, twenty four were classified as boiler waters, the remainder being potable water.

Foodstuffs.

Under this heading are included milks examined for the Public Health Authorities, alcoholic beverages, grains and flours, butter fats and various vegetable oils examined for suitability for human consumption. The quality of the refined vegetable oils produced locally improves each year, and at present edible oil of very high quality is being manufactured. A variety of miscellaneous foodstuffs have also been received.

Medico-legal and miscellaneous drugs.

These are divided into pathological (21) toxicological (133) and miscellaneous drugs (28). Of the first the majority were ante or post-mortem specimens associated with ten separate cases of suspected poisoning, in seven of which there were positive findings, four being due to arsenic. In addition to the above, various samples of blood serum have been submitted for determination of albumin-globulin ratio, calcium, chloride, and/or uric acid.

Among the toxicological samples submitted, several household utensils were examined for lead in the surface coating, a plant material was shown to be hashish, and once again many of the specimens concerned in cases of suspected poisoning were shown to contain *Datura stramonium* or *D. metal.* Six samples described as sesame oil were found to be heavily contaminated with mineral oil and ethylene glycol ; and a powder submitted in connection with a poisoning case was identified as crushed Blister beetles (*Mylabris sp.*) Forty nine wall-scrapings from mud houses were analysed for residual D.D.T. or B.H.C. content.

The miscellaneous drugs include a wide range of samples, many of which were tested for conformity to B.P. standard. Two samples of penicillin were shown to be highly adulterated, and three samples examined in connection with a police prosecution for alleged possession of unlawful drugs were shown to be sulphathiazole. A sample described as morphine hydrochloride proved to be atropine sulphate, and various samples of industrial chemicals, including tanning liquors and fertilisers were analysed.

Mineralogical.

Included in this category are twenty five samples of coal, eight samples of mineral oil and forty two samples of white metals, gland metals and brass, mainly submitted by the Sudan Railways. In addition, a wide variety of minerals from the Geological Survey (mainly iron and manganese ores), building materials, samples from Sudan Salt Ltd., and a number of salty incrustations have been analysed.

Miscellaneous.

One hundred and sixty five samples of oil-cakes, mainly cottonseed and sesame, were received, and in addition a large number of oil-bearing seeds, cotton-seed (57), sesame (28), groundnut (14), sunflower (12), castor (10), soyabean (9), safflower (5) and *hyptis spicigera* (4). These were submitted mainly by commercial firms engaged in the local seed-crushing industry, and also by the Agriculture Department. Twenty seven samples of methylated spirit were examined for the Customs. One hundred and six samples of various kinds were examined for spoilage, mainly in connection with insurance claims, the principal cause of damage being contact with sea-water.

Eleven samples of soap and soap-stock were submitted, mainly by local manu--facturers, and six hundred and thirty samples of gum arabic have been examined, the majority submitted by the Forests Department in connection with the investigation concerning stringiness in this commodity. Other samples classified in this category include perfumes examined for the Customs, various textiles, beeswax, samples of Abavit B received from the Research Division, Department of Agriculture, and other miscellaneous samples.

INVESTIGATIONS

Shortage of staff has severely curtailed the amount of work of this nature that could be undertaken, and is the principal limiting factor in future development in this sphere.

The effect of atmospheric humidity on the deterioration of sugar.

Many cargoes of sugar, particularly those arriving from Formosa had been found to become damp, and once this has occurred the sugar does not easily dry out under normally prevailing conditions of storage. It has been shown that the sugar becomes partially inverted, particularly in the vicinity of the sacking material itself, and this is thought likely to be caused by local acidity being developed from the alum-sizing of the sacking, although it has been conclusively shown that moisture alone, or storage in a humid atmosphere can give rise to inversion. Once a small surface layer of the sugar has been inverted, the hygroscopic invert sugar appears to draw in more water and enable the change to proceed further. Although a small degree of inversion is in no way deleterious to health, once this has occurred the sugar never properly dries out.

Effect of temperature on the composition of the fatty acids of sunflower seed oil.

This important oil-bearing seed was sown in the same area in October and again in April, so that the crops would ripen in the coldest and hottest months of the year respectively. Although the length of time taken to ripen, the average daily hours of sunshine and daylight and average relative humidity for the two periods were not vastly different, the composition of the seed oils of the two crops differed very materially, and it was evident that increased temperature during the ripening period led to a big decrease in the linoleic acid content of the final oil. The same effect is also observed in the case of safflower seed, but to a very much

less pronounced extent. Winter cultivation of sunflowers produced an oil of unsaturation approaching the requirement of the paint industry, whereas the summer oil would be more attractive as an edible. It is therefore a matter of great importance that crops grown at different times of the year be marketed separately, otherwise an oil would result having intermediate properties which would not be particularly attractive to either the edible oil or paint industries.

