Report of the Medical Services, Ministry of Health, Sudan Government.

REPORT

OF THE

MEDICAL SERVICES, MINISTRY OF HEALTH SUDAN GOVERNMENT

FOR THE YEAR

1950/51

(McC. 2398) S.G. 427 M. of H. 350 Books 3/52.

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CONTENTS.

CHAPTER I.

INTRODUCTION.

This report refers to the eighteen months period of 1st January 1950 to 30th June, 1951.

The period was one of planning. A programme for the consolidation and development of all branches of medical services over a decade was ready for submission to the Executive Council at the end of the period.

Labour disputes throughout the period caused some interference with normal work and training of nursing staff.

The rains of 1950 were abnormally heavy in most parts of the country and resulted in excellent crops and abundant grazing.

A severe epidemic of cerebrospinal meningitis visited the Sudan in the first part of 1950 and persisted until the onset of the rains. Darfur was the major focus of infection, but Khartoum, the Blue Nile and Kordofan provinces were seriously affected. The disease reappeared after the rains of 1950 and in the early months of 1951 had become widespread throughout the northern areas of the Sudan. The outbreak had largely subsided by the end of June. The resources of medical and administrative services were heavily strained in dealing with the epidemic. The number of cases recorded was the greatest in the epidemiological history of the Sudan. Excellent results were obtained from treatment with drugs of the sulphonamide group, but limitations of medical staff and mechanical transport were gravely felt.

The Egyptian Ministry of Public Health gave most valuable assistance by seconding three doctors to relieve Sudanese doctors for epidemic work.

The good rain-grown crops were offset by a heavy incidence of " rain-borne " malaria. The disease was severely felt in Northern Province and in parts of Kassala Province, districts in which, during seasons of normal rainfall, the incidence of malaria is relatively light.

CHAPTER II.

ADMINISTRATION.

(a) STAFF AND FUNCTIONS.

Work throughout the period was handicapped by a shortage of most classes of professional and technical staff.

Table I shows the establishment of classified officials of Medical Services at 30.6.51. Staff serving with local government authorities on secondment is included.

TABLE I.

Establishment of Classified or Certified Officials.

CATEGORY	Establishment		
	British	Sudanese	Others
HEADQUARTERS.			
Director	1	—	—
Asst. Director (Public Health)	1	—	—
Asst. Director (Hospitals)	1	—	—
D.A.D. (Quarantine)	—	1	—
Controller of Medical Stores	1	—	—
Principal Matron	1	—	—
Inspector of Administration	1	—	—
Establishments Officer	—	1	—
Chief Public Health Inspector	1	—	—
Principal, School of Hygiene and Asst. to Chief Public Health Inspector	1	—	—
Labour Officer	—	1	—
Head Staff Clerk	—	1	—
Staff Clerk	—	2	—
Clerk	—	28	—
Head Accountant	—	—	1
Accountant	—	2	—
Bookkeeper	—	21	—
Supt. of Stores	1	—	—
Asst. Supt.of Stores	—	—	1
Stores Supervisor	—	6	—
Storekeeper	—	11	—
HOSPITALS AND DISPENSARIES.			
Director, Khartoum Civil Hospital and Senior Physician	1	—	—
Senior Surgeon	1	—	—
Director, Omdurman Civil Hospital	—	1	—
Senior Obstetrician and Gynaecologist	1	—	—
Asst. Surgeon	1	—	—
Specialist (Surgical, Medical)	10	—	—
Medical Inspector	17	27	—
Anaethetist	1	—	—
Lady Doctor	4	—	—
Asst. Medical Officer of Health (Special Duties)	1	—	—
Dental Surgeon	1	—	—
Supt. Radiographer	1	—	—
Ophthalmologist	—	1	—
Asst. Ophthalmologist	—	1	—
Obstetrician and Gynaecologist, Omdurman Civil Hospital	—	1	—

Category	Establishment		
	British	Sudanese	Others
Senior Medical Officer	—	5	—
Surgeon, Omdurman Civil Hospital	—	1	—
Pharmaceutical Registrar	—	—	1
Dental Mechanic	1	—	—
Dental Officer	—	—	1
Medical Officer (Special Duties)	14	—	2
Medical Officer	—	47	—
Asst. Registrar (Medical, Ophthalmic, Surgical, Obstetrical)	—	4	—
Houseman	—	4	—
Hospital Superintendent	—	2	—
Pharmacist, Omdurman Civil Hospital	—	1	—
Province Medical Assistants	—	9	—
Medical Assistants	—	428	—
Asst. Radiographer	—	9	—
Asst. Radiographer (under training)	—	5	—
Charge Nurse	—	5	—
Nursing Instuctor	—	10	—
Matron	2	—	—
Physiotherapist	1	—	—
Charge Sister	10	—	—
Nursing Sisters	17	—	—
Theatre Attendant	—	24	—
Beshmumarid	—	32	—
Clerk	—	29	—
Southern Clerk	—	1	—
Bookkeeper	—	56	—
Southern Bookkeeper	—	1	—
Ration Clerk	—	28	—
Stores Supervisor	—	2	—
Storekeeper	—	16	—
Telephone Operator	—	2	—
Quarantine Overseer	—	1	—
Southern Trainees	—	10	—
Staff Nurse	—	20	—
Public Health.			
Medical Officer of Health, Khartoum	—	1	—
Asst. Medical Officer of Health, Khartoum	—	1	—
Senior Public Health Inspector	4	—	—
Public Health Inspector	1	6	—
Public Health Officer	—	32	—
Sanitary Overseer	—	151	—
Principal, Midwives Training School	1	—	—
Charge Sister	1	—	—
Supervisor, Health Visitor	1	—	—
Clerk	—	5	—
Senior Staff Midwife	—	2	—
Staff Midwife	—	7	—
Staff Health Visitor	—	2	—
Health Visitor	—	15	—

Category	Establishment		
	British	Sudanese	Others
Research and Laboratory Service.			
Stack Medical Research.			
Asst. Director (Research)	1	—	—
Bacteriologist	—	1	—
Asst. Bacteriologist	1	—	—
Senior Laboratory Assistant	3	—	—
Laboratory Assistant	1	50	—
Head Laboratory Attendant	—	1	—
Junior Technical Assistant	—	1	—
Clerk	—	1	—
Medical Entomology.			
Medical Entomologist	1	—	—
Aedes Control Officer	—	1	—
Technical Assistant	—	3	—
Clerk	—	1	—
Wellcome Chemical Laboratories.			
Government Analyst (Senior Scientific Officer)	1	—	—
Chemist (Scientific Officer)	1	—	—
Senior Technical Assistant	—	2	—
Technical Assistants	—	8	—
Clerk	—	1	—
Kitchener School of Medicine.			
Dean	1	—	—
Lecturer in Anatomy	1	—	—
Asst. Physician and Lecturer in Medicine	1	—	—
Lecturer in Pathology	1	—	—
Lecturer in Physiology	1	—	—
Technician—Physiologist	1	—	—
Library Clerk (Secretary)	—	1	—
Asst. Curator	—	1	—
Graphic Museum.			
Technical Assistant	—	1	—
Museum Attendant	—	1	—
	116	1153	6

The unclassified staff (*i.e.* employees not on establishment) number 5700 approximately.

(b) LEGISLATION.

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

Ordinance.

Date	Short Title	Provision
15.7.50.	The Town Replanning Ordinance, 1950.	For improvement of layout of towns in the public interest.

Regulations and Orders.

Date	Short Title	Provision
15. 6.50	The Workmen's Compensation (Forms) Rules, 1950.	Forms of Schedule to be used in giving notice of death of a workman.
15. 8.50	The Sleeping Sickness (Cancellation) Order, 1950.	Uganda deleted from the list of infected territories.
15.11.50	The Workshops and Factories Regulations, 1950.	For the safety, health and welfare of persons employed in workshops and factories.
15.12.50	The Quarantine (Yellow Fever) Amendment Regulations, 1950.	Relaxation of quarantine formalities in case of air transit passengers.
15.12.50	The Poisons (Amendment) Regulations, 1950.	For the control of anti-microbial organic substances produced by living organisms.
15.12.50	Communicable Diseases (Amendment) Order, 1950.	Acute anterior poliomyelitis made notifiable.
15. 4.51	Order under the Standard Local Government (Townships) Regulations, 1938.	Defining minimum area of building plots in a part of Medani Towa.
5. 4.51	The El Obeid Building Plots (Native Lodging Areas) Minimum Area Order, 1951.	Defining minimum area of building plots in El Obeid Native Lodging Areas.

(c) FINANCE.

TABLE II. (A)

Income and Expenditure of Medical Services in the Past Four Years.

ITEM	1947	1948	1949	1950/51
	£E.	£E.	£E.	£E.
Revenue	68,775	54,393	42,279	51,009
Expenditure.				
Personnel and Personal Allowances	453,703	537,691	594,508	1,200,238
Services	340,841	348,891	414,245	924,926
Extraordinary	11,846	8,837	6,992	26,686
TOTAL	806,390	895,419	1,015,745	2,151,850

TABLE II. (B)

Analysis of Expenditure, 1950/51.

ITEM	Personnel	Services	Extra-ordinary	Total
	£E.	£E.	£E.	£E.
Headquarters	82,269	287,185	705	370,159
Hospitals and Dispensaries	871,250	562,393	25,347	1,458,990
Hygiene and Public Health	196,434	69,652	634	266,720
Research	45,732	5,696	—	51,428
Graphic Museum	1,163	—	—	1,163
Seconded Staff	3,390	—	—	3,390
TOTAL	1,200,238	924,926	26,686	2,151,850

CHAPTER III.

PUBLIC HEALTH.

(a) HEALTH OF OFFICIALS.

TABLE III.

NATIONALITY		Number of officials employed	Total: Placed on sick list	Total: No. of days sick	Average days sickness: For all officials	Average days sickness: For those who were sick	Died	Invalided
British	1949	925	174	1,336	1.44	7.68	2	—
	1950/51	1,004	361	2,850	2.83	7.89	4	4
Sudanese	1949	5,492	1,295	13,612	2.48	10.51	9	11
	1950/51	5,975	2,473	22,314	3.73	9.02	7	21
Others	1949	243	78	726	3.39	9.30	1	2
	1950/51	213	90	800	3.75	8.88	—	2

(b) GENERAL HEALTH.

The following table shows an almost uninterrupted increase in the work done in hospitals and out-patient centres in the past ten years. It is probable that this increase is partly due to expansion of medical facilities, but more to a growing public readiness to seek medical aid and that it does not represent an increase in the incidence of sickness. Estimates of population are not sufficiently precise to make it possible to relate increase of medical work to growth of population served.

TABLE IV (a)

Work done in hospitals and out-patient centres.

YEAR	Admissions	Attendances	Operations
1941	103,023	6,330,711	10,417
1942	114,837	6,750,329	11,353
1943	112,275	6,796,372	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	302,526	16,503,371	31,459

TABLE IV (b)

Year to year percentage increase/decrease for admissions, attendances and operations.

YEAR	Increase/decrease percentage		
	Admissions	Attendances	Operations
1941	—	—	—
1942	+ 11.5	+ 6.6	+ 8.9
1943	— 2.2	+ 0.7	+ 12.1
1944	+ 16.7	+ 4.1	+ 8.4
1945	+ 0.4	+ 11.6	+ 12.0
1946	— 3.8	+ 7.3	+ 0.3
1947	+ 12.4	+ 9.1	+ 8.2
1948	— 1.3	+ 6.1	+ 4.6
1949	+ 7.5	+ 3.7	+ 21.3
1950/51	+ 33.5	+ 8.0	— 1.7

(NOTE : The percentages for 1950/51 are based on two-thirds of the total figures for the period 1.1.50 to 30.6.51. Two factors commonly affect admissions to hospital. During the rains the demands of cultivation often override the demands for treatment and admissions fall. After the rains an increased malaria incidence may cause admissions to rise. Only one full rainy season is included in the 18 months period. Thus two-thirds of the total figures is probably a fair basis for the calculation of percentages).

The percentage increases over the whole ten year period are :—

Admissions	95.8
Attendances	73.8
Operations	101.2

(c) VITAL STATISTICS.

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

TABLE V.

Estimated population of provinces.

Province	Men	Women	Children	Total
Bahr El Ghazal	205,106	217,977	351,657	774,740
Blue Nile	479,869	574,575	786,093	1,840,537
Darfur	234,982	358,015	412,573	1,005,570
Equatoria	169,077	181,536	282,258	632,871
Kassala	244,868	228,169	314,202	787,239
Khartoum	133,978	124,935	207,341	466,254
Kordofan	399,938	493,988	777,702	1,671,628
Northern	174,904	238,146	297,056	710,106
Upper Nile	211,000	250,368	388,833	850,201
TOTAL	2,253,722	2,667,709	3,817,715	8,739,146

TABLE VI.

Estimated increase/decrease of population since 1949.

Province	Men	Women	Children	Total
Bahr el Ghazal	+ 28,092	+ 30,612	— 11,811	+ 46,893
Blue Nile	+ 15,296	+ 29,277	+ 23,898	+ 68,471
Darfur	+ 22,604	+ 29,416	+ 3,910	+ 55,930
Equatoria	+ 6,824	+ 7,879	— 11,455	+ 3,248
Kassala	+ 16,609	+ 14,201	+ 18,644	+ 49,454
Khartoum	+ 14,491	+ 15,393	+ 40,371	+ 70,255
Kordofan	+ 7,329	— 411	+ 15,581	+ 22,499
Northern	+ 18,020	+ 9,826	— 8,346	+ 19,500
Upper Nile	+ 36,961	+ 29,725	+ 24,155	+ 90,841
TOTAL	166,226	165,929	94,947	427,102

(NOTE : The large increase in Khartoum Province is in part due to an increase in the administrative area of the province).

TABLE VII.

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

TOWN	Estimated population.			Total
	Men	Women	Children	
Khartoum	29,443	23,719	25,543	78,705
Omdurman	33,709	42,488	51,686	127,883
Khartoum North	12,519	10,916	17,029	40,464
TOTAL	75,671	77,123	94,258	247,052

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

TABLE VIII.

Number of registered births and crude birth rate.

Khartoum, Omdurman, Khartoum North.

TOWN	No. of Births	Birth rate per 1000.
Khartoum	2,580	21.9
Omdurman	4,618	24.1
Khartoum North	1,424	21.1

(d) PREVENTIVE MEDICINE.

1. Insect-borne Diseases.

(a) *Malaria.* Abnormally heavy rains in 1950 were followed by a much increased incidence of malaria in the northern provinces. Larvicidal control proved quite inadequate to deal with the widespread and often inaccessible breeding conditions caused by the rains and extensive breeding of *Anopheles gambiae* occurred. For the first time since eradication was reported complete in 1947, (after 2 years observation) *A. gambiae* larvae were discovered in the Faras to Saras reach of Wadi Halfa district. The larvae were also reported in the neighbourhood of Abu Simbel over the Egyptian frontier.

The outbreak of malaria reached a sudden peak in the northern provinces in September and October. The usually lightly affected Northern Province, parts of Kassala Province and the rural district of Khartoum were heavily attacked. Following control measures the incidence fell, but rose again during the cold weather of January and February. During the latter peak no evidence of extensive mosquito-breeding, nor any great number of adult mosquitoes, could be found. It appeared probable that the recrudescent peak was largely attributable to relapsed cases or latent infections.

Control measures adopted included :—

(a) Employment of large bodies of casual labour to deal with rainwater collections.

(b) Residual spraying of all buildings in heavily infected areas. Benzene hexachloride ('Gammexane' P.520 Wettable Powder) was mainly employed.

(c) Teams of medical assistants and hospital dressers toured affected areas carrying out treatment.

(d) Widespread distribution of anti-malarial drugs was carried out through local authorities and local societies and institutions.

Residual spraying.

Apart from the emergency spraying carried out as an epidemic control measure several planned 'pilot schemes' of residual spraying were effected. A limited amount of residual spraying, firstly with D.D.T. in paraffin, then with D.D.T. Wettable Powder and finally with B.H.C. ('Gammexane' P.520) has been undertaken in large urban centres since 1946. The object of the pilot schemes was to work out administrative methods and costs of residual spraying in semi-urban and rural areas and to overcome passive resistance by creating a demand for this form of protection amongst less sophisticated populations. Four blocks of the Gezira Irrigated Area had all dwellings sprayed in a period of a fortnight in September through the agency of Pest Control Ltd. The whole of Gedaref town was sprayed in three weeks in June, 1950, by a team from the Public Health Service. Perimeter spraying of Kassala Town and of much of the Gash Area was done by the Public Health Service. Perimeter spraying in El Obeid and adjacent villages was done by the Public Health Service.

No attempt was made to effect an accurate assessment of the value of the measure. In a country as large, and with a population so scattered, as the rural Sudan, it is considered that accurate checks of mosquito breeding, spleen indices and parasite rates are economically impracticable. Moreover, in the Northern Sudan malaria is largely seasonal and its incidence depends upon the rainfall. It is believed that residual spraying will have to be done over a succession of seasons, with all their variations of climatic conditions, before judgment can be made as to its effectiveness in the control of rural malaria under Sudan conditions.

The measure has certainly succeeded in gaining popularity amongst rural populations. There was some evidence that the rate of *A. gambiae* breeding fell abruptly in areas treated with residual spray. It was considered that the result achieved were sufficiently promising to justify, the institution of a wide measure of residual spraying carried out at suitable time intervals in subsequent years.

Chemoprophylaxis.

Administration of suppressive Paludrine was employed in certain schools, police forces and other circumscribed population groups. As far as could be decided from tests without controls the measure greatly decreased the malaria infection rate. The Acting Medical Inspector, Roseires, after a careful experiment amongst the local police, concluded that the results from a twice-weekly dose were as good as those from a daily dose.

38,788 cases of malaria were admitted to hospitals. 431 deaths were attributed to the disease. In the 12-months period of 1949 the figures were 14,360 and 210 respectively.

Table IX shows the total attendances diagnosed as malaria at out-patient departments in 1949 compared with two-thirds of such total for the eighteen months 1950-51. The value of such comparison is partly impaired by the largely seasonal incidence in much of the Sudan. Moreover, recorded attendances for treatment present a very imperfect picture of the real incidence since, particularly in an epidemic season, a large number of cases are treated in their homes by peripatetic therapeutic teams and by self-medication.

TABLE IX.

PROVINCE	Attendances for Malaria 1949.	2/3 Attendances for Malaria 1950/51
Bahr El Ghazal	6,690	4,144
Blue Nile	82,375	129,326
Darfur	10,566	18,848
Equatoria	13,900	24,140
Kassala	21,238	38,272
Khartoum	7,076	21,638
Kordofan	44,097	56,270
Northern	13,251	47,840
Upper Nile..	19,733	11,550
TOTAL	219,226	352,028

TABLE X.

Species of parasite in 24,848 *Positive Slides.*

Province.	*P. falciparum*	*P. vivax*	*P. malaria*	Total
Bahr El Ghazal	1,469	44	3	1,516
Blue Nile	3,781	238	6	4,025
Darfur	500	306	—	806
Equatoria	6,158	333	91	6,582
Kassala	1,714	56	—	1,770
Khartoum	3,337	206	—	3,543
Kordofan	2,960	441	17	3,418
Northern	2,719	222	20	2,961
Upper Nile	223	4	—	227
TOTAL	22,861	1,850	137	24,848

(b) *Blackwater fever* has almost ceased to be a condition of significance in the Sudan. 6 cases, with two deaths, were recorded. During the six years ending 1949 the annual mean number of cases diagnosed was 9.66.

(c) *Relapsing fever.* The diagnosed incidence of this disease was the lowest on recent record. 36 cases with 2 deaths were notified.

TABLE XI.

Relapsing fever: cases and deaths over 10 years.

Year	Cases	Deaths
1941	3,028	110
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
1950/51	36	2

TABLE XII.

Relapsing fever 1950/51.

Distribution in provinces.

Province	Cases	Deaths
Blue Nile	4	—
Darfur	10	—
Kassala	8	—
Khartoum	10	2
Northern	3	—
Upper Nile	1	—
TOTAL	36	2

(d) *Leishmaniasis.* There was a considerably increased incidence in the endemic focus of Kapoeta and in Singa. Treatment with Pentostam (sodium stibogluconate) was of great value. It is not possible to connect a fall in the incidence in Kassala Province with the institution of insecticidal residual spraying.

Table XIII.

Leishmaniasis : Reported incidence over 10 years.

Year	Cases
1941	434
1942	432
1943	225
1944	205
1945	192
1946	246
1947	327
1948	460
1949	523
1950/51	638

Table XIV.

Leishmaniasis 1950/51. *Distribution.*

Province	Cases	Deaths
Bahr El Ghazal	—	—
Blue Nile	233	22
Darfur	1	—
Equatoria	188	6
Kassala	104	16
Khartoum	80	—
Kordofan	12	3
Northern	1	—
Upper Nile	19	3
Total	638	50

(c) *Trypanosomiasis.* Recorded incidence of the disease was confined to Equatoria Province. 61 new cases were notified as compared with 34 in the preceding twelve months. In the Zande district dispersion of the population under the re-settlement scheme has made fly control more difficult and may have increased the risk of "fly-man contact." The only line of defence against the disease is regular inspection of the whole population in infected or suspected areas. New population registers were still in the course of completion.

TABLE XV.

Sleeping Sickness. Distribution of cases over 10 years.

YEAR	S. Yubu	Yambio	Yei	Kajo-Kaji	Meridi	Imported	Other Localities	TOTAL
1941 ..	69	—	—	1	47	8	—	125
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

Filariasis. 402 cases were reported, of which 366 were in Equatoria Province.

Typhus Fever. No case of exanthematic typhus was diagnosed. One case of rat-flea typhus was diagnosed in patient who had come from the Gezira between Sennar and Wad Medani. Investigations undertaken are reported in the Laboratory Services chapter of this report.

Yellow Fever. No case was reported.

2. EPIDEMIC AND ENDEMIC DISEASES.

(a) *Cerebrospinal Meningitis.* The early part of 1951 saw the largest recorded outbreak of cerebrospinal meningitis in the Sudan. The epidemic followed upon a smaller outbreak in 1950.

Four cases of the disease were diagnosed in the Dar Masalit District of Darfur in December 1949. The disease rapidly became epidemic in Darfur and reached its peak with a total of 2,007 cases in April 1950. Following the rains in May the epidemic subsided. Meanwhile infection had spread to all other northern provinces in the Sudan, with Khartoum, Blue Nile and Kordofan provinces most seriously affected. The total cases recorded up to subsidence of the outbreak during the rains, and excluding cases notified in 1949, was 5,335 distributed as follows :—

Darfur	3,837
Khartoum	707
Blue Nile	338
Kordofan	312
Kassala	125
Northern	16

834 deaths resulted during this epidemic, a case fatality rate of nearly 22 per cent.

The infection broke out again in Khartoum, Kassala and the Blue Nile provinces in October 1950.

No immediate spread occurred in these centres, but with the appearance of cases so early in the season it was realised that a large epidemic was probable. Cases were reported from Darfur in November and here the disease immediately became epidemic. 52 cases were reported from this province during December 1950. The epidemic reached a peak in Darfur with 1,256 cases in the week ending 31st. March and did not markedly subside until the middle of June. The disease was still smouldering at the end of this month.

During December 1950, cases were reported from all the northern provinces except Khartoum and Northern Province. By January 1951 the Blue Nile and Kordofan Provinces, mainly the Nuba area, were severely affected and infection was spreading in Kassala Province. Khartoum and Northern provinces were not heavily attacked until the beginning of April.

The first rains in 1951 were throughout most of the northern provinces lighter than those of 1950. Though greatly abated in incidence cases of cerebrospinal meningitis were still reported from all northern provinces at the end of June.

The period of maximum incidence in all northern provinces is indicated in the following table :—

TABLE XVI.

Province	Maximum Weekly incidence	Week ending
Blue Nile	2,729	12.5.51
Darfur	1,256	31.3.51
Kassala	191	12.5.51
Khartoum	1,028	19.5.51
Kordofan	1,671	12.5.51
Northern	150	19.5.51

Restrictions sufficiently stringent to limit the spread of cerebrospinal meningitis would be intolerable to public opinion, almost impossible to enforce and paralysing to the normal life of the country. Moreover, to be effective, such restrictions would have to be enforced at the appearance of the first cases of infection early in the season. Fear of imposition of quarantine measures is a major cause of concealment of cases. Since drugs of the sulphonamide group offer an effective treatment in early cases of the disease this was emphasised in propaganda through radio, press, posters and leaflets. Control measures, were concentrated on establishment of treatment centres which were designed to place treatment within reach of every infected area. Travelling staff undertook inspections of all villages in infected areas. Quarantine impositions were reduced to a minimum.

The epidemics of 1950/51 were the first major outbreaks of cerebrospinal meningitis in the northern provinces of the Sudan since the introduction of the sulphonamide drugs. During the early weeks of the first outbreak there was probably a tendency on the part of the people, with memories of quarantine restrictions and ineffective treatment of past years, to fail to report cases. Confidence in treatment rapidly increased and this, combined with the realisation that onerous quarantine restrictions were not imposed, led to a general desire to bring patients to treatment centres and to report outbreaks of the disease. It is believed that the control policy adopted was responsible for a greatly reduced mortality rate and an almost negligible degree of concealment of cases. The greater readiness with which cases were reported may mean that a comparison between the recorded incidence of the disease and that of former years is fallacious.

There has been no big epidemic of cerrebrospinal meningitis in the southern provinces since 1945/46, but the condition remains eudermic in the Bahr El Ghazal and Equatoria Provinces.

TABLE XVII.

Cerebrospinal meningitis : Distribution of recorded cases 1.1.50 *to* 30.6.51.

Province	Recorded cases	Recorded deaths	Case fatality rate
Blue Nile	17,192	1,864	10.8
Darfur	17,954	2,581	14.4
Kassala	1,276	259	20.3
Khartoum	5,682	366	6.5
Kordofan	14,253	2,388	16.7
Northern	719	138	20.3
Total Northern Provinces	57,076	7,596	13.3
Bahr El Ghazal	143	66	46.2
Equatoria	64	25	36.3
Upper Nile	30	—	—
Total Southern Provinces	237	91	38.4
GRAND TOTAL	57,313	7,687	13.4

It is probable that the distances involved and relative infrequency of intercourse between the northern and the southern provinces make any spread of this infection between the two areas unlikely.

TABLE XVIII.

Cerebrospinal meningitis : Recorded incidence over 10 years.

YEAR	Recorded cases	Recorded deaths	Case fatality rate
1941	1,824	459	25.2
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	57,313	7,687	13.4

In the Sudan cerebrospinal meningitis is predominantly a disease of rural areas. It is probable that housing conditions are worse in villages than in towns and that in the former there is a relatively higher degree of overcrowding in houses. Moreover, particularly upon traffic routes, villages may be subjected to a succession of visitors who are potential carriers. During 1950 only 24.7 per cent of the total cases recorded were reported from towns. In 1951 urban cases amounted to 14.5 per cent of the total. It is certain that an unrecorded number of the urban cases contracted the disease in villages adjacent to the towns.

TABLE XIX.

Cerebrospinal meningitis and relative humidity.

District cases and mean of day relative humidity (R.H.)

Month	Blue Nile (North)		Blue Nile (Fung)		Darfur		Nuba Area	
	Cases	R.H.	Cases	R.H.	Cases	R.H.	Cases	R.H.
January ..	23	43	4	43	536	38	110	27
February ..	96	25	17	32	1,115	29	2,306	17
March	1,335	28	99	28	3,220	24	2,722	16
April	4,865	12	1,197	17	4,835	20	2,001	15
May	5,185	36	3,054	43	3,265	36	1,092	57
June	411	42	148	47	916	45	35	74
TOTAL ..	11,915	—	4,519	—	13,787	—	8,266	—

Means of Relative Humidity per cent as at 08.00 hrs. were recorded at Wad Medani, Sennar, El Fasher and Kadugli.

The following tables show the estimated age distribution of cases. Unfortunately uniform age-groups were not employed in all districts. All cases were included in the analyses in the Fung district and the Nuba area, but accurate analysis was only possible in 5,313 cases in Darfur.

TABLE XX.

Cerebrospinal meningitis. Distribution by age-group.

	Age-group	Percentage of total cases.
(i) *Fung District.*	0— 5	14
	6—10	17
	11—20	22
	21—30	26
	31—40	10
	41—60	8
	over 60	3
(ii) *Nuba area.*		
	0— 5	25
	6—10	28
	11—15	20
	16—25	11
	26—40	12
	41—60	3
	over 60	1
(iii) *Darfur*		
	0— 4	23
	5— 9	31
	10—19	23
	20—40	16
	over 40	7

Amongst adults males were affected more than females.

Figures showing the case fatality rate at different age groups are not of value. The main factor affecting mortality was the period of time which elapsed between the onset of symptoms and the start of treatment.

Complications and sequelae in surviving cases were relatively infrequent.

(b) *Diphtheria* : 573 cases with 77 deaths represented no significant change in the mildly endemic state of this disease. The incidence of the disease was not high enough to justify the routine immunisation of susceptibles, though this protection was available if requested.

TABLE XXI.

Diphtheria. Reported incidence and deaths since 1941.

YEAR	Cases	Deaths
1941	186	38
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

TABLE XXII.

Diphtheria 1950/51. *Distribution.*

Province	Cases	Deaths
Blue Nile	210	33
Darfur	12	3
Equatoria	43	1
Kassala	71	10
Khartoum	109	11
Kordofan	36	4
Northern	84	14
Upper Nile	7	1
TOTAL	573	77

(c) *Dysentery.* 6,261 cases were admitted to hospital. 139 deaths were reported. 67,053 cases were diagnosed at out-patient centres. These figures compared with the reported incidence in previous years, show no significant change. Differentiation between amoebic and bacillary infections was not generally possible. There was probably a tendency to include too many cases in the former group on a clinical diagnosis only.

(d) *Enteric fever.* The mean of the recorded annual incidence during the ten years ending 1949 is 195.6, with 116 cases in 1946 and 336 cases in 1940 as the extreme figures.

Table XXIII shows a relative increase above the mean figure and above the comparatively high incidence of the previous 12 months.

TABLE XXIII.

Enteric fever : Incidence and deaths by provinces.

1949 *and* 1950/51.

Province	1949		1950/51 (18 months)	
	Cases	Deaths	Cases	Deaths
Bahr El Ghazal	—	—	—	—
Blue Nile	107	6	115	11
Darfur	19	1	5	—
Equatoria	25	2	101	4
Kassala	22	3	67	3
Khartoum	65	5	103	8
Kordofan	4	2	—	—
Northern	50	4	146	3
Upper Nile	19	1	23	—
TOTAL	311	24	560	29

The relative increase in Equatoria Province was due to an epidemic in Katire, involving a total of 88 persons. The source was traced to a carrier employed as a food-handler in a public eating house. No epidemic outbreak occurred in other provinces.