Vegetable oils.

The survey of Sudan seed oils has been further extended to include the species *Capparis rothii* (Capparidaceae) and *Datura strammonium* and *D. metel.* The results afford additional evidence of the close relationship between botanical classification based on morphological considerations and the chemical composition of the seed fat.

Seaweed from Port Sudan.

A comprehensive analysis of the sea-weed *Turbinaria conoides*, one of the brown algae from Port Sudan, has been undertaken with a view to its use for supplementing the very scanty pastural diet of the Port Sudan dairy herd. Analyses were carried out before and after soaking the weed in water. Particular points of interest were the very low iodine content, especially after soaking, but the ash of the weed was very high in potassium, most of which was not removed by washing as it was probably present in the original weed as a polysaccharide sulphate ester, such as carragheenin. The fatty matter, which was small, was examined in detail, and the unsaponifiable fraction was shown to contain major proportions of fucosterol, and also to be rich in carotene.

Gum arabic.

Several hundred samples of the gum of the species *Acacia verek* have been examined in an endeavour to discover the cause of " stringiness " in gum which from time to time appears and which is very objectionable in certain industries. Samples have been examined from individual trees growing in different localities and tapped at differing times of the year in order to observe the effect of locality, time of collection, type of soil, age of tree, rainfall and other climatic conditions on the quality of the gum. The work is by no means complete, but there are indications that stringiness does not occur in samples collected towards the later part of the gum season.

Incidence of nimitti.

Continuation of the collection of nimitti (*Tanytarus lewisi*) referred to in the last annual report was undertaken for the Medical Entomologist in an endeavour to relate the prevalence of these insects with the varying climatic conditions. Complete daily observations for nearly two years are now available. The results suggest that the insects are blown inland from the river bank by a moderate to strong wind blowing early in the day.

Courbonia virgata.

Further progress has been made in the investigation of the basic constituents of this plant, which have been fractionated *via* their aurichlorides, resulting in the isolation of two further compounds both of which appear to be hitherto unknown.

Datura species.

The occurrence of quaternary bases in the various members of the Cappari daceae suggested that many other alkaloid-bearing plants might also contain quaternary bases not previously discovered. The solanaceous plant *Datura metel* has been examined from this point of view, and yielded, after complete removal of the extractable bases, a crystalline periodide, which has been shown to be derived from choline, a base widely distributed in the vegetable kingdom, but not hitherto reported in *Datura spp*. Other members of this family are being similarly examined. A sample of tea, after removal of the extractable bases, gave no precipitate of periodide when treated by the usual method, so the absence of quaternary compound is presumed.

REPORT OF THE SECTION OF MEDICAL ENTOMOLOGY.

By Mr. D. J. Lewis.

In 62 collections, received from various parts of the country, 460 specimens of many species, and some 5,000 of *Oscinella aharonii*, were identified. Enquiries from many quarters were answered, many specimens and exhibits supplied on request, and visitors were shown demonstrations. Many tests of insecticides were carried out with particular reference to household pyrethrum sprays. This and other work was greatly assisted by the facilities of the Agricultural Research Division.

SANDFLIES.

Two surveys were carried out in the Paloic area following an outbreak of kala-azar there. In November and December 1355 sandflies of 11 species and 4 varieties were collected on oil traps around 19 localities in the Melut—Paloich area. The collection included one each of *Phlebotomus papatasi*, *P. orientalis*, *P. lesleyae* and *P. rodhaini*. These belong to the subgenus *Phlebotomus*, which includes the Old World vectors of kala—azar. *P. papatasi* is unlikely to be a vector but *P. orientalis* is already regarded as the vector in the Gedaref area, and *P. lesleyae* is known from a kala-azar area in the Nuba Hills. *P. rodhaini* has a rather general distribution. Other species were 147 of the man-biting *P. clydei* and 361 of *P. squamipleuris* which flourishes in damp places. Much of the area is flooded for a long period and it may be that the sandfly season, and the season when people are infected, is short. A survey in May and June, with traps baited with guinea-pigs, yielded more *P. lesleyae* and *P. rodhaini*. It was recommended that, in addition to residual spraying of houses, attempts should be made to fill soil cracks near houses, and that people should be encouraged to use dimethyl phthalate repellent.

A specimen of *P. clydei* from Malha and other north-western areas extended the known range of this species.

ANOPHELINE MOSQUITOES.

Specimens of *Anopheles pharoensis* and *Aedes arabiensis* from Rahib Wells in the north-western desert, obtained by a Locust Survey team, show the wide range of these species.