(e) *Leprosy.* No change was introduced in the methods of control adopted. Encouraging results were reported following sulphone treatment. Marked symptomatic improvement was frequent, but cases remained bacteriologically positive. It appeared that more prolonged courses of the drug must be given before it is possible to decide if a radical cure of the infection can be achieved.

TABLE XXIV.

Leprosy: 1950/51.

Province	Total known cases	Total in Settlements		Bacteriologically positive new cases found.
		Government	Missions	
Bahr El Ghazal	202	144	—	19
Blue Nile	189	46	—	19
Darfur	42	33	—	36
Equatoria	6,821	969	201	208
Kassala	42	36	—	23
Khartoum	46	10	—	13
Kordofan	2,122	80	—	16
Northern	11	—	—	11
Upper Nile	57	21	—	10
TOTAL	9,532	1,339	201	355

(f) *Rabies.* 20 cases of human hydrophobia were recorded.

(g) *Smallpox.* 110 cases were notified, of these 71 cases, diagnosed as alastrim, were in the Upper Nile Province where the disease smoulders in this mild form. 136,728 vaccinations were performed, largely on the transport routes of Darfur, Kordofan and the Blue Nile Provinces.

(h) *Tuberculosis.* A Chest Physician was appointed in March, 1950. He undertook organisation of a pilot Tuberculosis Scheme in the Three Towns. Three female tuberculosis visitors were appointed to carry out domiciliary supervision. Late in 1950 public interest in tuberculosis stimulated the formation of a voluntary body, the Sudan Association for the Prevention of Tuberculosis. The organisation has attracted considerable support and has already afforded useful assistance to patients undergoing domiciliary care and to dependents of patients in hospital.

The following beds were available for the care of cases of tuberculosis in the Three Towns :—

River Hospital	62
Khartoum Hospital	14
Omdurman Hospital	13
Khartoum North Hospital	12
Hamad El Nil Hospital	56
TOTAL	157

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

Cases under domiciliary care at 30.6.51.		171
Admissions to hospital		260
Discharged		160
(a) Quiescent and fit for light duty	121	
(b) Transferred to other institutions as unlikely to benefit from specialist treatment ..	39	
Died		44
Out-patients seen		
(a) Pulmonary Tuberculosis		570
(b) Non-Pulmonary Tuberculosis		71
(c) Non-tuberculosis chest conditions and suspects under surveillance		2,061
TOTAL		2,702
New contacts examined		790
Contacts under surveillance at 30.6.51		423
Number of visits by tuberculosis visitors to patients' homes		688
Screening examinations		3,193

The recorded incidence of both pulmonary and non-pulmonary tuberculosis has shown an almost uninterrupted upward trend for a number of years. Admissions to hospital do not represent the full diagnosed incidence of the disease since cases unlikely to benefit from in-patient treatment are often kept under domiciliary supervision in their homes. Moreover, some of the diagnoses of tuberculosis made in out-patient centres may not be entirely reliable.

It is difficult to decide if the increase in hospital admissions represents a real increase in the incidence of infection, or to what effect it reflects such incalculable factors as a greater readiness to seek medical aid, extension of medical services and improved means of diagnosis.

The increase in admissions for tuberculosis is paralleled by the general increase in hospital work. Establishment of improved facilities for treatment in the Chest Unit has encouraged a comparative rush of cases seeking advice.

Deaths recorded in cases admitted to hospital do not indicate the true fatality rate of tuberculosis in the Sudan. The Sudanese are as a rule intolerant of prolonged detention in hospital and in this chronic disease large numbers of patients discharge themselves and many probably die in their own homes where accurate registration of the cause of death is not possible. The fatality rate of tuberculosis over a short period, and under the best conditions of treatment, may be indicated by the figures from the Chest Unit.

The view that African races lack resistance to tuberculosis is not shared by those with most experience of tuberculosis in the Sudan

Tuberculosis of cattle is very rare in the Sudan. Both pulmonary and all forms of non-pulmonary tuberculosis in man are probably always due to the human type of organism. The source of infection in both varieties of the disease is probably almost exclusively the open case of human tuberculosis. Apart from the social and economic factors which everywhere play so large a part in the genesis of human tuberculosis control of the disease may be largely resolved into supervision of open cases and a system of case-finding designed to detect infection in its early stages. Preliminary steps were taken with a view to investigation of the role to be played by immunisation with B.C.G. vaccine in the prevention of tuberculosis, but it is not believed that immunisation can replace the less dramatic hygienic and social measures necessary for control of the disease.

TABLE XXV.

Tuberculosis. Admissions to hospital over 10 *years.*

YEAR	Pulmonary	Non-Pulmonary	Total
1941	631	511	1,142
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

TABLE XXVI.

Tuberculosis 1950/51. *Distribution.*

Province	Pulmonary	Non-Pulmonary	Total
Bahr El Ghazal	63	25	88
Blue Nile	327	169	496
Darfur	33	36	69
Equatoria	84	49	133
Kassala	268	174	442
Khartoum	350	221	571
Kordofan	135	94	229
Northern	264	79	343
Upper Nile	87	36	123
TOTAL	1,611	883	2,494

34 of the cases admitted to hospital contracted the infection in countries other than the Sudan.

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

TABLE XXVII.

Tuberculosis 1950/51. *Age distribution.*

	Age Periods.								Undefined
	0-1	1-5	6-15	16-25	26-35	36-45	46-65	Over 65	
Northern Province.									
Pulmonary	1	3	28	247	398	247	163	45	70
Non-Pulmonary ..	2	43	56	138	187	145	51	12	10
Southern Province. ..									
Pulmonary	—	—	1	77	147	84	29	5	10
Non-Pulmonary ..	—	13	41	47	45	21	5	—	3
Non-Sudanese. ..									
Pulmonary ..	—	—	1	10	27	14	3	1	—
Non-Pulmonary ..	—	1	5	13	30	8	7	—	—

The site of the main lesion in 883 cases of non-pulmonary tuberculosis admitted to hospital is shown in TABLE XXVIII.

TABLE XXVIII.

Site of Lesion	Northern Provinces	Southern Provinces	Non-Sudanese	Total
Gland	253	64	39	356
Bone	236	43	39	318
Joint	83	29	13	125
Abdomen	49	4	9	62
Skin	19	—	1	20
Genito-urinary	1	—	—	1
Meninges	1	—	—	1
TOTAL	642	140	101	883

The rarity with which tuberculosis meningitis was diagnosed corresponded with the comparative rareness of any form of tuberculosis diagnosed in infants.

(*j*) *Undulant fever.*

TABLE XXIX.

Undulant fever 1950/51. *Distribution.*

Province	Cases	Deaths.
Bahr El Ghazel	—	—
Blue Nile	20	1
Darfur	—	—
Equatoria	7	2
Kassala	15	3
Khartoum	8	—
Kordofan	7	1
Northern	—	—
Upper Nile	2	—
TOTAL	59	7

The patchy distribution and low incidence of this disease suggests that there exists a high degree of immunity amongst the population at risk. The habit of boiling milk before use is common, and in many parts milk is allowed to sour before it is consumed.

3. HELMINTHIC DISEASES.

(a) *Ancylostomiasis.* 12,559 cases were treated, of which 11,574 were in the two southernmost provinces. 619 cases were notified from Northern Province.

(b) *Dracontiasis.* 3,881 cases were reported. Equatoria, the Bahr El Ghazal and the Nuba area were the main centres of infection.

(c) *Schistosomiasis.* Professor T. H. Davey and Professor R. M. Gordon, of the Liverpool School of Tropical Medicine, visited the Gezira Irrigated Area at the invitation of the Sudan Government to examine the problem of control of schistosomiasis. A valuable report has been submitted to the Ministry of Health. The report refers to the accurate collection of data compiled by Dr. W. H. Greany during five years work. Its recommendations are mainly based on Dr. Greany's findings. Some 17 per cent of the population are proved infected with schistosomiasis, but it is probable that more specialised methods of examination would show a higher incidence. A considerable proportion of those infected are unaware of their condition, which is only revealed by routine survey. There is, however, no doubt that the disease gravely affects the health of a proportion of the population. The report states " We believe it to be highly unlikely that any marked increase in efficiency or reduction in cost of schistosomiasis control in the Gezira will be effected until further knowledge concerning some of the factors just referred to has been gained, and that the answer to the problem can best be provided by a research team."

Proposals for the composition, control and location of the research team are given in the report, which also emphasises the importance of health education to improve local hygienic standards.

Table XXX (a)

S. haematobium. Routine examinations.

Province	Men		Women		Children		Total	
	No. examined	No. infected	No. examined	No. infected	No. examined	No. infected	No. examined	No. infected
Bahr El Ghazal	5,672	4	3,049	—	441	—	9,162	5
Blue Nile (Gezira)	7,937	120	8,437	98	10,348	275	26,722	493
Blue Nile (Fung)	600	82	595	22	460	13	1,655	117
Blue Nile (Immigrants)	986	22	985	35	946	19	2,917	74
Darfur	10,102	658	2,960	164	3,195	711	16,257	1,523
Equatoria ..	—	—	—	—	—	—	—	—
Kassala ..	12,134	543	5,716	65	6,984	338	24,834	946
Khartoum ..	17,298	561	16,111	59	3,018	55	36,427	675
Kordofan ..	25,711	2,484	7,544	806	10,262	2,183	43,517	5,473
Northern ..	33,622	2,322	16,707	558	29,996	2,571	80,325	5,451
Upper Nile ..	136	50	36	7	54	12	226	69

Table XXX. (b)

S. Mansoni. Routine examinations.

Province	Men		Women		Children		Total	
	No. examined	No. infected	No. examined	No. infected	No. examined	No. infected	No. examined	No. infected
Bahr El Ghazal	7,475	335	3,583	145	2,035	62	13,093	542
Blue Nile (Gezira)	7,794	952	7,957	695	10,078	1,823	25,829	3,470
Blue Nile (Fung)	985	6	—	—	10	2	995	8
Blue Nile (Immigrants).	1,006	165	996	144	960	257	2,962	566
Darfur	—	—	—	—	—	—	—	—
Equatoria ..	22,072	1,857	13,663	868	5,568	331	41,303	2,756
Kassala ..	2,539	36	1,751	4	1,249	12	5,539	52
Khartoum ..	7,780	68	9,869	4	17,649	72	35,298	144
Kordofan ..	6,325	17	2,400	6	4,700	7	13,425	30
Northern ..	5,993	46	2,296	6	860	5	9,149	57
Upper Nile ..	121	58	26	13	9	4	156	75

4. OTHER DISEASES.

(a) *Acute Rheumatism.* 405 cases were diagnosed. 4 deaths were recorded.

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

Carcinoma	156
Sarcoma	71
Undefined	133
Benign tumours	549
TOTAL	909

(c) *Venereal Disease.* There is no indication of any change in the incidence of these infections.

(d) *Yaws*: The condition is practically confined to the three southern provinces.

E. SANITARY CIRCUMSTANCES.

The responsibility for sanitation was increasingly assumed by local government authorities.

Water supplies. Expansion of the towns of Khartoum and Khartoum North outran the capacity of the water company. Economy measures were instituted. Regular bacteriological examination of the public supply was maintained.

The Bano dam improved the water supply to El Obeid. Progress was made on the work on El Ein dam.

Extensions of piped water supply were made in Atbara, Kassala and the scheme for a piped supply in Wau neared completion. Much of the Juba water supply system was relaid. In Fasher work on the Wadi Golo dam met with difficulties and delays. Supply in three of the town water yards at Fasher was improved.

Yei, Li Rangu and Li Yubu were all reported short of water.

Progress was made with the programme of well boring and hafir (rain water reservoir) digging in Kordofan, Darfur, Kassala, Blue Nile and Upper Nile provinces. Provision of an alternative water supply from deep bores in the Gezira Irrigated Area is regarded as an important measure of control of schistosomiasis

Disposal of waste matter.

Conservancy. A loan to the Khartoum Municipal Council to enable the installation of a water carriage system was approved. The estimated cost of the Municipality's share of the scheme was £E. 750,000.

Private septic tank installations grew in popularity in large towns.

A communal "Water Privy" latrine installed in Port Sudan proved successful. Local Government authorities showed interest in this form of flushless septic tank.

Omdurman Municipal Council employed 'Gammexane' on a wide scale to control fly breeding in pit latrines. A considerable measure of success resulted, but there was some evidence that Gammexane—resistant strains of fly developed.

Housing. Further progress was made in the Deims clearance scheme in Khartoum. A part of the Medinine quarter in Wad Medani was cleared and re-developed. A large part of the native lodging area in El Obeid was reclassified as third class building land. A large extension of first class building was made on the open space between the Governor's office and the town.

A re-planning scheme of the Mirghania quarter, Kassala was successfully initiated. A small re-planning scheme was carried out in the Deims of Wadi Halfa. A large amount of building development was carried out in Juba.

Private building enterprise was active in most urban areas. An improved standard of house was generally demanded.

Food in relation to health. Inspection and control of foodstuffs was carried out in large towns. Attempts to enforce standards for public restaurants, dairies, bakeries, mineral water and ice factories, markets and shops were met with varying degrees of success.

Abundant rains brought excellent crops throughout the northern provinces. There was generally a sharp fall in the price of grain, but the prices of meat and milk showed an upward trend.

Reports of dietary surveys amongst the Azande and in the Gezira Irrigated Area and East bank villages were published. Both surveys were carried out in great detail by Mrs. G. M. Culwick. The author pointed out that in the Zande area the diet of the people was geared to a slow rate of living with a low output of energy. April and May, the months of hardest work, coincided with the lowest energy intake. She considered that the protein-carbohydrate ratio was too low for safety, but that, among other ways, the position might be improved by a reduction of the proportion of cassava in the diet and its partial replacement with a cereal. Too great reliance on cassava threatened to undermine the whole nutritional position. Riboflavin was somewhat deficient in the diet and also Vitamin A for most of the dry season.

In the Gezira and East Bank villages Mrs. Culwick found that within the framework of a common basic pattern of food habits a wide range of actual day-to-day practice from good feeding down to very poor and restricted feeding. The primary limiting factor in matters of diet was economic necessity.

Education in nutrition is only practicable when economic factors allow an adequate field of choice of foodstuffs. Dietary improvement may follow spontaneously in the wake of economic development as the food pattern at the top of the present social ladder has many good points. Specific recommendations included the need for more vegetable gardens and more milk.

Industrial hygiene. The enactment of the Workshops and Factories Regulations, 1950, enabled a start to be made in improvement in the sanitary environment of industrial workers.

CHAPTER IV.

SOCIAL HYGIENE.

Midwifery. A new ante-natal clinic was opened in connection with the Midwives Training School, Omdurman. A block of two four-bedded lying-in-wards with appropriate ancillary departments was opened in the School. This institution will be of value for training of medical students and midwives. 95 mothers were delivered in the lying-in wards from February to June, 1951.

30 out of 37 pupil-midwives were successful in their qualifying test in 1950. 30 out of 35 were successful in 1951. Four pupils at El Obeid Midwives Training School and two at the Juba School were successful.

The Principal and Assistant Principal, accompanied by staff midwives carried out tours in Wadi Halfa-Merowe, Kassala Northern Area, Kassala Southern Area, the Gezira, Khartoum Rural District, El Obeid, Darfur, Fung district, White Nile district, Atbara-Shendi Area, Juba, Malakal and Wau.

418 Government trained district midwives were practising at the end of the period. In addition there were 36 midwives with nurses' certificates and 15 midwives with nurses and health visitors certificates.

TABLE XXXI.

Distribution of Midwives.

Province	District Midwives	Trained nurse midwives	Health Visitors	Total
Bahr El Ghazal	—	2	—	2
Blue Nile	97	5	3	105
Darfur	28	1	1	30
Equatoria	2	2	—	4
Kassala North	11	1	1	13
Kassala South	24	1	—	25
Khartoum	94	22	9	125
Kordofan	55	—	1	56
Northern	102	2	—	104
Upper Nile	5	—	—	5
TOTAL	418	36	15	469

Maternal and Child Welfare. Six pupil health visitors qualified, bringing the total of Sudanese health visitors employed to 15. They were distributed as follows :—

Khartoum	2
Omdurman	3
Khartoum North	2
Kordofan (El Obeid)	2
Darfur (El Fasher)	1
Port Sudan	1
Blue Nile (Wad Medani)	1
Blue Nile (Kosti)	1
Gezira (seconded to Ministry of Education for Adult Education Scheme)	2

Port Sudan Municipal Council established a new Welfare centre.

The numbers attending both ante-natal and child welfare clinics showed a slight rise. There was a noticeable decrease in the number of merely sick children attending and an increasing number of mothers appeared to accept and carry out the instructions of health visitors.

More women attended for ante-natal examination in the early months of pregnancy. The value of ante-natal care is well recognised.

School Medical Service. This service suffered in both 1950 and 1951 from the necessity for diverting staff to epidemic control work and general shortage of medical staff.

Health Education.

The Graphic Museum exercised a wide appeal and attracted a steady flow of non-medical visitors.

Health exhibitions were organised at agricultural shows and other gatherings throughout the country. Material for such exhibitions was furnished from the Graphic Museum.

Lessons on personal hygiene, conducted by the teaching staff, formed a part of the curriculum in Government schools. It is believed that such lessons, on lines laid down by the Medical Services, are better given by school teachers than by medical staff who lack teaching experience.

Articles on matters of health were frequently published in the press. Editors are generally anxious to include material of this nature.

A Sudanese " Radio doctor " gave regular broadcast health talks. There was evidence that such talks attracted wide interest.

Health, and the responsibility of medical staff to undertake health teaching, was emphasised in the training of medical assistants, health visitors, and sanitary staff. It is believed that an individual approach is the soundest and most lasting form of health teaching.

A poster campaign drew attention to the precautions to be taken against cerebrospinal meningitis.

The period was punctuated with criticism of and attacks on Medical Services in certain sections of the press. Such attacks, perhaps not always without ulterior motive and sometimes irritating, are not without value and indicate a laudable public awareness of health and hygiene.

Mental Health. The Mental Diseases Board did 68 examinations on 54 cases, classified as follows :

Psychosis	19
Psychoneurosis	12
Senile dementia	5
Epilepsy	2
Mentally subnormal	4
Normal or recovered	12

A centre for treatment of functional nervous diseases as out-patients was established in Khartoum North in charge of a Sudanese specialist psychiatrist. The centre is serving a useful purpose in bringing relief to the large number of sufferers from these forms of invalidism and as a pilot scheme for working out the methods suitable for the care of functional nervous diseases in Sudanese.

1,090 new cases and 1,010 old cases were treated at the centre. They were classified as follows :—

Psychosis	286
Psychoneurosis	894
Other conditions	1,020

A criminal lunatic asylum for the reception of mentally unsound persons detained under the Penal Code was opened. The institution is under the administration of the Civil Secretary. The Ministry of Health has undertaken responsibility for the medical care of inmates.

CHAPTER V.

PORT HEALTH. QUARANTINES.

No seaport or airport was declared infected.

The *Aedes* index at Port Sudan and Wadi Halfa was nil throughout the period. The Aedes index is calculated on an inspection of all premises within a district in accordance with the recommendation of the World Health Organisation.

Anopheles gambiae re-appeared in the Wadi Halfa eradication reach, Faras to Saras. At the same time the Egyptian public health authorities reported *A. gambiae* larvae near Abu Simbel. Disin ection of craft proceeding from the Sudan to Egypt and from Egypt to the Sudan was instituted. Eradication measures were re-started in the Faras—Saras reach.

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

Port Sudan Quarantine. 1,271 ships entered Port Sudan harbour. 596 Sambuks entered Flamingo Bay. The figures in 1949 were 932 and 446 respectively. 2,187 persons disembarked from ships at Port Sudan and 2,078 embarked. The comparable figures in 1949 were 2,896 and 3,399 respectively.

Radio pratique was given to 107 ships.

Only 2 ships were subjected to quarantine restrictions as having arrived from an endemic yellow fever zone within 6 days. This fall in numbers was largely due to the exclusion of French Somaliland from the endemic area. 2 ships were placed under quarantine for smallpox.

5,990 rats were caught, in addition to those destroyed by other means.

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

1941/42	8,647
1942/43	7,670
1943/44	17,818
1944/45	6,999
1945/46	2,214
1946/47	8,404
1947/48	12,020
1948/49	11,105
1949/50	5,091
1950/51	4,374

All pilgrims in the last season were immunised against smallpox, cholera and, when necessary, yellow fever. The greater number of pilgrims had been immunised in their homes. Only 812 needed immunisation against smallpox and cholera at Suakin.

Wadi Halfa Quarantine. 18,345 persons entering the Sudan were examined. 1,271 were detained in quarantine, mainly for schistosomiasis. When practicable to arrange treatment at their destination sufferers from schistosomiasis were allowed to proceed.

Geneina Quarantine. 11,280 persons were examined.

TABLE XXXII.

Medical Mission: Total attendances:—

Nationality	Mecca	Medina	Jeddah	Totals
Sudanese	704	483	2,481	3,668
Saudi Arabs	300	123	3,722	4,145
Egyptians	30	32	—	62
Yemanese	13	66	220	299
Indians	20	6	—	26
Hadramis	—	—	1,122	1,122
TOTALS	1,067	710	7,545	9,322

Nine cases only were treated as inpatients with no deaths.

CHAPTER VI.

HOSPITALS. DISPENSARIES.

OTHER UNITS.

Table XXXIII shows, by provinces, the number of hospitals and the number of beds available per 1000 estimated population at 30.6.51. The figures include mission hospitals.

TABLE XXXIII.

Province	Number of hospitals	Beds in hospitals	Beds in dispensaries	Total beds	Beds per 1000 population
Bahr El Ghazal ..	2	364	209	573	0.7
Blue Nile	7	1,121	61	1,182	0.6
Darfur	3	376	168	544	0.5
Equatoria	8	932	586	1,518	2.4
Kassala	3	639	242	881	1.1
Khartoum	7	1,051	22	1,073	2.3
Kordofan	5	646	582	1,228	0.7
Northern	6	666	6	672	0.9
Upper Nile	1	275	162	437	0.5

Building operations in all provinces resulted in some improvement of hospital facilities and staff quarters.

Bahr el Ghazal. 3 new houses in Wau. Delivery room in Wau hospital. Additional storage at Rumbek hospital.

Blue Nile. 11 houses for medical assistants and 10 new dispensaries in Wad Medani district were built largely in replacement of existing institutions. 2 new dispensaries in Abu Usher district. 8 new dressing stations in the Fung district. A new surgical ward in El Dueim hospital and a new dressing station in the district.

Darfur. Improvements resulting in increased accommodation in El Fasher, Nyala and Geneina hospitals ; ante-natal centres at El Fasher and Geneina ; 2 new dispensaries and 7 new dressing stations.

Equatoria. Maternity block in Juba hospital ; 3 new wards ; theatre ; kitchen and office at Li Rangu hospital ; 2 new dispensaries in the district ; 1 new dispensary in Meridi district.

Kassala. Improvements to Port Sudan hospital ; 2 wards ; out-patient block at Kassala hospital ; 1 ward ; kitchen and laundry ; office and 1 house at Gedaref hospital ; 6 new dressing stations.

Khartoum. 1 new dispensary.

Kordofan. A hostel for female nurses ; 1 ward and laundry at El Obeid hospital ; 2 houses for medical assistants ; 4 new dispensaries and 3 new dressing stations ; Maternity ward and out-patient department at Kadugli hospital ; Out-patient department, laboratory and mortuary at Dilling hospital ; store at Talodi hospital.

Northern Province. 1 ward and 1 dispensary. 2 dispensaries were nearing completion.

Upper Nile. 2 wards, 2 new dispensaries and 7 new dressing stations.

Dental Services. A second dental surgeon was appointed for Khartoum. Private dental practitioners employed on a sessional basis were engaged in the school dental service in Khartoum Province.

CHAPTER VII.

MEDICAL MISSIONS.

TABLE XXXIV.

Work Done by Medical Missions.

	In-patients	Out-patients	Operations
CHURCH MISSIONARY SOCIETY.			
Omdurman (Khartoum Province) ..	2,344	57,334	336
Salara (Kordofan Province)	321	38,332	—
Katcha (Kordofan Province)	728	16,104	—
Lui (Equatoria Province)	1,278	49,805	341
AMERICAN MISSION.			
Upper Nile Province	112	40,574	—
SUDAN UNITED MISSION.			
Abri (Kordofan Province)	369	30,193	—
Kauda (Kordofan Province)	339	9,433	—
Heiban (Kordofan Province)	320	19,038	—
More (Kordofan Province)	—	3,533	—
SUDAN INTERIOR MISSION.			
Abayath (Upper Nile Province) ..	—	2,405	—
Banjang (Upper Nile Province)	245	3,006	—
TOTAL	6,056	269,757	677

Nuns of the Verona Fathers' Mission worked as ward sisters in Juba and Wau and, having undergone a course of training at the Midwives Training School, Omdurman, as midwives.

CHAPTER VIII.

MEDICAL TRAINING.

Kitchener School of Medicine.

Number of students:

Pre-clinical	15
Junior clinical	9
Senior clinical	11
TOTAL	35

Examinations.

Organic chemistry. 10 candidates passed; 2 were referred for three months.

Anatomy. 8 candidates passed, 4 were referred for three months.

Physiology. 8 candidates passed; 4 were referred for three months.

Pathology. 9 candidates passed; 2 were referred for three months.

Public Health. 9 candidates passed; 2 were referred for three months.

Examinations for Referred Students.

Organic chemistry. 2 candidates passed.

Anatomy. 3 candidates passed; 1 was referred for six months.

Physiology. One candidate passed; 3 were referred for six months.

School of Hygiene.

Number of students:

1st. year	5
2nd. year	5
3rd. year	6

Four candidates entered for the examination for the Certificate of the Royal Sanitary Institute in January 1950. Three were successful, the fourth was referred for one year.

Six candidates entered for this examination in December 1950. Five were successful, one was disqualified for a breach of the examination rules.

Sanitary overseers. 17 candidates passed their proficiency test as sanitary overseers.

Medical Assistants Training School, Omdurman.

One student sent by the Government of Cyrenaica entered the school in January, 1950. He passed his qualifying test satisfactorily.

Two students were sent by the Government of Tripolitania in January, 1951.

19 students passed the final examination at the end of 1950.

From January 1951 the course of study has been extended from one year to 18 months.

A number of visitors from other territories and the World Health Organisation inspected the school. It is widely held that the Sudanese medical assistant offers a considerable part of the solution of the problem of providing medical aid in under-doctored countries.

Juba Training Centre.

Students under training.

Medical assistants.

First year ..	.. 10
Second year ..	.. 7
Third year ..	.. 6

Sanitary overseers.

First year.. ..	.. 4
Second year ..	.. 6

Six medical assistant candidates passed their qualifying examination at the beginning of 1950. A further six passed at the beginning of 1951.

Six sanitary overseer candidates passed their qualifying test in 1950.

Nurses' Training School, Omdurman.

Students in the school have been much involved in labour disputes since July 1950. Training has suffered in consequence. The introduction of the eight-hour shift has not reacted favourably on training.

Examinations. Final examinations were held in July and December, 1950 and July, 1951.

June 1950. *Appendix A Course.* (Shortened Course for Nurses with more than six years hospital experience).

20 male nurses from Khartoum, Omdurman, Wad Medani, Abu Usher, El Dueim and Roseires Hospitals qualified.

December 1950. *Appendix B Course.* (Normal recognised 3 year Course).

4 female nurses from Omdurman and the Church Missionary Society hospitals and 3 male nurses from Khartoum hospital qualified.

December 1950. *Appendix A Course.*

3 male nurses from Khartoum and one male nurse from Khartoum North hospitals qualified.

July 1951. *Appendix A Course.*

7 female nurses from Omdurman hospital qualified.

The entry to the later examinations was greatly restricted by the boycott of lecture courses arranged by the Hospital Workers' Trade Union.

School of Dispensers.

4 dispensers qualified in 1950 and 3 in 1951.

Laboratory assistants training.

One Sudanese laboratory assistant, having undergone an advanced course of training, was promoted to Scale H. Two hospital laboratory assistants were trained. Two further laboratory assistants were undertaking the advanced training course designed to fit them for higher posts.

CHAPTER IX.

LABORATORY SERVICES.

STACK MEDICAL RESEARCH LABORATORIES.

By Dr. R. Kirk.

This report covers the period from January 1st 1950 to June 30th 1951. During this period *ad hoc* investigations have been carried out in connection with schistosomiasis, typhus fevers, *Phlebotomus*, the effects of antibiotics on rabies and undulant fever, the use of phenol in the preparation of vaccine lymph, and the action of Chironomidae as allergens causing asthma. Summaries of these and other research activities will be found under the appropriate heading. Past work in these laboratories leaves us endowed with rather unique facilities for research of a more fundamental character in certain subjects, and during the period under review we have attempted to make the best use of these facilities in connection with (I) studies in *Phlebotomus*, and (2) malignant disease (cancer) in the Sudanese.

In July 1950 Professor J. C. Cruickshank, of the London School of Hygiene and Tropical Medicine visited the Laboratories as a guest and spent about a week with us. Advantage was taken of this visit to discuss with Professor Cruickshank many of our bacteriological problems in the Sudan.

In January 1951 Dr. H. P. Himsworth, Secretary of the Medical Research Council, visited the Laboratories as a guest and spent about a week with us *en route* for East Africa. As he was able to provide up-to-date and authoritative information on numerous subjects of great interest to workers in this country, Dr. Himsworth's visit was very stimulating to many people whom he met in addition to the present writer.

At the invitation of the Sudan Government, Professors Gordon and Davey of the Liverpool School of Tropical Medicine visited the Sudan in February, 1951 and spent some weeks in Gezira investigating the problems of schistosomiasis there and have recorded their conclusions in an extremely interesting and valuable report.

Mr. A. G. Watson worked in the Laboratories as a visitor from November 1950 till July 1951 and carried out investigations on *Phlebotomus* and on the storage of stilbamidine in the animal body and its effects on mineral and fat metabolism.

I record with regret that alterations in the budget of United States Navy have, during the period under review, led to the suppression of the Sudan (Torit) sub-station of the United States Naval Medical Research Unit in Cairo (Namru—3). Some valuable work has been achieved in the Torit sub-station, in spite of its short life. Several papers have been published on malarial and other parasites of birds and mammals in the Southern Sudan, and a comprehensive monograph on the ticks of the Sudan is in preparation by Mr. Hoogstraal. This should be an authoritative and up-to-date work of reference for all future workers in this country.