Gambusia were supplied on request : 100 to Khartoum, 1200 to Kordofan, and 200 by air to the Assistant Director of Medical Services, Aden Protectorate, for use at Mukalla.

The Gezira.

With the development of residual spraying of B.H.C. the question has risen of the future of anti-larval measures. During the season larvae of *Anopheles gambiae* were so scarce that it was most difficult to obtain enough for experimental purposes. It is hoped that this was a result of anti-adult measures but the question was complicated by the unusually light rains.

Experiments with the weed-eating fish *Tilapia melanopleura* in the Barakat III canal were unsuccessful, possibly owing to dispersal of the fish upstream or attacks by predatory species which abound in the Gezira canals. Accordingly an experiment was carried out at the Wad Maak canal where the Irrigation Department pumped out the water in order to remove the existing fish after dynamite had failed to kill them. Altogether 1800 *T. melanopleura* were introduced, 1200 on October 25, 250 on April 23, and 350 on April 26. Results are not yet conclusive.

Wadi Halfa area.

No anophelines were received during the year and no *A. gambiae* reported from the Sudan north of Ferka or from Egypt.

CULICINE MOSQUITOES.

Information supplied about Stegomya mosquitoes in the Sudan have been used in Mattingly's (1952 Bull. Brit. Mus. Nat. Hist. Ent., 2, pp. 235—304) survey of this subgenus in Africa. Hoogstraal and Knight (1951, Amer. J. Trop. Med., 31, pp. 659—664) recorded a manbiting species, *Eretmopodites silvestris conchobius* Edwards, from the endemic yellow fever area in the south-eastern Sudan which is discussed by Woodman (1949) in Beaton's Equatoria Province Handbook Vol. 2. Mattingly (1951. Trans. R. Ent. Soc. Lond., 102, pp. 331—382) has surveyed the *Culex pipiens* group and discussed the Sudan in this respect. *C. fatigans* are received for identification from Port Sudan from time to time. It is the only species ever reported to cause trouble now that *Aedes aegypti* has been almost exterminated there. A malarial parasite of the elephant shrew in the southern Sudan was recorded by Hoogstraal, Huff and Lawless (1950. J. Nat. Malaria Soc. 2, pp. 293—306) who discussed the possibility of its transmission by mosquitoes.

Monthly reports on provincial returns of *Aedes aegypti control* were prepared for the World Health Organization and for local use. Good results of control have been reported from all important areas for many years. It has proved most difficult even to obtain specimens for the laboratory colony used for teaching and experimental purposes. A special survey of 185 houses in Port Sudan and buildings in the aerodrome and transit camp revealed no *A. aegypti* and demonstrated the success of control measures there. Constant vigilance is required however to prevent infestation from sambuks. Touch is maintained with the Mosquito Control Officer who reports on the control of all mosquitoes in the various provinces.

Biology.

Further studies were made on the "Green Nimitti" *Tanytarsus lewisi*, at Khartoum and Wad Medani, chiefly on the factors causing bad "nimitti nights" and on the time and manner of emergence.

The Government Analyst has kindly made valuable records in the form of regular nightly light trap catches. He dried and weighed the specimens and deduced the number caught per night on the basis of 18,000 *Tanytarsus* per gramme. The results have been examined in relation to meteorological and other conditions. It appears that the main factor causing day-to-day fluctuations is wind, a strong north wind in the day preceding a heavy infestation in the evening. A strong wind is often associated with a "cold front" which can be forecast by the Government Meteorologist several days in advance.

With regard to emergence, it was found that although pupae rise to the surface at dusk and vast numbers of adults appear at that time the pupae are not then ready for emergence. They remain immature for several hours and begin to darken after midnight. Shortly before sunrise air appears beneath the cuticle and soon many flies emerge. A relatively small number continue to emerge for several hours. When an individual emerges it floats on the pupal skin for a short time and then walks forward on the water for a few moments before flying away. The accompanying figures indicate the time of emergence at Wad Medani on March 30, for example. They show the estimated emergence for each hour as a percentage of the total emergence for the day and are based on the condition of pupae captured in tow nets designed for this purpose.

Time	Estimated percentage of the day's emergence
03—04	3.2
04—05	25.2
05—06	50.5
06—07	12.7
07—08	5.9
08—09	1.7
09—10	0.6
10—11	0.2
11—12	0.3
12—13	0
13—14	0

Control.