In December, 1950 the writer was privileged to attend the Kampala Conference of Experts on Malaria held under the auspices of the World Health Organization. It was definitely a meeting of experts, a highly technical conference, and there is no doubt that the experts consider malaria control, or even complete eradication, to be a matter of practical politics with modern methods. Time will be the final arbiter of this in different localities, but large continental areas like the Sudan will be difficult places in which to obtain results comparable with those of islands, for example, such as Cyprus and Mauritius. It is, however, evident that malaria control is going to be a matter which will receive much international interest, and will become an important criterion in assessing the efficiency of any medical or Public Health Administration.

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 38,740. The volume of routine work remains practically the same as in my last report, if allowance is made for the fact that the present report covers a period of eighteen months, not twelve months as in past reports. This stabilization is largely due to the greater number and varieties of examinations which are now delegated to the hospital laboratories, and to the restriction or elimination of tests which appear non-essential. Even so the volume of routine work carried out by the Laboratories has more than doubled since 1935. While such increases are no doubt very gratifying there is a certain risk of laying undue emphasis on the volume of routine examinations and allowing them to choke the essential research activities of a research laboratory.

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. An additional committment undertaken during the period under review was the teaching of medico-legal subjects to cadets in the Police Officers Training School.

Hospital Laboratory Services. A vast amount of routine work, not shown in this report has been carried out in the hospital laboratories throughout the country by Scale K and J members of the Laboratory service trained in and generally supervised from Stack Laboratories. The work of these hospital laboratories, though simple and restricted in its scope, is an important factor in maintaining the efficient functioning of the medical and health services throughout the country.

One Sudanese Laboratory Assistant has been promoted to Scale H during the period under review, two new Assistants have been trained and two are undergoing advanced training for promotion to Scale H. Two Laboratory Assistants have resigned, one to take up private work in Wad Medani, the other to take up an appointment with the Sudan Light and Power Company. One Laboratory Assistant under training resigned before his training was completed to take up an appointment in Gordon Memorial College.

POST MORTEMS.

72 autopsies were carried out in Khartoum Civil Hospital during the period under review, and of these 53 were medico-legal. The number shows a considerable increase as compared with previous years, but demonstrates that police cases still comprise the majority of the examinations performed. Three cases merit special mention. Two were cases of cerebral malaria ; the third was a case of haemorrhagic necrosis of the adrenals, and in this case a pure culture of meningococcus was obtained from the patient's blood at post mortem examination.

PATHOLOGICAL SPECIMENS.

The total was 588 (excluding brains for rabies). Of special interest was a specimen of a lymph gland infected with histoplasmosis, sent from Juba. A few cases of this condition have been noted in the Sudan in recent years, from Kordofan and the Gezira. A case from Medani has recently been reported in detail by Dr. D. B. Jelliffe (1949, J. Trop. Med. and Hyg., 52,177).

NEOPLASMS.

135 malignant neoplasms were received and following table is a brief summary.

Site	Carcinoma	Sacroma	Melonoma	Mixed Tumour	Total
Scalp	2	—	—	—	2
Face	2	—	—	1	3
Tongue	3	—	—	—	3
Mouth	1	—	—	1	2
Tonsil	1	—	—	—	1
Jaw	1	—	—	1	2
Eye	2	2	1	—	5
Ear	1	—	—	—	1
Thyroid	1	—	—	—	1
Neck	4	—	—	1	5
Parotid	—	—	—	2	2
Chest	2	1	—	—	3
Arm	—	2	—	—	2
Leg	4	2	2	—	8
Foot	1	1	8	—	10
Rectum-Anal Canal	9	—	—	—	9
Abdomen	4	—	—	—	4
Stomach	1	—	—	—	1
Intestine	1	—	—	—	1
Bladder	3	—	—	—	3
Groin	1	—	1	—	2
Ovary	3	—	—	—	3
Uterus	12	1	—	—	13
Breast	19	—	—	—	19
Lymphatic Glands	9	6	—	—	15
Skin	3	—	—	—	3
Prostate	2	—	—	—	2
Prepuce	1	—	—	—	1
Unspecified	9	—	—	—	9
TOTAL	102	15	12	6	135

Dr. Bates has undertaken an extensive study of the tumour specimens preserved in the collections of these Laboratories. 3,244 sections have been examined, representing one of the largest series recorded from Africa. Each specimen was examined separately, its diagnosis checked against the records, and the figures so obtained have been analysed. This investigation rests on a broad basis of work performed over a period of many years by the staff of these Laboratories, and it is hoped that the results, which are of great interest, will be published by Dr. Bates in due course. Many interesting points emerge from this study, some of which have been mentioned from time to time in past reports from these Laboratories ; and the analysis of one of the largest collections of tumours available in Africa will be in itself an important contribution to our knowledge about malignant disease in this continent.

RABIES.

417 brains were received, of which 37 were decomposed and useless for examination. 120 were positive for Negri Bodies, including 88 dogs, 13 donkeys, 3 horses, 4 goats, 3 calves, 2 cats, 2 camels, 1 sheep, 1 hyaena and 1 human.

Antirabic vaccine. 209,625 ml. were issued during the period under review, enough to treat 2,795 cases. This represents a considerable increase over the quantities issued in previous years. Much of this vaccine is undoubtedly wasted. Some wastage is probably inevitable in a decentralized system of antirabic treatment such as is employed in the Sudan.

Negri bodies and the inclusion bodies of canine distemper. It is sometimes stated that in dog brains inclusion bodies caused by distemper virus may be found which resemble the Negri bodies of rabies. As most of our records of rabies refer to dogs, and diagnosis depends on the demonstration of Negri bodies in the brain it was considered that this possible source of error required investigation. Dr. David Trevan, of the Wellcome Foundation, kindly made available a number of dog brains infected with distemper and showing the inclusion bodies (which are not always present in distemper). Examination of those brains by the staining methods ordinarily used in the Laboratories for the diagnosis of rabies indicates that there is not much likelihood of confusion between Negri bodies and the inclusion bodies of canine distemper. The latter are paler, smaller and more irregular in shape than Negri bodies, and show no inner structure of vacuolation.

Antibiotics in rabies. It was found in a small-scale experiment that experimental rabies in rabbits was not influenced in any way by chloromycetin, penicillin or streptomycin. Fixed virus (Paris strain) was used, the rabbits were inoculated subdurally and then given heavy and regularly spaced doses of the antibiotics so as to maintain effective concentrations in the body, but this had no effect on the course of the infection. The incubation period was not altered, nor were the clinical features and course of the disease. (Bates, J. D., Nature, 22nd July, 1950, p. 155).

VACCINE LYMPH.

66 sheep were used for production of 3,585 grams of pulp with an average yield of 54.3 grams per sheep. Experiments to test the action of phenol, mentioned in the last report, have been continued during the period under review. The results appear to be very satisfactory, and the use of phenol in the routine manufacture of vaccine lymph is now under consideration.

TYPHUS FEVER.

Investigations to discover cases of fevers of the typhus group have been described in previous reports (1937, 1941, 1943) and indicate that such infections are infrequent. The records were recently summarized by Pratt, Drysdale and Kirk (Journal of Tropical Medicine and Hygiene, 52,157 ; 1949) in October, 1950, a British Inspector of the Sudan Plantations Syndicate was admitted to Khartoum Civil Hospital with an obscure illness clinically suggestive of typhus. A Weil Felix reaction done the fourth day, was negative, but a second test, on the tenth day of illness, showed agglutination of *Proteus* OX19 in 1 : 1250, and of *Proteus* OX2 in 1 : 125, *Proteus* OXK being negative. Inquiries revealed that the infection must have been contracted in the patient's station at Kilo 57 in the Gezira, so an investigation was instituted there. All likely contacts were traced and bled for Weil Felix test. In only one case was there a history of recent illness, the wife of the patient's groom, who lives in the same compound, and who at the time of investigation, was convalescing from a sharp febrile illness. Her serum gave a positive Weil Felix reaction (OX19 in 1 : 500). All the other sera collected gave negative reactions. The skinrash, comparatively mild illness, absence of primary eschar, type of Weil Felix agglutination, and absence of local epidemic spread, suggested murine typhus. By courtesy of the Chief Public Health Inspector a rat catcher was employed and caught 46 rats and rodents in the patient's compound and immediate vicinity. These were sent to Khartoum and emulsions of their brains inoculated into guinea pigs. No result, in the way of fever or scrotal reaction, was observed. As a final check, the guinea pigs were sacrificed and their sera sent to Dr. J. H. S. Gear, of the South African Institute for Medical Research. Dr. Gear kindly submitted the sera to complement fixation tests and reported completely negative results with *Rickettsia prowazeki*, *R. mooseri* and *R. ricketts*. Five months after recovery the sera of both patients were submitted for complement fixation tests. One proved negative against the organisms mentioned above and also against Q fever and rickettsial pox. The other was anti-complementary and unsuitable for the complement fixation tests.

SCHISTOSOMIASIS.

Schistosomiasis in the Gezira. Professors Gordon and Davey have produced a most illuminating report on the problems of schistosomiasis in the Gezira, after spending time there in February and March 1951. This report mentions the collection of accurate data compiled by Dr. Greany during his detailed and extensive investigations on schistosomiasis in the Gezira during the last five years. Dr. Greany's investigations have shown that the routine examinations of urine and faeces which have been carried out during the past few years reveal that some 17 per cent of the population are infected with schistosomiasis and it is likely that the use of more specialized methods of examination would reveal a far higher incidence. On the other hand, a considerable proportion of those infected (about 25 per cent) are apparently unaware of their infection which is only discovered as a result of routine laboratory investigation. Although there is no doubt that the disease gravely affects a proportion of population Professors Gordon and Davey draw attention to the absence of factual evidence that schistosomiasis upsets the economy of the indigenous community in the Gezira in the manner that certain other diseases do, notably malaria, and emphasize the importance of investigations to clarify this point. Many other points need investigation. After discussing these Professors Davey and Gordon conclude :—

" We believe it to be highly unlikely that any marked increase in efficiency or reduction in the cost of schistosomiasis control in the Gezira will be achieved until further knowledge concerning some of the factors just referred to has been gained, and that the answers to these problems can best be provided by a research team."

Proposals for the composition, control and location of the research team are given in the report, which emphasizes also the importance of health education and propaganda to improve local hygienic standards.

Chemotherapy. Further attempts to use Nilodin in the treatment of schistosomiasis by Dr. Mansour Ali Haseeb confirm the rather disappointing results mentioned in the last report. This drug is not well tolerated by Sudanese patients, over 50 per cent of whom are unable to continue treatment after the first three days owing to severe toxic symptoms, mainly nausea, loss of weight and intractable vomiting. Unless some method of avoiding these toxic effects can be evolved the drug is unlikely ever to become a popular form of treatment in the Sudan. Combination of the drug with promethazine chlorotheophyllinate has been suggested as a possible method of avoiding the toxic reactions, and Dr. John Harper, of May and Baker, Ltd. has kindly provided a supply of the latter compound for testing.

BACTERIOLOGICAL STUDIES IN CEREBROSPINAL MENINGITIS.

1. *Grouping* : Twenty-five fresh strains of *N. meningitidis* were isolated from cases of cerebro-spinal meningitis in Khartoum Omdurman and Khartoum North. Meningococcal grouping sera were kindly supplied by Col. Bensted, Director of the Central Public Health Laboratory, Colindale, London. All the twenty-five strains fell into group II.

2. *Virulence* : Experiments were carried out on white mice to throw light on the virulence of *N. meningitidis*. The strains used for the test were freshly isolated from human cases. It was found that the minimum lethal dose for white mice was 1,000 million organisms. Mice inoculated with less than this dose developed little abscesses in the joints a fortnight after inoculation. Smears made from these abscesses showed Gram-negative diplococci which were morphologically and culturally identical with *N. meningitidis*.

3. *Immunity*: Twenty-three mice were used for this experiment. Phenolised and heat-treated (60° C/30 minutes) vaccines were prepared from freshly isolated strains. Care was taken that the strains were smooth. Mice were immunised by intraperitoneal injections of three doses (each dose=4,000 million organisms given by the intraperitoneal route). The results were conclusive and both test and control mice died within 24 hours from the time of the challenging dose. The result of this experiment is that phenolised killed vaccines do not produce immunity in mice even when special care was taken to use smooth and freshly isolated strains in the preparation of such vaccines.

STILBAMIDINE.

It has been shown (Report 1947) that cases of kala azar treated with stilbamidine may retain considerable quantities of the drug in the body and excrete it in small amounts for periods up to five years after the completion of treatment. A possible connection has been suggested between this retention of the drug and the peculiar neuropathy first described in such cases by Napier and Sen Gupta (1942) in India. During the period reviewed by the present report, work on this most interesting subject has been resumed in these Laboratories by Mr. A. G. Watson in collaboration with Dr. Henry in the Wellcome Chemical Laboratories. The preliminary results, which are described by Dr. Henry in the Report of the Wellcome Chemical Laboratories, are of great interest and significance. But although considerable progress has been achieved, the results mainly emphasize the complexity of the problems involved. Extensive investigation will be necessary to determine conclusively the extent and sites of storage of stilbamidine or its products in the body under different conditions, and its relation to the delayed toxic effects.

UNDULANT FEVER.

Hitherto no form of treatment has proved effective in undulant fever, but it appears that in chloramphenicol (chloromycetin) we now have a satisfactory remedy for this disease. One case was treated, with full bacteriological investigations, during the period under review, with very satisfactory results. In reporting the case Dr. Mansour Ali Haseeb (J. Trop. Med. and Hyg., 53,241 ; 1950) summarizes and reviews our records of *Brucella* infections in the Sudan.

PHLEBOTOMUS.

For the past few years work on *Phlebotomus* has been largely a spare-time occupation in these Laboratories, but the nature of the work, and the accumulated material available make it very suitable for such a purpose. In addition to material from the Sudan, we have received several collections from East Africa for determination during the period under review, and new species or varieties have been found and described.

Some time ago it was suggested by Dr. P. C. C. Garnham, of the London School of Hygiene and Tropical Medicine, that the numerous publications and records on this subject in the Laboratories should be collected and published as a monograph on the African species of *Phlebotomus*. This has been done, and the work is now in process of publication by the Royal Entomological Society of London, assisted by grants from the Royal Society of London, the Colonial Medical Research Committee and the Sudan Government.

CHIRONOMIDAE.

Chironomidae are non-biting midges, generally considered to be of no medical importance. Khartoum and a few other places on the Nile are subject to invasion by myriads of these flies, known locally as " nimitti " which breed in the river and on emergence make for gardens and houses in the vicinity, where they collect amongst the vegetation and swarm round lights in the evenings. There is strong

circumstantial evidence that these flies may be an important cause of asthma, hay fever, and similar maladies in persons who have become sensitized. The geographical distribution and seasonal incidence of the asthma often coincides with that of the flies. Individual cases are known who develop asthma on coming to a locality heavily infested with " nimitti " but remain free from it so long as they are not in such a locality. The main species of fly concerned appears to be *Tanytarsus lewisi* Freeman, 1950. A skin-testing antigen was prepared by making an extract of the bodies of this insect. A series of asthmatics in Wadi Halfa gave a very high proportion of strongly positive reactions when tested with this antigen control tests in the same individuals being negative with antigens prepared from feathers, sheep's wool, donkey dandruff and neem tree pollen.

PUBLICATIONS

During the period under review several papers on medical and allied subjects relating to the Sudan have been published by the staff of the Laboratories and others including past and present members of the Medical Services, A list of these papers has been compiled and sent to the Editorial Secretary of Sudan Notes and Records, in which journal the full bibliography can be consulted by anyone who is interested. The following papers have been published from the Stack Laboratories during the period under review.