When very thin films of waste engine oil about 0.0002 mm. thick, were spread on the Blue Nile many dead newly-emerged midges were found. They were not attached to pupa skins however and were thought to have fallen on the oil. Further observations showed that the flies can emerge through a thin film, or through breaks in it, but that they are killed when they walk on the surface as mentioned above. The chances of success with large scale oiling were therefore considered hopeful and tests were made, greatly facilitated by the cooperation of the Senior Public Health Inspector and the Dockyard Manager. After many methods of applying oil had been tried, the one adopted was to fix two four gallon tins to the

stern of a fast launch and to discharge oil at the rate of one gallon a minute when travelling between the dockyard and the Blue Nile Bridge in eight minutes. When preliminary results proved encouraging a Public Health team was trained and a full-scale trial arranged. This was unavoidably postponed till the beginning of next season. Watch was kept for adverse effects of the oil on people downstream but none was observed.

Laboratory experiments showed that the adult midges were quickly killed by deposits of 0.1 gr. DDT or 0.01 ga. B.H.C. per square metre. DDT emulsion was then sprayed on the vegetation of four large gardens covering 40 feddans by a motor pump kindly operated by Dr. W. S. Richards. Several residents reported an improvement for a few days but results were not promising. Adult midges were also attacked by space sprays, namely pyrethrum in kerosene and BHC. solution applied by a Tifa fogging machine operated by the Sudan Mercantile Co. Ltd. Many flies were killed but the method proved uneconomic for large scale use owing to the high dosage necessitated by strong winds on bad midge nights. Further tests with light traps caused only a partial kill. Mosquito wire was found to be ineffective in keeping out nimitti unless of very small mesh which would greatly reduce air circulation. The results of these tests points to oiling as the hope for the future.

SIMULIIDAE.

The Province Medical Inspector, Bahr el Ghazal, continued to supply *S. damnosum* collected under supervision of the Father Superior, Raffili Mission, and 2226 were dissected in one year. From this and other work it is concluded that nearly all transmission of onchocerciasis takes place in the rains and that the fewer flies which occur in the dry season have a low infection rate. It is hoped that this observation can be put to practical use, for instance by employing wood cutters in infected districts only during the dry season.

Two papers have been prepared for publication. One shows the distribution of the 20 species and three varieties of *Simulium* now known to occur in this country. The other deals with the distribution and biology of *Simulium damnosum* in the Sudan, its relation to onchocerciasis, and such preventive measures as are believed to be possible in the large remote areas infected with the disease.

S. griseicolle is often said to kill turkeys in the Sudan, and Garside and Darling (1951. Bull. Ent. Res., 42, pp. 583—584) have described a case in detail.

TABANIDAE.

A paper has been prepared for publication on the Tabanidae of the Sudan. Seventy species are known in this country. In addition to their important effect on domestic animals, one or more species transmit human loiasis in the Zande area. Many records from the Sudan are given by Oldroyd (1952. The horse-flies of the Ethiopian Region 1. London).

MUSCIDAE.

A survey of house-fly breeding places was carried out in the Wad Medani area at the request of the Senior Public Health Inspector. One of the main problems is promiscuous defaecation, especially near the Nile.

A map of tsetse-fly distribution prepared by this Section has been employed by Potts (1951. Bur. interafr. tse-tse Tryp. No. 157/0. Mimeo.) in his map of tsetse distribution in Africa. Much general information on tsetse-flies in the Sudan is given by Beaton (1949. Equatoria Province Handbook. 2).

CALLIPHORIDAE.

Specimens of *Auchmeromyia Luteola*, the Congo Floor Maggot fly, sent from the Sudan have been used in Garret-Jones's (1951. Bull. Ent. Res., 41, pp. 679—708) investigation of this insect.

SCORPIONS.

Scorpions are frequently killed when houses are being sprayed for mosquito control. On one occasion 19 *Buthus minax* and three *B. quinquestriatus* were found in a single room. These are the common species in the Gezira, and *Pandinus* sp. also is found in Wad Medani.

TICKS.

Mr. H. Hoogstraal, of the United States Navy Medical Research Service, spent a week with this Section studying the Sudan collection of ticks while preparing his accounts of ticks of Africa and the Sudan.

PUBLICATIONS.

Papers prepared in this Section are concerned with particular problems or are intended to provide readily available information on what is known of each of the insect groups of medical importance in the Sudan. Apart from particular problems, the Cimicidae, Sand-flies, Tabanidae and tsetse flies have recently been dealt with, and the mosquitoes and other groups are under revision.

The following papers have appeared since the last report.

KIRK, R. and LEWIS, D. J. (1951). The Phlebotominae of the Ethiopian Region. Trans. R. Ent. Soc. Lond., 102, pp 383—510.

LEWIS, D. J. (1950). Notes on tsetse flies in the Anglo-Egyptian Sudan. *Sudan Notes*, 32, pp. 96—105.

Some publications, which deal partly with medical entomology in the Sudan but did not emanate from this Section, have been referred to above. Others are omitted which only refer briefly to the Sudan or are mentioned in recent publications of this Section.

CHAPTER X.

METEOROLOGY

Table XXXVIII shows the mean of the rainfall recorded in provincial meteorological stations. The stations at which readings were made are widely distributed throughout provinces and cover most districts of a province. The wide variations between maximum and minimum recordings illustrate the wide climatic differences which may be experienced with the compass of a single province.

TABLE XXXVIII.

Recorded rainfall.

Province	No. of stations	Mean rainfall m.m.	Highest recorded m.m.	Lowest recorded m.m.
Bahr El Ghazal	13	877	1,355	605
Blue Nile	46	358	853	143
Darfur	19	567	960	216
Equatoria	24	1,264	1,953	494
Kassala	51	284	761	4
Khartoum	5	112	166	71
Kordofan	30	517	827	178
Northern	16	24	77	0
Upper Nile	23	850	1,477	475

TABLE I.

OUT-PATIENTS.

NEW CASES BY DISEASES

AND

TOTAL ATTENDANCES.

DISEASE	BAHR EL GHAZAL	BLUE NILE	DARFUR	EQUATORIA	KASSALA	KHARTOUM	KORDOFAN	NORTHERN	UPPER NILE	TOTAL	
1. Cholera	—	—	—	—	—	—	—	—	—	—	1
2. Plague	—	—	—	—	—	—	—	—	—	—	2
3. Smallpox	2	—	253	4	3	—	21	—	Var Min 63	346	3
4. Typhus	—	—	—	—	—	—	—	—	—	—	4
5. Yellow Fever	—	—	—	—	—	—	—	—	—	—	5
6. T.B. Pulmonary	123	316	60	89	273	457	178	323	75	1,894	6
7. T.B. Non-Pulmonary	52	218	28	45	344	300	176	117	63	1,543	7
8. Pneumonia	681	6,918	2,627	2,010	1,962	4,633	3,863	2,458	1,225	26,377	8
9. Influenza	175	2,317	1,585	1,882	1,866	10,692	2,951	5,668	314	27,450	9
10. Other Respiratory Diseases	11,883	138,527	52,581	76,299	75,811	91,438	86,417	63,395	16,878	613,229	10
11. Cerebrospinal meningitis	1,431	2,324	2,374	6	380	499	6,410	563	540	14,527	11
12. Chickenpox	444	1,224	456	678	270	951	1,025	1,752	626	7,426	12
13. Diphtheria	1	98	9	—	35	82	6	28	21	280	13
14. Encephalitis Lethargica	—	—	—	41	—	38	—	—	—	79	14
15. Measles	255	1,535	693	258	641	979	1,705	965	622	7,653	15
16. Mumps	103	6,751	538	316	684	1,243	2,395	838	327	13,195	16
17. Poliomyelitis, acute	—	1	—	7	—	84	—	—	—	92	17
18. Rheumatism, acute	313	661	242	1,156	223	3,696	345	658	13	7,307	18
19. Whooping cough	11	3,119	139	363	452	1,849	1,458	1,316	135	8,842	19
20. Dysentery	1,514	37,230	7,863	823	3,093	6,888	5,330	6,688	2,743	72,172	20
21. Enteric Fever	1	82	2	15	17	391	—	50	20	578	21
22. Gastro-enteritis of children	108	9,130	1,348	195	1,135	10,714	974	2,229	1,650	27,483	22
23. Undulant Fever	—	15	—	6	9	9	3	2	1	45	23
24. Filariasis	28	9	15	226	—	4	5	—	—	287	24
25. Leishmaniasis	1	207	8	122	154	173	8	—	290	963	25
26. Malaria	7,442	85,727	17,987	26,052	22,169	13,679	41,612	18,884	11,497	245,049	26
27. Blackwater Fever	—	3	—	2	—	3	1	—	—	9	27
28. Onchocerciasis	19	—	—	36	—	94	—	—	98	247	28
29. Phlebotomus Fever	—	—	—	—	2	19	—	5	—	26	29
30. Relapsing Fever	—	—	2	3	—	2	2	—	3	12	30
31. Trypanosomiasis	—	—	—	122	—	—	—	—	—	122	31
32. Ancylostomiasis	1,849	102	131	6,144	17	30	79	280	37	8,669	32
33. Dracontiasis	481	85	135	1,378	92	61	215	9	130	2,586	33
34. Schistosomiasis	336	14,869	3,205	3,121	389	710	4,793	2,550	14	29,987	34
35. Gonorrhoea	1,977	7,537	5,260	2,860	3,705	3,756	5,121	872	2,330	33,418	35