" Two epidemics of cerebrospinal meningitis." by R. Kirk (Sudan Notes and Records, 31,43 ; 1950)

" Haemoglobin standards in the Sudan." by Mansour Ali Haseeb (Sudan Notes and Records, 31,300 ; 1950)

" Attempts to cultivate rabies in a cell free medium." by R. Kirk, M. A. Haseeb and A. T. Davis (J. Tropical Medicine and Hyg., 53, 167 ; 1950).

" Undulant fever in the Sudan : the successful treatment of one case with chloramphenicol." by Mansour Ali Haseeb (J. Trop. Med. and Hyg., 53, 241 ; 1950)

" The sandflies (Phlebotominae) of the Sudan " by D. J. Lewis and R. Kirk (Bull. Ent. Res., 41,565, 1951).

" Three new sandflies from East Africa." by R. Kirk and D. J. Jewis (Proc. R. Ent. Soc. Lond. (b) 19, 11 ; 1950).

" A new species of *Phlebotomus* (Diptera, Psychodidae) from Uganda." by A. C. Watson (Ann. Trop. Med. and Parasit., 45, 78 ; 1951).

" Failure of antibiotics in experimental rabies. " by J.D. Bates (Nature, July 22nd, 155 ; 1950).

" Purification of vaccine lymph with phenol " by M. A. Haseeb (Lancet, January 13th, 114 ; 1951).

Summary of Routine Examinations.

From: 1*st January*, 1950 *To*: 31*st June*, 1951.

Kahn Tests	21,770
Widal Reactions	2,608
Weil Felix Reactions	19
Heterophile agglutination tests (Paul—Bunnell)	8
Blood Cultures	1,205
Blood Films	2,424
Blood Counts	59
Cerebro-Spinal Fluids	1,144
Medico-legal Specimens (Blood and Seminal Stains)	57
Biochemical Tests	302
Autogenous Vaccines	1
Pathological Histology (including brains for rabies)	968
Faeces	2,175
Urines	1,570
Throat and Nasal Swabs for *C. diphtheriae* Positive	193
,, ,, ,, ,, ,, ,, Negative	3,077
Sputa *Myco. tuberculosis* Positive	19
,, ,, ,, Negative	112
Spleen Smears (Kala-azar Positive)	5
General Bacteriological Examinations	748
Water Examinations	276
TOTAL EXAMINATIONS	38,740

Summary of Faeces Examinations.

Bact. dysenteriae Flexner V-Z types	90
Bact. dysenteriae Sonne	1
Bact. shigae	24
Bact. typhosum	79
Bact. paratyphosum A.	3
Entamoeba histolytica	18
Ova present	17
Negative	1,943

Summary of Urine Examinations.

Bact. typhosum	67
Bact. paratyphosum A.	1
Ova present	15
Negative	1,487

Summary of Kahn Tests.

Positive	6,217
Negative	15,553

Summary of Blood Films for Parasites.

Malaria :—

Benign Tertian	19
Subtertian	598
Negative	1,807

Summary of Widal Reactions.

Bact. typhosum	393
Bact. paratyphosum A.	2
Bact. paratyphosum B.	10
Br. Melitensis	106
Negative	2,097

Summary of Blood Cultures.

Bact. typhosum isolated	72
Bact. paratyphosum A. isolated	10
Bact. paratyphosum B. isolated	2
Streptococcus-pyogenes isolated	24
Other organisms	24
Negative	1,073

Summary of Heterophile Agglutination Tests.

Positive	3
Negative	5

Summary of Vaccines Issued.

T.A.B. Vaccine	18,550	ml.
Anti-Rabic Vaccine	209,625	ml.
Cholera Vaccine	16,900	ml.
Staphylocccus aureus Vaccine	200	ml.
Vaccine Lymph	593,940	doses.

THE WELLCOME CHEMICAL LABORATORIES

DR. A. J. HENRY

In 1949 it was decided that the Sudan Government's financial year should be changed to July 1st.- June 30th. instead of coinciding with the calendar year, that the transition financial " year " should extend from January 1st. 1950 to June 30th. 1951 and that all Reports such as the present should cover the same period. The fact that this Report therefore covers a period of eighteen months must be taken into consideration in assessing the volume of work recorded therein in relation to that recorded in previous Annual Reports.

During the period under review the number of samples examined was 17,141 This is equivalent to 1,142 per year, 50 percent more than the average of the previous three years. Owing to the greatly improved laboratory facilities now available this large increase in demands could be met without undue difficulty, and with only a small increase in staff at the junior level ; but progress in research work was seriously impeded by the constant interruptions due to routine demands.

The general distribution of samples amongst the various categories was not vastly different from that of recent years, and again a high proportion of the routine work involved samples of a medical or semi-medical nature, while much of the research work had a pronounced medical bias. The volume of work carried out for private firms during the period under review was double that of the average of the previous three years, and this large increase is expected to be maintained.

The research work to be recorded consisted of further investigation of the basic constituents of some members of the Capparidaceae ; an investigation of the dependence of the composition of cottonseed, and the oil therein, on the stage of growth ; preliminary work on the storage of Stilbamidine in the animal body ; and an investigation of the composition of the body fat of nimitti. During the period under review five original papers and the Report of the Government Analyst for 1949 were published or prepared for publication.

The routine samples examined were classified as follows, the corresponding figures for 1949 being also given :—

	1.1.1950 to 30.6.1951	1949
Waters	177	85
Foodstuffs	479	162
Medico-legal and miscellaneous drugs	278	102
Mineralogical	191	93
Miscellaneous	589	321

ROUTINE WORK

Waters.

The majority of the samples submitted were from the Geological Survey, mainly from new bores in various parts of the country. Of the samples examined one hundred and sixty four were classified as potable water, the remaining thirteen being boiler waters from the Sudan Railways.

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. During the period under review one hundred and eighty samples of sugar, damaged in transit via Port Sudan have been submitted for analysis, many of which had become damp and had undergone partial inversion. A variety of miscellaneous foodstuffs has also been received.

Medico-legal and miscellaneous drugs.

These are divided into pathological (105) toxicological (120) and miscellaneous drugs (53). Of the first group, all but eighteen were ante—or postmortem specimens associated with 23 separate cases of suspected poisoning, in six of which there were positive findings, three being due to arsenic. In addition to the above, five antigens were submitted in an attempt to establish a connection between nimitti and the occurrence of asthma and hay fever.

Among the toxicological samples submitted, 19 various household utensils were examined for lead in the surface coating, cigarettes were shown to contain hashish, various specimens concerned in cases of suspected poisoning were shown to contain *Datura strammonium* and *D metel*, and the bark of the Mbele tree (*Alstonia congensis*) concerned in a further case of suspected poisoning was shown to contain echitamine or echitamidine.

The miscellaneous drugs include a wide range of samples, many of which were tested for conformity to B. P. standards.

Nine powders reputed to be antrypol were shown to be highly adulterated. Thirteen tablets were examined in connection with police prosecution for alleged possession of unlawful drugs, and were shown to be various sulpha drugs, mepacrine and paludrine. Storage tests were carried out on samples of hydrogen peroxide, which showed no significant deterioration over a period of six months.

Mineralogical.

Included in this category are 38 samples of coal, nine samples of mineral oil and seventy three samples of metals examined for the Sudan Railways, seventy of which were white metals. In addition a wide variety of paints, minerals from the Geological Survey, building materials, samples from Sudan Salt Ltd., and a number of incrustations associated with cases of corrosion were received.

Miscellaneous.

One hundred and sixty five samples of oil cake, mainly cottonseed or sesame, were received, and in addition various oil bearing seeds, cottonseed (76), groundnut (23), sunflower (22) and sesame (13). Thirty nine samples of methylated spirit were examined for the Customs. Fifty samples of various sorts were examined for spoilage, which in many cases was attributed to sea water. Thirteen samples of soap, mainly of poor quality and made by small producers in outstations, and one hundred and thirty three samples of gum were also received, the latter mainly in an endeavour to elucidate the cause of stringiness, which has not yet been explained. It is hoped to carry out a fuller investigation on this very important problem in the coming season. Other samples classified in the category are various textiles, abavit B and other miscellanceous samples.

INVESTIGATIONS.

The research work which has been carried out during the period under review has consisted mainly of extensions of the lines of investigation which have been pursued during the past few years. It is regretted that a great deal more work of this nature cannot be undertaken, but with present staff and volume of routine work this is not possible.

Development of the Cottonseed.

The salient points arising from an investigation of the changes in composition of cottonseed from the earliest stages up to the final splitting-open of the bolls were : (1) no appreciable oil develops in the seed until about the 35th. day after flowering, after which it increases rapidly ; (2) the composition of the fatty acids remains constant over the period of oil production ; (3) carbohydrates decrease over this period ; (4) protein and ash increase throughout approximately in proportion to weight of seed B.

Body fat of Nimitti.

These insects (*Tanytarsus lewisi*, of the family Chironomidae) were collected over a considerable period to try to provide data for the Medical Entomologist on the variation of their incidence with seasonal and climatic factors. Since large quantities were available it was decided to extract and examine the body fat of these insects and it is of special interest, in view of their feeding habits, to record that the fatty acid composition of the body fat of the adult insect is closely in line with that of the body fat of fresh water fish.

Courbonia virgata.

The two dextro-rotatory betaines, virgatin-I and virgatin-II, isolation of which from the husks of the fruit of this plant was described in the last Report, have now been identified by Dr. Cornforth of the National Institute for Medical Research, as *cis*—and *trans*—forms of D-(3)-hydroxyst achydrine. The solutions obtained after removal of as much as possible of the crystallisable virgatins from extracts of the husks, kernels and roots (the last had yielded only tetramethy lammonium nitrate) have been submitted to a detailed treatment for the isolation and separation of other basic constituents. This work had to be interrupted on account of other demands, but a detailed fractionation of the hydrochlorides of the other ba ic constituents, obtained via the periodides, has indicated the probable presence of several bases additional to those already isolated from this interesting plant. This work will be continued as soon as opportunity permits.

Capparis tomentosa.

Investigation of this number of the Capparidaceae has led to the isolation in substantial quantity of *laevo*-stachydrine in pure form as the hydrate, hydrochloride and picrate. No other basic constituent appears to be present. This work has been submitted for publication in collaboration with Dr. Cornforth, National Institute for Medical Research.

Stilbamidine.

Earlier work on this drug had led to the conclusion that extensive retention and storage for prolonged periods must almost certainly occur after injection into the animal body, but lack of opportunity had prevented experimental proof. The subject has recently been taken up again and substantial progress has been made in solving the preliminary aspects of the problem of determining the sites and extent of storage, and its effect upon mineral and fat metabolism. A simple method by which absorbed stilbamidine, fatty matter and mineral constituents can be determined on the same specimen has been elaborated. The organ is digested on the water bath with 10 per cent hydrochloric acid, when the tissue disintegrates and the stilbamidine goes into solution completely. After filtration fatty matter is extracted from both filtrate and dry undissolved material, stilbamidine is estimated fluorimetrically in the filtrate, and filtrate and undissolved material are kjeldahled for mineral constituents.

It has already been demonstrated that the drug is rapidly eliminated from the blood plasma, and that no absorption by the blood corpuscles occurs. The liver of a sheep which died, presumably from delayed toxic effects, three months after termination of a course of injections was shown to contain a high proportion of stilbamidine most of which was isolated as the hydrochloride and shown to be free from hydrolysis product. Preliminary experiments indicate that sheep, rabbits and rats show substantial differences in both capacity for storage and resistance to the toxic action of the drug ; but much further work is necessary to confirm this, and to determine whether significant disturbance of fat or mineral metabolism results.

MEDICAL ENTOMOLOGY.

MR. D. J. LEWIS

Enquiries about insects were received from many parts of the country. 124 collections, comprising some 1,700 specimens, were received for identification. Collections and specimens of many species of insects were sent on request, mainly for teaching, to various parts of the Sudan and to institutions in America, Britain, Egypt, Iraq, Nigeria and Pakistan. Dr. D. S. Bertram, Reader in Entomology at the London School of Hygiene, visited the section, and Professor R. M. Gordon and Professor T. H. Davey carried out some of their experiments on bilharzia snails in the fish ponds maintained by this section.

Collaboration with the Blue Nile Province Public Health Department afforded opportunities for large scale tests of insecticides. The facilities provided by the Research Division of the Ministry of Agriculture were of great value.

Insecticides.

Tests were made on two benzene hexachloride (BHC) larvicides, four types of larvicidal plaster of Paris bricks, four types of space spray, an aerosol dispenser, BHC wettable powder, BHC emulsion, BHC liquid concentrate, a DDT paste, and BHC smoke generators, to ascertain their value for general use in the Sudan. Three samples of space spray were tested for evidence of deterioration.

A ten per cent Gamma isomer formulation of BHC was effective against house fly larva and adults, bed-bugs and larvae of *Anopheles gambiae*. All stages of the latter were killed when the insecticide was diluted at the rate of 4 grammes of powder to 500 c.c. of river silt dust and applied at the rate of 0.004 gramme of Gamma isomer per square metre (half an ounce per feddan). This larvicide should be useful against many insects but the weight of diluent precludes its general use against mosquito larvae.

A 6.5 per cent gamma isomer BHC wettable powder, used for house spraying, was tested as an alternative to DDT in oil against Anopheles larvae. It was not quite so effective, but could be of considerable value when applied undiluted at the rate of 0.02 gramme gamma isomer per square metre. It does not kill pupae but weakens them so that many adults die on emergence.

An emulsion and a liquid concentrate of BHC, both 20 per cent gamma, were tested against adult *A. gambiae* and house flies. These preparations have the advantage that they do not make the slight marks on distempered walls that wettable powder does. They are more expensive however and so were sprayed at half the concentration of wettable powder, being applied at 0.055 gr. gamma per square metre. They both killed considerable numbers of insects two months after application. The emulsion should be useful for houses whose owners are prepared to provide this non-marking preparation.

A cage colony of *Musca* was established so that flies unresistant to DDT would be available for tests. The adults were kept at a high humidity and eggs laid and larvae bred on cotton wool soaked in milk.

Training.

A practical course of instruction in the control of mosquitoes and other insects was given to 17 sanitary overseers and some house-to-house inspectors, and other health workers received training.

Parties of school boys and other visitors were shown disease-carrying insects.

HEMIPTERA.

Some lygaeid bugs from the Wadi Halfa arodrome have been identified as *Leptodemus bicolor* var. *ventralis* Lindb. This is one of the plant-sucking Hemiptera which pierce the human skin in arid areas and cause irritation.

Bugs closely resembling bed-bugs were sent from a store at Gogrial. They proved to be *Loxaspis miranda* Roths., a rare species of bat bug.

SANDFLIES.

The classification of the *Phlebotomus* of the Ethiopian Region was continued in collaboration with Dr. R. Kirk, 306 figures of the 81 species and varieties being prepared.

Several tropical African species were found at Wadi Halfa.

ANOPHELES MOSQUITOES.

Insecticides in the Gezira.

The Section cooperated with the Public Health Department in the planning and observation of certain control measures. In four blocks houses were sprayed by contract, with BHC wettable powder. In two others the application of DDT in oil as a larvicide, with the aid of a system of maps, was continued, the work being handed over to local authorities in the shape of village councils.

At the Research Farm periodic application of residual spray was replaced by regular spraying, a small team treating each building in rotation every three months.