36. Soft Sore	57	1,288	754	79	635	2,149	524	84	14	5,584	36
37. Syphilis	12,408	22,878	30,112	6,629	12,117	6,911	26,221	4,346	15,433	137,055	37
38. Yaws	9,931	800	3	11,470	—	62	—	—	4,918	27,184	38
39. Anthrax	—	2	—	—	3	86	—	—	2	93	39
40. Hydrophobia, human	3	19	1	1	—	1	2	—	14	41	40
41. Leprosy	58	37	18	426	17	24	19	12	21	632	41
42. Madura Disease	—	178	33	—	40	753	110	97	32	1,243	42
43. Tetanus	29	44	8	15	10	21	16	8	4	155	43
44. Heat Stroke Syndrome	1	2	1	—	36	49	—	30	7	126	44
45. Confinements	137	433	102	221	117	797	304	230	66	2,407	45
46. Gynaecological	52	5,888	476	24	2,565	4,927	1,845	877	201	16,855	46
47. Diseases of Pregnancy and Parturition	—	11	20	53	76	1,259	245	505	—	2,169	47
48. Puerperal Fever	2	40	13	1	17	65	8	14	1	161	48
49. Wounds and injuries	24,791	175,659	72,583	99,294	120,748	99,330	106,867	74,549	30,531	804,352	49
50. Tropical Ulcer	14,714	3,781	2,062	8,983	867	110	7,745	10	2,705	40,977	50
51. Diabetes	1	80	16	1	110	431	125	222	—	986	51
52. Pellagra	—	1	—	—	2	18	—	6	2	29	52
53. Scurvy	—	399	3	12	130	2	162	—	2	710	53
54. Neoplasms, malignant	16	493	32	10	46	52	88	205	6	948	54
55. Neoplasms, non-malignant	34	3,510	75	109	740	197	295	318	39	5,317	55
56. Trachoma	390	49,370	8,540	827	13,449	40,196	9,571	39,658	1,603	163,604	56
57. All other eye diseases	8,279	143,684	35,155	30,488	60,403	70,599	59,700	65,521	23,985	497,814	57
58. Ear Diseases	2,863	28,931	11,502	8,057	16,373	21,757	17,810	16,164	4,710	128,167	58
59. Skin Diseases	3,400	21,597	16,857	20,602	8,429	10,352	20,638	21,559	9,699	133,133	59
60. Alimentary diseases	9,232	180,643	67,174	70,659	84,423	99,722	102,421	77,312	21,066	712,652	60
61. Circulatory diseases	96	26,679	3,053	284	4,187	9,282	6,984	6,724	104	57,393	61
62. Genito-urinary diseases	85	18,340	12,103	303	7,427	13,947	13,245	17,679	1,204	84,333	62
63. Organic Nervous diseases	11	6,086	1,024	22	176	2,492	1,378	3,343	892	15,424	63
64. Functional Nervous diseases.	31	1,528	25	20	—	4,739	3	5	—	6,351	64
65. Fever of uncertain origin	3,021	29,244	10,639	11,875	16,904	55,665	7,490	24,650	9,316	168,804	65
66. All other conditions	11,377	137,785	24,109	63,138	53,992	69,495	69,484	47,372	19,351	496,103	66
67. Poisoning	2	37	22	6	6	15	35	510	4	637	67
68. Beri Beri	—	4	—	—	—	—	—	—	—	4	68
69. Hydatid Disease.	—	—	—	38	—	—	—	—	—	38	69
Total New Cases	130,251	1,178,476	394,056	457,906	517,771	669,179	618,428	511,660	185,647	4,663,374	
ATTENDANCES: MEN	232,716	953,646	399,444	410,626	537,593	715,033	653,147	459,525	225,546	4,587,276	
WOMEN	83,943	411,842	309,273	199,277	221,042	629,057	531,967	387,438	126,850	2,900,689	
CHILDREN	127,883	1,105,452	400,419	288,439	412,242	589,390	725,579	636,892	169,607	4,455,903	
Total Attendances	444,542	2,470,940	1,109,136	898,342	1,170,877	1,933,480	1,910,693	1,483,855	522,003	11,943,868	
MISSIONS	—	—	—	42,649	—	47,215	78,594	—	69,605	238,063	
Grand Total	444,542	2,470,940	1,109,136	940,991	1,170,877	1,980,695	1,989,287	1,483,855	591,608	12,181,931	

TABLE II.

SUDAN: 1951/1952.

ADMISSIONS AND DEATHS BY DISEASES.