Tilapia melanopleura in the Gezira.

This is a plant-eating fish of the same family as the Nile *bulti*. According to De Bont (1948), Nature, 162, P. 998) it is a valuable food fish and is also useful in mosquito control by destroying aquatic vegetation. A supply of this fish was imported by air by the Sudan Irrigation Department from the Mission Piscicole, Elisabethville, Belgian Congo, at the suggestion of Dr. E.B. Worthington, with the object of controlling Gezira canal weeds. The fish were entrusted to this Section for preliminary rearing and testing. They were found to breed readily under Gezira conditions and to eat the principle species of water plants. Small scale field tests indicate that a considerable concentration of adult fish is required to produce adequate results.

The use of *Tilapia* (*T. zillii*) had previously been suggested by Dr. E. N. Trewavas, but it has not been possible to obtain enough of them for experiments, despite several expeditions to the White Nile by the Fishery Officer and by members of this Section.

Gambusia.

7,300 Gambusia were sent on request to Kordofan for mosquito control in hafirs where they appear to flourish in the absence of predaceous Nile fish. 150 were sent to Khartoum, 100 to Merowe, and 100 to Sennar.

Wadi Halfa.

The Egyptian Ministry of Health reported that *Anopheles gambiae* had been found at Abu Simbel, a short distance north of the Sudan frontier, on September 10, A survey of the Wadi Halfa area was accordingly made by the Medical Entomologist in September and October but no anophelines were found. Discussions were held with Dr. S. Madwar, Director General of the Endemic Diseases Division of the Egyptian Ministry. Recommendations were made regarding the methods of reporting and other aspects of the prevention work which has been continued since *A. gambiae* was exterminated in 1945. The use of " detection pools " was advocated. These are cement tanks filled with water and if any adults of *A. gambiae* were to reach Wadi Halfa when there are no natural breeding places they would probably lay eggs in these artficial pools and so reveal their presence.

Three months after this survey, on December 12, three larvae of *A. gambiae* were collected at Abdin just north of the Second Cataract during routine inspections. These are the first to be found at Wadi Halfa since 1943 and the first seen in the Saras-Faras area since 1945. It was recommended that larvicidal measures should be immediately started and continued until a date to be decided after consultation with the Egyptian Ministry.

The return of *A. gambiae* is unfortunate, but it is a matter for satisfaction that not a single specimen had been found in the town for seven years, despite its presence in areas to the south from which several lines of communication converge on Wadi Halfa. A technical Assistant of this Section visited Wadi Halfa in May to advise on control methods.

The Mosquito Control Officer found larvae of *A. gambiae* at Mograkka on January 20, thus affording confirmatory evidence that this species breeds throughout the winter in the cataract region.

The Red Sea Coast.

A. d' thali was received from Khor es Said, west of Port Sudan. *A. gambiae* has not been reported from the coastal area for several years.

CULICINE MOSQUITOES.

Monthly reports of provincial returns of *Aedes aegypti* control have been prepared as usual. The World Health Organization now requires that official Aedes indices should be ascertained by monthly inspection of all houses in a town. A list of towns where this should be done was drawn up and the new system began in January 1951. Many places of less importance continue to be examined by sampling.

Aedes aegypti has not been found in Khartoum for many years but a few *A. metallicus* were reported after the heavy rains.

A new species of *Eretmopodites* has been reported from Torit by Mr. H. Hoogstraal.

CHIRONOMIDAE

Control measures hitherto tested against chironomids in Khartoum have not been successful on an adequate scale. The large extent of the breeding place and other factors make control extremely difficult. and experience showed that more knowledge of the life history of the insects was essential before further attempts could usefully be made. The results of recent observations are summarized below.

The identity of the principle species was established when collections from Khartoum and Wadi Halfa were sent to the British Museum. Over 90 per cent of the midges belonged to an undescribed small greenish species with reddish thoracic stripes and darker abdominal bands in the male. It was named *Tanytarsus* (*Cladotanytarsus*) *lewisi* (Freeman, P., 1950, Proc. Roy Ent. Soc. Lond B. 19, pp. 58.59). It is suggested that the Khartoum chironomidaes should be generally known as " green nimitti " to distinguish them from the biting grey nimitti

A floating trap was tested with the object of mapping the chief breeding grounds. It was damaged by persons unknown, so a tow net was used instead and yielded instructive results. Numerous catches were made in different parts of the river between sunset and midnight from a motor launch. Pupae of *T. lewisis* were found to be widly distributed and not markedly numerous in any one area. About dusk many insects rise to the surface with the plankton. Twenty five-minutes from catches yielded 487 chironomid larvae, 142 pupae of *T. lewisi*, 54 pupae of other species, various other insects and about a million copepods. It is evident that *Tanytarsus* larvae spend a considerable time on the surface, so that those which reach maturity at Khartoum may begin life some distance upstream. Several species of fish feed on the larvae but make little impression on the population.

The ovaries of *T. lewisi* develop in the pupal stage and each female can lay about 240 eggs very soon after emergence.

Some years ago (S. M. S. Report for 1938) it was thought that the flies emerged from the mud flats and that oiling these would be useful but expensive. We now know that midge larvae breed over hundreds of feddans of the river bottom, living in tunnels down to a depth of 23 feet or more beneath moving water, and move from place to place. Immense number of adults emerge from the general surface of the river and can oviposit soon afterwards.

After experiments with submerged DDT bricks had failed, tests were made with lubricating oil on the river surface to kill emerging adults. Although the oil does not usually spread well if used on mosquito breeding places, it does so very well on the river, one litre covering about 5,000 square metres. This oil costs nothing and can be applied from the shore and the Blue Nile Bridge. A full scale test could not be carried out owing to a sudden decrease of nimitti, but it is proposed to continue this work next season.

In planning control measures it would be useful to forecast the outbreaks of nimitti. To this end the effect of weather conditions is being studied with the help of regular catches and observations made by Dr. A. J. Henry and Mr. D.N. Grindley of the Wellcome Chemical Laboratories.

Many residents have obtained some relief from the pest by installing outdoor fluorescent lights and sitting at some distance from them. On the other hand red lights, which attract few midges, are sometimes used for illumination at close quarquarters.

The Khartoum species of midge was reported to be troublesome on the river front at Atbara in April.

SIMULIIDAE.

Twenty species and three varieties have now been found. *S. damnosum* and *S. griseicolle* bite man, and *S. dentulosum* causes annoyance without biting.

The study of the peritorphic membrane and its effect on microfilariae was continued by examination of sections prepared by the Stack Laboratories and by other specimens examined at the Zoology Department of Cambridge University. A fly can take in hundreds of worms with a single blood meal, but on the average only three survive to reach the proboscis. Some microfilariae remain in the tubular part of the mid-intestine but most pass further back and are imprisoned by the membrane.

This structure is thus responsible for the small number of infective forms and probably partly also for the fact that people can be bitten by many flies without developing symptoms.

The function of the oesophageal diverticulum was studied in view of the fact that in South American *Simulium* it is considered to be associated with the migration of microfilariae. The contents were analysed with a chromatogram by Mr. H. D. Fowler who found considerable quantities of glucose, fructose and sucrose. This and the finding of pollen grains and pollinia in and on some specimens, suggests that the females habitually feed on nectar.

Through the cooperation of the Province Medical Inspector, Bahr El Ghazal, a series of monthly dissections of *S. damnosum* from Raffili was started to test the theory, evolved in 1949, that the fly does not transmit the disease in the dry season. If this is true the disease would seem unlikely to establish itself in the north. The numbers hitherto dissected and number with developing *Onchocerca* are :

October	213	3
November	262	0
December	216	0
January	224	0
February	54	0

S. damnosum, found biting, were received from Amadi, not far from the Mundiri educational centre. This species was also receiving from the R. Pongo near the Wau-Aweil Road.

Dr. J. F. E. Bloss sent 236 pupae from Pochala, of which 234 were *S. damnosum*.

TABANIDAE

Dr. H. M. Woodman's studies on loiasis (1949, Trans, Roy. Soc. Trop. Med. Hyg., **42**, p.p. 543-558, and earlier papers) showed that the parasite developed in *Chrysops distinctipennis*, but he did not find many of this species biting man and considered that it might not be the main vector in the Sudan.

According to Dr. Bloss (1949, ibid, 43, pp. 236-238) it attacks man and can be found commonly near habitations, Woodman found (1950, ibid, 43, pp. 549-550) that the number of *Chrysops* fluctuated to some extent from year to year. The Medical Entomologist has found very few *Chrysops* during short visits to the loiasis area in the rains. Dr. Ahmed Bukhari has sent a collection of tabanids from Sources Yubu which comprised nine *Chrysops silacea* and one *Tabanocella perpulcra*. He reported that the flies had been abundant 14 years before but had gradually disappeared. A few were seen towards the end of 1949, and they were commonly seen among cattle in the late afternoon in 1950. Several biting insects increase sporadically in parts of the Sudan, and it may be that one or more species of *Chrysops* transmit *loiasis* over limited periods.

C. distinctipennis was received from Muklei, north-east of Nasir, an entirely new locality for this species.

An account of the Tabanidae of the Sudan is nearing completion. Seventy species and varieties are now known and include several hitherto undescribed.

TSETSE FLIES

Professor P. A. Buxton's notes on his 1949 tour, which were sent to the Sudan Government, have also been circulated by the Bureau Permanent Interafricain de la Tsetse et de la Trypanosomiase (No.85, multigraphed.—Notes on trypanosomiasis and tsetse in the southern parts of the Anglo-Egyptian Sudan). In addition to much information on veterinary problems Professor Buxton referred to sleeping sickness control. He supported the view that in the Sudan this disease should be kept under control by medical surveys and treatment, but also advocated certain measures against *G. palpalis*.

di *G. tachinoides*, an important West African vector of sleeping sickness, was Gscovered at Kigille in the Sudan in 1948. Specimens have been sent by Captain p. S. Renny from Cielkong and a forest near Jokau, and the species has been reported from the Khor Yabus by the Veterinary Entomologist.

He has also reported, from near Meridi, *G. pallidipes* which was the vector of Rhodesian sleeping sickness in the 1940 epidemic in Uganda.

OTHER DIPTERA.

An unusual case of myiasis occurred when a patient in Khartoum vomited fly larvae. They were identified as a species of trypetid or fruit fly and had probably been eaten with ripe fruit.

Specimens of the Sudan swarming gnat, *Oscinella aharonii* Duda, were sent from Atbara in October.

Records of some Sudan species of *Musca* are given by Van Emden (1949, Diptera Muscidae.—Expedition to South-West Arabia 1937-8. Vol 1 part 14. British Museum (Natural History).

Specimens of *Sarcophaga* and *Fannia* were recorded from Wau where they had bred in shells of the giant snail *Burtoa nilotica* (Pfeiffer). It was reported that 1,293 shells had been collected in June and that one per cent contained fly maggots and one per cent mosquito larvae, probably *Eretmopodites quinquevittatus* which was present in 1949.

FLEAS.

Xenopsylla cheopis was found on town rats in Wad Medani and *Synosternus pallidus* in ground squirrel burrows and on a mongoose. Both these species are plague vectors in some countries.

TICKS

Specimens of *Rhipicephalus sanguineus* were received from Atbara where they were infesting the walls of a house, hidden behind plaster.

Ornithodorus savignyi was sent on request to Cambridge some time ago and was found to be the most resistant to desiccation among all species tested (Lees, A.D., 1947, J. exp. Biol., 23, pp. 379-410).

PUBLICATIONS.

The following papers have been published. LEWIS, D.J. (1949). The tsetse fly problem in the Anglo-Egyptian Sudan.- Sudan Notes and Records, 30, pp. 179-210.

A summary of all information on tsetse flies up to the middle of 1949, with a distribution map on the 1 : 3,000,000 scale and 133 references.

(1950). A peritrophic membrane in *Simulium* Nature, 165, p. 978. A preliminary note on the existence and nature of this structure and its effect on the microfilaria of onchocerca.

The following were published in collaboration. KIRK, R. and LEWIS, D.J. (1949). Taxonomy of the Ethiopian sandflies (*Phlebotomus*) IV.—*P. bedfordi* Newstead and *P. antennatus* Newstead.—Ann. trop. Med. Parasit., **43,** pp. 333-336.

(1950). Three new sandflies (Phlebotomus) from East Africa.—Proc. Roy. Ent. Soc. Lond (B), **19,** pp. 11-13.

LEWIS, D. J. and KIRK, R. (1951). The sandflies (Phlebotominae) of the Anglo-Egyptian Sudan—Bull. entom. Res., **41,** pp. 563-575.

CHAPTER X

METEOROLOGY

Province	No. of stations	Mean rainfall m.m.	Highest recorded m.m.	Lowest recorded m.m.
Bahr El Ghazal	17	646	663	123
Blue Nile	200	74	213	0
Darfur	17	88	193	0
Equatoria	31	891	1,204	121
Kassala	45	18	203	0
Khartoum	6	19	20	4
Kordofan	33	210	361	0
Northern	17	2	5	0
Upper Nile	27	433	567	37