	DISEASE	BAHR-EL-GHAZAL		BLUE NILE		DARFUR		EQUATORIA		KASSALA		KHARTOUM		KORDOFAN		NORTHERN		UPPER NILE		TOTAL		
		Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	
1.	Cholera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
2.	Plague	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
3.	Smallpox	2	—	—	—	253	30	4	—	3	1	—	—	21	9	—	—	2	—	285	40	3
4.	Typhus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
5.	Yellow Fever	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
6.	T.B. Pulmonary	96	20	283	48	46	6	60	15	179	29	343	55	82	10	164	13	72	9	1,325	205	6
7.	T.B. Non-Pulmonary	28	6	163	11	22	2	45	5	146	7	121	—	106	7	78	4	38	2	747	44	7
8.	Pneumonia	495	31	1,211	54	855	54	1,324	131	1,073	57	1,049	54	1,544	117	605	33	277	15	8,433	546	8
9.	Influenza	71	—	43	—	107	2	268	7	59	1	217	—	174	5	33	2	—	—	972	17	9
10.	Other Respiratory diseases	318	4	1,171	26	408	9	726	10	887	11	495	20	1,257	9	740	4	243	8	6,247	101	10
11.	Cerebrospinal Meningitis	1,431	238	2,324	341	2,374	379	6	4	380	94	499	16	6,410	828	563	90	540	41	14,527	2,031	11
12.	Chickenpox	444	—	122	1	253	—	295	—	113	—	154	—	293	—	26	—	303	1	2,003	2	12
13.	Diphtheria	1	1	98	10	9	1	—	—	28	4	45	6	6	—	28	8	21	—	236	30	13
14.	Encephalitis Lethargica	—	—	—	—	—	—	—	—	—	—	8	—	—	—	—	—	—	—	8	—	14
15.	Measles	192	1	71	—	208	—	50	3	95	—	72	1	243	3	20	1	146	1	1,097	10	15
16.	Mumps	30	—	68	—	83	1	102	—	87	—	54	—	246	—	5	—	40	—	715	1	16
17.	Poliomyelitis, acute	—	—	1	—	—	—	7	—	—	—	11	—	—	—	—	—	—	—	19	—	17
18.	Rheumatism, acute	32	—	56	2	29	1	76	—	22	1	48	1	19	—	56	—	13	—	351	5	18
19.	Whooping cough	3	—	83	5	16	—	129	3	2	—	71	4	86	—	17	1	4	—	411	13	19
20.	Dysentery	288	7	548	12	723	17	390	20	456	11	416	2	528	10	309	—	388	15	4,046	94	20
21.	Enteric Fever	1	—	82	4	2	—	15	—	16	—	256	45	—	—	22	2	20	1	414	52	21
22.	Gastro-enteritis of children	9	4	135	12	1	—	61	4	71	7	315	61	101	8	141	14	60	5	894	115	22
23.	Undulant Fever	—	—	15	—	—	—	6	—	9	1	8	—	3	—	1	—	1	—	43	1	23
24.	Filariasis	11	—	7	—	9	—	54	—	—	—	3	—	4	—	—	—	—	—	88	—	24
25.	Leishmaniasis	1	—	207	21	8	—	120	11	137	27	66	—	7	1	—	—	290	71	836	131	25
26.	Malaria	1,800	17	2,925	70	784	18	3,729	87	1,681	32	1,094	8	2,324	26	1,096	10	583	21	16,016	289	26
27.	Blackwater fever	—	—	3	—	—	—	2	—	—	—	3	—	1	1	—	—	—	—	9	1	27
28.	Onchocerciasis	16	—	—	—	—	—	36	—	—	—	94	—	—	—	—	—	—	—	146	—	28
29.	Phlebotomus Fever	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	29
30.	Relapsing Fever	—	—	—	—	2	—	3	—	—	—	2	—	2	—	—	—	—	—	9	—	30
31.	Trypanosomiasis	—	—	—	—	—	—	122	2	—	—	—	—	—	—	—	—	—	—	122	2	31
32.	Ancylostomiasis	758	8	16	1	67	—	2,813	17	3	1	20	—	2	—	127	—	22	—	3,828	27	32
33.	Dracontiasis	197	1	28	—	7	—	186	—	43	—	7	—	55	—	9	—	41	—	573	1	33
34.	Schistosomiasis	139	1	389	8	70	2	1,596	3	44	1	75	—	112	2	338	—	14	—	2,777	17	34
35.	Gonorrhoea	1,204	—	488	—	414	—	1,257	—	414	—	59	—	705	—	140	—	161	—	4,842	—	35
36.	Soft Sore	11	—	28	1	46	—	17	—	40	—	39	—	68	—	—	—	1	—	250	1	36
37.	Syphilis	915	4	597	4	2,195	11	2,308	3	366	4	128	1	1,343	3	308	7	1,354	1	9,514	38	37
38.	Yaws	536	1	5	—	3	—	1,363	4	—	—	10	—	—	—	—	—	418	—	2,335	5	38
39.	Anthrax	—	—	2	—	—	—	—	—	2	—	—	—	—	—	—	—	2	—	6	—	39
40.	Hydrophobia, human	3	3	8	2	1	1	1	—	—	—	1	1	2	2	—	—	14	—	30	9	40
41.	Leprosy	47	3	16	1	8	2	191	1	3	1	10	2	11	—	6	1	21	—	313	11	41
42.	Madura Disease	—	—	178	3	19	—	—	—	38	—	49	—	45	—	47	—	5	3	381	6	42
43.	Tetanus	28	10	44	19	2	2	14	7	10	7	20	—	10	7	12	5	4	1	144	58	43
44.	Heat Stroke Syndrome	1	—	2	—	1	—	—	—	19	1	—	—	—	—	2	—	—	—	25	1	44
45.	Confinements	125	5	433	9	79	2	221	11	114	5	326	2	304	3	125	7	—	—	1,727	44	45
46.	Gynaecological	30	1	1,387	11	99	—	22	—	284	1	738	12	574	10	383	6	122	—	3,639	41	46
47.	Diseases of Pregnancy and Parturition	—	—	11	—	17	—	47	1	1	—	352	3	27	3	14	2	—	—	469	9	47
48.	Puerperal Fever	2	1	40	2	11	—	1	1	12	—	18	—	8	—	13	1	—	—	105	5	48
49.	Wounds and injuries	1,883	30	3,941	22	2,807	27	4,890	78	2,794	51	2,524	29	4,027	59	1,500	27	1,304	10	25,670	333	49
50.	Tropical Ulcer	773	9	105	—	255	—	1,071	—	47	—	20	—	870	3	—	—	448	—	3,589	12	50
51.	Diabetes	1	—	62	—	3	—	1	—	42	1	91	2	22	5	73	1	2	—	297	9	51
52.	Pellagra	—	—	1	1	—	—	—	—	1	—	18	—	—	—	5	—	2	—	27	1	52
53.	Scurvy	—	—	23	1	3	—	5	—	20	3	1	—	6	5	2	—	5	1	65	10	53
54.	Neoplasms, malignant	13	1	59	5	16	—	10	3	33	1	72	3	61	6	16	—	6	—	286	19	54
55.	Neoplasms, non-malignant	29	1	98	1	36	—	109	2	83	—	61	2	95	—	22	—	39	—	572	6	55
56.	Trachoma	9	—	72	—	71	—	31	—	18	—	47	—	34	—	31	—	666	—	979	—	56
57.	All other eye diseases	273	1	236	—	277	—	511	4	275	—	918	1	258	—	595	—	50	—	3,393	6	57
58.	Ear Diseases	76	—	67	—	93	1	202	2	58	—	102	—	126	—	61	—	222	—	1,007	3	58
59.	Skin Diseases	489	—	308	3	152	—	515	3	118	—	117	—	272	1	239	1	639	24	2,849	32	59
60.	Alimentary Diseases	735	21	1,735	33	588	14	1,884	56	1,313	95	1,235	47	1,453	81	1,103	19	17	5	10,063	371	60
61.	Circulatory Diseases	47	8	383	20	182	14	24	4	315	45	614	37	338	41	475	15	47	2	2,425	186	61
62.	Genito-urinary Diseases	52	3	737	19	223	7	138	2	446	16	455	6	556	24	375	14	27	—	3,009	91	62
63.	Organic Nervous diseases	11	—	84	4	93	4	14	4	66	3	148	3	100	7	170	6	126	12	812	43	63
64.	Functional Nervous diseases	31	—	7	1	1	1	19	3	—	—	48	—	3	—	46	1	—	—	155	6	64
65.	Fever of uncertain origin	172	—	373	21	342	6	161	11	479	45	565	20	485	25	408	10	1,765	5	4,750	143	65
66.	All other conditions	3,344	53	635	17	772	8	2,252	54	1,274	47	554	14	1,487	39	2,351	2	703	11	13,364	247	66
67.	Poisoning	1	—	129	4	24	1	5	—	2	—	6	—	17	—	29	3	1	—	222	6	67
68.	Beri Beri	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	68
69.	Hydatid Disease	—	—	—	—	—	—	38	5	—	—	—	—	—	—	—	—	—	—	38	5	69
	Total	17,204	494	22,348	829	15,169	623	29,549	581	14,221	611	14,892	458	26,933	1,360	12,929	310	11,289	265	164,534	5,531	
	MISSIONS	—	—	—	—	—	—	723	15	—	—	1,572	144	1,422	—	—	—	—	—	3,717	159	
	Grand Total	17,204	494	22,348	829	15,169	623	30,272	596	14,221	611	16,464	602	28,355	1,360	12,929	310	11,289	265	168,251	5,690