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	17	10	1	—	9	—	71	110	3
4. Typhus	—	—	—	—	—	—	—	—	—	—	4
5. Yellow Fever	—	—	—	—	—	—	—	—	—	—	5
6. T.B. Pulmonary	135	724	58	160	463	509	274	540	152	2,955	6
7. T.B. Non-Pulmonary	57	796	84	68	437	399	203	88	114	2,246	7
8. Pneumonia	741	10,385	2,981	2,913	3,774	5,743	3,846	3,668	1,279	35,340	8
9. Influenza	7	3,230	2,884	1,387	3,826	3,165	3,759	7,644	341	26,243	9
10. Other Respiratory Diseases	6,676	186,178	53,731	102,647	112,837	129,547	117,842	90,065	23,476	824,044	10
11. Cerebrospinal meningitis	143	17,192	17,954	64	1,276	5,682	14,253	719	30	57,313	11
12. Chickenpox	397	4,117	1,245	498	2,034	1,035	1,193	1,394	316	12,229	12
13. Diphtheria	—	210	13	43	71	109	36	84	7	573	13
14. Encephalitis Lethargica	—	—	—	—	—	—	—	—	—	—	14
15. Measles	69	3,976	430	4,368	1,056	1,554	875	2,341	396	15,029	15
16. Mumps	233	6,165	1,077	187	552	2,497	1,660	2,378	119	15,668	16
17. Poliomyelitis, acute	—	226	—	—	—	—	—	—	—	226	17
18. Rheumatism, acute	13	908	30	2,151	327	683	251	1,110	11	5,484	18
19. Whooping cough	34	2,908	878	429	1,155	1,578	827	1,494	75	9,578	19
20. Dysentery	1,549	20,754	7,265	935	6,741	10,263	7,439	8,432	3,675	67,053	20
21. Enteric Fever	—	115	5	101	67	103	—	146	23	560	21
22. Gastro-enteritis of children	77	9,359	2,451	484	1,469	9,380	1,077	1,361	3,465	28,123	22
23. Undulant Fever	—	20	—	7	15	8	7	—	2	59	23
24. Filariasis	4	5	—	366	—	7	12	—	8	402	24
25. Leishmaniasis	—	233	1	188	104	80	12	1	19	638	25
26. Malaria	6,216	193,853	28,272	36,211	57,407	32,457	84,415	71,707	17,226	527,864	26
27. Blackwater Fever	—	3	—	1	2	—	—	—	—	6	27
28. Onchocerciasis	—	—	—	4	—	—	—	—	—	4	28
29. Phlebotomus Fever	—	5	—	—	—	—	1	31	1	38	29
30. Relapsing Fever	—	4	10	—	8	10	—	3	1	36	30
31. Trypanosomiasis	—	—	—	174	—	—	—	—	—	174	31
32. Ancylostomiasis	1,913	20	136	9,661	19	54	52	619	85	12,559	32
33. Dracontiasis	628	130	68	2,204	83	106	556	16	90	3,881	33
34. Schistosomiasis	547	10,387	2,707	5,768	862	1,116	7,159	30,061	112	58,809	34
35. Gonorrhoea	2,607	11,478	5,852	5,879	6,834	7,232	8,959	1,546	2,994	52,781	35
36. Soft Sore	268	2,619	848	775	1,255	1,040	647	383	37	7,872	36
37. Syphilis	9,298	27,297	42,014	9,521	17,428	9,868	39,157	4,952	17,554	177,629	37
38. Yaws	291	1	—	25,637	—	2	—	—	6,040	31,971	38
39. Anthrax	—	3	1	—	8	7	—	—	—	19	39
40. Hydrophobia, human	—	258	4	2	3	—	6	—	14	287	40
41. Leprosy	67	54	36	371	24	22	109	9	26	718	41
42. Madura Disease	1	596	22	23	113	766	66	139	3	1,729	42
43. Tetanus	15	59	1	19	7	17	20	84	3	242	43
44. Heat Stroke Syndrome	—	—	3	2	12	4	2	5	9	37	44
45. Confinements	256	576	111	260	128	3,370	290	272	82	5,355	45
46. Gynaecological	61	2,432	362	112	2,088	18,281	1,722	1,984	441	27,483	46
47. Diseases of Pregnancy and Parturition	—	6	—	8	76	—	—	141	—	231	47
48. Puerperal Fever	—	36	7	1	21	2	27	39	6	139	48
49. Wounds and injuries	36,439	223,555	94,873	146,163	157,129	140,071	163,852	118,928	39,976	1,120,986	49
50. Tropical Ulcer	18,824	5,686	1,556	11,940	2,581	35	10,160	14	3,465	54,261	50
51. Diabetes	—	66	37	2	123	443	95	362	3	1,071	51
52. Pellagra	—	1	—	—	1	—	4	—	—	6	52
53. Scurvy	—	159	17	4	218	81	188	3	14	684	53
54. Neoplasms, malignant	8	197	26	29	40	127	208	46	245	926	54
55. Neoplasms, non-malignant	17	2,962	167	60	346	214	346	571	32	4,715	55
56. Trachoma	327	64,580	14,594	3,128	19,421	73,031	11,742	60,762	323	247,908	56
57. All other eye diseases	9,273	181,883	45,722	63,044	92,771	109,508	146,271	97,161	10,534	756,167	57
58. Ear Diseases	1,553	36,740	13,513	13,567	18,444	18,164	21,784	22,232	35,848	181,845	58
59. Skin Diseases	3,792	30,245	20,295	34,207	10,864	16,525	29,860	21,863	6,604	174,255	59
60. Alimentary diseases	4,398	207,970	81,002	85,503	133,815	161,200	129,562	151,317	17,110	971,975	60
61. Circulatory diseases	80	19,743	2,005	924	4,096	7,235	9,043	9,382	19,307	71,815	61
62. Genito-urinary diseases	654	24,924	8,246	202	9,981	16,053	15,538	24,269	576	100,443	62
63. Organic Nervous diseases	24	2,955	875	54	142	1,066	2,232	6,549	502	14,399	63
64. Functional Nervous diseases.	51	8,799	—	25	97	70	62	179	232	9,515	64
65. Fever of uncertain origin	2,167	50,717	8,126	19,048	23,468	63,854	16,798	32,486	9,776	226,440	65
66. All other conditions	6,114	138,194	35,999	72,833	76,013	98,685	93,089	77,582	26,467	627,827	66
67. Poisoning	6	99	106	31	53	40	135	518	—	1,048	67
68. Jaundice	8	2	—	—	16	—	75	1	3	105	68
69. Erysipelas	—	27	—	—	—	2	—	—	—	29	69
70. Beri Beri	—	2	—	—	—	—	—	—	—	2	70
71. Dengue	—	1	—	—	—	—	—	—	—	1	71
72. Jiggers	—	—	—	4	—	—	—	—	—	4	72
73. Ascaris	—	—	—	233	—	—	—	—	—	233	73
74. Goitre	—	—	—	26	—	—	—	—	—	26	74
75. Ostemylitis	—	—	—	6	—	—	—	—	—	6	75
76. Hydrocele	—	—	—	8	—	—	—	—	—	8	76
77. Hernia	—	—	—	55	—	—	—	—	—	55	77
Total New Cases	115,438	1,516,181	499,017	664,675	772,302	954,228	947,727	857,681	249,430	6,576,678	
ATTENDANCES: MEN	289,354	1,254,584	506,686	556,050	941,308	1,010,868	921,751	698,220	160,586	6,339,407	
WOMEN	83,244	684,903	335,987	261,154	346,105	830,166	743,742	527,908	94,545	3,907,754	
CHILDREN	72,469	1,162,004	514,263	348,460	697,297	969,716	1,051,722	1,044,257	126,265	5,986,453	
Total Attendances	445,067	3,101,491	1,356,936	1,165,664	1,984,710	2,810,750	2,717,215	2,270,385	381,396	16,233,614	
MISSIONS	—	—	—	49,805	—	57,334	116,633	—	45,985	269,757	
Grand Total	445,067	3,101,491	1,356,936	1,215,469	1,984,710	2,868,084	2,833,848	2,270,385	427,381	16,503,371	

TABLE II.

SUDAN: 1950/1951.

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	—	14	1	2	—	—	—	—	—	9	3	—	—	71	—	98	4	3
4. Typhus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
5. Yellow Fever	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
6. T.B. Pulmonary	113	17	392	43	35	4	79	14	275	42	486	88	149	26	264	29	120	11	1,913	284	6
7. T.B. Non-Pulmonary	39	2	169	9	49	3	60	3	196	9	225	6	101	15	79	4	68	—	986	51	7
8. Pneumonia	665	49	2,724	154	1,277	109	1,558	89	2,065	101	2,140	100	1,688	101	1,237	73	535	5	13,889	781	8
9. Influenza	2	—	38	—	151	2	540	10	165	1	231	3	236	2	219	—	4	—	1,588	18	9
10. Other Respiratory diseases	377	6	1,741	67	579	10	1,402	16	1,586	24	765	14	1,659	44	1,149	14	320	3	9,278	198	10
11. Cerebrospinal Meningitis	168	66	17,192	1,864	17,954	2,581	64	25	1,276	259	5,682	366	14,253	2,388	243	40	22	—	56,854	7,589	11
12. Chickenpox	318	—	272	2	620	1	384	3	687	—	161	—	455	1	144	—	128	—	3,169	7	12
13. Diphtheria	—	—	206	33	13	3	43	1	71	10	96	11	36	4	49	14	7	1	521	77	13
14. Encephalitis Lethargica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14
15. Measles	69	—	225	5	41	1	1,276	18	143	2	158	9	74	3	54	3	106	1	2,146	42	15
16. Mumps	233	—	192	3	210	—	187	—	140	—	97	—	306	12	77	—	14	—	1,456	15	16
17. Poliomyelitis, acute	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17
18. Rheumatism, acute	13	—	73	—	7	—	61	—	22	—	45	—	35	2	138	2	11	—	405	4	18
19. Whooping cough	21	—	84	11	4	1	284	4	53	1	137	2	38	—	32	4	2	—	655	23	19
20. Dysentery	520	16	675	26	1,772	25	431	15	661	17	579	7	664	15	522	12	437	6	6,561	139	20
21. Enteric Fever	—	—	115	11	5	—	101	4	67	3	163	8	—	—	66	3	23	—	480	26	21
22. Gastro-enteritis of children	21	2	308	31	116	—	448	9	117	9	160	23	61	10	166	22	54	—	1,451	116	22
23. Undulant Fever	—	—	19	1	—	—	7	2	15	3	8	—	7	1	—	—	1	—	57	7	23
24. Filariasis	4	—	4	—	—	—	99	—	—	—	—	—	7	—	—	—	2	—	116	—	24
25. Leishmaniasis	—	—	233	22	1	—	188	6	100	16	80	—	11	3	—	—	19	3	632	50	25
26. Malaria	3,189	44	6,317	114	1,806	27	10,499	64	3,480	76	3,819	21	4,750	45	4,198	40	730	—	38,788	431	26
27. Blackwater fever	—	—	3	1	—	—	1	—	2	1	—	—	—	—	—	—	—	—	6	2	27
28. Onchocercisasis	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—	4	—	28
29. Phlebotomus Fever	—	—	5	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	7	1	29
30. Relapsing Fever	—	—	4	—	6	—	—	—	8	—	10	2	—	—	—	—	—	—	28	2	30
31. Trypanosomiasis	—	—	—	—	—	—	60	1	—	—	—	—	—	—	—	—	—	—	60	1	31
32. Ancylostomiasis	949	14	20	2	103	3	5,614	34	15	—	49	3	4	1	145	—	24	—	6,923	57	32
33. Dracontiasis	209	—	40	—	18	1	426	—	32	—	105	—	58	—	13	—	27	—	938	1	33
34. Schistosomiasis	152	—	653	25	91	1	2,247	6	84	1	41	—	220	1	608	—	22	1	4,118	35	34
35. Gonorrhoea	1,017	1	1,001	—	815	1	1,878	4	1,109	—	217	—	1,238	4	233	—	294	—	8,362	10	35
36. Soft Sore	58	—	32	1	96	6	17	—	64	—	104	—	79	—	31	—	6	—	487	7	36
37. Syphilis	1,051	3	966	5	4,960	9	3,443	5	711	2	287	4	2,558	10	391	3	1,964	—	15,831	41	37
38. Yaws	89	5	1	—	—	—	2,212	—	—	—	1	—	—	—	—	—	730	—	3,033	5	38
39. Anthrax	—	—	3	1	1	—	—	—	8	2	6	—	—	—	—	—	—	—	18	3	39
40. Hydrophobia, human	—	—	12	6	—	—	1	—	1	1	—	—	6	6	—	—	—	—	20	13	40
41. Leprosy	29	14	10	1	32	8	132	1	20	—	8	2	50	12	7	—	5	—	293	38	41
42. Madura Disease	1	—	177	2	21	—	23	1	74	—	119	—	45	—	24	—	3	—	537	3	42
43. Tetanus	12	8	59	29	1	—	19	11	7	3	17	1	19	8	16	4	2	1	162	53	43
44. Heat Stroke Syndrome	—	—	—	—	—	—	2	—	12	—	4	—	2	—	4	2	9	—	33	2	44
45. Confinements	234	5	576	18	94	4	257	7	123	10	829	12	288	11	250	11	92	—	2,743	78	45
46. Gynaecological	61	—	1,732	5	175	1	112	1	493	—	1,546	6	532	8	502	—	171	—	5,124	21	46
47. Diseases of Pregnancy and Parturition	—	—	6	—	—	—	8	3	70	—	—	—	—	—	15	—	—	—	99	3	47
48. Puerperal Fever	—	—	36	2	6	—	1	—	20	—	—	—	21	4	18	1	1	—	105	7	48
49. Wounds and injuries	2,383	10	6,162	111	4,448	59	6,271	68	3,505	53	2,230	40	5,281	82	2,248	29	2,118	7	34,766	459	49
50. Tropical Ulcer	1,511	16	115	1	322	1	1,634	15	73	1	22	—	1,150	3	7	—	870	—	5,704	37	50
51. Diabetes	—	—	63	2	12	2	—	—	45	2	209	6	24	3	108	6	2	—	463	21	51
52. Pellagra	—	—	1	—	—	—	—	—	1	—	—	—	4	—	—	—	—	—	6	—	52
53. Scurvy	—	—	6	2	6	—	—	—	30	—	67	—	16	2	—	—	14	—	139	4	53
54. Neoplasms, malignant	2	—	64	5	25	3	19	3	21	1	102	8	90	7	32	8	3	2	365	37	54
55. Neoplasms, non-malignant	15	1	86	1	66	—	60	2	81	—	129	—	52	2	48	—	7	—	544	6	55
56. Trachoma	92	—	75	1	120	2	48	—	21	—	72	—	134	—	177	—	123	—	1,062	3	56
57. All other eye diseases	316	—	366	—	290	—	303	—	493	—	1,400	—	499	—	763	2	2,552	—	7,182	2	57
58. Ear Diseases	101	—	223	—	78	1	850	—	106	1	118	2	126	2	107	—	63	—	1,772	6	58
59. Skin Diseases	843	3	365	3	239	1	884	—	208	1	137	2	378	4	245	—	247	—	3,246	14	59
60. Alimentary Diseases	729	15	2,516	193	894	44	2,919	139	2,153	160	2,000	59	1,870	113	1,932	85	836	9	15,869	815	60
61. Circulatory Diseases	53	2	814	107	158	23	250	4	425	45	712	56	562	79	706	55	43	4	3,723	375	61
62. Genito-urinary Diseases	31	1	785	25	334	10	146	1	639	21	613	17	768	33	706	29	131	—	4,183	137	62
63. Organic Nervous diseases	24	—	235	13	83	8	54	7	83	7	245	12	56	5	294	13	18	1	1,092	66	63
64. Functional Nervous diseases	46	2	115	6	—	—	11	1	7	—	2	—	62	6	—	—	—	—	243	15	64
65. Fever of uncertain origin	143	—	1,063	46	461	12	280	10	689	67	1,000	18	418	31	449	13	263	2	4,766	199	65
66. All other conditions	3,273	23	1,423	42	1,290	27	3,194	77	1,929	40	1,500	39	3,053	101	2,358	13	2,956	4	20,576	376	66
67. Jaundice	8	1	—	—	—	—	—	—	16	—	—	—	75	10	—	—	3	—	102	11	67
68. Poisoning	—	—	78	13	83	—	17	3	1	—	39	2	—	—	48	6	—	—	266	24	68
69. Erysipelas	—	—	6	—	—	—	—	—	—	—	2	—	—	—	1	—	—	—	9	—	69
70. Beri Beri	—	—	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	70
71. Dengue	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	71
72. Ascaris	—	—	—	—	—	—	233	—	—	—	—	—	—	—	—	—	—	—	233	—	72
73. Jiggers	—	—	—	—	—	—	7	—	—	—	—	—	—	—	—	—	—	—	7	—	73
74. Goitre	—	—	—	—	—	—	26	—	—	—	—	—	—	—	—	—	—	—	26	—	74
75. Ostemylitis	—	—	—	—	—	—	6	—	—	—	—	—	—	—	—	—	—	—	6	—	75
76. Hydrocele	—	—	—	—	—	—	8	—	—	—	—	—	—	—	—	—	—	—	8	—	76
77. Hernia	—	—	—	—	—	—	55	—	—	—	—	—	—	—	—	—	—	—	55	—	77
Total	19,384	326	50,881	3,066	40,082	2,995	51,455	687	24,498	992	28,836	959	43,278	3,224	21,214	550	16,580	61	296,208	12,860	
MISSIONS	—	—	—	—	—	—	1,278	—	—	—	2,344	—	2,077	—	—	—	357	—	6,056	—	
Grand Total	19,384	326	50,881	3,066	40,082	2,995	52,733	687	24,498	992	31,180	959	45,355	3,224	21,214	550	16,937	61	302,264	12,860	